PADUCAH GASEOUS DIFFUSION PLANT SITE SPECIFIC ADVISORY BOARD

Chartered under the Federal Advisory Committee Act

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Meeting Minutes

March 19, 1998

The March 19, 1998, Site Specific Advisory Board (SSAB) meeting took place in the Van Buren Room at the Executive Inn at 5:00 p.m.

The following board members were present: Mark Donham, Edward Duff, Vicki Jones, Lynn Lane, Linda Long, Ray McLennan, Craig Rhodes, and Gregory Waldrop. Ex Officio members present were: Wayne Davis, Jimmie Hodges and John Volpe. Facilitator Present: Steve Kay. Also present were: David Allen, Carlos Alvarado, Patricia Barnhill, Jeannie Brandstetter, Raúl Castañeda, Scott Creasey, Angela Eaton, Teresa Fields, Shelley Hawkins, Dennis Hill, Norman Jetta, Todd Mullins, Gayla Puckett, Greg Shaia and Elisabeth Stull.

Steve Kay called the meeting to order. Steve asked if there were any modifications to the agenda. The Bechtel/Jacobs Presentation and the Waste Area Grouping (WAG) 22 Presentation were removed and a National Environmental Policy Act (NEPA) Overview Presentation was added. The modified agenda was approved.

Administrative plans were the first item on the agenda. Ray McLennan stated that the office location at the Information Age Park, a 10' x 20' room, costs a little less than $5,000 a year. It includes the use of the conference room once a month. There is a charge for setting up tables and chairs that was not very clear and will have to be clarified. Ray stated that he thought it was a win-win situation. Carlos Alvarado stated that Bill Tanner had talked to Jacobs about getting the lease in place.

The next item on the agenda was Administrative Support. Carlos stated that Bill had been in contact with Shelley Hawkins. Due to the fact that Bill Tanner was not present the board was unable to proceed on this item.

Board evaluation was the next item on the agenda. Vicki Jones stated that she had talked to Mark Donham and he agreed that the report was okay. Vicki said she would put the finishing touches on it and get together with Teresa Fields on getting the report out to the board.

The next item on the agenda was the draft Work Plan. Changes were made to the plan and agreed to by consensus. A revised work plan will be sent to all of the board.

Jimmie Hodges stated that the Oil, Chemical, & Atomic Workers (OCAW) Former Workers Health Study Presentation is tentatively scheduled for the same night as the SSAB meeting. There will be a presentation for the site people the day before or the day after. The board is invited to attend the presentation. The board will be informed when a final date is set.

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The next item on the agenda was the approval of the minutes. Carlos stated that their were some changes made for clarification to the paragraph concerning the Bechtel Jacobs contract. The amended minutes were approved by consensus.

An information/handouts update was the next item on the agenda. Carlos Alvarado presented the board with a handout that Bill Tanner had prepared with the Jacobs people. The handout was a list of equipment needed to supply the office at the Information Age Park. Gregory Waldrop suggested that the overhead projector be dropped from the list. Carlos stated that Jimmie Hodges has asked him to check to see if there are any desks, chairs, tables, or guest chairs available for usage by the SSAB. The proposal was made that these first 4 items and the overhead projector be removed from the list and the rest of the list be approved. The proposal was approved by consensus. This list did not include a computer or typewriter.

The next item on the board was the resignation of Rev. W. G. Harvey. Vicki Jones stated that he had sent a letter stating that due to the constraints on his time he felt that he could not do justice to the board. He also forwarded a name of someone he thought would be a good replacement. Vicki will forward the name on to Nola Courtney.

The EMEF Project Updates were the next thing on the agenda. Jeannie Brandstetter stated that the WAG 27 fieldwork has started. There is a lengthier update in the report so that the board can decide if it wants a presentation.

The next item on the agenda was the Department of Energy (DOE) response to SSAB recommendations. A handout was presented to the board. Jimmie Hodges went over each recommendation and DOE's response. Jimmie stated that there was one recommendation that did not make the list. That was the recommendation that the charcoal filters not be removed from the Northwest pump and treat system. DOE did not remove them. Mark Donham thanked DOE for making the effort to respond to the board's recommendations. Jimmie stated that DOE would try to do a better job in responding to the board's recommendations in a timely fashion.

Decontamination and Decommissioning (D&D) was the next item on the agenda. Carlos Alvarado stated that the information was put into a handout which was presented to the board. John Volpe asked if DOE had taken into account the Nuclear Regulatory Commission's (NRC) approach to D&D. Jimmie stated that DOE had put together a series of booklets which cover what DOE would do. Jimmie also stated that in the long run DOE has not factored in NRC's approach. David Allen stated that there are some major negotiations going on to discuss this issue. Mark asked about C-340 and C-410. Carlos stated that they are shut down and in the process of stabilization. Greg Waldrop asked how this related to the exploding drum incident. Carlos stated that the drum was part of the Waste Management Program. This is a little different. Both of these buildings are shut down. Jimmie Hodges stated that there are sweeps made of these buildings to make sure there are no chemicals stored that could cause problems. Mark asked about Paducah's D&D budget fund. Jimmie stated that Paducah, Portsmouth and the East Tennessee Technology Park (ETTP) work are all funded out of the D&D fund. D&D is used in two different ways, as the fund and the program. Steve Kay suggested that D&D be put back on the workplan for September.

The next item on the agenda was Cost Effectiveness. There were some general comments on how this matter should be handled. Jimmie stated that he felt this subject could be covered as a general theme with the M&I contract. Mark stated that it might be covered under the 2006 Plan -

Accelerated Cleanup Paths to Closure. Steve suggested it be rolled into the M&I presentation question and answer period.

The Site Treatment Plan (STP) annual report was the next item on the agenda. The information was presented as a handout. Tom Shadoan of Lockheed Martin Energy Systems(LMES) was on hand to answer any questions. Mark asked what the procedural requirements are. Mark asked if there are any milestones coming up where an official document is required. Tom stated that there is the Federal Facility Agreement (FFA) and the 97 Annual Report which will come out at the end of this month. Greg Waldrop stated that the board is trying to get input in before the documents go out to the public. Tom stated that the STP compliance dates were set in 1995 and a public comment period was held of 30 days. Mark asked if there are any more shipments going to the Toxic Substances Control Act (TSCA) Incinerator. Tom stated that there are ongoing liquid shipments going out at a rate of 2-3 a year and the soft solids shipments begin in fiscal year (FY) 1999. Mark asked if the Governor of Tennessee's Blue Ribbon panel on the TSCA Incinerator issued a report or any kind of findings yet. Jimmie stated that they had and Portsmouth (Ohio) and Paducah (Kentucky) are allowed to ship there but no other states are allowed to ship to the incinerator. Jimmie stated they made some other recommendations concerning looking at the community and the health impacts to the communities. Jimmie stated he would try to get Mark a copy of the report. Mark stated that it concerned him that Paducah is sending material to be incinerated to this incinerator, the only radioactive waste incinerator in the country as he understood it and it is growing in controversy. Tom stated there are two other DOE incinerators - one in Savannah River that is not open to any other states and one in Idaho that Paducah is planning on shipping to that is called the Waste Experimental Reduction Facility (WERF) Incinerator which does not take polychlorinated biphenyls (PCBs). John Volpe stated that there are two commercial facilities (one in Tennessee and one in Texas) also that take mixed waste.

The next item on the agenda was the report on the Prioritization Meeting. Carlos Alvarado and Greg Waldrop attended a meeting in Oak Ridge where they prioritize the projects. All the Paducah responses were discussed. Greg stated that there were 2 things he found particularly interesting. Greg stated that the mortgage reduction became less of an issue and that the notion that any project that might save money really got pulled up higher in the rankings. What they found was that very few projects could be identified as having saved money. They also found that the compliance component was a little peculiar because everything has to comply. What was finally agreed to was a change of 5 percent from compliance and given to Environmental Protection. This is a monthly meeting. Carlos stated that he was a little disappointed in the attendance. Carlos stated that usually the State has representation at these meetings. Jimmie Hodges stated that it is a tool to be used. Mark Donham stated that it would be interesting to see if the list in the 2006 document was the same as the one that Greg and Carlos came back with. Mark agreed that the rankings could be discussed next month in the 2006 discussion. Greg said he felt that this was a good meeting for the board to try to attend if possible and he felt that they would be invited back. Greg also brought back a Glossary Of Useful Terms Found in EMBAM, Risk Assessment, and Waste Management Reports that will be distributed to the SSAB by Teresa Fields.

A National Environmental Policy Act (NEPA) Presentation by David Allen, DOE Oak Ridge, was the next item on the agenda. David gave out handouts and gave a general overview of the NEPA process. Craig Rhodes asked how many categorical exclusions (CXs) there are. David Allen and David Tidwell stated that there are dozens of CXs. Craig asked if any are used more than others. David Allen stated that there are some CXs that are used for basic maintenance, mowing lawns, etc.

Mark Donham stated that after the bursting barrel incident a CX was used to treat the waste in the barrels. Mark stated that there was no public comment, no environmental analysis. The public was completely cut out of the process because DOE uses these CXs. Mark stated that he felt that this was one of DOE's more irritating points. Mark also stated that he challenges the whole CX rule. Mark stated he felt that DOE Headquarters (HQ) had sent out a letter to each site telling them that if they had projects that they wanted done to send HQ a list of all the projects that each site wanted HQ to write a CX on and that is what HQ has been writing CXs on so the sites could get projects done without going through the public comment period. Mark stated he felt that there is a lot of abuse going on. Mark stated that use of CXs cuts the public out completely. Mark also stated that until he had submitted a Freedom of Information Act (FOIA) request he did not know that a CX had been done on treating the waste barrels. Mark stated that when you look at the checklist for this CX that there were as many yes's and uncertains as there were no's. Mark felt that should have triggered something. Mark also stated that it is a pain to go through the public comment process for any agency because it slows things down but it's not necessarily a reason not to do it. David Allen stated that he agreed that it is a pain to go through the public comment period from the time frame aspect. David stated that when CXs are reviewed in Oak Ridge DOE is looking at them to see if there are circumstances there that push them into something of significance. There are some things that are significant because there is general concern about it. David stated that there are some CXs that come through that he says no. David stated that how these CXs came to be in place he did not know since he was not involved in the process. Mark stated that DOE has certain criteria in the CEQ regulations that have to be weighed in order to make something significant. There are other laws such as whether there are Endangered Species, whether it is a Historic Property or whether it is a wetlands or whether there are any cumulative effects. Mark stated that not just DOE, but other agencies need to be made to look at everything they are supposed to.

Mark stated that the comment that he has been making for quite a few months, that with everything that it is going on at Paducah, how could DOE not have to look at everything, site wide. Mark asked how Paducah is functioning, complying with NEPA having never done a site wide Environmental Impact Statement (EIS). David asked Mark what a site wide EIS does for you. Mark stated that it gives you a bigger picture of everything that's going on and what potential alternatives are in one document instead of coming out one project at a time. David stated that site wide documents are basically general documents not alternative analysis because you do not have an action. David stated that there has been discussion on doing a site wide EIS for years. David stated that what DOE has seen is that when you do a site wide EIS they are very umbrella and very general. Because it covers the whole site there is nothing specific for you to home in on to determine alternatives because you don't have an action. Site wide EISs cost millions and millions of dollars. David stated that what they have seen is that 3-4 months after a site wide EIS is completed that it is outdated and a supplement has to be done in order to add data that has happened since the first document was completed. So you never actually gain any ground. David stated that there are some in the process of being done. The general intent of the CXs is for something to be where there is basically no impact at all or impact so little that if you added up 100 of these things there would be no impact. In order for the basic process to go forward we have to have some basis to say these things have no impact. DOEs role is to look at these things and make a determination - somewhat like a policeman - of looking at them and making a determination whether DOE agrees or not. Steve Kay asked if the SSAB was interested in the looking at the CX for the bursting barrel, could they do it. Greg Waldrop asked if the SSAB could be in on the conversations when DOE is making the decisions on CXs. David Allen stated that they cannot. David stated that it is a good idea to take one and go through the process. David suggested that a

listing of the CXs that have been issued be provided to the SSAB. David stated that on the bursting barrel incident (because of the emergency situation of having another one that could possibly burst) that DOE went to everyone (State, EPA, etc.) and got approval that DOE needed to act on in. DOE did go ahead and very quickly look at it from an impact stand point and processed a CX based upon the impacts. David stated he would stand behind that CX. Mark asked why DOE didn't process it as an emergency under NEPA. David stated that DOE had time to process it as a normal CX and DOE quickly did that because they were in the middle of getting their contract in place. Mark stated that he felt that this situation had been going on for a couple of decades and then all of a sudden it became an emergency and a bunch of public money had to be spent and public resources but there was no time to notify the public or just tell them what is going on. Mark said he did not agree with it. John Volpe stated that when there is a threat to the workers you have to proceed. Mark stated that the public should be involved sooner. It is public money that DOE is spending. Mark also stated that in this situation there might have been a reason for doing it but when you look at the bigger picture he doesn't think that should be the habit the agencies should be getting into as a reason to avoid disclosing what they are doing. Steve asked if it is possible to see a list of the CXs for this site. Greg Waldrop asked David if he determines as the compliance officer the CXs based on a checklist or regulations. David stated that he has the ultimate signature authority. David explained that the plants have to make their own determinations, then the program officers review and then they are sent to Oak Ridge for review by David's staff. Then once he gets the CX back from his staff he decides whether or not to sign off on the CX. Mark stated that there is one thing lacking from that process. Congress said when they passed NEPA that one of the important things is public scrutiny because sometimes agencies have their own agendas or for whatever reasons an agency can get skewed and they might not make the proper determination. It states in the law that having the pubic scrutinize these determinations that the agencies make is essential to ensure that the decisions that they make are done right. When too many of these decisions are done behind closed doors without public scrutiny then that part of the law that Congress passed is not being fulfilled. Mark stated that you can say that you had all this input and it was looked at by all these multiple disciplines, interdisciplinary teams but this is still talking about intergovernmental without public scrutiny and that should be an important part of the process. Mark stated that is a real problem with CXs and he thinks the agencies should be using them only when it's really clear that this is something that has been done over and over again that where there has been very little controversy generated, where knowingly the impacts is really small and just where it's just as obvious that there is not going to be a lot of interest in generating a lot of paperwork on this. Mark asked how you translate this into the bursting barrel incident. This was something brand new, something that had not been done at the plant before, something unique. David stated that once again you have to look at what the human impacts would be from that event. Mark stated the SSAB did not have a chance to go to their experts to see if what the agency was saying was correct. Mark also stated that is the whole point of NEPA, to get public input. David stated that Mark made a very good point, that is the intent of the environmental assessment (EA) process and public involvement and the EIS process and public involvement. David said that they look at all of the different impacts such as air, water, radiological, etc. David said if you looked at all the different things and took out the sensationalism of quote "exploding drum" which is not something that goes into the process, you are looking at what is the impact on the human environment. David said he did not see any impact to the human environment. David stated that no one wants to exclude the public. David stated that he looks at all of the different points to determine if something falls under the CX process. Vicki Jones suggested that the SSAB get copies of the regulations on CXs and the list of CXs for Paducah for the last year. Vicki stated that the board could review the regulations and the CXs then at some time in the future have another discussion on the NEPA process. Greg Waldrop

asked if there is alternative way to arrive at a cumulative impact other than an EIS. David stated that when you are looking at an EA you are trying to look at the cumulative impacts of that particular action. Steve Kay suggested that the board schedule another presentation on NEPA in June.

The Vortec EA was the last item on the agenda. Libby Stull of Argonne National Laboratories handed out copies of the EA and gave a presentation. The Vortec EA is being released for public comment from March 20 to April 20, 1998. Craig Rhodes asked what the highest temperature is that the process reaches. Norm Jetta, Vortec Corporation stated that it is between 2,200° and 3,000° depending on the particular waste stream that is going in to be vitrified - this is within the melter itself. Craig asked what is being volatilized at that temperature. Libby stated that all the air emissions, all the criteria pollutants as well as emissions of hazardous air pollutants are discussed in the document. Craig asked how much of the percentage of the total mass is volatilized. Craig stated that lead volatizes before 3,000° and so it would be going up into the air. Libby stated that it would not. Norm explained how the system works. The final product is the size of rock salt. The air emissions are within the limits of the Kentucky air regulations. Section 2 of the EA describes the process, section 3 is the effect to the environment and section 5 is the discusses the consequences. John Volpe asked how the air filters will be handled and will they be treated as mixed waste. David Tidwell stated that they would be tested. John asked if these filters would be part of DOEs waste. Jimmie Hodges stated that they would be stored on site. Craig had several more questions on the logistics of the process which were answered by those present. Craig asked when DOE disposes of the glass that has hairline fractures in it what will keep the material from leaching out of the glass. Norm stated that the material is atomically bonded into the glass matrix. Mark asked how much of the waste material has been characterized. David stated that pretty much all of the mixed waste and the toxicity characteristic leaching procedure (TCLP) waste has been characterized and a variety of other waste. There is some characterization on all waste that DOE has. Some waste that would go through the Vortec process would require additional testing. Libby stated that the SSAB would be receiving an official copy through the mail. Greg Waldrop asked about the monitoring. Jimmie stated that DOE owns the air permit and the discharge permit and is responsible for them. Craig stated that he is concerned about the air discharge. John Volpe stated that there is an ambient air monitoring system out there. Jimmie suggested that since there are many questions concerning the EA that DOE would make itself available for questions and answers. Steve Kay suggested that the Vortec EA be back on the agenda for April.

Steve Kay had some questions on the location and it was agreed that the meeting would be held at the Executive Inn. Steve proposed moving the Administrative Issues back to the end of the meeting.

The next meeting will be held April 16, 1998, in the Roosevelt Room at the Executive Inn. The meeting was adjourned.

Tentative agenda for the April 16, 1998, meeting:

Minutes
Information (Handouts)
EMEF Project Updates
DOE Response to SSAB Recommendations (15 minutes)

Vortec EA (30 minutes)
Paths to Closure - Accelerated Cleanup Plan (30 minutes)
Cylinder Programmatic Environmental Impact Statement (PEIS) (30 minutes)
Administrative Plans for the Board -

- Office Location (10 minutes)
- Administrative Support (10 minutes)
- Board Evaluation (10 minutes)
- Review of the SSAB Draft Work Plan (10 minutes)

Action Items

Vicki Jones will send board copies of the board evaluation.
Teresa Fields will send the board copies of the revised SSAB work plan.
Jimmie Hodges will try to get Mark a copy of the Governor of Tennessee's Blue Ribbon panel on the TSCA Incinerator report.
Teresa Fields will distribute the Glossary Of Useful Terms Found in EMBAM, Risk Assessment, and Waste Management Reports.
Provide the SSAB with copies of the regulations on CXs and the list of CXs for Paducah for the last year.

PADUCAH GASEOUS DIFFUSION PLANT SITE SPECIFIC ADVISORY BOARD
U.S. DEPARTMENT OF ENERGY
ENVIRONMENTAL MANAGEMENT & ENRICHMENT FACILITIES
PROJECT UPDATES
MARCH 19, 1998

Northwest Plume Interim Remedial Action Pilot Plant

More than 248 million gallons of water have been treated at the Northwest Plume Groundwater Treatment Facility since operations began Sept. 1, 1995. The facility operates to contain a high contamination zone of the degreaser trichloroethylene and the man-made radionuclide technetium-99.

When an Explanation of Significant Difference (ESD) was proposed in November 1996, one of the items DOE proposed was removal of the carbon filters from the treatment process.

However, when DOE put the ESD out for public comment, sentiment during a public meeting and in comments received from the Site Specific Advisory Board against removal of the filters was strong enough that the filters were left in. The filters, which were voluntarily installed by DOE, are replaced every three months.

Northeast Plume Interim Containment System

The Northeast Plume project includes extraction wells in the northeast quadrant of DOE property with an underground pipeline running to the existing PGDP cooling towers as part of the containment system.

Routine operations began in March 1997, with more than 94 million gallons of groundwater treated to date.

The system experienced three hours and 49 minutes of down time the week of March 9 due to four shut downs resulting from low pressure alarms at the cooling tower. During each response, personnel were sent to the cooling tower to check pressures and found that they were normal. Further investigation revealed that the pressure switch is incorrectly sized, and a configuration change is underway to prepare for switch replacement.

Lasagna demonstration

The Lasagna soil remediation technology tested at PGDP works by using buried electrodes to move water through contaminated soil. Applied current drives the water an inch a day from a positive to a negative electrode. Along the way, the water picks up contaminants from the soil which are removed by treatment zones containing iron filings.

Phase IIA installation was completed in August 1996 and the process was operational through Feb. 26, 1997, with post-demonstration sampling completed the week of March 3, 1997. DOE EM-50 granted the Lasagna consortium another extension of the Phase IIA project, allowing it to operate through August 1997. The DOE now plans to propose its preferred remedial measures for SWMU 91, which is advancement into Phase IIB, full-scale remediation. The spoils from the Lasagna Phase IIA demonstration were sampled March 6 for waste characterization. The spoils consist of soil containing a mix of iron filings, carbon and clay, which are the basic ingredients of the electrodes and treatment zones in the Lasagna process. The analytical results from this sampling event will be used to determine final disposition of this waste.

The project now includes a revised Feasibility Evaluation rather than the earlier proposed Feasibility Study. The proposed public comment period for the Proposed Remedial Action Plan is Feb. 23 — April 8, 1998. Both a public meeting (DOE) and a public hearing (KDEP) were tentatively scheduled (contingent on a public request by April 16) for March 24 in the Paducah

Public Library. Because neither was requested, a cancellation notice will appear in the March 22 edition of The Paducah Sun. KDEP and EPA have conditionally approved the PRAP.

If full-scale remediation is undertaken, the remediation will be funded by EM-40 (the office of the Deputy Assistant Secretary for Environmental Restoration), which funds the remainder of Paducah's Environmental Restoration and Waste Management program.

Waste Area Groups 1 & 7/C-746-K Landfill, Kentucky Ordnance Works
WAG 1 consists of a fire training area, the plant sewage treatment facility and a known trichloroethylene spill site inside the PGDP security fence. WAG 7 consists of five underground storage tanks at the plant water treatment facility, and an inactive sanitary landfill outside the security fence. Three SWMUs are connected with the former Kentucky Ordnance Works (KOW) and are located on the DOE reservation. They are the KOW sewage treatment facility, a known Toluene spill site and a burn area.

The current proposed plan includes continued controlled access, groundwater monitoring and deed restrictions in the preferred alternative. DOE signature of the Record of Decision came in February, with EPA and KDWM expected to sign the ROD in late March.

Two wells were recently abandoned at the landfill and a new monitoring well has been installed.

Waste Area Group 3/burial grounds
WAG 3 is composed of three burial grounds within the PGDP security fence — C-747 Contaminated Burial Yard (SWMU 4), C-746-F Classified Burial Yard (SWMU 5) and C-747-B Burial Yard (SWMU 6). The yards, located in the western section of PGDP, contain natural and slightly depleted uranium, Technetium-99, magnesium fluoride, uranium-contaminated solid waste, security-classified weapons components, radionuclide-contaminated scrap metal, and slag from nickel and aluminum smelters.

The D2 Remedial Investigation/Work Plan was issued to regulatory agencies on Nov. 13, 1997.

The state agency has exercised its option for a seven-day extension to comment on the document, pushing the date from Feb. 13, 1998 to Feb. 20, 1998.The state faxed its comments on March 4. As of March 18, 1998, there has been no response from the EPA.

Waste Area Group 6/Trichloroethylene spill site
The C-400 TCE spill site is a major source of TCE in the groundwater and soil. The Industrial Hydrogeologic Study focused on piping, utilities and building foundations in the C-400 building area to determine how these man-made structures and systems influence groundwater infiltration and flow.

The data from this investigation was used to prepare a WAG 6 Remedial Investigation Work Plan which focuses on contaminant distribution and movement. Treatability studies to get data necessary to remediate contaminants expected to be found during the investigation have been completed.

All of the borings for the remedial investigation have been completed and data is in the process of being validated. Following completion of the RI/FS, a Proposed Plan and Record of Decision for the preferred remedial action will be developed. The selected action will be designed and implemented following the signing of the ROD.

Waste Area Groups 9 & 11
WAGs 9 & 11 are composed of seven below ground liquid containment vessels.
The scope of work for this project includes development of an Site Action Plan, field sampling and development of a Site Evaluation Report. Historical analytical data has been transmitted

electronically to the Kentucky Division for Waste Management, and the data assessment report completed and delivered to DOE and KDEP.

Initial cost estimates for field work and the Site Evaluation are finished, and approval has been granted by KDEP.

Waste Area Group 22/Burial grounds
This project includes the investigation of burial grounds in the northwest corner of the plant (SWMUs 7 & 30) and in the west-central portion of the plant (SWMU 2). Original plans included installation of a cap at SWMU 2, the C-749 Uranium Burial Ground, but investigation activities have determined that the buried material was saturated in the water table, indicating a cap would have limited effect. DOE was advised by the Kentucky Division of Waste Management in the fall of 1997 that it will issue a letter requiring the DOE to excavate the buried wastes at SWMU 2.

The development of a Feasibility Study is ongoing at SWMUs 7 & 30 (the C-747-A Uranium Burial Ground and C-747-A Burn Area). This report is due to be issued to the regulatory agencies on March 30, 1998. The Feasibility Study for SWMUs 2 & 3 was issued to the Regulatory Agencies on Nov. 26, 1997. Regulatory comments were due Feb. 28, 1998, but EPA requested a 30-day extension. Comments are now due March 30, 1998.

Waste Area Group 23/Polychlorinated Biphenyls (PCBs) Spill Sites
The DOE recently finished excavation of approximately 175 cubic yards of contaminated soil at several PCB sites. The excavation and temporary on-site storage of the contaminated soil was necessary to eliminate risk to workers from contact with soil.

These sites include eight SWMUs inside the security fence, and one outside the fence, located near the C-611 Water Treatment Facility fence. One of the SWMUs is actually a part of WAG 27, but has been grouped with the WAG 23 SWMUs because it has similar physical characteristics and contamination present.

Past use of PCBs and subsequent accidental spills and leaks of oils that contain PCBs caused the surface soil contamination at the SWMUs.

This action was performed with an Engineering Evaluation/Cost Analysis Summary for the cleanup and an Action Memorandum. This process allows for the non-time critical removal action to be completed with DOE approval. The final disposition of the soil will be determined at a later date, consistent with applicable laws and regulations.

A continuing issue is the disagreement between the Commonwealth and DOE on the PCB clean-up level.

Waste Area Group 27/Potential trichloroethylene sources (MAP ATTACHED)
WAG 27 consists of potential or known sources of trichloroethylene on the west side of the Paducah Gaseous Diffusion Plant. This includes 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. SWMU 1 is part of WAG 27, but excavation work was recently completed at this SWMU to remove dioxin contamination as part of the WAG 23 removal actions.

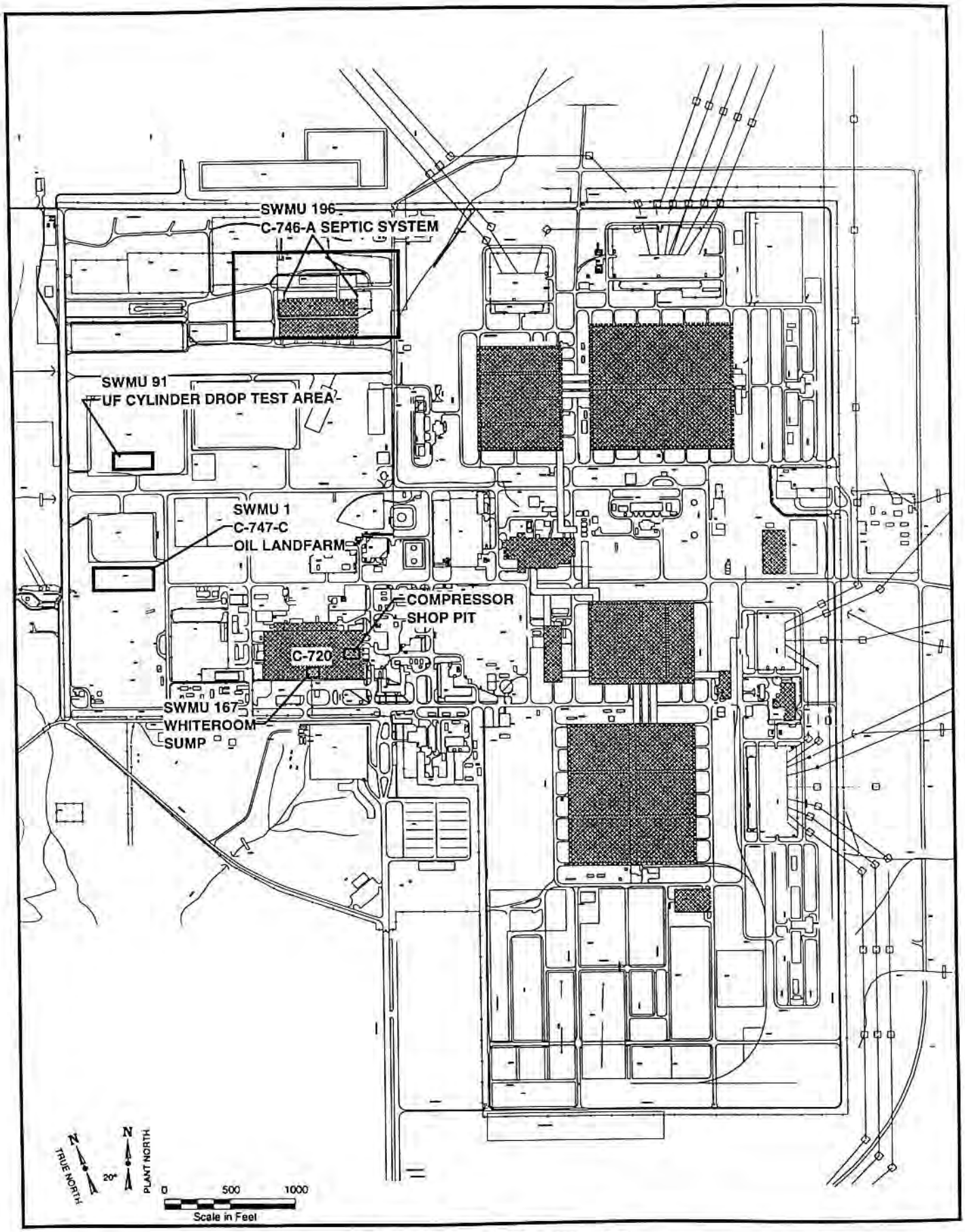
Shallow drilling, sampling and field analytical work began in February 1998, with an approved work plan outlining more than 100 soil borings to be taken, more than 20 of which require deep drilling. Environmental and waste characterization samples have been contracted to be shipped to four labs — K-25 Analytical Lab in Oak Ridge, CORE Labs in Denver, Colo., Southwest Laboratory in San Antonio, Texas, and C-710 at PGDP (LMUS). Analyses to be performed include radiological, volatiles (TCE and its degradation products), metals and PCBs.

On March 17, deep drilling began at the northwest corner of C-720, following an OSHA refresher for drillers and a safety walkdown that emphasized safe positioning of personnel and use of proper tag line equipment to handle heavy drilling rods.

The week of March 9, 6 borings were completed and 31 samples were collected. Volatile and radiological screening was performed on these samples, and 178 analytes were jprepared to be shipped off-site to analytical laboratories for further analysis. Normally, that shipment would be handled by the subcontractor, CH2MHill. However, following an occurrance at Oak Ridge National Laboratories, LMES has temporarily halted off-site sample shipments by subcontractors. A DOE Type B investigation has been convened. After review and approval of local protocols, permission to restart is expected by Friday, March 20, 1998.

Following the remedial investigation, a Feasibility Study will be completed prior to a Proposed Plan. It is in the Proposed Plan that DOE names the "preferred" alternative for remediation. Following a public comment period on this plan, DOE issues a Record of Decision, first internally, then to the regulatory agencies, then to the public.

The Administrative Record File for WAG 27 is available at the DOE Environmental Information Center. Access to the ARFs may be obtained by contacting Shelley Hawkins at the DOE Environmental Information Center, West Kentucky Technology Park, U.S. 60 Kevil, Ky. 42053. Phone 502-462-2550, 7:30 a.m. - 4:30 p.m. weekdays.



Waste Area Group 27

Vortec Vitrification Project

DOE has just completed an Environmental Assessment (EA) before continuing construction on the project. Argonne National Laboratory (ANL), which conducted a site visit in August, prepared the EA. DOE chose ANL because ANL had no prior knowledge of the Vortec system or Paducah's waste management program. DOE's original plan for release the EA for public review the week of Feb. 23 was preempted because of extensive internal review. Attached to this set of project updates is the public notice that will appear in the Friday, March 20 edition of The Paducah Sun.

U.S. DEPARTMENT OF ENERGY
PUBLIC NOTICE

To comply with the requirements of the National Environmental Policy Act (NEPA) of 1969, the U.S. Department of Energy (DOE) has prepared an Environmental Assessment (EA) of the potential impacts from construction and operation of the Vortec Corporation Cyclone Melting System technology at the Paducah Gaseous Diffusion Plant (PGDP) in Paducah, Ky. With this assessment, DOE has evaluated the capability of the Vortec system for treating low-level radioactive, Resource Conservation and Recovery Act (RCRA) hazardous and Polychlorinated Biphenyls (PCB) mixed (radioactive, PCB and RCRA-hazardous) waste, primarily contaminated soils, currently stored at PGDP. The Vortec system would use a glass-making technology known as vitrification to melt wastes into a solid product that will meet the land disposal requirements of RCRA.

The EA was prepared in accordance with the President's Council on Environmental Quality (CEQ) regulations implementing NEPA (40 CFR Parts 1500-1508) and DOE NEPA Implementing Procedures and Guidelines (10 CFR 1021). **The public is invited to comment on the draft EA from March 20 - April 20, 1998.**

Based on the impacts analysis of the Environmental Assessment, DOE will determine whether to issue a Finding of No Significant Impact (FONSI) for the proposed Vortec project or prepare an Environmental Impact Statement (EIS), which would further study the project's impact to human health and the environment. The draft EA is presently available for review at the Environmental Information Center located in the West Kentucky Technology Park, 175 Freedom Boulevard, Kevil, Ky., 42053. The center is open from 7:30 a.m. to 4:30 p.m. Monday-Friday, telephone 502-462-2550.

For information about the Vortec project, please contact:

W. David Tidwell
U.S. Department of Energy
P.O. Box 1410
Paducah, Ky. 42001
Phone 502-441-6807
Fax 502-441-6801

OR

Dennis Hill
Lockheed Martin Energy Systems
761 Veterans Ave.
Kevil, Ky. 42053
Phone 502-441-5099
Fax 502-441-5101

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FEDERAL FACILITY AGREEMENT

FOR THE

PADUCAH GASEOUS DIFFUSION PLANT

EI00802-0001

U.S. Department of Energy
Public Notice

The Paducah Gaseous Diffusion Plant is among sites included in a draft strategy document designed as part of an initiative to efficiently complete cleanup at U.S. Department of Energy sites nationwide. The plant is located in west McCracken County, Kentucky. The U.S. Department of Energy owns the facility and is responsible for environmental cleanup.

The public is being asked to comment on "Accelerating Cleanup: Paths to Closure," from March 3, 1998 through April 30, 1998. The document, formerly known as the "Ten-Year Plan" and "Accelerating Cleanup: Focus on 2006," focuses on the Oak Ridge Operations complex, which includes facilities in Paducah, Portsmouth, Ohio and Oak Ridge, Tenn.

A national document is also available for comment. Both drafts are available at the Paducah Public Library, 555 Washington St., and the DOE Environmental Information Center in the West Kentucky Technology Park, 175 Freedom Blvd. The center is open 7:30 a.m.-4:30 p.m. M-F, or by appointment.

Comments on the Oak Ridge Operations document should be sent to Estraletta Green, U.S. Department of Energy, EW-90, Oak Ridge Operations Office, P.O. Box 2001, Oak Ridge, Tenn., 37831-8540. Comments on the national document should be sent to Gene Schmitt, U.S. Department of Energy, P.O. Box 44818, Washington, D.C. 20026-4481

A public meeting to discuss the documents is planned for 7 p.m., Thursday, April 2, 1998 in the Eisenhower Room of the Executive Inn Convention Center, 1 Executive Blvd., Paducah, Ky.

All comments made during the comment period will be addressed in the final document.

U.S. Department of Energy Public Notice

The U.S. Department of Energy, in conjunction with the United States Environmental Protection Agency Region IV and the Commonwealth of Kentucky, announces the availability of the Federal Facilities Agreement (FFA) for the Paducah Gaseous Diffusion Plant (PGDP). The purpose of the FFA, an integrating agreement among these three entities, is to provide a comprehensive set of guidelines agreed upon by DOE, EPA and the Commonwealth for PGDP cleanup.

The Comprehensive Environmental Response Compensation and Liability Act (CERCLA) requires sites listed on the National Priorities List (NPL) to enter into a Federal Facilities Agreement with EPA. The PGDP was placed on the NPL on May 31, 1994.

Because PGDP is also governed by the Resource Conservation and Recovery Act (RCRA), which is administered by the Commonwealth of Kentucky, the FFA integrates CERCLA (Superfund) and RCRA (hazardous waste) requirements in order to streamline the cleanup process by reducing the duplication of efforts that would be required under the two acts if complied with separately.

The FFA is available at the Paducah Public Library, 555 Washington St., and the DOE Environmental Information Center in the West Kentucky Technology Park, 175 Freedom Blvd. The center is open 7:30 a.m.-4:30 p.m. M-F, or by appointment.

A.M. BRIEFING
CALENDAR

INVESTMENT SEMINAR PLANNED THURSDAY

Dr. Suzanne Badenhop, University of Kentucky extension specialist for Family Resource Management, will conduct a free investment seminar at 6 p.m. Thursday at the McCracken County Extension Center, 2705 Olivet Church Road. Most employers today offer 401k or 403b retirement plans that require the employee to make decisions about where retirement funds are invested. Participants at the seminar will learn how to read the newspaper financial page and where to find information on investing.

INTERRACIAL MEN'S GROUP TO MEET FRIDAY

The Interracial Men's Group will meet at 8 a.m. Friday in the Garden Restaurant of the Executive Inn. Bob Qualls of the Paducah Area Chamber of Commerce and Everett Fair of the Western Kentucky Economic Development Corp. will speak on job-related issues.

For more information, contact Gregory Waldrop at 444-9997 or Anton Reece at 554-9200.

BOOK CELLAR TO HOST ENVIRONMENTALIST

Environmentalist Craig Rhodes will discuss toxic pollution and cancer at 8 p.m. Friday at The BookCellar, 409 Broadway. He will discuss "Living Down," a new book by biologist Sandra Steingraber that includes toxic-release data and new cancer registry data.

Rhodes is a member of the Site Specific Advisory Board which oversees and makes recommendations regarding clean-up efforts at the Paducah Gaseous Diffusion Plant. He has taught environmental education for Paducah schools at the Land Between the Lakes Youth Station and is a charter member of the Regional Association of Concerned Environmentalists. For further information, phone 575-3452.

EAGLES BENEFIT FOR MISSY JENKINS SATURDAY

Fraternal Order of Eagles District 5 will conduct a benefit for Missy Jenkins Saturday at the River City Eagles Club, 1919 Cairo Road.

Steak dinners will be served from 11 a.m. to 8 p.m. (dine in or carry out). Cost is $8. Entertainment will begin at 2 p.m. For more information, phone Allen Buchanan at 442-3469 or any local Eagles club.

DOE NEWS

MEDIA CONTACT:
Jeannie Brandstetter, 441-5105

FOR IMMEDIATE RELEASE
March 12, 1997

DOE ADVISORY BOARD HOSTING MONTHLY MEETING

The U.S. Department of Energy's Site Specific Advisory Board (SSAB) will meet at 5 p.m. Thursday, March 19, in the Van Buren Room of the Executive Inn Convention Center in Paducah.

The SSAB meets monthly to discuss and develop recommendations on high-level policy issues, including cleanup strategies, technology development, and long-term waste management issues. Board meetings are open to the public.

For more information, please contact Carlos Alvarado at 441-6804.

—30—

DOE NEWS

MEDIA CONTACT:
Jeannie Brandstetter, 441-5105

FOR IMMEDIATE RELEASE
March 12, 1997

DOE ADVISORY BOARD HOSTING MONTHLY MEETING

The U.S. Department of Energy's Site Specific Advisory Board (SSAB) for the Paducah Gaseous Diffusion Plant will meet at 5 p.m. Thursday, March 19 in the Van Buren Room at the Executive Inn Convention Center.

Agenda items include administrative plans for the board, Decontamination & Decommissioning work at PGDP, the Site Treatment Plan and a presentation by Bechtel Jacobs Company, DOE's new managing and integrating contractor for environmental management work at the site.

The board is comprised of 20 representatives from local communities as well as governing bodies and other interested groups potentially affected by cleanup decisions at the Paducah Gaseous Diffusion Plant.

The SSAB meets monthly to discuss and develop recommendations on high-level policy issues, including cleanup strategies, technology development, and long-term waste management issues. Board meetings are open to the public.

For more information, please contact Carlos Alvarado at 441-6804.

—30—

PUBLIC NOTICE OF MEETING CANCELLATION
U.S. Department of Energy
Paducah Gaseous Diffusion Plant

DRAFT

A public meeting and hearing scheduled for March 24 on the Proposed Plan to address Remedial Action for Solid Waste Management Unit (SWMU) 91 (the former Cylinder Drop Test Area) at the Paducah Gaseous Diffusion Plant (PGDP) has been cancelled because no requests were made by March 16. However, comments on the document will be accepted through April 8.

Investigation of the unit revealed trichloroethylene (TCE) contamination in the shallow soil and groundwater. The Proposed Plan describes DOE's preferred remedial option for preventing off-site ground water from exceeding allowable limits. The remedy is a form of in-situ remediation (treating the soil in place) known as the Lasagna™ process, which uses buried electrodes to move water through contaminated soil. The water moves contaminants from the soil as the water passes through treatment zones. This technology has been tested at PGDP and has proven effective at treating TCE-contaminated soil with minimal risk to workers and the environment.

The Proposed Plan complies with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), also known as the Federal Superfund Law, and Resource Conservation and Recovery Act (RCRA), and complies with federal and state hazardous waste management laws and regulations. The plan, jointly issued with the Commonwealth of Kentucky, will also serve as a Statement of Basis for modifying the facility's Hazardous Waste Permit to include this action.

Following the public comment period, DOE will prepare a Record of Decision (ROD) for the selected remedial action. The Proposed Remedial Action Plan is available at these locations:

The Proposed Remedial Action Plan is available for review at the following locations:

U.S. Department of Energy
Environmental Information Center
175 Freedom Blvd.
Kevil, KY 42053
502-462-2550

Paducah Public Library
555 Washington St.
Paducah, KY 42001
502-442-2510

Kentucky Div. of Waste Management
14 Reilly Road
Frankfort, Ky. 40601
502-564-6716, ext. 247

Comments on the Proposed Plan can be submitted to Dennis Hill, Lockheed Martin Energy Systems Inc., 761 Veterans Ave., Kevil, Ky., 42053. Comments on the Statement of Basis can be submitted to Robert H. Daniell, Kentucky Division of Waste Management, 14 Reilly Road, Frankfort, Ky., 40601. The cabinet secretary will consider all comments received by the close of the public comment period in making a final decision. If the final decision is substantially changed, the cabinet will issue a public notice indicating the revised decision.

Sunday, March 22

Decontamination & Decommissioning Surveillance & Maintenance

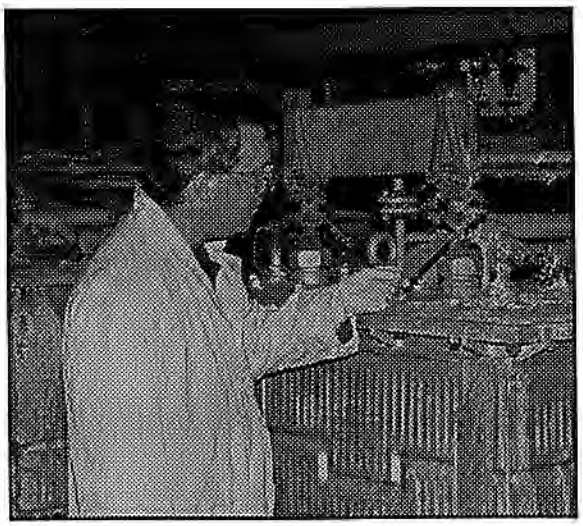
The Paducah Gaseous Diffusion Plant Decontamination and Decommissioning Program provides for the management and final disposition of shutdown DOE facilities accepted for decontamination and decommissioning. The program was organized during fiscal year 1989 to provide for the disposition of facilities that were no longer required to fulfill the mission and operation of the plant.

Most PGDP facilities remain active in day-to-day operation of the plant. As a result, structural integrity has been maintained. A few facilities are in standby mode and exhibit varying degrees of deterioration..

To date, two facilities have been accepted into the program as D&D facilities — the C-340 Metals Plant and the C-410 Feed Plant. Current work consists of routine inspection of the facility to maintain compliance, housekeeping and preventive maintenance and repairs to the structures.

These facilities are specifically related to the operation or support of uranium enrichment by the gaseous diffusion method, and as such, the piping, process equipment and some of the surrounding environment are contaminated with low-level radioactive material from the process gas, principally uranium-238, from uranium hexafluoride and transuranics from reprocessing spent reactor fuel. In addition, various hazardous materials, including trichloroethylene, polychlorinated biphenyls and asbestos are also present.

Recent work at the C-410 Feed Plant has included preparation for the off-site shipment of 34 fluorine cells to be transferred from DOE to the Department of Defense. This is the first move in a facility stabilization project to allow for waste minimization at the site. About 70 cells remain.



Recent work in the C-410 former feed plant involved preparation of fluorine cells for off-site shipment.

D &D activities include the following:

✔ providing surveillance and maintenance (S&M) activities in support of facilities in standby awaiting D&D,
✔ developing specific methods, schedules and funding plans for the D&D of shutdown facilities, and
✔ implementing plans to provide for facility disposition in a safe, effective and cost-effective manner.

To accomplish S&M, a formal plan has been prepared to document and direct the S&M requirements for facilities awaiting D&D.

S&M Program Objectives:

✔ ensure adequate containment of residual radioactive and hazardous materials remaining in the facilities,
✔ provide safety and security controls to minimize the potential hazards to on-site personnel and the general public,
✔ maintain facility excellence and prepare facility for final disposition, and
✔ maintain compliance with applicable regulations.

Scope of the S&M Plan:

The S&M plan provides for the S&M requirements appropriate for each facility from the time the facility is accepted into the D&D Program until a facility's D&D activities are complete. The plan provides:

✔ a description of the program structure including functional and reporting responsibilities;
✔ the security and safeguard requirements for general employee, radiological, health and safety, environmental and personnel training,
✔ the requirements for facility maintenance including scheduled and special maintenance activities;
✔ documentation of program activities;
✔ quality assurance requirements;
✔ project summaries describing facility characteristics pertinent to S&M and estimates of annual resource commitments to carry out S&M; and
✔ an integrated S&M strategy that will summarize the resource requirements used in a budget planning base for near-term (<10 years) program funding requirements.

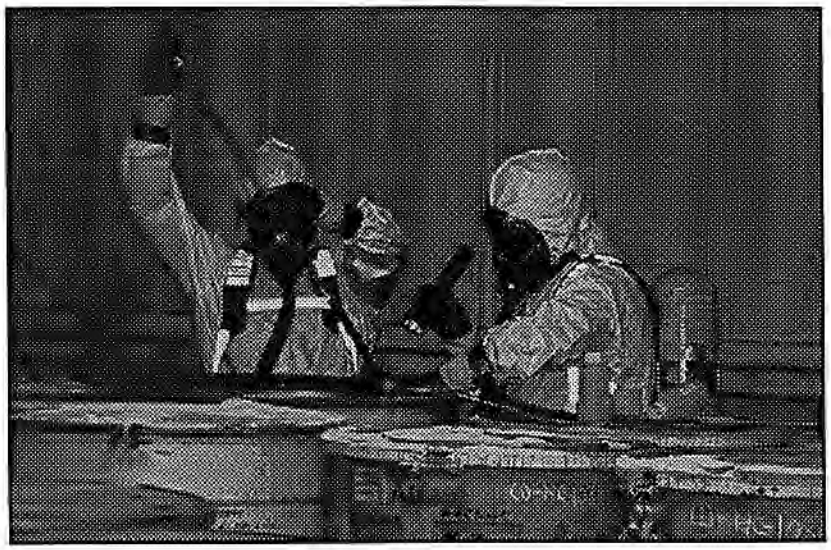
Site Treatment Plan

Under the Federal Facility Compliance Act (FFCAct) of 1992, the Department of Energy is required to develop site treatment plans for each site where it generates and/or stores mixed wastes. The FFCAct also requires the hazardous components of mixed waste to be treated before disposal.

A large portion of the waste in storage at PGDP has been characterized and is scheduled for off-site treatment using a variety of options, including non-thermal stabilization, macroencapsulation, incineration and recycling.

To date, all reporting requirements, and compliance date (milestones) listed in the PGDP STP have been met.

The PGDP Site Treatment Plan includes the following:



July 1993 — present

✔ 2030 containers were pumped & the liquid shipped to the K-25 TSCA incinerator
✔ 809 ash receivers have been characterized
✔ 1,081 containers sampled
✔ 716 containers characterized
✔ 52 containers shipped for macroencapsulation treatment and disposal at Envirocare of Utah
✔ 7 containers shipped for treatability studies at Oak Ridge National Laboratories
✔ 11 containers were shipped as part of treatability studies

Fiscal Year 1997 activities

✔ 480 containers sampled
✔ 7 containers were determined to be non-hazardous
✔ 23 containers were made RCRA empty (22 of these containers are empty and can be reused, one (1) container had less than 1 percent residue).
✔ 276 containers were characterized

Waste matrices:

✔ metal and plastics debris
✔ lab packs
✔ soft combustibles
✔ wooden pallets
✔ liquids
✔ miscellaneous mixed waste solids

Fiscal Year 1998 Proposed Treatment/Disposal Shipments

✔ Envirocare of Utah: containers of glass and metal debris, ash receivers residue
✔ Idaho National Environmental and Engineering Lab: soft combustibles and paint
✔ OHM: miscellaneous liquids
✔ OHM: treatability study (activated carbon)
✔ Treat 36 containers of acid waste from the C-746-Q drum rupture and ship treated waste to Hanford

Fiscal Year 1998 Proposed Sampling Activities

Eighteen sampling events are planned, including 607 containers from 85 PGDP waste streams
Waste matrices:
✔ concrete, brick/mortar and HEPA filters
✔ metal and plastics debris
✔ sludge (including residual TSCA shipment sludge)
✔ lab packs
✔ activated carbon
✔ soft combustibles (Tc-99 tank)
✔ magnesium fluoride pellets
✔ liquids (including high radiological liquid tank)

Site Specific Advisory Board Office Equipment

The office which will be used by the SSAB at the Information Age Park in West Paducah is 9 ½ feet wide by 14 feet long.

Office Equipment

Description	Price	Catalog Number
Desk — 72 x 36" double pedestal	$652.00	OID-10404 (Page 20)
High back swivel/tilt chair	$245.00	HON-4001GG16T (Page 77)
Deluxe folding table 25 x 36 x 26 ½" economy series	$125.00	BVS-F2436WA (Page 167)
Guest chairs without arms	4 for $143.00 each @ $572.00	HON-4004GG16T (Page 77)
Filing cabinets — four-drawer, letter size, 25" deep with locks	2 for $237.00 each @ $474.00	HON-514P-Q (Page 134)
Cordless telephone with digital answering machine	$199.00	ATT-22213 (Page 945)
Overhead projector — 3M Model 2000 portable	$716.47	MMM-2000-AG (Page 186)
Easel with dry-erase board — 27 x 36 ½"	$311.00	BRE-OR8504-BK(Page 149)
Swivel-arm brass lamp	$84.95	ARS-9120 (Page 668)
In/out front load desk trays	2 for $8.39 each @ $16.78	RUB-2370001 (Page 461)
Waste basket — 7-gallon	$5.50	TEN-16021 (Page 970)
Bookshelf — 60", three shelves	$214.00	OID-86401 (Page 50)
Box of pens	$1.19 for a dozen	PAP-963-01 (Page 781)
Box of pencils	$1.89 for a dozen	UNV-55400 (Page 764)
Scissors	$6.95	ACM-4151E-8 (Page 888)
Calendar/appointment book	$15.80	AAG-70-207-05 (Page 296)
Full strip stapler	$11.39	SWI-54501 (Page 917)
Tape dispenser	$5.63	MMM-C38-BK (Page 936)
Tape	$2.44	MMM-810-12-12 (Page 937)
Reinforced hanging file folders	$18.59 for a box of 25	ESS-4152-1/5 (Page 530)
Dry erase board — 24 x 18"	$32.75	QRT-7551 (Page 248)
Compact desk organizer	$2.99	TEN-24101 (Page 466)
Note/message center	$37.31	FEL-36220 (Page 470)
Message book	$7.95	TOP-4001 (Page 596)
Avery mailing labels	$13.32 for 25 sheets	AVE-5354 (Page 657)
Envelopes	$18.35 for 500	QUA-90070 (Page 504)
Note pads 5 x 8" Letter	$10.60 per dozen $16.60 per dozen	TOP-7500 (Page 741) TOP-7533 (Page 741)
Hi-liters — six-color pack	$4.50	BIC-BLP-61 (Page 791)
Three-hole punch	$54.00	ACC-74250 (Page 835)
Cost of Furniture and Supplies	**$3,877.95***	

* This price will be discounted approximately 30% upon the order from Jacobs

GLOSSARY OF USEFUL TERMS FOUND IN EMBAM, RISK ASSESSMENT, AND WASTE MANAGEMENT REPORTS

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

A

ACRS: Advisory Committee on Reactor Safeguards

AEC: Atomic Energy Commission, 1947-1974. Broken up in 1974 into the Energy Research and development administration (ERDA) and the Nuclear Regulatory Commission (NRC). ERDA later became the Department of Energy (DOE).

alpha decay: The emission of a nucleus of a helium atom from the nucleus of an element, generally of a heavy element, in the process of its radioactive decay.

alpha particle: The nuclei of a helium atom (with two neutrons and two protons each) that are discharged by radioactive decay of many heavy elements, such as uranium-238 and plutonium-239.

alpha radiation: Radiation consisting of helium nuclei (atomic wt. 4, atomic number 2) that are discharged by radioactive disintegration of some heavy elements, including uranium-238, radium-226, and plutonium-239.

atomic number (symbolized Z): The number of protons in a nucleus. It determines the chemical properties of an element.

atomic weight: The nominal atomic weight of an isotope is given by the sum of the number of neutrons and protons in each nucleus. The exact atomic weight differs fractionally from that whole number, because neutrons are slightly heavier than protons and the mass of the nucleus is also affected by the binding energy.

B

becquerel: A unit of radioactivity equal to one disintegration per second. It is an extremely small unit, equal to about 27 picocuries.

beta decay: The emission of electrons or positrons (particles identical to electrons, but with a positive electrical charge) from the nucleus of an element in the process of radioactive decay of the element.

beta particle: Electrons or positrons (positively charged electrons) emitted by many elements in the course of radioactive decay.

beta radiation: Radiation consisting of electrons or positrons emitted in many radioactive disintegrations, at speeds approaching the speed of light.

binding energy: The energy that is required to separate the nucleons in a nucleus into separate, free particles.

breeder reactor: A reactor that is designed to produce more fissile material than it consumes; also sometimes called "fast reactor" since most
breeder reactors use fast neutrons for sustaining the nuclear chain reaction.

BTU: British thermal unit. The amount of energy gained by a pound of water when its temperature is increased by one degree Fahrenheit.

burn-up: The amount of energy that has been generated from a unit of nuclear fuel; usually measured in megawatt-days per metric ton of initial heavy metal.

C

calorie: A unit of heat or energy sufficient to raise the temperature of 1 gram of water by 1 degree Celsius. In dietetics, the kilocalorie is the unit usually used, frequently called a "calorie," omitting the prefix.

CERCLA (Comprehensive Environmental Restoration and Compensation Liability Act): Cleanup Program focuses on human health and environmental concerns related to human health. The cleanup program is primarily carried out by EPA, working with States, on sites designated for cleanup on the NPL. Cleanup Program emphasizes local source control, prevention of further spread from sources. Cleanup Program is prohibited from "restoring" natural resources, although cleanup may prevent further injuries to natural resources.

CH (contact handled) waste: TRU waste that requires little or no shielding and emits a maximum external radiation dose rate of 0.2 rem/hr (200 mrem/hr).

controlled liquid waste is waste that meets the definition of a liquid waste and is in a container or piping system; a waste stream that can be shut off without a release to the environment.

critical mass: The amount of a fissile substance that will allow a self-sustaining chain reaction. The amount depends both on the properties of the fissile element and on the shape of the mass.

curie: Unit of radioactivity equal to the radioactivity of 1 gram of radium -226. It is equal to 37 billion disintegrations per second.

D

decay correction: The amount by which the calculated radioactivity (for example, of a release of radioisotopes) must be reduced after a period of time, to allow for its radioactive decay during that time.

decommissioning: Decontamination and dismantlement of retired, contaminated facilities and removal and/or disposal of the resulting wastes.

DWPF: Defense Waste Processing Facility, the name of the vitrification plant for high-level radioactive wastes at the Savannah River Site.

E

ELCR (excess lifetime cancer risk): Potential carcinogenic effects that are characterized by estimating the probability of cancer incidence in a population of individuals for a specific lifetime from projected intakes (and exposures) and chemical-specific dose-response data (i.e., slope factors). By multiplying the intake by the slope factor the ELCR result is a probability.

electron: An elementary particle carrying 1 unit of negative electric charge. Its mass is 1/1837 that of a proton.

EMBAM (Environmental Management Benefit Assessment Matrix): a management tool to evaluate and categorize EM activities based on the risks associated with the activities of each project.

external radiation dose: The dose from sources of radiation located outside the body. This is most often from gamma rays, though beta rays can contribute to dose in the skin and other relatively superficial tissues.

exposure: contact of an organism with a chemical, radiological, or physical agent. Exposure is quantified as the amount of the agent available at the exchange boundaries of the organism (e.g.; skin, lungs, gut) and available for absorption.

F

fissile material: A material consisting of atoms whose nuclei can be split when irradiated with low energy (ideally, zero energy) neutrons.

fissile uranium: these isotopes can be split by low to zero energy neutrons in a self-sustaining chain-reaction to release enormous amounts of energy. Natural uranium consists of only 0.711 % U-235, 99.28305 % U-238, and 0.0054 % U-234. U-235 is so fissionable with slow neutrons that a self-sustaining fission chain-reaction can be made to occur in a reactor constructed from natural uranium and a graphite moderator. Standard nuclear reactors use uranium that has been enriched to 3 or 4 % U-235.

fissile Waste is a subcategory of the other radioactive waste types (LLW, TRU, HLW) that contains U^{233}, U^{235}, Pu^{238},Pu^{239}, and Pu^{241} of sufficient percentage to release energy by fission after absorbing neutrons.

fission: The splitting of the nucleus of an element into fragments. Heavy elements such as uranium or plutonium release energy when fissioned.

fission product: Any atom created by the fission of a heavy element. Fission products are usually radioactive.

fusion: The combining of two nuclei to form a heavier one. Fusion of the isotopesof light elements such as hydrogen or lithium gives a large release of energy.

G

gamma radiation: Electromagnetic waves released during radioactive decay that can ionize atoms and split chemical bonds. Gamma rays are similar to X-rays, the latter term being applied usually to electromagnetic waves generated by electron accelerators, as for instance in medical equipment.

gray: A unit of absorbed radiation dose equal to 100 rads.

H

half-life: The time in which half the atoms of a radioactive substance will have disintegrated, leaving half the original amount. Half of the residue will disintegrate in another equal period of time.

HI (hazard index): Potential noncarcinogenic (systemic) effects are characterized by comparing projected intakes of chemicals to toxicity values (i.e, reference doses). The numerical risk or hazard quotient estimates that results is a ratio. The ratio of the intake over the reference dose (hazard index) is compared to unity (1.0). If the quotient is less than 1, then the systemic effects are assumed not to be of concern; if the hazard quotient is greater than 1, then the systemic effects are assumed to be of concern. The hazard index is the sum of hazard quatients.

hazardous Waste (HAZ) is waste regulated under the Resource Conservation and Recovery Act (RCRA). RCRA regulates solid waste, hazardous waste, and Underground Storage Tanks (USTs) holding petroleum or certain chemicals. Waste that is ignitable, corrosive, reactive, toxic, or contains certain amounts of toxic chemicals is considered hazardous according to the RCRA definition. In Oak Ridge the term Hazardous Waste also included wastes regulated under the Toxic Substances Control Act (TSCA). These are wastes that are contaminated with polychlorobiphenyls (PCB's) and asbestos. When the term Hazardous Waste is used, it implies that the material can be certified NOT to be contaminated with radioactive material, otherwise the term Mixed Waste is used.

HEU: (highly enriched uranium): An important fissile material that has been used for nuclear weapons, usually defined as uranium whose proportion of uranium-235, the fissile isotope of uranium, has been increased to over 90%.

HLW (high level waste): generally the highly radioactive material resulting from reprocessing of spent nuclear fuel. This includes mainly the liquid wastes remaining from the recovery of uranium and plutonium in a fuel reprocessing plant. This HLW may also be in the form of sludge, calcine, or other products into which such liquid wastes are converted to facilitate their handling and storage. Such waste contain fission products and traces of TRUs that result in the release of considerable decay energy. For this reason, heavy shielding is required to absorb penetrating radiation, and cooling systems) are needed to dissipate decay heat from HLW. Currently, no HLW exists on the Oak Ridge Reservation.

I

induced radioactivity: Radioactivity produced in any material as a result of nuclear reactions, especially by absorption of neutrons.

internal radiation dose: The dose to organs of the body from radioactive materials inside the body. It may consist of any combination of alpha, beta, and gamma radiation.

ionize: To split off one or more electrons from an atom, thus leaving it with a positive electric charge. The electrons usually attach to other atoms or molecules giving them a negative charge.

isotope: Atoms of the same element that have the same number of protons (and hence the same chemical properties), but a different number of neutrons, and therefore, different atomic weights.

K

kiloton (KT): In the context of nuclear weapons, this term, which means 1,000 tons, is always used as a measure of explosive power. It is equal to the explosvie power of 1,000 tons of TNT.

L

LEU: (low enriched uranium). Most nuclear reactors run on LEU, which is usually 3%-5% uranium-235. LEU cannot be used in nuclear weapons.

liquid Waste is any waste material that is determined to contain "free liquids" as defined by Method 9095 (Paint and Filter Liquid Test), as described in "Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods," Environmental Protection Agency (EPA), Pub. No. SW-846, November 1986. Liquid waste may then be classified as controlled, uncontrolled, or sanitary.

LLW (low level waste): is radioactive waste that is more easily described by what it is not. This is even true of the Policies Acts and Regulations that define LLW as radioactive material that is not TRU, HLW, spent nuclear fuel, or by product material from uranium, plutonium, or thorium mines (Atomic Energy Act section 11(e)2 by-product material). LLW can consist of short-lived and long-lived isotopes.

M

mass number (symbolized A): The sum of the number of protons and the number of neutrons in a nucleus.

MEM: A management tool to evaluate and categorize EM activities based on the risks associated with the activities of each project.

micron: One one-millionth of a meter.

mill tailings: A slurry of about 40 percent solids (including radioactive particles and chemically hazardous metals) and 60 percent liquid, primarily water.

mixed waste: Any radioactive waste that meets the requirements of LLW that contains a RCRA hazardous component. Also, mixed waste is waste that contains both hazardous waste and radioactive material (source, special nuclear, or by-product material as regulated by the Atomic Energy Act of 1954 [42 U.S.C. 2011 et seq.1). Mixed waste is classified by DOE according to the type of radioactive waste that it contains as either mixed low-level waste (MLLW), or mixed transuranic waste (MTRU). DOE's high-level waste (HLW) is assumed to be mixed waste because it contains hazardous components or exhibits the characteristic of corrosivity. If the radionuclides are those that have an atomic number greater than 92, have a half life longer than 20 years, and are present in concentrations greater than 100 nanocuries/gram the waste is termed Mixed TRU waste. The waste in Oak Ridge is predominantly Mixed Low Level Waste.

metric ton: 1,000 kilograms of about 2,204 pounds. The usual U.S. ton measurement, called a short ton, is 2,000 pounds.

MOX: A fuel composed of a mixture of plutonium dioxide and uranium dioxide.

N

NARM wastes (Naturally-Occurring and Accelerator-Produced Radioactive Materials): are orphan wastes not consistently regulated under any current federal standard. NARM includes such materials as radium-226 and thorium-230 produced outside the nuclear fuel-cycle, and radionuclides produced by particle accelerators. NARM wastes are generated by both federal and non-federal facilities.

NPL: National Priority List.

NPT: The nuclear Non-Proliferation Treaty.

neutron: An elementary particle slightly heavier than a proton, with no electric charge.

nucleus: The nucleus of an atom is the central core that comprises almost all the weight of the atom. All atomic nuclei (except H-1, which has a single proton) contain both protons and neutrons.

NRDA (Natural Resource Damage Assessment): Restores natural resources by returning ecosystems to full function and compensating public for injuries to its resources. This is part of the natural resource management role of Department of Natural Resource trustees.

P

photon: The indivisible unit, or quantum, of electro-magnetic radiation. The energy of the photons determines the nature of the radiation, from radio waves at the lowest energy levels, up through infra-red, visible, and ultra-violet light, to X-or gamma-rays, which have energy high enough to ionize atoms.

plutonium: A highly toxic, heavy, radioactive metallic element. There are 15 isotopes of plutonium, of which only five are produced in significant quantities: plutonium-238, -239, -240, -241, and -242. Plutonium-239 is the most important plutonium isotope as it is fissile and is used in nuclear weapons and some reactors. One the other hand, plutonium-240 is unsuitable for use in nuclear weapons and reactor fuel. Thus, in a reactor whose main purpose is plutonium production, the rate at which plutonium-240 is formed controls the length of time fuel is allowed to remain under irradiation. Plutonium is categorized according to plutonium-240 content, as follows: super-grade has 2-3% Pu-240; weapons-grade has less than 7% Pu-240; fuel-grade has 7-18 (or sometimes given as 7-19) % Pu-240; and reactor-grade has 18 or greater (or 19 or greater) % Pu-240. (Note: Despite what the name implies, "reactor-grade" plutonium has been used successfully to make a nuclear bomb.)

positron: An elementary particle with a positive electric charge, but in other respects identical with an electron.

proton: An elementary particle with a positive electric charge and a mass that is given the value 1 on the scale of atomic weights.

pyrophoric uranium: Uranium metal is pyrophoric especially when finely divided. This is a fire hazard as any pyrophoric substance can spontaneously self-ignite when exposed to normal atmospheric conditions. Uranium and its compounds are highly toxic, both from a chemical and radiological standpoint.

R

RCRA: Resource Conservation and Recovery Act.
rad: A unit of absorbed dose of radiation defined as deposition of 100 ergs of energy per gram of tissue. It amounts to approximately one ionization per cubic micron.

radioactivity: The spontaneous discharge of radiation from atomic nuclei. This is usually in the form of beta or alpha radiation, together with gamma radiation. Beta or alpha emission results in transformation of the atom into a different element, changing the atomic number by +1 or -2 respectively.

radionuclide: any radioactive isotope.

reference dose: Toxicity value for evaluating noncarcinogenic effects of daily exposure to contaminant levels without appreciable deleterious effects during a lifetime.

RH (remote handled) waste: TRU waste that 1) emits an external dose rate greater than 0.2 rem/hr (200 mrem/hr) and less than or equal to 1000 rem/hr. 2) relatively large quantity of beta and gamma emitting radionuclides with half lives typically 30 years or less. 3) requires shielding.

relative biological effectiveness (RBE): A factor that can be determined for different types of ionizing radiation, representing the relative amount of biological change caused by 1 rad. It depends upon the density of ionization along the tracks of the ionizing particles, being highest for the heavy particles: alpha rays and neutrons.

rem: A unit of equivalent absorbed dose of radiation, taking account of the relative biological effectiveness of the particular radiation. The dose in rems is the dose in rads multiplied by the RBE.

reprocessing: The chemical separation of irradiated nuclear fuel into uranium, plutonium, and fission products.

risk: The product of: impact of severity (consequence) and impact of likelihood (probability). Specifically for carcinogenic effects, risk is estimated as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to a potential carcinogen. Specifically for noncarcinogenic effects, risk is not expressed as a probability but rather is evaluated by comparing an exposure level over a period of time to a reference dose derived for a similar exposure period.

roentgen: A unit of gamma radiation measured by the amount of ionization in air. In non-bony biological tissue 1 roentgen delivers a dose approximately equal to 1 rad.

S

sanitary waste: This waste stream consists of cardboard, paper, plastic, glass, metal, food waste, office waste, etc.

sanitary liquid waste: is non-radioactive and non-hazardous material that meets the definition of a liquid waste.

specific activity: A measure of the radioactivity of a unit weight (generally one gram) of material.

sievert: A unit of equivalent absorbed dose equal to 100 rems.

slope factor: Toxicity value for evaluating the probability of an individual developing cancer from exposure to contaminant levels over a lifetime.

solid waste: any solid, semi-solid, liquid and containerized gaseous material generated as a result of routine operations and/or construction/demolition activities. This is the legal definition per the Resource Conservation and Recovery Act.

solid sanitary waste: is non-radioactive and non-hazardous material including garbage, refuse, and other discarded solid sanitary waste materials including those materials resulting from industrial, commercial, and agricultural operations, and from community activities. Solid sanitary waste does not include solids or dissolved material in domestic sewage or other significant pollutants in water resources, such as silt, dissolved or suspended solids in industrial waste water effluents, dissolved materials in irrigation return flows or other common water pollutants.

spent fuel: Spent fuel consists of irradiated fuel discharged from a nuclear reactor. Three categories of spent fuel are: fuel from commercial light-water reactors (LWRs), fuel from non-LWR commercial reactors, and special fuels associated with government-sponsored research and demonstration programs, universities, and private industries.

spontaneous fission: The spontaneous splitting of the nucleus into two new nuclei, generally with the emission of one or more neutrons and the release of energy.

T

TCE: Trichloroethene (trichloroethylene) is an organic solvent and degreaser.

thermonuclear weapon: A nuclear weapon that gets a large part of its explosive power from fusion reactions.

ton: A metric ton is 1,000 kilograms. This is approximately 2,200 pounds, and very nearly equal to a British ton (2,240 pounds). The U.S. tone is 2,000 pounds.

TNT equivalent: The weight of TNT which would release the same amount of energy as a particular nuclear explosion. One ton of TNT releases approximately 1.2 billion calories (that is, 5.1 kiloJoules per gram). Nuclear explosions are usually measured in kilotons (KT) or megatons (MT).

tritium: A radioactive isotope of hydrogen whose nucleus contains one proton and two neutrons.

TRU (transuranic waste): waste that contains more than 100 nCi/g of alpha emitting isotopes with atomic numbers greater than 92 and half-lives greater than 20 years. Such wastes result primarily from fuel reprocessing and from the fabrication of plutonium weapons and plutonium-bearing reactor fuel. Generally, little or no shielding is required ("contact-handled" TRU waste), but energetic gamma and neutron emissions from certain TRU nuclides and fission-product contaminants may require shielding or remote handling ("remote-handled" TRU waste).

U

uncontrolled liquid waste: waste that meets the definition of a liquid waste and is not bounded by container or piping, e.g., runoff, natural ponds, streams.

Uranium chips waste: are machine turnings which were cut from uranium parts that consist of <1% U^{235} (loose chips or wool bundle).

W

WVDP: West Valley Demonstration Plant, the name of the vitrification plant for high-level radioactive wastes at West Valley, New York.

Y

yield: The energy released by a nuclear explosion.

COMMENT RESPONSE PACKAGE

PADUCAH FEDERAL FACILITY AGREEMENT

PUBLIC COMMENT PERIOD

APRIL 19-JUNE 19, 1997

COMMENT NO. & REF.		COMMENT	RESPONSE TO COMMENT
1.	A. 1. Pg 20	Ensure that the environmental impacts associated with all past and present activities at the Site are thoroughly investigated.	All known releases have been identified as SWMUs or AOCs and have been scheduled for investigation under the FFA. Also, Section IX of the FFA requires reporting and plans for investigation of any newly discovered releases identified in the future.
2.	B. 1. Pg 22	Since the process has been ongoing, basically implementing the FFA for years, there needs to be a reference to an appendix which lists exactly which documents have been issued, when comments were made by the parties, and when approval, if any, has been made for all such documents prepared up to this point.	Page 31 contains a statement referencing work that has been completed prior to the FFA, and has been modified to refer the reader to Appendix E. This appendix contains a complete list of documents prepared to date, and their status.

COMMENT NO. & REF.		COMMENT	RESPONSE TO COMMENT
3.	B. 3-6 Pg 22,23	This needs to be done first, and needs to be done with public scrutiny. Also, what about NEPA? The agency keeps saying that it is incorporating NEPA values into the CERCLA process, but it isn't. Many actions have been taken to implement the CERCLA process over the last several years with no public input. This is inconsistent with NEPA. Also, where is the cumulative effects analysis?	It is not clear what the first statement in the comment is referring to; however, Section III of the FFA describes the "Purposes of Agreement" including a description of each phase of the remedial action process. Paragraphs 3 and 4, referenced in this comment, merely state the requirement that remedial investigations and feasibility studies, conducted under the Agreement, should meet the requirements of both RCRA and CERCLA, thereby eliminating any duplication of effort that might otherwise occur if these activities were independently conducted under each of the statutes. Paragraphs 4 and 5 emphasize the requirement to ensure the response actions selected will be protective of human health and the environment as defined under RCRA and CERCLA. This section also contains a reference to the CERCLA requirement to conduct periodic reviews of these actions (five-year reviews) to ensure they remain protective. With regard to NEPA concerns, a common goal of both NEPA and CERCLA is to evaluate and select alternatives that will be protective of human health and the environment. To prevent duplication of effort, the Secretary of Energy issued the June 1994 Secretarial Policy on NEPA for CERCLA actions. This Policy requires DOE to incorporate NEPA values into CERCLA documentation rather than developing separate NEPA documentation. The FFA requires DOE to conduct a Comprehensive Site Operable Unit (CSOU) that integrates information from the individual actions and collectively evaluates the cumulative effects for the entire site. The CSOU requirements are explained in greater detail in Section XIII of the FFA.

COMMENT NO. & REF.		COMMENT	RESPONSE TO COMMENT
4.	C. 1&2 Pg 25	This is a perfect example of how the public is not being assured their lawful opportunities to comment on the projects up to this point. The prioritization is certainly one of the most important decision points this document will attempt to make, yet the public has been out of the loop up to this point. Frankly, it is the opinion of the that this has been arbitrary and capricious. 40 CFR 300.430 (c)(2)(ii)(A) provides that the agencies will "Ensure the public appropriate opportunities for involvement in a wide variety of site-related decisions, including site analysis and characterization, alternatives, analysis, and selection of remedy." This regulation needs to be written into the FFA as a reminder of how the parties have failed to do this up to this point.	The prioritization referenced in this section refers to the priorities established in Section 3.4 on Page 11 of the Site Management Plan. These priorities have been presented to the SSAB on numerous occasions, featured during public information sessions, and attached to the FFA during the public comment period. However, DOE has not received any specific comments regarding these priorities. These priorities will be continuously evaluated, as new data becomes available, to ensure DOE resources are being directed at areas that pose the greatest risks. The SMP will be updated annually and will be available in the AR file at the time it is submitted to EPA and Kentucky. During the annual revisions, the site priorities and project schedules will be updated to reflect the most current information regarding site conditions. Section XVIII of the FFA requires such revisions to consider public input as specified by Items 13 and 14 on Page 73 of the Agreement. Additionally, DOE plans to routinely present major changes to the SSAB on a regular basis. Section XXXVII of the FFA states that nothing in this Agreement shall be construed to relieve DOE of its obligation to comply with all applicable Federal laws, which includes 40 CFR 300.430(c)(2)(ii)(A).
5.	C. 9 Pg 27	Where does the public fit in this process? Shouldn't the agencies have to file a public document stating their positions, and shouldn't the public have input into any modifications?	The CSOU will be subject to the same public participation requirements as any CERCLA action implemented under this Agreement, including requirements to establish an Administrative Record (AR) file and issue a proposed plan for public comment. All modifications of the Agreement are subject to Section XXXIII (Public Participation) and Section XXXIX (Modification of Agreement) of the FFA.
6.	C. 10 Pg 28	An administrative review process should be set up so that the public can seek administrative review of any RODs for any RAs.	CERCLA provides the public an opportunity, through the AR file and during the public comment period on the Proposed Plan, to provide input into the remedy selection process. In order to ensure timely implementation of remedial actions, CERCLA does not provide for pre-implementation review of RODs. Section 113 of CERCLA, which governs the timing and availability of judicial review of RODs, states that a ROD cannot be challenged prior to implementation. Furthermore, CERCLA does not provide an administrative review process for RODs.

COMMENT NO. & REF.		COMMENT	RESPONSE TO COMMENT
7.	A. Pg 28	Commentors question the combining of RCRA and CERCLA obligations. They feel that this will ultimately water down the State's and the public's right to judicial review of decisions. Commentors also aren't sure where the statutory authority for combining these obligations comes from. Commentors have to disagree at this time that this is a good idea. Why is there a reference to interim status facilities on the top of Page 29?	A primary purpose of the FFA and Site Management Plan (SMP) is to coordinate the cleanup programs of CERCLA and RCRA into a set of comprehensive requirements for site remediation to prevent costly duplication of effort, which ultimately would result in diversion of funds from actual cleanup activities. In general, RCRA requires corrective action of environmental releases of hazardous wastes and constituents originating from SWMUs. In comparison, CERCLA requires remedial action (RA) for releases of CERCLA-hazardous substances, regardless if the release originated from a regulated unit or a SWMU. With a few exceptions (e.g., radionuclides), a release of a CERCLA-hazardous substance would also constitute a release of a RCRA-hazardous constituent from a SWMU, and vice versa. The risks from these releases, in most instances, would be indistinguishable, and the facility would be required to pursue cleanup under one of these programs. Therefore, as part of the RCRA/CERCLA coordination strategy, all known environmental releases have been included under the FFA and SMP, regardless if the release is a RCRA- or CERCLA-type release. In addition to the similarities in RCRA and CERCLA cleanup authority, the RCRA corrective action and CERCLA RA processes are generally the same. The FFA and SMP recognize these processes as equivalent, and allows DOE to conduct a single activity to satisfy the requirements of both RCRA and CERCLA. For example, one field investigation conducted under the FFA will evaluate both RCRA-hazardous constituents and CERCLA-hazardous substances and will be documented in a single Remedial Investigation (RI) Report constituting the requirements from both the RFI and CERCLA RI for a given area. Appendix D of the FFA contains document outlines for each of the primary documents, which reflect the substantive requirements of both RCRA and CERCLA. However, the FFA was carefully designed to ensure the coordination of these requirements while expressly reserving whatever rights the state and public might have under RCRA (see Reservation of Rights/Section XL of FFA). For example, Section XXXII of the FFA requires EPA and KNREPC to maintain separate ARs for the EPA RCRA Permit and Kentucky Hazardous Waste Permit for all actions selected under the FFA.

COMMENT NO. & REF.		COMMENT	RESPONSE TO COMMENT
11.	C. Pg 31	Commentors are not sure that combining administrative records "facilitate(s) public participation in the selection of response actions under this Agreement." Please explain how this is the case.	CERCLA requires all information considered in selecting a remedial action to be maintained in the AR for that specific action. The reference in the FFA that refers to combining AR files is merely intended to recognize that a considerable amount of data has been generated prior to the FFA under the RCRA Program and Administrative Consent Order, and if any of that data is used to support the selection of a remedial action under the FFA, such data needs to be included in the AR for that remedial action. This language is intended to ensure that any such information is comprehensively presented as one file in a well-organized manner, rather than having such data fragmented among several various files at different locations. Also, future ARs may reference earlier AR files, as appropriate, rather than reproducing copies of data/reports for inclusion in new AR files.
12.	Pg 32,33	The clause regarding amendments due to public or appeal is vague and hard to understand. The commentors do not surrender any rights under RCRA to challenge anything that the commentors may construe as a violation of RCRA.	This language is not designed to impose any restrictions on the public's rights. It attempts to acknowledge and anticipate the potential affects of public participation or appeal under RCRA.
13.	E. Pg 33	It is Section 113 of CERCLA which brings into question the combining of RCRA, CERCLA, and FFCA obligations. While there is a significant bar to judicial review under CERCLA, there does not exist the same bar under RCRA and FFCA. The public retains the right to appeal and seek judicial review of any decisions under RCRA and FFCA which are arbitrary and capricious and which adversely affect the public.	See Comment Response Nos. 7 and 10.
14.	F. Pg 34	Why are these decisions excluded from this agreement? It appears that this includes all of the AOCs at the facility, but this can't be right. Please explain this clause.	The FFA is intended to provide the framework for investigation and remediation of nonoperating SWMUs and AOCs at PGDP, and does not establish operating, closure, or postclosure standards for permitted TSD units provided for under the RCRA Permits. This language is merely intended to recognize the separate authority for regulating permitted TSD units.

COMMENT NO. & REF.		COMMENT	RESPONSE TO COMMENT
15.	A. Pg 34	If the stipulations are "facts," then why won't the agencies "admit" to them?	This is a common legal convention. The facts in the FFA are admitted solely for the purposes of entry of the FFA and enforcement of its terms by the Parties. Parties outside the Agreement are free to try to establish any facts they wish in future proceedings, but may not rely upon facts set forth and agreed upon in the FFA as part of the negotiation process.
16.	A. Pg 50	What releases would not be covered by RCRA or KRS 224 Subchapter 46. The public should also be notified of removal actions and be provided with copies of such work plans upon request.	Radionuclides are not specifically regulated as RCRA-hazardous constituents; however, they are regulated as CERCLA-hazardous substances subject to the CERCLA cleanup program. CERCLA [40 CFR 300.415(m)] requires DOE to inform the community of actions taken, respond to inquiries, and provide information concerning the release. Additionally, CERCLA requires DOE to establish an AR for removal actions and include all related studies and work plans for public inspection. Also, DOE"s routine and frequent interaction with the SSAB should also prove beneficial in keeping concerned citizens informed. Additionally, DOE routinely publishes a public notice for removal actions at the site, with the exception of emergency removals that warrant immediate action.
17.	B. Pg 51	The public should be given notice of a Removal Notification.	See Comment Response No. 16.
18.	B. Pg 52	There should be a public period running concurrently with the EPA's and State's period, and all considered and responded to together.	Consistent with CERCLA and the NCP, documentation releied upon to select all removal actions will be placed in the AR file and made available tot he public. However, CERCLA requires public review and comment only for non-time critical removal actions (EE/CAs). Under the FFA, the public will still be able to review and comment upon EE/CAs. Under RCRA and KRS 224, there is no mechanism for public review and comment for interim corrective measures work plans. For those actions that will be incorporated into DOE's permit, the FFA provides for coordinating these public comment periods.

COMMENT NO. & REF.		COMMENT	RESPONSE TO COMMENT
19.	C. Pg 53	The public should be given notice of emergency Removal Action and an explanation of the situation prompting such action.	CERCLA or RCRA does not require public review or comment prior to emergency actions; however, DOE must comply with 40 CFR 300.415 (m) for public notification and communication for all removal actions.
20.	C. Pg 54	Once again, the public should have an opportunity to comment on any such documents concurrently with the regulatory agencies.	See Comment Response No. 18.
21.	E. Pg 55	The public should be given an opportunity to concurrently review with the regulatory agencies.	See Comment Response No. 18.
22.	E. Pg 56	The public should have an opportunity to evaluate any Removal Work Plans and any results of sampling prior to the implementation of the removal action. Considering the limitations on judicial review of removal actions, the only opportunity for the public to be heard is before the decisions are made.	All documents related to the performance of actions, including removal action work plans and sampling results, will be maintained in DOE's Site file. The public may obtain these documents under FOIA. However, the public will not have an opportunity to evaluate removal action work plans prior to implementation due to the need to ensure timely implementation of such actions (see Comment Response No. 6).

COMMENT NO. & REF.		COMMENT	RESPONSE TO COMMENT
23.	F. Pg 56,57	The public should have the opportunity to review and comment on any and all primary documents before final approval.	In accordance with CERCLA [40 CFR 300.815 (a)], DOE is required to include all primary and secondary documents in the AR file, which is available for public review. Accordingly, the AR file must be opened upon commencement of the RI phase and be made available to all members of the public at that time. Under similar provisions of CERCLA, the public is afforded review and comment on EE/CAs and Proposed Plans, which generally summarize the key information contained in primary and secondary documents. DOE, EPA, and Kentucky will continue to make every effort, through meetings, notices, fact sheets, and personal contacts to provide any and all information, on issues affecting the site, to the public. DOE maintains extensive mailing lists of stakeholders, including one with individuals and interest groups who have commented on previously-issued documents and projects. Anyone may be added to the mailing list upon request. When public input is sought on certain documents (e.g., Proposed Plan), a notice of availability is published in local newspapers. Copies of all primary and secondary documents are placed in the DOE Environmental Information Center at Kevil and at the Paducah Public Library. Finally, the FFA requires DOE to develop and submit a Community Relations Plan outlining DOE's strategy for community involvement, which is in addition to the SSAB process and public notice of Proposed Plans.

COMMENT NO. & REF.		COMMENT	RESPONSE TO COMMENT
24.	1-3. Pg 57-59	The regulations require that the public have notice and comment on investigations and site characterizations. There has been considerable action implementing these regulations up to this point, with no public input. This is a blatant violation of the regulations. The public should have access to the scoping meetings, and all other information early in the process so that decisions aren't already made before the public has a chance to be involved in the process.	DOE has complied with the public participation requirements of CERCLA. Regulation 40 CFR 300.815(a) states that DOE shall make the AR file available for public inspection upon commencement of the RI phase. This requirement has been met for each RI conducted to date. Additionally, all Proposed Plans and EE/CAs generated to date have been made available for public comment in accordance with CERCLA. Neither CERCLA nor RCRA/KRS 224 require public involvement in scoping activities. If interested citizens would like to become more involved, a primary objective of creating the SSAB was, and is, to get early and meaningful public involvement on issues affecting the Paducah Site, and to provide another avenue for public information and participation. That is not to say that the Board, in any way, precludes or replaces any other public involvement activities; but by meeting regularly and being briefed on a wide variety of issues that the Board decides upon, it provides a core group of stakeholders, intimately familiar with DOE activities at the site, from whom members of the public may draw information. (See Comment Response No. 23.)
25.	Pg 59-61	The public should have an opportunity to review all phases of an FS, and all steps of developing alternatives.	See Comment Response No. 23.
26.	Pg 60	Where does the 10(-6) figure come from, and does cumulative mean from all potential sources? Why is the figure for noncancer risk set at greater than 1? Isn't this extremely high as an action level? Please define "adverse environmental impacts." All Baseline Risk Agreements should be subject to public review and comment.	The 10^{-6} risk level and noncancer risk level of 1, are EPA-accepted standards contained in 40 CFR 300.430(e)(2) and various EPA guidance for conducting risk assessments. Cumulative impacts referenced in this section are referring to multiple pathways and/or multiple contaminants that may be present. Also, Kentucky regards 10^{-6} as its de minus risk level. The term "adverse environmental impacts" is a subjective phrase intended to give EPA and Kentucky the flexibility and discretion to determine whether certain site conditions pose unacceptable risks to human health and the environment, and warrant additional action. All baseline risk assessments will be included in the AR file for public inspection and comment.

COMMENT NO. & REF.		COMMENT	RESPONSE TO COMMENT
27.	Pg 61-64	Any significant changes in OUs should be subject to public review.	The operable units for PGDP are contained in the SMP and were issued for public comment as an attachment to the FFA. However, no specific comments were received that proposed changes to the current structure of the operable units at PGDP. The FFA and SMP will remain as part of the AR file and are available for further public inspection should anyone desire further information.
28.	Pg 65-67	Criteria for using interim Remedial Actions need to be clearly set out in the agreement, and the public needs to be involved in the process.	Decisions to utilize Interim Remedial Actions'(IRAs) will be based upon unit-specific facts and determinations consistent with criteria under CERCLA, RCRA, KRS 224, and applicable EPA and KNREPC guidance and policy. It is not possible at this juncture to describe every circumstance in which use of an IRA would be appropriate.
29.	C. Pg 67	The public review needs to be earlier and more regularly throughout the process. Again, this means that the right to review of the RCRA Permit mod is swallowed up under the CERCLA bar on judicial review? The commentors don't want to surrender any such rights.	See Comment Responses Nos. 7 and 10.
30.	D 1. Pg 68	Shouldn't the public who participated in the period also be provided the responsiveness summary?	The responsiveness summary is typically attached to the final ROD and included in the AR. However, copies of the responsiveness summary will be made available upon request.
31.	Pg 68,69	RODs should also be mailed to all members of the public who participated in the process or who have expressed an interest to be on the mailing list. By all rights, there should be an administrative review process of any challenges to any RODs by the public.	DOE's mailing list is quite extensive and it would not be feasible to automatically mail copies of all primary documents (e.g., RODs) to those on the list. However, in cases where an individual specifically requests a certain document, DOE will typically forward a courtesy copy to that individual unless the document is extremely lengthy or difficult to reproduce due the nature of the material. Otherwise, all primary documents including proposed plans and RODs are available for public review in the AR. Also, see Comment Response No. 6.
32.	Pg 69,70	Again, the public should be given early notice and opportunity to participate in the development of all documents.	See Comment Response No. 23.

COMMENT NO. & REF.		COMMENT	RESPONSE TO COMMENT
33.	Pg 70,71	When DOE requests such guidance and policy, the public should be given notice and allowed to review any such policy and guidance which EPA provides.	All official correspondence between DOE and the regulatory agencies is typically available in either the AR or through a FOIA request.
34.	A. Pg 71	Up to this point, the SMP has been developed with no public input. Actually, it is the commentors belief that the SMP constitutes a "major federal action" under NEPA which requires a hard look at the environmental effects, including cumulative effects. It is high time that this document be opened up for the public to have input on the administrative record. Any and all future amendments to this document should be subject to intense public scrutiny.	The concepts of the SMP have been presented to the SSAB, featured during past public workshops, and attached to the FFA for public comment. The FFA and SMP will remain as part of the AR file and are available for further public inspection should anyone desire further information. The SMP is a dynamic document that will be updated annually and requires regulator review and approval. The public is free to submit any comments they wish.
35.	Pg 72	Hopefully, the relevant factors at the bottom of Pg. 72 through 73 are not in order of importance. For example, why is public opinion way down near the bottom of the list, and why is the progression of the cleanup at the top? Shouldn't protection of human health and the environment be the No. 1 priority?	These factors are not presented in any particular order of priority.
36.	Pg 74	Shouldn't the development of the SMP include the input and consultation of the public as well as the regulatory agencies?	See Comment Response No. 34.
37.	B. Pg 74	Prioritization of projects is perhaps the most important phase of this process. The public should have early and regular notice and on the notification of projects.	The prioritization process is a valuable tool to assist in decision making. The FY 1999 prioritized list was prepared as part of the budget formulation package and is available to the public. Nationally, the FY 1999 budget formulation package has been prepared in conjunction with the 2006 Accelerated Cleanup Plan (ACP). The formal public comment period of the FY 1999 information contained in the ACP ran from mid-June through mid-July 1997. The comment period on the ACP, which began June 12, 1997, runs 90 days. Also, see Comment Response No. 4.

COMMENT NO. & REF.		COMMENT	RESPONSE TO COMMENT
38.	B. Pg 76	How much weight are the budgets targets going to be given? Couldn't this undercut the whole plan? Please explain the Anti-Deficiency Act Defense and under what conditions DOE may use this.	The FFA requires DOE to request adequate funding to meet its obligations under this Agreement. Prior to receiving DOE's budget from Congress, the Office of Management and Budget (OMB) develops the final budget request to Congress. In many cases, the Presidential budget request will contain less funding for DOE than originally requested. In these cases, the Parties of the Agreement will use this information to assist them in planning the necessary resources that may be needed to implement the work required by the FFA. However, these targets are not intended to strictly drive the requirements and schedules of the Agreement. Under the Anti-Deficiency Act, 31 U.S.C. Section 1341, as amended, it is unlawful for federal agencies to commit to expenditures of funds in excess of their appropriations from Congress. If certain actions were being required of DOE, under the FFA, that DOE felt would result in violation of the Anti-Deficiency Act (i.e., if actions costing more than appropriated funds were required), DOE is reserving its right to argue that the Anti-Deficiency Act would prohibit expenditures on those actions.

COMMENT NO. & REF.		COMMENT	RESPONSE TO COMMENT
39.	Pg 77	What is the Oak Ridge Reservation Environmental Restoration Prioritization Board, and how will the public have access to and review and comment on any decisions or recommendations issued by such a board?	Environmental Management (EM) has used an evolving project prioritization process for a number of years. Regulators from EPA, Regions IV and V, and the states of Ohio, Kentucky, and Tennessee participate in Prioritization Board meetings with DOE Oak Ridge Operations Office EM managers to score EM projects using a risk-based prioritization system. Prioritization is conducted to rank projects on the basis of the overall value they provide EM, thus focusing resources on those projects that provide the greatest risk reduction or return on investment. The following parameters with their associated weights are used to evaluate risk: *Categories* — *Weights* Public Safety and Health — 25% Worker Safety and Health — 15% Environmental Protection — 15% Compliance — 12% Mission Impact — 15% Mortgage Reduction — 15% Social/Cultural/Economic Effects — 3% The Board meets, as needed, to review and update project scores and to revise the overall process, if appropriate. Public involvement in prioritization has increased in the last two years. The published list is available for public review and comment. DOE welcomes ongoing dialog on the list and the process.
40.	B1. Pg 81,82	DOE should make the target funding guidance available to the public at the same time it provides it to regulatory agencies. Also, is the initial contractor budget guidance prepared with any public input?	Budget formulation guidance is published annually and will be made available to both the public and regulators upon receipt in the Operations Office. The contractor uses the same budget guidance that DOE receives.
41.	2. Pg 82	What are the "other site activities" mentioned in this section?	This phrase is just intended to provide flexibility to identify additional funding needs that may not be specifically associated with a project. The annual AIP, FFA, and SSAB grant funding are examples of funding needs that are not associated with a specific project.

COMMENT NO. & REF.		COMMENT	RESPONSE TO COMMENT
42.	4. Pg 83	The section regarding privileged information is bad. Under this section, it appears that DOE can unilaterally withhold information from the regulatory agencies which may be significant in the decision making process, with little or no recourse for the regulatory agencies. If DOE is withholding any pertinent information, they should be required to set forth, in full, their justification for such withholding and it should be subject to challenge.	The effect of this provision is simply to make explicit the fact that there may be some privileged documents that would be responsive, but which would nonetheless be protected by some doctrine of privilege. By entering into this agreement, DOE has not waived its right to claim privilege with respect to appropriate documents. This provision does not create privileged status where there otherwise would be none. The status of privileged documents is determined pursuant to long-established legal precedent. Any privileged documents would have to be identified with enough specificity to establish that a particular privilege applies. In the event EPA or KNREPC does not believe that a document is actually privileged and entitled to protection, they can challenge DOE's claim of privilege in accordance with the dispute resolution provisions of the FFA.
43.	E. 1 Pg 85	Are the minutes to scheduled project manager meetings available to the public? Again, any documentation made available to the regulatory agencies should be made available to the public.	All official correspondence between DOE and the regulatory agencies is typically available in either the AR or through a FOIA request.
44.	F. 1 Pg 87	Which standards and requirements would be sacrificed for cost savings, and if a standard or requirement is a standard or requirement, how can they be arbitrarily changed? The number one priority should unequivocally be protection of human health and the environment.	The language is not intended to suggest, and the Parties do not understand it to mean, that any legal standards and requirements would be sacrificed for cost savings. The language merely indicates that legal standards and requirements will be met in the most efficient and cost-effective manner.
45.	2. Pg 88	What work at the site would be eligible to receive excess funds?	Any EM-40 work at the site would be eligible to receive these funds. However, management discretion will be used to actually reallocate these funds, including consideration of the prioritization process, project overruns, and other program factors. (See Comment Response No. 37.)

COMMENT NO. & REF.		COMMENT	RESPONSE TO COMMENT
46.	6. Pg 89,90	There should be public notice if some of the funds are going to other sites for an imminent danger. It appears that this clause contradicts No. 2 of this section in regard to DOE discretion to make the determination being outside the dispute resolution process.	This clause is intended to provide DOE with the necessary flexibility to make determinations with respect to the appropriate use of excess funds. In the event there are excess funds at Paducah that are needed to address an imminent danger at another site, DOE has preserved the ability, in its sole discretion, to make a determination that the funds should go there. Dispute resolution would not be available to challenge such a decision. In contrast, dispute resolution will be available if DOE has made a determination to use excess funds at Paducah, but there is disagreement between DOE, EPA, and KNREPC as to the appropriate use of those excess funds at Paducah.
47.	C. Pg 91	If new sites aren't addressed under this section, what section would they be addressed under?	The FFA and RCRA Permit are designed to automatically incorporate newly identified sites into the remedial action process. Once a new site is discovered, DOE must notify the agencies within 15 days and then conduct a site evaluation/SWMU assessment within a specified time frame, pursuant to Section IX of the FFA. If the evaluation determines a release has occurred that poses an unacceptable risk, the SWMU must be assigned to an existing WAG that is already scheduled for investigation. In addition to these provisions, the "Additional Work" language, contained in Section XIX, also provides EPA and Kentucky authority to require DOE to perform additional studies at selected sites, if the evaluations presented by DOE are not deemed adequate.
48.	B.2 Pg 93	What about public review of secondary documents? Sometimes they contain very important information for the public to be aware of. Under what authority is the RCRA and CERCLA obligations being combined?	See Comment Responses Nos. 7 and 23.
49.	C. Pg 93-95	Primary documents should be made available to the public at the D1 stage. Public should have the right to review and at every stage in the process.	See Comment Response No. 23.

COMMENT NO. & REF.		COMMENT	RESPONSE TO COMMENT
50.	D. Pg. 95,96	Disagree that the following should be secondary documents: (b) preliminary RA Reports; (c) Preliminary Characterization Summary; (d) Screening/analysis of Alternatives; (if CERCLA is equivalent to NEPA, public has a right to this info); (f) treatability study reports; (g) fiscal year quarterly reports; (k) health and safety plans; (l) sampling and analysis results; (v) removal site evaluations. Secondary documents should be made available to the public when presented to the regulatory agencies.	Secondary documents typically include preliminary information that serves as a feed document to primary documents. For example, the information in a Preliminary Characterization Summary is ultimately reissued and explained in greater detail in the RI Report. Screening of alternatives and treatability studies are summarized in Feasibility Study Reports. All documents listed meet the intent of a secondary document. With regard to public review of these documents, please see Comment Response No. 23.
51.	E. Pg 97	What about public meetings? What about minutes or reports from project manager's meetings? Shouldn't there be public access to these meetings and information?	This information will be included in the AR file and through FOIA requests.
52.	I. Pg 103	Where does early and regular public input come into this process?	See Comment Response 23.
53.	A. Pg 105,106	Don't understand how the activities listed in this section can be exempted from permitting requirements. What about air and water discharge permits if the activities result in discharge? What about Clean Water Act certification? What about associated permits such as storage? This appears to be a giant loophole which will significantly lessen public involvement and regulatory authority.	This section reflects the provisions contained in Section 121 (e)(1) of CERCLA which exempts on-site CERCLA actions from all administrative permitting requirements, but requires compliance with substantive requirements that would otherwise be included in an applicable permit. The intent of this exemption is to allow the agencies to respond to site risks in an expedited manner without delays that may otherwise be incurred if the administrative process for obtaining permits was used. The FFA requires DOE to identify any such permits that would otherwise be required and provide an explanation of how the proposed response action will meet the substantive requirements. This information is provided in the CERCLA documentation and will be part of the AR.

COMMENT NO. & REF.		COMMENT	RESPONSE TO COMMENT
54.	Pg 107	The last sentence in Sec. A needs to be clarified. This appears to contradict or bring into question the earlier section in this clause, but seems to soften regulatory authority and the public's right to review under permitting regulations.	See Comment Responses Nos. 7 and 10 regarding reservation of rights.
55.	B. Pg 107, 108	The public should be notified of any such modifications proposed by DOE. There should also be public information if DOE appeals any permits.	See Comment Response No. 5.
56.	Pg 108,109	There should be public notice of any finding of creation of danger. Also, what is DOE's site health and safety plan and how does that play into this agreement?	The public will be notified in the event of any finding of creation of danger. Should EPA or Kentucky perform work on site at PGDP, they will be required to follow DOE's health and safety requirements. For example, DOE has certain safety requirements for working in radiological areas that need to be complied with to ensure adequate precautions are taken, as well as other OSHA 1910.120 requirements and plant procedures.
57.	Pg 110,111	A public notice in the paper of record and mailings to interested parties who have previously given notice to DOE or the other agencies to be notified of such activities should be made giving this notice of availability to the public of such documents.	See Comment Response No. 33.
58.	B. Pg 121	Shouldn't sample splitting be mandatory, just to be sure that something isn't overlooked or bypassed?	The determination as to whether to split samples during a sampling event will be at the sole discretion of EPA and KNREPC. DOE is also required to have a quality assurance plan to ensure the samples being collected are of sufficient quality and quantity to effectively implement the FFA. In addition to DOE's plan, the Kentucky AIP provides for split sampling as an independent verification of data quality.
59.	Pg 122-125	How does DOE propose to get access to private property which the owners deny access? Under what authority does DOE have to force entry, or does such authority exist?	CERCLA Section 104 provides authority for gaining access to property for purposes of conducting certain CERCLA activities.

COMMENT NO. & REF.		COMMENT	RESPONSE TO COMMENT
60.	Pg 126-129	The public should be notified of any extensions and of any invoking of dispute resolution, for any reason, for that matter.	All correspondence between DOE, EPA, and KNREPC, seeking extensions and invoking dispute resolution, would be public documents and subject to FOIA. Additionally, the FFA will remain a public document, and any modifications of the FFA or its schedules, as a result of the extensions or dispute resolution provision, would be reflected in the FFA and made available to the public.
61.	Pg 129,130	Public should be given notice of the five-year reviews.	Information regarding five-year reviews will be placed in the information repository and briefings can be provided to the SSAB.
62.	Pg 130,131	Public should be given notice of the destruction of any records and given the opportunity to review them.	Under CERCLA and RCRA/KRS 224, as well as other applicable law, DOE is not required to notify the public of the destruction of documents. Members of the public remain free to exercise their FOIA rights, whenever and however they see fit, and obtain documents of which they are interested.
63.	Pg 133,134	Since the Federal Facilities Environmental Restoration Dialogue Committee Final Report dated April 1996 is referenced, those principles should be attached to the agreement.	This report will be placed in the information repository.
64.	Pg 141,142	Can nonmajor modifications be made without public notification? If this is the case, this needs change. Public scrutiny is necessary to ensure that this clause is not abused.	Public notice is not required for non-major modifications to the FFA. EPA and KNREPC, in their roles as regulators, will ensure that this clause is not abused.
65.	Pg 142-147	What about the public's right to judicial review of decisions arising out of the agreement? Is it DOE's position that Section 113 of CERCLA bars any such reviews? This right should by all rights be guaranteed in this agreement if the agencies were really concerned about the public's rights.	While it is possible that Section 113 of CERCLA might very well bar judicial review of certain decisions arising out of the Agreement, it is not possible at this point to answer this question with respect to all future decisions arising out of the Agreement.

COMMENT NO. & REF.		COMMENT	RESPONSE TO COMMENT
66.	Pg 147,148	The public should be notified and involved in any plans to expend public funds for natural resource restoration from funds arising out of the agreement. There should be NEPA compliance for any such plans or actions.	Comment noted.
67.	Pg 148,149	The public should be given notice and an opportunity to comment on any proposed property transfers. NEPA should be complied with in regard to any such actions.	Section XLII of the FFA requires DOE to notify EPA and Kentucky of all property transfers. All official notifications and correspondence to EPA and Kentucky are available in the information repository upon request.
68.	Pg 149-154	The public should be given notice of any penalties and the agency levying the penalties should be required to make a public explanation of the basis for such penalties and where the receipts from such penalties will go.	KRS 224.10-250 establishes how penalties are paid to the Commonwealth of Kentucky. Penalties assessed by EPA are payable to the Hazardous Substances Response Fund for uses provided under CERCLA. Documents levying such penalties will be available in the information repository. Additionally, EPA and Kentucky can provide such information upon request.
69.	B. Pg 156	This is why the commentors are concerned about the consolidation of CERCLA and RCRA obligations. Nothing in this agreement should be construed as the waiver of any rights under judicial review under RCRA.	See Comment Response No. 7.
70.	Pg 156,157	The public should be given notice when the regulatory agencies are proposing to declare an action completed.	DOE's written request proposing that the regulatory agencies declare an action completed will be an official correspondence available to the public in the information repository.

COMMENT NO. & REF.	COMMENT	RESPONSE TO COMMENT
73.	The enforceable timetables for DOE action could be the source of future problems which could potentially compromise human health and the environment. For example, if a site does not get properly characterized, there should not be a rushed effort to meet an enforceable deadline. Instead, while expedience and budget consideration are important, properly characterizing the problem and designing remedial and removal actions which first and foremost protect human health and the environment should be the most important consideration.	DOE, EPA, and KNREPC agree that adequate characterization is critical to effectively design remedial and removal actions protective of human health and the environment. However, the Parties do not believe that establishing enforceable timetables under the FFA will preclude the Parties from gathering sufficient data to support these goals. In fact, the FFA has been specifically developed to ensure proper scoping and review of all characterization plans are conducted prior to initiation of any field investigations. For example, Section XI (Remedial Investigation) of the FFA requires DOE to develop and submit a scoping document to the regulators and participate in a scoping meeting to ensure the RI/FS Work Plan reflects data collection strategies sufficient to select and implement effective actions. Once the scoping process is completed, then DOE is required to develop and submit a RI/FS Work Plan to EPA and KNREPC for review and approval prior to implementation. Once the RI/FS is conducted, if it is determined additional data collection is necessary, Section XIX of the FFA contains provisions to conduct additional work to obtain any additional information deemed appropriate. Accordingly, the FFA allows DOE to request a schedule extention for the enforceable timetables to allow adequate time to conduct any additional work needed.
74.	There should be public notice of some sort for every step of every document, including secondary and primary documents. Also, the DOE should maintain a mailing list of interested parties who request to be on the mailing list or who have regularly commented on projects in the past. This mailing list should receive notice of the availability of secondary documents and should receive the draft primary documents.	See Comment Response No. 23.

PADUCAH GASEOUS DIFFUSION PLANT
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Chartered under the Federal Advisory Committee Act

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MEMORANDUM
SITE SPECIFIC ADVISORY BOARD

TO: SSAB Members
Ex Officio Members

FROM: Mark Donham
Vicki Jones

DATE: March 9, 1998

SUBJECT: **MEETING REMINDER**

The next SSAB meeting will be March 19, 1998, at 5:00 p.m. in the Van Buren Room at the Executive Inn. The following is the tentative agenda and action items:

Tentative agenda for the March 19, 1998, meeting:

Administrative Plans for the Board - 5:00 p.m. - 6:00 p.m.
- Office Location (10 minutes)
- Administrative Support (10 minutes)
- Board Evaluation (10 minutes)
- Review of the SSAB Draft Work Plan (10 minutes)

Minutes
Information (Handouts)
EMEF Project Updates
DOE Response to SSAB Recommendations (15 minutes)
Decontamination and Decommissioning (D&D) (30 minutes)
Cost Effectiveness (30 minutes)
Site Treatment Plan (STP) Annual Report (30 minutes)
Bechtel/Jacobs Management and Integration (M&I) Presentation (30 minutes)
Report on Prioritization Meeting from Gregory Waldrop (30 minutes)
WAG 22 (If regulatory comments have been received) (30 minutes)
Vortec EA (if available) (30 minutes)

Action Items

DOE will mail the SSAB the Vortec EA when released.
Jeannie Brandstetter will provide the SSAB with copies of the results from the survey that was sent out last year.

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MEMORANDUM
SITE SPECIFIC ADVISORY BOARD

TO: Distribution

FROM: Mark Donham
Vicki Jones

DATE: April 6, 1998

SUBJECT: **MARCH 19, 1998, MEETING MINUTES**

Attached are the subject meeting minutes. The next meeting will be held April 16, 1998, in the Roosevelt Room at the Executive Inn, at 5:00 p.m. Please review and provide comments or changes at the March meeting.

SSAB Distribution List
Nola Courtney
Mark Donham
Edward Duff
David Fuller
Eddie Gray II
Vicki Jones
Ronald Lamb
Lynn Lane
Linda Long
Ray McLennan
Craig Rhodes
Connie J. Sykes
Bill Tanner
Gregory Waldrop

Ex Officio Distribution List
Wayne Davis
Carl Froede, Jr.
Jimmie C. Hodges
Tuss Taylor
John A. Volpe

PADUCAH GASEOUS DIFFUSION PLANT SITE SPECIFIC ADVISORY BOARD

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Meeting Minutes

March 19, 1998

DRAFT

The March 19, 1998, Site Specific Advisory Board (SSAB) meeting took place in the Van Buren Room at the Executive Inn at 5:00 p.m.

The following board members were present: Mark Donham, Edward Duff, Vicki Jones, Lynn Lane, Linda Long, Ray McLennan, Craig Rhodes, and Gregory Waldrop. Ex Officio members present were: Wayne Davis, Jimmie Hodges and John Volpe. Facilitator Present: Steve Kay. Also present were: David Allen, Carlos Alvarado, Patricia Barnhill, Jeannie Brandstetter, Raúl Castañeda, Scott Creasey, Angela Eaton, Teresa Fields, Shelley Hawkins, Dennis Hill, Norman Jetta, Todd Mullins, Gayla Puckett, Greg Shaia and Elisabeth Stull.

Steve Kay called the meeting to order. Steve asked if there were any modifications to the agenda. The Bechtel/Jacobs Presentation and the Waste Area Grouping (WAG) 22 Presentation were removed and a National Environmental Policy Act (NEPA) Overview Presentation was added. The modified agenda was approved.

Administrative plans were the first item on the agenda. Ray McLennan stated that the office location at the Information Age Park, a 10' x 20' room, costs a little less than $5,000 a year. It includes the use of the conference room once a month. There is a charge for setting up tables and chairs that was not very clear and will have to be clarified. Ray stated that he thought it was a win-win situation. Carlos Alvarado stated that Bill Tanner had talked to Jacobs about getting the lease in place.

The next item on the agenda was Administrative Support. Carlos stated that Bill had been in contact with Shelley Hawkins. Due to the fact that Bill Tanner was not present the board was unable to proceed on this item.

Board evaluation was the next item on the agenda. Vicki Jones stated that she had talked to Mark Donham and he agreed that the report was okay. Vicki said she would put the finishing touches on it and get together with Teresa Fields on getting the report out to the board.

The next item on the agenda was the draft Work Plan. Changes were made to the plan and agreed to by consensus. A revised work plan will be sent to all of the board.

Jimmie Hodges stated that the Oil, Chemical, & Atomic Workers (OCAW) Former Workers Health Study Presentation is tentatively scheduled for the same night as the SSAB meeting. There will be a presentation for the site people the day before or the day after. The board is invited to attend the presentation. The board will be informed when a final date is set.

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The next item on the agenda was the approval of the minutes. Carlos stated that their were some changes made for clarification to the paragraph concerning the Bechtel Jacobs contract. The amended minutes were approved by consensus.

An information/handouts update was the next item on the agenda. Carlos Alvarado presented the board with a handout that Bill Tanner had prepared with the Jacobs people. The handout was a list of equipment needed to supply the office at the Information Age Park. Gregory Waldrop suggested that the overhead projector be dropped from the list. Carlos stated that Jimmie Hodges has asked him to check to see if there are any desks, chairs, tables, or guest chairs available for usage by the SSAB. The proposal was made that these first 4 items and the overhead projector be removed from the list and the rest of the list be approved. The proposal was approved by consensus. This list did not include a computer or typewriter.

The next item on the board was the resignation of Rev. W. G. Harvey. Vicki Jones stated that he had sent a letter stating that due to the constraints on his time he felt that he could not do justice to the board. He also forwarded a name of someone he thought would be a good replacement. Vicki will forward the name on to Nola Courtney.

The EMEF Project Updates were the next thing on the agenda. Jeannie Brandstetter stated that the WAG 27 fieldwork has started. There is a lengthier update in the report so that the board can decide if it wants a presentation.

The next item on the agenda was the Department of Energy (DOE) response to SSAB recommendations. A handout was presented to the board. Jimmie Hodges went over each recommendation and DOE's response. Jimmie stated that there was one recommendation that did not make the list. That was the recommendation that the charcoal filters not be removed from the Northwest pump and treat system. DOE did not remove them. Mark Donham thanked DOE for making the effort to respond to the board's recommendations. Jimmie stated that DOE would try to do a better job in responding to the board's recommendations in a timely fashion.

Decontamination and Decommissioning (D&D) was the next item on the agenda. Carlos Alvarado stated that the information was put into a handout which was presented to the board. John Volpe asked if DOE had taken into account the Nuclear Regulatory Commission's (NRC) approach to D&D. Jimmie stated that DOE had put together a series of booklets which cover what DOE would do. Jimmie also stated that in the long run DOE has not factored in NRC's approach. David Allen stated that there are some major negotiations going on to discuss this issue. Mark asked about C-340 and C-410. Carlos stated that they are shut down and in the process of stabilization. Greg Waldrop asked how this related to the exploding drum incident. Carlos stated that the drum was part of the Waste Management Program. This is a little different. Both of these buildings are shut down. Jimmie Hodges stated that there are sweeps made of these buildings to make sure there are no chemicals stored that could cause problems. Mark asked about Paducah's D&D budget fund. Jimmie stated that Paducah, Portsmouth and the East Tennessee Technology Park (ETTP) work are all funded out of the D&D fund. D&D is used in two different ways, as the fund and the program. Steve Kay suggested that D&D be put back on the workplan for September.

The next item on the agenda was Cost Effectiveness. There were some general comments on how this matter should be handled. Jimmie stated that he felt this subject could be covered as a general theme with the M&I contract. Mark stated that it might be covered under the 2006 Plan -

Accelerated Cleanup Paths to Closure. Steve suggested it be rolled into the M&I presentation question and answer period.

The Site Treatment Plan (STP) annual report was the next item on the agenda. The information was presented as a handout. Tom Shadoan of Lockheed Martin Energy Systems(LMES) was on hand to answer any questions. Mark asked what the procedural requirements are. Mark asked if there are any milestones coming up where an official document is required. Tom stated that there is the Federal Facility Agreement (FFA) and the 97 Annual Report which will come out at the end of this month. Greg Waldrop stated that the board is trying to get input in before the documents go out to the public. Tom stated that the STP compliance dates were set in 1995 and a public comment period was held of 30 days. Mark asked if there are any more shipments going to the Toxic Substances Control Act (TSCA) Incinerator. Tom stated that there are ongoing liquid shipments going out at a rate of 2-3 a year and the soft solids shipments begin in fiscal year (FY) 1999. Mark asked if the Governor of Tennessee's Blue Ribbon panel on the TSCA Incinerator issued a report or any kind of findings yet. Jimmie stated that they had and Portsmouth (Ohio) and Paducah (Kentucky) are allowed to ship there but no other states are allowed to ship to the incinerator. Jimmie stated they made some other recommendations concerning looking at the community and the health impacts to the communities. Jimmie stated he would try to get Mark a copy of the report. Mark stated that it concerned him that Paducah is sending material to be incinerated to this incinerator, the only radioactive waste incinerator in the country as he understood it and it is growing in controversy. Tom stated there are two other DOE incinerators - one in Savannah River that is not open to any other states and one in Idaho that Paducah is planning on shipping to that is called the Waste Experimental Reduction Facility (WERF) Incinerator which does not take polychlorinated biphenyls (PCBs). John Volpe stated that there are two commercial facilities (one in Tennessee and one in Texas) also that take mixed waste.

The next item on the agenda was the report on the Prioritization Meeting. Carlos Alvarado and Greg Waldrop attended a meeting in Oak Ridge where they prioritize the projects. All the Paducah responses were discussed. Greg stated that there were 2 things he found particularly interesting. Greg stated that the mortgage reduction became less of an issue and that the notion that any project that might save money really got pulled up higher in the rankings. What they found was that very few projects could be identified as having saved money. They also found that the compliance component was a little peculiar because everything has to comply. What was finally agreed to was a change of 5 percent from compliance and given to Environmental Protection. This is a monthly meeting. Carlos stated that he was a little disappointed in the attendance. Carlos stated that usually the State has representation at these meetings. Jimmie Hodges stated that it is a tool to be used. Mark Donham stated that it would be interesting to see if the list in the 2006 document was the same as the one that Greg and Carlos came back with. Mark agreed that the rankings could be discussed next month in the 2006 discussion. Greg said he felt that this was a good meeting for the board to try to attend if possible and he felt that they would be invited back. Greg also brought back a Glossary Of Useful Terms Found in EMBAM, Risk Assessment, and Waste Management Reports that will be distributed to the SSAB by Teresa Fields.

A National Environmental Policy Act (NEPA) Presentation by David Allen, DOE Oak Ridge, was the next item on the agenda. David gave out handouts and gave a general overview of the NEPA process. Craig Rhodes asked how many categorical exclusions (CXs) there are. David Allen and David Tidwell stated that there are dozens of CXs. Craig asked if any are used more than others. David Allen stated that there are some CXs that are used for basic maintenance, mowing lawns, etc.

Mark Donham stated that after the bursting barrel incident a CX was used to treat the waste in the barrels. Mark stated that there was no public comment, no environmental analysis. The public was completely cut out of the process because DOE uses these CXs. Mark stated that he felt that this was one of DOE's more irritating points. Mark also stated that he challenges the whole CX rule. Mark stated he felt that DOE Headquarters (HQ) had sent out a letter to each site telling them that if they had projects that they wanted done to send HQ a list of all the projects that each site wanted HQ to write a CX on and that is what HQ has been writing CXs on so the sites could get projects done without going through the public comment period. Mark stated he felt that there is a lot of abuse going on. Mark stated that use of CXs cuts the public out completely. Mark also stated that until he had submitted a Freedom of Information Act (FOIA) request he did not know that a CX had been done on treating the waste barrels. Mark stated that when you look at the checklist for this CX that there were as many yes's and uncertains as there were no's. Mark felt that should have triggered something. Mark also stated that it is a pain to go through the public comment process for any agency because it slows things down but it's not necessarily a reason not to do it. David Allen stated that he agreed that it is a pain to go through the public comment period from the time frame aspect. David stated that when CXs are reviewed in Oak Ridge DOE is looking at them to see if there are circumstances there that push them into something of significance. There are some things that are significant because there is general concern about it. David stated that there are some CXs that come through that he says no. David stated that how these CXs came to be in place he did not know since he was not involved in the process. Mark stated that DOE has certain criteria in the CEQ regulations that have to be weighed in order to make something significant. There are other laws such as whether there are Endangered Species, whether it is a Historic Property or whether it is a wetlands or whether there are any cumulative effects. Mark stated that not just DOE, but other agencies need to be made to look at everything they are supposed to.

Mark stated that the comment that he has been making for quite a few months, that with everything that it is going on at Paducah, how could DOE not have to look at everything, site wide. Mark asked how Paducah is functioning, complying with NEPA having never done a site wide Environmental Impact Statement (EIS). David asked Mark what a site wide EIS does for you. Mark stated that it gives you a bigger picture of everything that's going on and what potential alternatives are in one document instead of coming out one project at a time. David stated that site wide documents are basically general documents not alternative analysis because you do not have an action. David stated that there has been discussion on doing a site wide EIS for years. David stated that what DOE has seen is that when you do a site wide EIS they are very umbrella and very general. Because it covers the whole site there is nothing specific for you to home in on to determine alternatives because you don't have an action. Site wide EISs cost millions and millions of dollars. David stated that what they have seen is that 3-4 months after a site wide EIS is completed that it is outdated and a supplement has to be done in order to add data that has happened since the first document was completed. So you never actually gain any ground. David stated that there are some in the process of being done. The general intent of the CXs is for something to be where there is basically no impact at all or impact so little that if you added up 100 of these things there would be no impact. In order for the basic process to go forward we have to have some basis to say these things have no impact. DOEs role is to look at these things and make a determination - somewhat like a policeman - of looking at them and making a determination whether DOE agrees or not. Steve Kay asked if the SSAB was interested in the looking at the CX for the bursting barrel, could they do it. Greg Waldrop asked if the SSAB could be in on the conversations when DOE is making the decisions on CXs. David Allen stated that they cannot. David stated that it is a good idea to take one and go through the process. David suggested that a

listing of the CXs that have been issued be provided to the SSAB. David stated that on the bursting barrel incident (because of the emergency situation of having another one that could possibly burst) that DOE went to everyone (State, EPA, etc.) and got approval that DOE needed to act on in. DOE did go ahead and very quickly look at it from an impact stand point and processed a CX based upon the impacts. David stated he would stand behind that CX. Mark asked why DOE didn't process it as an emergency under NEPA. David stated that DOE had time to process it as a normal CX and DOE quickly did that because they were in the middle of getting their contract in place. Mark stated that he felt that this situation had been going on for a couple of decades and then all of a sudden it became an emergency and a bunch of public money had to be spent and public resources but there was no time to notify the public or just tell them what is going on. Mark said he did not agree with it. John Volpe stated that when there is a threat to the workers you have to proceed. Mark stated that the public should be involved sooner. It is public money that DOE is spending. Mark also stated that in this situation there might have been a reason for doing it but when you look at the bigger picture he doesn't think that should be the habit the agencies should be getting into as a reason to avoid disclosing what they are doing. Steve asked if it is possible to see a list of the CXs for this site. Greg Waldrop asked David if he determines as the compliance officer the CXs based on a checklist or regulations. David stated that he has the ultimate signature authority. David explained that the plants have to make their own determinations, then the program officers review and then they are sent to Oak Ridge for review by David's staff. Then once he gets the CX back from his staff he decides whether or not to sign off on the CX. Mark stated that there is one thing lacking from that process. Congress said when they passed NEPA that one of the important things is public scrutiny because sometimes agencies have their own agendas or for whatever reasons an agency can get skewed and they might not make the proper determination. It states in the law that having the pubic scrutinize these determinations that the agencies make is essential to ensure that the decisions that they make are done right. When too many of these decisions are done behind closed doors without public scrutiny then that part of the law that Congress passed is not being fulfilled. Mark stated that you can say that you had all this input and it was looked at by all these multiple disciplines, interdisciplinary teams but this is still talking about intergovernmental without public scrutiny and that should be an important part of the process. Mark stated that is a real problem with CXs and he thinks the agencies should be using them only when it's really clear that this is something that has been done over and over again that where there has been very little controversy generated, where knowingly the impacts is really small and just where it's just as obvious that there is not going to be a lot of interest in generating a lot of paperwork on this. Mark asked how you translate this into the bursting barrel incident. This was something brand new, something that had not been done at the plant before, something unique. David stated that once again you have to look at what the human impacts would be from that event. Mark stated the SSAB did not have a chance to go to their experts to see if what the agency was saying was correct. Mark also stated that is the whole point of NEPA, to get public input. David stated that Mark made a very good point, that is the intent of the environmental assessment (EA) process and public involvement and the EIS process and public involvement. David said that they look at all of the different impacts such as air, water, radiological, etc. David said if you looked at all the different things and took out the sensationalism of quote "exploding drum" which is not something that goes into the process, you are looking at what is the impact on the human environment. David said he did not see any impact to the human environment. David stated that no one wants to exclude the public. David stated that he looks at all of the different points to determine if something falls under the CX process. Vicki Jones suggested that the SSAB get copies of the regulations on CXs and the list of CXs for Paducah for the last year. Vicki stated that the board could review the regulations and the CXs then at some time in the future have another discussion on the NEPA process. Greg Waldrop

PLEASE SIGN IN

Paducah Gaseous Diffusion Plant
Site Specific Advisory Board

NAME	AFFILIATION
Shelley Hawkins	Jacobs/EIC
Patricia Barnhill	Jacobs
Vicki Jones	SSAB
Craig Rhodes	SSAB
[illegible]	SSAB
Carlos A Alvarado	DOE
[illegible] Fields	EASI/DOE
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Steve Ray	RIKI
David R. [illegible]	DOE
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[illegible]	SSAB
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Mysory Waldron	SSAB
Wayne [illegible]	KDFWR
J. Raul Castaneda	DOE
L. Angela Eaton	Jacobs EM Team
Elisabeth Stull	Argonne Nat'l Laboratory
G. L. Shaik	LMES
Norman Wickette	Vortec Corp.
Gayla Puckett	SMS

March 19, 1998

Scott Creasey LMES

Paducah Gaseous Diffusion Plant (PGDP)
Site Specific Advisory Board (SSAB)
1998/1999 Work Plan

DRAFT

ISSUE	EXPECTED ACTIONS	STATUS/APPROACH	March 98	April 98	May 98	June 98	July 98	August 98	Sept. 98	Oct. 98	Nov. 98	Dec. 98	Jan. 99	Feb. 99
Waste Management	Review documents	Monitor & provide suggestions as appropriate					XX							
Waste Minimization/ Pollution Prevention	Review documents	Monitor & provide suggestions as appropriate					XX							
Transportation of wastes/ hazardous materials	Review documents	Monitor & provide suggestions as appropriate					XX							
Decontamination & Decommissioning	Review documents	Monitor & provide suggestions as appropriate	XX						XX					
Economic Impact on Community	Monitor	Monitor & provide suggestions as appropriate												
Protection/Restoration of Natural Resources & Ecological Values	Review documents	Monitor & provide suggestions as appropriate												
Protection of Workers, Public Health and Safety	Monitor Projects	Monitor & provide suggestions as appropriate												
Technology Development and Transfer	Review documents	Monitor & provide suggestions as appropriate												
Strategies for effective and meaningful Public Input	Work 2 DOE/ Community Relations Plan	Monitor & provide suggestions as appropriate												
Cost Effectiveness	Review documents	Monitor & provide suggestions as appropriate	XX											
WAG 6	Review documents	Continue monitoring						XX RI Rpt.						
WAG 22 (7 & 30)	Comment on D1 RI							XX D1PP						

Paducah Gaseous Diffusion Plant (PGDP)
Site Specific Advisory Board (SSAB)
1998/1999 Work Plan

ISSUE	EXPECTED ACTIONS	STATUS/APPROACH	March 98	April 98	May 98	June 98	July 98	August 98	Sept. 98	Oct. 98	Nov. 98	Dec. 98	Jan. 99	Feb. 99
WAG 22 (2 & 3)	Comment on D1 FS				XX D1PP									
WAGs 9 & 11 Preliminary Assessment/Site Inspection (PA/SI) process Site Evaluation Report										XX				
WAG 17		Record of Decision (ROD) signed 9/29/97												
LASAGNA								XX D1 ROD						
Drum Mountain (WAG 24)	Review documents	Provide recommendations												
Site Treatment Plan Annual Report			XX STP Annual Update											
Federal Facilities Agreement (FFA)														
Integrated Waste Management (IWMP)		IWMP Yearly Update Completed 12/15/97												
Vortec			XX	XX					XX					
Board Evaluation			XX											
Bechtel/Jacobs M&I Presentation					XX									
NEPA Presentation			XX			XX								
Environmental Report					XX									

March 24, 1998

Paducah Gaseous Diffusion Plant (PGDP)
Site Specific Advisory Board (SSAB)
1998/1999 Work Plan

ISSUE	EXPECTED ACTIONS	STATUS/APPROACH	March 98	April 98	May 98	June 98	July 98	August 98	Sept. 98	Oct. 98	Nov. 98	Dec. 98	Jan. 99	Feb. 99
Accelerated Cleanup Plan - Paths to Closure				XX										
Cylinder PEIS				XX										

National Environmental Policy Act

David R. Allen
NEPA Compliance Officer

U. S. Department of Energy
Oak Ridge Operations Office

DOE NEPA Compliance Program
The Framework

- National Environmental Policy Act (NEPA)
- Council on Environmental Quality(CEQ) Regulations
- CEQs Forty Most Asked Questions

National Environmental Policy Act

- Passed by Congress in 1969
- Basic National Policy for the Environment (Sections 2 and 101)
- Established Council on Environmental Quality (CEQ) (Title II)

National Environmental Policy Act

- Action-forcing provisions {Section 102(2)}
  - Detailed statement for "major Federal actions significantly affecting the quality of the human environment" {Section 102(2)(C)}
  - To ensure environmental values considered in decision making with economic, technical considerations {Section 102(2)(B)}

CEQ REGULATIONS 40 CFR 1500-1508

- Implement Section 102(2) of NEPA
- First issued 1978; binding on all Federal Agencies
- Necessitated Accurate Scientific Analysis, Expert Agency Comments, and Public Scrutiny

CEQ REGULATIONS 40 CFR 1500-1508

- Emphasized making better decisions, based on understanding of environmental consequences
- Amended July 1, 1986 to withdraw requirement for worst case analysis, add approach for evaluating reasonably foreseeable significant adverse impacts when information is incomplete or unavailable (40 CFR 1502.22)

CEQ REGULATIONS 40 CFR 1500-1508

- Three Levels of NEPA Review
  - Environmental Impact Statement (EIS)
    - Detailed Statement Required for Proposed Actions with Potentially Significant Effects
  - Environmental Assessment (EA)
    - Analysis to determine whether to prepare an EIS or a Finding of No Significant Impact (FONSI)
  - Categorical Exclusion (CX)
    - Class of actions with no individual or cumulative significant effects
    - Established for Agency Use Through Public Review and Comment Process, Consultation with CEQ

CEQs Forty Most Asked Questions (46 FR 18026, March 23, 1981)

- What is meant by "range of alternatives"? How many alternatives when infinite number possible?
- Must agency analyze alternatives outside its capability or jurisdiction?
- What does the "no action" alternative include?
- What is the "agency's preferred alternative"? What is the "environmentally preferable alternative"?

DOE NEPA Compliance Program The Tools

- DOE NEPA Regulations (10 CFR 1021)
- DOE Order 451.1A(NEPA Compliance Program)
- Secretarial Policy Statement on NEPA
- Other DOE Tools

DOE NEPA Regulations 10 CFR 1021

- Effective May 26, 1992 (Published April 24, 1992, 57 FR 15122)
- Revised 1980 DOE NEPA Guidelines (as amended) to incorporate SEN-15-90 initiatives
- Policy for site-wide NEPA documents

DOE NEPA Regulations 10 CFR 1021

- Enhanced opportunities for Public and State Participation in NEPA Process
  - Required EIS Scoping Meeting, draft EIS Hearing
  - Public availability of EIS Implementation Plan, supplement Analysis
  - State Pre-approval review of EAs
- Expanded list of Categorical Exclusions

DOE NEPA Regulations 10 CFR 1021

- Also amended on July 9, 1996
  - Deleted requirement for EIS Implementation Plan
  - Added Additional Categorical Exclusions

DOE Order 451.1A

- Established Internal DOE Authorities, Responsibilities, and Procedures to Implement DOEs NEPA Regulations
- Issued June 5, 1997
- Requires Internal Scoping Procedures, Quality Assurance Plans, and Public Participation Plans
- Annual Planning Summaries

DOE Order 451.1A

- ORO Manager has EA/FONSI Authority
- NEPA Compliance Officer has CX Authority
- Incorporate NEPA Values In CERCLA Documents
- Mitigation Tracking and Reporting
- Lessons Learned System
- NEPA Document Managers

Other DOE Tools

- Effective Public Participation Under NEPA
- Directory of Potential Stakeholders for DOE Actions Under NEPA
- DOE NEPA Compliance Guide
- NEPA Contracting Reform Guidance
- Recommendations for the Preparation of EAs and EISs

Special Topics In The NEPA Process

Integrating Other Environmental Review Requirements Into NEPA Reviews

NEPA and Other Reviews

- CEQs NEPA regulations state that agencies shall integrate the requirements of NEPA with other environmental review procedures
- Procedures should run CONCURRENTLY rather than CONSECUTIVELY

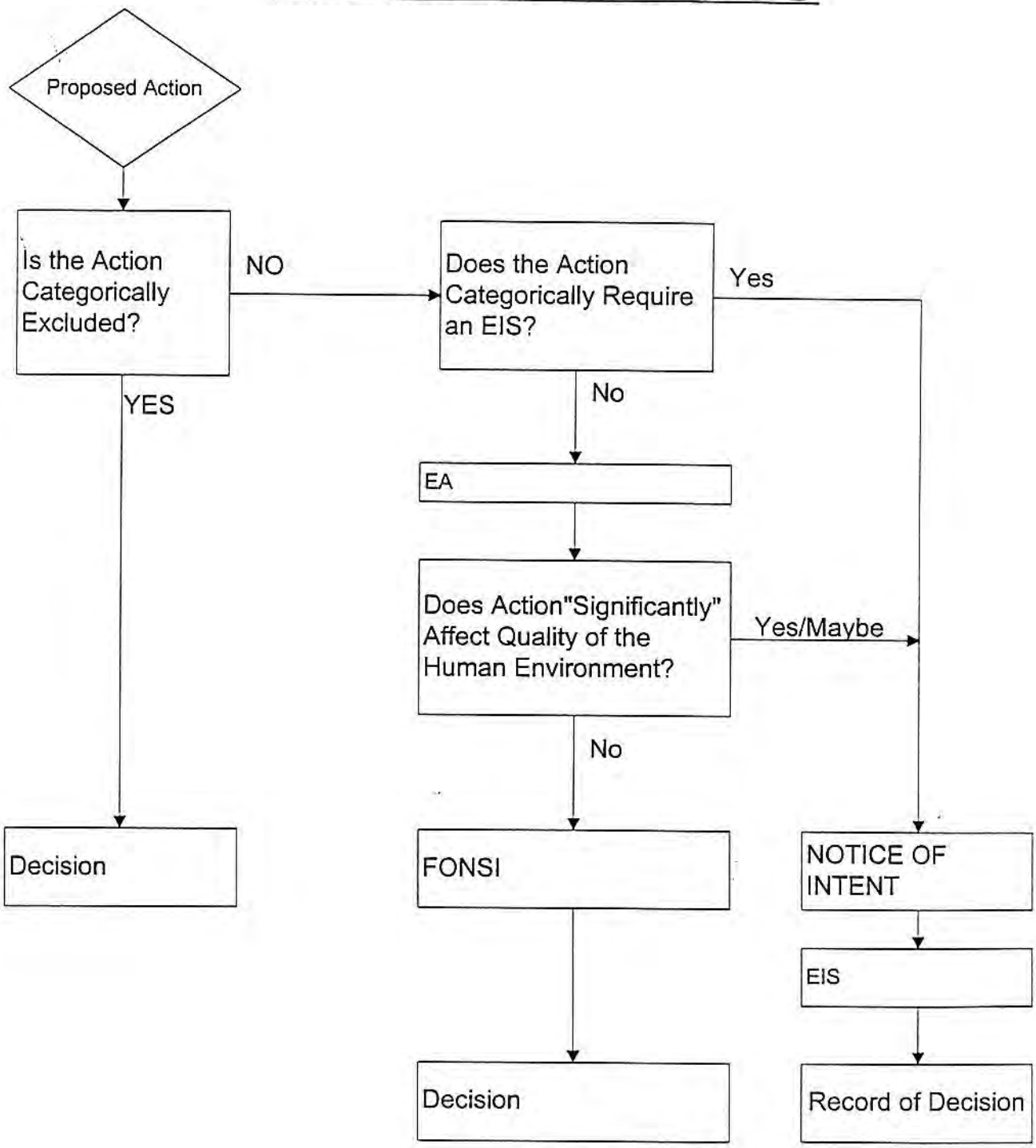
Other Laws and Executive Orders

- Endangered Species Act
- Floodplain Wetlands EOs and Regulations
- Fish and Wildlife Coordination Act
- Coastal Zone Management Act
- Farmland Protection Policy Act
- National Historic Preservation Act
- American Indian Religious Freedom Act
- Wild and Scenic Rivers Act

Environmental Laws with Permit Requirements

- For example CAA, CWA and Safe Drinking Water Act
- However, fulfilling the permit requirements under these laws does not mean that NEPA requirements have been fulfilled

NEPA Process



COMMENT NO. & REF.	COMMENT	RESPONSE TO COMMENT
75.	The PGDP SSAB recommends that parties to the Federal Facilities Agreement interpret the agreement to provide public participation in the planning process to the maximum extent possible.	Public participation will occur, at a minimum, in accordance with the provisions of CERCLA, the NCP, and RCRA/KRS 224. There are several provisions incorporated into the FFA and CERCLA that provide for public participation during the planning process at both the program and project level. For example, Section XVIII of the FFA requires DOE to develop and submit an annual SMP no later than November 15 of each year. From a programmatic perspective, the SMP will propose site priorities for the remedial action program and will identify work activities for FY, FY+1, and FY+2, which will be the basis for defining enforceable commitments under the FFA. Additionally, the SMP will also contain long-term projections for completing work that is planned beyond FY+3 and will serve as a dynamic document that is updated every year. In accordance with Section XXXIII (Public Participation) of the FFA, it is the Parties intent to disseminate SMP-related information to the SSAB for early input prior to finalizing work scope and priorities each year. From a project perspective, Section XXXII of the FFA requires DOE to develop and maintain an AR for each project, in accordance with CERCLA. Subpart I (40 CFR 300.815(a) of CERCLA requires DOE to establish an AR file upon commencement of the remedial investigation phase to ensure the public has sufficient opportunity to get involved early in the remedial process. Additionally, DOE would also be willing to provide briefings during the development of RI/FS work plans, should the SSAB desire involvement at that stage. Finally, in addition to the above actions required by the FFA, DOE plans to continue the public workshops and information sessions that have been routinely held in the past.

DOE/EA-1230

DRAFT

ENVIRONMENTAL ASSESSMENT

PROPOSED TREATMENT OF MIXED WASTES AT THE PADUCAH GASEOUS DIFFUSION PLANT USING THE VORTEC VITRIFICATION SYSTEM

March 1998

U.S. Department of Energy
Oak Ridge Operations Office
Oak Ridge, Tennessee

DOE/EA-1230

DRAFT

ENVIRONMENTAL ASSESSMENT

PROPOSED TREATMENT OF MIXED WASTES AT THE PADUCAH GASEOUS DIFFUSION PLANT USING THE VORTEC VITRIFICATION SYSTEM

March 1998

Prepared by
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Oak Ridge Operations Office
Oak Ridge, Tennessee

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NOTATION

This list includes acronyms, initialisms, chemical nomenclature, and nonstandard units of measure.

ANL	Argonne National Laboratory
CEQ	Council on Environmental Quality
CFR	*Code of Federal Regulations*
CMS	(Vortec) Cyclone Melting System™
CO	carbon monoxide
CRV	counter-rotating vortex
CX	categorical exclusion
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
EA	environmental assessment
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
EPI	emergency prediction information
ERPG	emergency response planning guide
FFCA	Federal Facility Compliance Agreement
FFCAct	Federal Facility Compliance Act
FONSI	Finding of No Significant Impact
FWS	U.S. Fish and Wildlife Service
gpm	gallon(s) per minute
H_2S	hydrogen sulfide
HAP	hazardous air pollutant
HCl	hydrogen chloride
HEPA	high-efficiency particulate air
ICRP	International Commission on Radiological Protection
ID	induced draft
KAR	Kentucky Administrative Regulation
KDEP	Kentucky Department of Environmental Protection
KDFWR	Kentucky Department of Fish and Wildlife Resources
KPDES	Kentucky Pollutant Discharge Elimination System
KRS	Kentucky Revised Statute
KSNPC	Kentucky State Nature Preserves Commission
LDR	land disposal restriction
LMES	Lockheed Martin Energy Systems, Inc.
LMUS	Lockheed Martin Utility Systems
MEI	maximally exposed individual
mph	mile(s) per hour
NAAQS	National Ambient Air Quality Standard
NCRP	National Council on Radiation Protection and Measurements
NEPA	National Environmental Policy Act
NESHAPS	National Emission Standards for Hazardous Air Pollutants

NO_2	nitrogen dioxide
NO_x	nitrogen oxides
Np	neptunium
O_3	ozone
OSHA	Occupational Safety and Health Administration
Pb	lead
PCB	polychlorinated biphenyl
PGDP	Paducah Gaseous Diffusion Plant
PM_{10}	particulate matter less than or equal to 10 micrometers in diameter
ppb	part(s) per billion
ppm	part(s) per million
PSD	prevention of significant deterioration
psig	pound(s) per square inch, gauge
Pu	plutonium
RCRA	Resource Recovery and Conservation Act
RD&D	research, development and demonstration
SO_2	sulfur dioxide
S/S	solidification and stabilization
STP	site treatment plan
SVOC	semivolatile organic compound
Tc	technetium
TCE	trichloroethylene
TCLP	toxicity characteristic leaching procedure
TEEL	temporary emergency exposure limit
TSCA	Toxic Substances Control Act
TVA	Tennessee Valley Authority
USEC	United States Enrichment Corporation
VISITT	Vendor Information System for Innovative Treatment Technologies
VOC	volatile organic compound
WKWMA	Western Kentucky Wildlife Management Area
WM PEIS	Waste Management Programmatic Environmental Impact Statement

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DRAFT

ENVIRONMENTAL ASSESSMENT

PROPOSED TREATMENT OF MIXED WASTES AT THE PADUCAH GASEOUS DIFFUSION PLANT USING THE VORTEC VITRIFICATION SYSTEM

SUMMARY

This environmental assessment (EA) has been prepared by the U.S. Department of Energy (DOE) to comply with the National Environmental Policy Act of 1969 (NEPA), implementing regulations of the President's Council on Environmental Quality (CEQ; *Code of Federal Regulations*, Title 40, Parts 1500–1508 [40 CFR Parts 1500–1508]), and DOE's implementing procedures and guidelines (10 CFR Part 1021). Its purpose is to evaluate potential environmental impacts associated with building and operating the Vortec Cyclone Melting System™ (CMS) at the Paducah Site, about 10 mi west of Paducah, Kentucky. The Vortec facility would treat low-level radioactive waste and mixed wastes (containing both radioactive and hazardous chemical components) stored at the Paducah Gaseous Diffusion Plant (PGDP). Following the analysis of the environmental impacts and preparation of this EA, DOE will either issue a Finding of No Significant Impact or determine that an environmental impact statement is necessary.

The wastes proposed for treatment by the Vortec CMS are stored in drums at PGDP. They could represent 10–70% of the 8,500 tons of legacy wastes that have accumulated since 1952 as a result of the production of enriched uranium for civilian and defense purposes. Actual volumes will depend on characterization, system performance, and economics. About 4,000 tons of these legacy wastes are low-level radioactive waste, 4,000 tons are wastes and mixed wastes contaminated with polychlorinated biphenyls (PCBs), and 500 tons are other mixed wastes containing both radioactive and hazardous contaminants as defined in the Resource Conservation and Recovery Act (RCRA) or the Toxic Substances Control Act (TSCA). Low-level wastes consist primarily of soil, rock, concrete, and drilling muds contaminated with depleted uranium, technetium-99, and other radionuclides. The PCB-contaminated wastes consist mostly of concrete, soil, rock, gravel, sewage sludge, and personal protective equipment.

The purpose of the proposed action is to treat the mixed wastes stored at PGDP so that they meet the land disposal restriction (LDR) requirements of RCRA, thus allowing the wastes to be removed from storage to disposal. Currently, treatment capability for these wastes does not exist at the Paducah Site, and no DOE or commercial disposal facilities can accept this waste for final disposal until it has been treated. The Agreed Order with the Commonwealth of Kentucky for

implementation of the Site Treatment Plan (STP) developed under the Federal Facility Compliance Act (FFCAct) requires sites to identify technologies and schedules for treating their mixed wastes. Installing Vortec at Paducah would give PGDP the capability to treat much of Paducah's existing mixed wastes. In addition, action is needed so DOE can comply with the Federal Facility Compliance Agreement (FFCA) for TSCA wastes, including PCB wastes, stored at PGDP.

Wastes not treated by Vortec are included in schedules in the STP for development of treatment for these wastes. These wastes would be treated and/or disposed of at appropriate facilities such as the Hanford Site, Nevada Test Site, or Envirocare of Utah.

S.1 DESCRIPTION OF ALTERNATIVES

S.1.1 Proposed Action

The proposed action is to treat low-level radioactive and mixed wastes with the Vortec CMS developed by Vortec Corporation, Inc., in Collegeville, Pennsylvania. The system uses a technology that produces a glass (vitrified) product that is expected to meet LDR criteria for disposal in a landfill. In the vitrification process, shredded, ground wastes are combined with glass-making ingredients (such as calcium carbonate, silicon dioxide, and soda ash) at high temperatures in a melter to produce a gravel-like glass material. Under the proposed action, waste drums would be transported a short distance (less than 0.5 mi) from their current location at PGDP to the proposed Vortec site located in the Paducah Site adjacent to the northwestern portion of PGDP just beyond the exclusion fence. The drums and their contents would be run through shredders and grinders, and other glass-making ingredients would be added. The material would then be melted at high temperatures in the cyclone melter and conveyed to a water tank to be quenched, resulting in a glass fractured to the consistency of gravel. This material's suitability for disposal in the PGDP landfill would then be tested.

The Vortec process, which has been developed by DOE's Office of Science and Technology, has been tested at bench and pilot scales. A 10–15 ton/d pilot unit successfully treated a wide variety of soils spiked with surrogate contaminants, as described in the 1996 application for a Research, Development and Demonstration (RD&D) Permit. The Vortec process is now ready for full-scale evaluation and operation. Operation would be accomplished in several phases. The first phase, which would last 30 days, would involve operating the vitrification unit to treat clean soils, mixed RCRA wastes, and low-level wastes that contain nonregulated PCBs. This initial trial period of operation would provide information and data on unit performance. DOE and the Vortec Corporation are co-applicants for an RD&D Permit that would encompass this initial research phase. Over the next 2 years, additional phases of facility operations would proceed as follows. The second phase would treat wastes with regulated concentrations of PCBs. The third phase would involve

making process enhancements and improving performance for the fourth phase, which would constitute treatment of the remaining wastes.

Early operation would include the characterization and quantification of air emissions, wastewater composition, and melted product composition because this would be the first time such a treatment process would be used for PCB and PCB mixed wastes. Subsequent operation would last for up to 2 years and involve the potential treatment of 10–70% of Paducah's mixed and low-level wastes, including those that are legacies of the Cold War.

S.1.2 Alternatives

S.1.2.1 No Action

The no action alternative is considered in accordance with the CEQ NEPA regulations (40 CFR 1502.14) and provides a baseline for comparison with the proposed action. Under the no action alternative, DOE would not treat RCRA and TSCA mixed wastes stored at PGDP with the Vortec system or any other treatment technology. Storage of these untreated wastes would continue indefinitely into the future at PGDP.

The continued long-term storage of mixed wastes would require DOE to maintain its management control of the approximately 50,000 drums of legacy wastes currently stored at PGDP. These wastes would be stored at their present PGDP storage locations. Ongoing and future environmental remediation and restoration activities at PGDP would continue to produce such wastes until storage capacity was reached. At that time, more storage capacity would be developed. Also, requirements to search for treatment and disposal methods would continue.

The continued long-term storage of legacy wastes at PGDP would contradict the terms of the TSCA FFCA with the U.S. Environmental Protection Agency (EPA) and the Agreed Order with the Commonwealth of Kentucky implementing the STP prepared under the FFCAct. These agreements identify waste cleanup plans for PGDP and set definitive schedule milestones. The STP specifies schedules and plans for how RCRA mixed wastes should be managed in accordance with applicable regulations. It requires DOE to complete characterization of mixed wastes and develop a treatment plan by December 31, 2001. It requires DOE to identify treatment strategies and schedule them by December 31, 2005.

S.1.2.2 Off-Site Storage, Treatment, or Disposal

The Waste Management Programmatic Environmental Impact Statement (WM PEIS) issued by DOE identified a preferred alternative for PGDP mixed waste: ship it to a regional location for

treatment and disposal (although some mixed wastes would be treated on site, consistent with the PGDP STP). Although the WM PEIS has been finalized, a Record of Decision for the mixed wastes portion has not been issued. Some of the mixed waste generated at PGDP is contaminated with PCBs, and no off-site facilities that would accept that type of waste for disposal currently exist. Disposal of other mixed wastes is not permissible until LDRs are met. Treatment of non-PCB-contaminated mixed wastes exists for some waste forms. The STP includes treatment methods for some mixed wastes for which Paducah has outlets, such as the TSCA incinerator at Oak Ridge or waste stabilization. The STP requires that treatment be sought for the balance. Current regulatory agreements with the EPA and the Commonwealth of Kentucky do not address an off-site option for these wastes. These agreements take precedence over and supersede the WM PEIS alternatives, which, to date, have not been incorporated in a final Record of Decision. Therefore, this alternative is not evaluated further in this EA.

S.1.2.3 Other Treatment Technologies

Other treatment technologies that have been proposed or are being used for hazardous and mixed wastes include other vitrification technologies and waste stabilization technologies. Incineration of the mixed wastes was not further considered because the product ash would still contain a hazardous component that would require further vitrification or solidification and stabilization prior to disposal.

Several vitrification technologies have progressed to full-scale demonstration, but none of them can treat the range of low-level, hazardous, and mixed waste types currently stored at PGDP. These technologies would either (1) be unable to treat PCB wastes; (2) be unable to immobilize radionuclides; (3) require extensive pretreatment; or (4) incompletely convert PCBs, resulting in off-gas concerns. For these reasons, other vitrification technologies are not considered further in this EA.

In solidification and stabilization technology, chemical reagents are mixed with waste so that complex chemical and physical reactions can be used to improve physical properties and reduce contaminant solubility, toxicity, and/or mobility. Disadvantages of waste stabilization processes include the large increases in waste volume that result from the additives necessary to achieve stabilization and the fact that the final waste form is not as leach-resistant as glass or slag.

The solidification and stabilization process is generally most effective for inorganic compounds and radionuclides. Specific contaminants or contaminant groups for which it is generally effective include volatile and nonvolatile compounds containing metals (with some exceptions, including anionic complexes of metals such as chromium, selenium, and arsenic), cyanides, strong acids, oxidizing agents, reducing agents, other inorganics (inorganic corrosives and inorganic cyanides), asbestos, and radionuclides. Treatment of some semivolatile organic compounds has been documented, but treatment of volatile organic compounds is currently the focus of much research

and debate. Because the solidification and stabilization process has not been recommended or used to treat PCBs (because of the large volume increases), and because the product may not be as leach-resistant as glass, solidification and stabilization technologies are not considered further in this EA.

S.1.2.4 Other Vortec Facility Locations

The site for the Vortec facility is located on 5 acres of land just outside and to the west of the PGDP boundary. DOE considered five locations for the Vortec facility at the Paducah Site (Tidwell 1997, personal communication). The DOE siting team used the following criteria to evaluate each site for suitability: (1) size (i.e., at least 4 acres), (2) accessibility from the mixed waste storage facilities at PGDP, and (3) potential to interfere with PGDP activities. The DOE siting team determined that ready access was required to move containers safely and efficiently between the storage facilities and the Vortec facility. The size requirement eliminated three potential sites, and the combination of the access and noninterference requirements eliminated a fourth site. The proposed location is big enough for the Vortec facility, easily accessible from the storage facilities, and not expected to interfere with ongoing or future PGDP activities. Other locations for the Vortec facility are not considered further in this EA.

S.2 IMPACTS OF NO ACTION ALTERNATIVE

Site conditions in the affected environment at PGDP would stay as they are now. The continued storage of mixed wastes would not have any additional impact on workers or the public under the current management control of PGDP. Exposures to the public would continue to be minimal because access to PGDP is restricted. Risks from a highly unlikely but credible accident that would release the entire contents of a waste drum to the environment would be the same as those from the proposed action.

Continued storage of low-level and mixed wastes results in continued exposure to workers. Proposed changes in DOE orders may require construction of buildings for low-level waste storage; impacts would most likely be limited to areas already disturbed. Drums stored for long periods of time can build up pressure and explode, creating a risk to workers and resulting in high cleanup costs and amplification of the waste volume after cleanup.

S.3 IMPACTS OF PROPOSED ACTION

S.3.1 Impacts from Construction

The construction impacts are expected to be minor and of short duration. It would take about 6–9 months to finish building concrete piers and pads and to assemble the plant components. An estimated 28 workers would be on site during peak construction periods. The proposed Vortec site is an area of about 5 acres located just beyond the northwestern boundary and security fence of PGDP. The site was originally a grassland. It was disturbed when vegetation was cleared, graded, and gravelled as part of a previous project in which the area was being considered as the location for a warehouse to store mixed waste. No impact to adjacent land use is expected during construction.

Increased dust emissions are expected to be minor, of short duration, and intermittent during the construction period. To minimize fugitive dust emissions, good engineering practices such as watering of roads and soil stockpiles would be used. Noise levels from construction at off-site locations are not expected to affect local residents. The nearest residence is about 1,580 m north-northeast of the proposed Vortec site.

Construction activities would not affect surface water in the site vicinity. Some temporary resuspension of sediments would occur in the drainage ditch adjacent to the boundary during installation of the plant discharge pipe and diffuser structure. Because of the relatively rapid flow rate (about 1,630 gallons per minute [gpm] during 1996) of water in the drainage ditch and the high mixing capacity, the impacts of sediment loading on Big Bayou Creek downstream of the ditch would be negligible.

Ecological impacts from construction are expected to be minor and of short duration. The site is nearly devoid of vegetation as a result of previous disturbances and would support only a few plants and wildlife species typical of disturbed habitats. No federal or state threatened or endangered species are known to occur in the proposed site or immediate vicinity; thus, no such species would be affected by construction.

S.3.2 Impacts from Operations

S.3.2.1 Routine Operations

Routine operations are not expected to affect land use of adjacent areas, including recreational use of the Western Kentucky Wildlife Management Area west and northwest of the Vortec site.

Routine operations are expected to have minor impacts on local air quality. Modeling results indicate that Vortec facility operations would result in an annual average increase of 7.5 $\mu g/m^3$ in the nitrogen dioxide (NO_2) emission level and that carbon monoxide (CO) levels would increase 2.8 and 1.7 $\mu g/m^3$, respectively, for 1-hour and 8-hour average concentrations. The annual emissions of nitrogen oxides (NO_x), CO, volatile organic compounds (VOCs), and particulate matter less than or equal to 10 μm in diameter (PM_{10}) would represent 13%, 14%, 6%, and 2%, respectively, of PGDP emissions, and they all would be less than 1% of the annual total emissions for McCracken County, Kentucky. Impacts of sulfur dioxide (SO_2) and PM_{10} emissions on local concentrations would be negligible. Operations are expected to result in the release of small amounts of PCBs and hydrogen chloride (HCl) gas, at rates of up to 1.76×10^{-6} and 1.087 lb/h, respectively. These levels are considerably below the applicable Commonwealth of Kentucky emission limits of 2.03×10^{-2} lb/h for PCBs and 20.48 lb/h for HCl. Further control of air emissions by the addition of a caustic solution to the wet electrostatic precipitator is expected to remove an additional 94.6% of the HCl to a level of 0.0587 lb/h. Operation of the Vortec facility is expected to comply with Commonwealth of Kentucky standards and National Ambient Air Quality Standards and air toxic regulations, and these emissions would not adversely impact workers or the public.

No adverse impacts on surface water are anticipated from normal operations. The discharge of water from the facility is expected to occur intermittently at a rate of 15 gpm. This rate represents only a small percentage of the current flow rate in the discharge drainage ditch, which averaged about 1,630 gpm during 1996. Water will be monitored to assure compliance with Kentucky Pollutant Discharge Elimination System permit requirements at outfall 001, located about 30 m downstream of the Vortec discharge line.

Ecological impacts from air emissions or water discharges are expected to be negligible. Songbirds and other wildlife species inhabiting the wooded area immediately to the west and south of the proposed site may experience minor impacts from noise produced by the crushers and from intermittent noise associated with vehicles transporting calcium carbonate and soda ash to the site.

Computer models were used to assess potential radiological impacts on three categories of people exposed to radiological releases during normal operations: vitrification (Vortec) workers, noninvolved (PGDP) workers, and the public off-site population. Exposures and health impacts to all three receptor categories from Vortec operations are expected to be negligible. The potential average annual radiological dose to Vortec facility workers was estimated to be 0.5 mrem, and the potential risk of acquiring excess fatal cancer was estimated to be 2×10^{-7} (2 in 10 million). An uninvolved PGDP worker in the Vortec site vicinity would receive an estimated annual dose of 7.5×10^{-5} mrem and be subject to a risk of 3×10^{-11} (3 in 100 billion) for acquiring a fatal cancer. The closest member of the public (defined as a maximally exposed individual [MEI]) is located about 1,560 m north-northeast of the proposed site. This individual could receive a potential annual dose of up to 1.3×10^{-4} mrem and have a risk of 7×10^{-11} (7 in 100 billion) of acquiring a fatal cancer. Calculations made by using the GENII computer code indicate that the dose received by the

population of 500,000 people living within an 80-km (50-mi) radius of the site would total 5.1×10^{-4} person-rem, and the risk of excess fatal cancers for the entire population would be 3×10^{-7} (chance of 3 in 10 million of an additional cancer in the population). In comparison, the exposure from background radiation for the same 500,000 people is 180,000 person-rem. The dose levels to workers and the general public would be well below the 5,000-mrem/yr limit for workers set forth in DOE regulations (10 CFR Part 835, Occupational Radiation Protection) and the 10-rem/yr air-pathway-only limit for the general public set forth in EPA regulations (40 CFR Part 61, National Emission Standards for Hazardous Air Pollutants).

S.3.2.2 Accidents

Potential impacts from both probable and highly improbable accidents and from natural disasters such as a tornado were assessed. Under the worst situation resulting from a highly improbable, but credible, accident (such as an explosion of the propane tank or a tornado; probability of occurrence being 1×10^{-6} [1 in 1 million]), no emissions that could limit off-site land use would be expected to occur. The planned design, which uses concrete pads and curbing under major facility components, would limit the release of waste that was being processed, if an accident that would rupture components were to occur. A rupture in a propane tank would result in the release of flammable gases and volatile flammable liquids. If it is conservatively assumed that 10% of the flammable vapor cloud would subsequently explode, the overpressure resulting from the detonation of the vapor cloud might damage nearby buildings, injuring people with shattered and flying glass. The distance at which such an accident might cause injury would be 500 m. Vortec trailers and the PGDP C-612 pump-and-treat facility are located within that distance. Other PGDP buildings and nearby residents are all farther than 500 m from the proposed Vortec facility.

A highly energetic event such as a lightning strike or propane gas explosion might result in the release of some fraction of a waste drum. If all the contents of the drum were released to the air under the most stable atmospheric conditions, modeling suggests that concentrations of some substances for a few seconds would reach levels that are considered potentially life-threatening if exposures lasted 1 hour or longer. Since a large proportion of the wastes would be solids, not all the wastes would actually become airborne. Because of this situation and the short (2-second) exposure time, such an accident might result in non-life-threatening effects, including odors or irritation, for a distance of up to 500 m.

Emission and other control equipment would be placed in tandem at the facility, thereby reducing the likelihood of simultaneous malfunction of controls. If one were to assume that all control equipment would fail for 24 hours, the estimated maximum 24-hour average PM_{10} concentrations would be 951 $\mu g/m^3$. Emissions of toxic chemicals would be several orders of magnitude below the significant emission levels established by the Commonwealth of Kentucky.

Such emissions would not last more than 1 or 2 hours and thus would have only minor, temporary impacts on ambient air quality.

An explosion of the propane tank followed by a fire could result in the loss of vegetation immediately beyond the periphery of the site. Some small animals would be displaced or killed by a fire, but the impact to biotic communities in the site vicinity would be negligible. Impacts from a fire would be local and thus not affect aquatic organisms in Big Bayou Creek below its confluence with drainage ditch 001.

Potential radiological impacts were evaluated for a reasonably conservative, low-probability accident. The analysis assumed that a highly energetic release would occur from a drum of low-level mixed waste. The release was assumed to occur as a result of one of four events: lightning striking a drum, the mixing of incompatible materials, spontaneous combustion within a drum, or a localized propane explosion associated with the high-air-flow dryer. No allowance was made for mitigation measures such as the safety-related structures and components that are expected to be incorporated into the final design or operating procedures. Radiological doses were calculated on the basis of conservative assumptions about meteorological conditions at the time of release and on the basis of conservative estimates of release fractions and bounding concentrations. Inhalation was the primary pathway for human exposure that was evaluated. The projected doses for three categories of receptors are as follows. A worker would receive 26 rem (which is a 50-year committed dose). An MEI residing 1,580 m north-northeast of the proposed site would receive a dose of 0.31 rem. The off-site population of an area extending 80 km (50 mi) in the direction expected to receive the highest exposures consists of 61,943 people. This population would receive a collective dose through inhalation of 169 person-rem from a drum accident release. The natural background radiation exposure for this same population is about 22,000 person-rem. The impacts of a drum rupture accident would be negligible with respect to radiation exposures and subsequent health effects.

S.3.3 Impacts on Environmental Justice

The population within a 50-mi radius of the Paducah Site is generally low income but not predominantly minority compared with the national average. The construction and operation of the Vortex facility would not impose disproportionately high and adverse health or environmental impacts on either low-income or minority populations. The impacts from construction and operation of the Vortec facility on all affected populations, including low-income and minority populations, would be low and within accepted guidelines and values. Adverse impacts would be largely confined to the Vortec site.

S.3.4 Impacts from Decommissioning

At the end of Vortec operations, clean sand or other suitable material would be processed through the Vortec facility to remove any remaining wastes. Equipment would be decontaminated, disassembled, and packaged to meet U.S. Department of Transportation requirements for shipment. Decontamination of any soils found to be contaminated would involve removal of the soils and treatment in the vitrification facility prior to its closure. Any liquid or solid wastes generated by decontamination and decommissioning would be treated at PGDP waste treatment facilities. Any mixed or hazardous wastes would be treated, or stored as appropriate, at existing DOE facilities.

S.3.5 Cumulative Impacts

Cumulative impacts are the impacts of the proposed action when added to the impacts of other past, present, and future actions, regardless of the agency responsible for the action. The impacts of the Vortec facility would largely be confined to the immediate site vicinity, with the exception of air emissions. The total annual emissions of criteria pollutants from the Vortec facility would be negligible or minor when compared with other emissions in McCracken County in Kentucky and Massac County in Illinois. Since the Vortec operational period is 2 years, these incremental additions would be temporary.

The Vortec facility would also produce toxic air emissions; however, these would represent a very small addition to regional releases of toxic air pollutants. Toxic emissions in 1994 in nearby Ballard County, Kentucky, were more than 2,000 times greater than potential Vortec emissions.

The radiological releases from Vortec would expose members of the public to negligible increases in radiological doses. The dose of 1.3×10^{-4} mrem/yr is less than 0.009% of the dose from PGDP operations. It is also less than doses from routine activities, such as the dose from an airplane trip.

1 INTRODUCTION

The U.S. Department of Energy (DOE), Paducah Site Office, proposes to construct and operate the Vortec Cyclone Melting System™ (hereinafter referred to as Vortec or Vortec CMS) at the Paducah Site near Paducah, Kentucky (Figure 1.1). This proposed action is intended to provide for the treatment of low-level and mixed wastes that are currently stored at the Paducah Gaseous Diffusion Plant (PGDP) (Figure 1.2). Throughout this environmental assessment (EA), the area within the boundaries of the gaseous diffusion plant is identified as PGDP, while the DOE site within which the PGDP is located is referred to as the Paducah Site. Figure 1.1 delineates these two areas.

The Vortec technology, which is adapted from the glass-making industry, produces an inert, nonleaching glass (or vitrified) product. From 10% to 70% of PGDP wastes would be vitrified. The product would be tested for Resource Conservation and Recovery Act[1] (RCRA) toxicity by using toxicity characteristic leaching procedures (TCLPs) specified in the *Code of Federal Regulations,* Title 40 (40 CFR), Subpart C, "Characteristics of Hazardous Waste," Paragraph 261.24. Any product that passed the TCLP panel of product consistency tests would comply with RCRA land disposal restrictions (LDRs) and could be disposed of in the C-746-U on-site landfill (Figure 1.1). Any product that did not pass these tests would be stored on site until a time when other storage or disposal facilities might become available. This EA addresses the construction and assembly of the Vortec facility, its operation with regard to treating specific wastes stored at PGDP, and the eventual decontamination and disassembly of its components.

Wastes not treated by Vortec are included in schedules in the Agreed Order for implementation of the Site Treatment Plan (STP) and are not evaluated in this EA. These wastes would be treated and/or disposed of at appropriate facilities such as the Hanford Site, the Nevada Test Site, or Envirocare of Utah.

1.1 BACKGROUND

1.1.1 Waste Streams

From the early 1950s until the end of the Cold War (early 1990s), DOE and its predecessor agencies provided defense materials in support of Cold War diplomacy. When the Cold War ended, DOE was left with an environmental legacy of wastes from producing weapons materials. Since 1952, PGDP has produced enriched uranium for civilian and defense purposes. As a result of these

[1] 42 U.S.C. 6901 et seq.

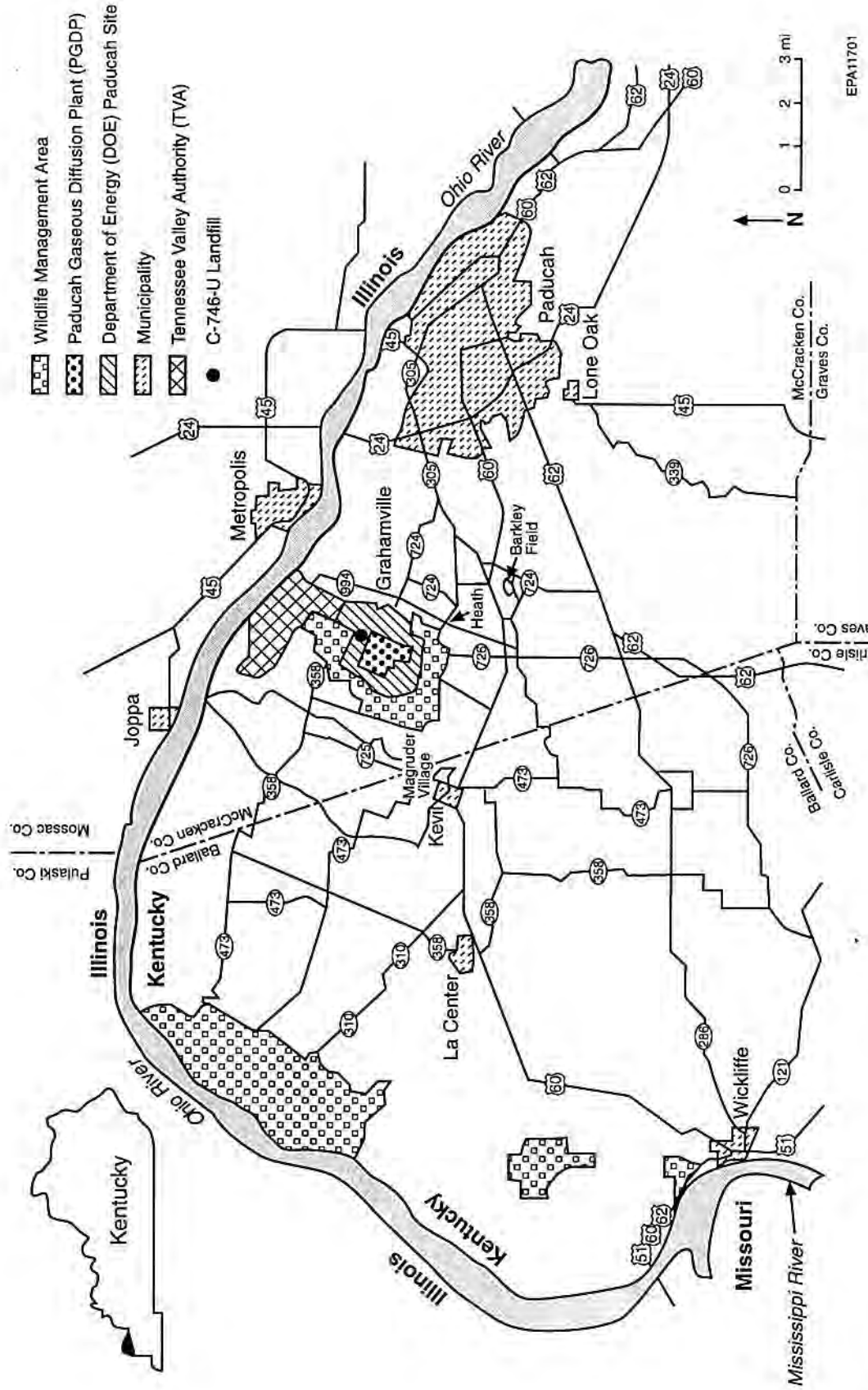

FIGURE 1.1 DOE Paducah Site and Vicinity

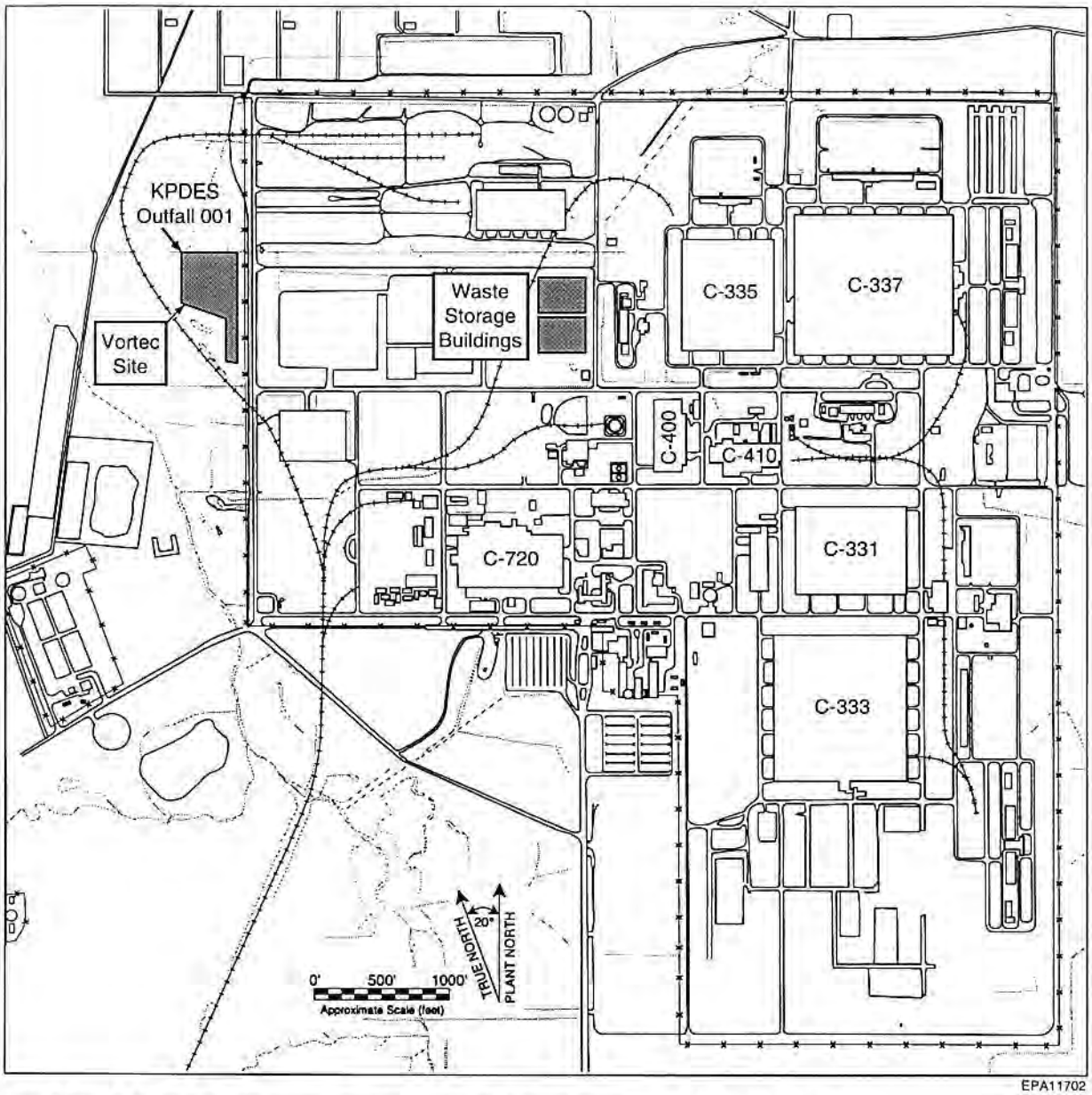

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FIGURE 1.2 Waste Storage Locations at Paducah Gaseous Diffusion Plant

activities, the DOE Waste Management Program stores approximately 8,500 tons (50,000 drums) of legacy waste at PGDP. The waste consists primarily of soil, rock, concrete, and gravel. Details on the origins and quantities of PGDP wastes proposed for treatment by Vortec are presented in Appendix A, Table A.1; a general description is provided here.

About 4,000 tons of legacy wastes stored at PGDP are contaminated only with radionuclides. These are classified as low-level wastes. They consist primarily of soil, rock, concrete, and drilling mud contaminated with depleted uranium, technetium-99, and other radionuclides. About 500 tons of stored legacy wastes are contaminated with a combination of radionuclides and one or more hazardous or toxic constituents listed or defined in RCRA. These are called RCRA mixed wastes. Finally, about 4,000 tons of legacy wastes at PGDP are contaminated with polychlorinated biphenyls (PCBs), which are regulated by the Toxic Substances Control Act (TSCA).[2] These are called TSCA wastes and are also called PCB wastes if no radionuclide constituents are present or PCB mixed wastes if radionuclides are present. The 4,000 tons of PCB wastes and PCB mixed wastes stored at PGDP consist of concrete, soil, rock, gravel, sewage sludge, and personal protective equipment.

Site remediation activities during the next 2 years may also result in low-level or mixed wastes consisting of contaminated concrete, soil, and gravel. The quantities of such wastes are expected to be small. Selection of methods for storage, treatment, and/or disposal would be developed as part of the Record of Decision for these actions. It is possible that the wastes would be suitable for treatment by Vortec, but such treatment is uncertain and speculative at this time.

1.1.2 Regulatory Agreements

In 1992, DOE signed two agreements with federal and state regulatory agencies to address the treatment and final disposition of PGDP RCRA and TSCA mixed waste streams. One covers RCRA mixed wastes; the other covers TSCA mixed wastes. These agreements are Federal Facility Compliance Agreements (FFCAs) for LDR under RCRA and for TSCA.

DOE also developed an STP for RCRA wastes, as required by the Federal Facility Compliance Act of 1992 (FFCAct). The STP was approved by the Commonwealth of Kentucky, and the Agreed Order was signed on September 10, 1997. The STP Agreed Order supercedes the RCRA FFCA (for LDR) between DOE and EPA. The STP requires DOE to characterize mixed low-level waste streams and develop a plan for their treatment by December 31, 2001. It also requires DOE, by December 31, 2005, to identify the treatment strategies needed for wastes to meet the LDR treatment standards and develop a schedule for the prioritization, implementation, and completion of such treatment strategies.

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[2] 15 U.S.C. 2601 et seq.

The TSCA FFCA, which DOE entered into with the U.S. Environmental Protection Agency (EPA), establishes committed milestones for compliance with TSCA. DOE developed a TSCA Implementation Plan for PGDP to ensure that the milestones in the TSCA FFCA are met on schedule. Both the TSCA FFCA and the TSCA Implementation Plan for PGDP have requirements for the disposal of PCB and PCB mixed wastes. The TSCA FFCA requires treatment of PCB and PCB mixed wastes to begin as soon as the EPA approves a disposal method. Moreover, it requires that treatment of wastes already in storage in 1992 be completed within 10 years of 1992. However, according to the TSCA FFCA, as long as DOE is using its best efforts to locate or develop treatment capability, the EPA will not initiate enforcement actions against DOE.

In 1995, after bench- and pilot-scale testing of the Vortec process, DOE selected Vortec as the method that could best treat PGDP mixed wastes to meet the requirements and milestones of the FFCAs. DOE will be able to treat nearly all of its PGDP RCRA and TSCA mixed wastes in storage, including PCB and PCB mixed wastes, with the Vortec system. Current storage areas at PGDP are at or near capacity, and PGDP does not currently have on-site treatment or disposal facilities to accept these wastes.

1.1.3 Waste Management Programmatic Environmental Impact Statement

In May 1997, DOE published the *Final Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste* (WM PEIS, DOE 1997a). It presents an analysis of the impacts that would result from several options for waste management throughout the DOE complex. A Record of Decision on the WM PEIS has not been issued, and DOE has not decided which alternatives to pursue for the DOE system as a whole.

The four alternatives that the WM PEIS evaluates for mixed wastes are (1) a no action alternative, (2) a decentralized alternative under which each DOE site would treat contact-handled[3] mixed wastes and 16 DOE sites would dispose of them, (3) four regionalized alternatives under which certain DOE sites would ship mixed wastes to other DOE sites for treatment and disposal, and (4) a centralized alternative under which the DOE Hanford Site would treat and dispose of all DOE contact-handled mixed wastes.

The WM PEIS lists the Paducah Site as a site that would ship low-level mixed wastes for off-site treatment and disposal, although it also acknowledges that the Paducah STP would allow some waste treatment on the Paducah Site. The WM PEIS also acknowledges that compliance orders issued by state and federal regulators on the basis of STPs establish the requirements for treatment of DOE's low-level mixed wastes. Thus, sites may develop their own waste treatment and disposal

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[3] Contact-handled wastes have a surface dose rate equal to or less than 200 mrem/h.

options with the assistance of their regulators. At present, the agreements between the Paducah Site and its regulators, including the EPA, take precedence over any alternative in the WM PEIS.

1.2 PURPOSE OF AND NEED FOR DOE ACTION

The purpose of the proposed action is to treat the RCRA and TSCA mixed wastes stored at PGDP so that they meet the LDR requirements of RCRA, thus allowing the wastes to be removed from storage to disposal. DOE and commercial disposal facilities cannot accept such wastes for disposal until they have been treated. Action is needed so that DOE can comply with the FFCAs for RCRA and TSCA wastes, including PCB wastes, stored at PGDP. Construction and operation of Vortec would give DOE the capability to treat PGDP legacy RCRA and TSCA mixed wastes. DOE presently has no treatment capability for these PGDP wastes. Operations would last for up to 2 years and involve the treatment of 10-70% of Paducah's mixed and low-level wastes, including those that are legacies of the Cold War.

1.3 SCOPE OF THIS ENVIRONMENTAL ASSESSMENT

This EA has been prepared by the DOE Oak Ridge Operations Office pursuant to the requirements of the National Environmental Policy Act of 1969 (NEPA)[4]; the regulations of the President's Council on Environmental Quality (CEQ) for implementing NEPA (40 CFR Parts 1500-1508); and DOE's implementing procedures (10 CFR Part 1021), policy, and guidance. DOE has determined that the proposed action requires an EA to determine whether any environmental impacts should be considered "significant" as defined in NEPA. This EA is intended to:

- Provide sufficient evidence and analysis for DOE to determine whether to prepare an environmental impact statement (EIS) or issue a Finding of No Significant Impact (FONSI),
- Assure that DOE complies with NEPA when an EIS is not necessary, and/or
- Facilitate preparation of an EIS, should one be determined to be necessary.

The NEPA process for the proposed action began on September 28, 1995, when the DOE Office of Science and Technology at the Pittsburgh Energy Technology Center issued a categorical exclusion (CX) for a 30-day test of the Vortec technology. Categorical exclusions, as the concept of a CX is defined in DOE's NEPA implementing procedures (10 CFR Part 1021), apply to a group of actions for which no further NEPA documentation is required. On January 26, 1996, a second CX

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[4] 42 U.S.C. 4321 et seq.

was issued on behalf of DOE's Office of Environmental Restoration at Oak Ridge Operations Office, which addressed the operation of the facility to vitrify approximately 70% of Paducah's stored wastes. On February 25, 1997, a complaint was filed in U.S. District Court alleging that DOE had failed to abide by NEPA and DOE's implementing regulations. The second CX was subsequently withdrawn. In the settlement agreement[5] reached on July 3, 1997, DOE agreed to withdraw the first CX and to prepare this EA.

This EA addresses the environmental impacts associated with (1) construction and assembly of the Vortec facility, (2) four operational steps during which the technology would be evaluated and some portion of the legacy wastes stored at PGDP would be treated, and (3) eventual decontamination and disassembly of the facility components. Following preparation of this EA, DOE will either issue a FONSI or determine that an EIS is necessary.

The scope of this EA focuses on those areas for which there is a potential for impact. In assessing impacts, DOE applies a "sliding scale" approach (DOE 1993). Key elements of this approach are to "focus effort on significant environmental issues and alternatives and to discuss impacts in proportion to their significance." Thus issues and impacts should be analyzed in proportion to their importance.

For the proposed action, under which mixed wastes would be vitrified, the most important issues to be addressed are air quality, radiological impacts to workers and the public, and waste management. Other areas for which potential impacts have been identified include impacts of accidents, impacts on surface water, and impacts on biota.

Several impact areas are not addressed further in this EA for various reasons. Geology is not addressed further because the Vortec facility would not affect the geology of the site. However, the impacts of accidents (including accidents from natural causes such as earthquakes) on health and safety are addressed. Impacts on soils are not addressed further because the site was recently cleared and disturbed; thus, soil impacts were caused by these other actions. Land use (other than recreational use of adjacent areas) is not addressed further because the site is in an area already dedicated to industrial activities. Since the Vortec facility would neither withdraw from or discharge to groundwater, impacts on groundwater are not further addressed. Prime farmlands, wild and scenic rivers, floodplains, and wetlands are not addressed further because the Vortec facility is not located on nor would it affect these types of resources.

Cultural and archaeological resources are not considered further in this assessment. Archaeological areas of significance do not exist in the 5-acre site area according to information provided in 1992 by the Kentucky State Historic Preservation Office (DOE 1994). DOE consulted

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[5] *Mark Donham vs. United States Department of Energy et al.*, 5:97CV-43-R, U.S. District Court of the Western District of Kentucky.

with this office in 1993 during the initial preparation of an EA for a proposed waste storage facility to be located at the site that has been prepared for the Vortec facility. The response is included in Appendix B.

1.4 PUBLIC INVOLVEMENT

The Paducah Site Office published a Notice of Intent to prepare this EA on November 2, 1997, in the *Paducah Sun*. The newspaper notice invited interested parties to provide comments on the proposed Vortec facility to the DOE Paducah Site Office or DOE Oak Ridge Operations Office. With the issuance of this EA, DOE invites public comments.

In preparing this EA, DOE contacted the following state and federal agencies to address issues involving state lands managed for fish and wildlife, federally listed and state-listed protected species, and air and water permits:

Commonwealth of Kentucky
Department of Fish and Wildlife Resources
Frankfort, Kentucky
Timothy Stone

Kentucky State Nature Preserves Commission
Frankfort, Kentucky
Robert McCance, Jr.

Commonwealth of Kentucky
Department for Environmental Protection
Frankfort, Kentucky

Commonwealth of Kentucky
Department of Fish and Wildlife Resources
West Kentucky Wildlife Management Area
Charlie Logsdon, Supervisor

U. S. Fish and Wildlife Service
Field Office
Cookeville, Tennessee
Lee Barclay, Supervisor

2 ALTERNATIVES

The alternatives considered in this EA are the no action alternative, the proposed action, and other alternatives not considered in detail. The latter category includes using an off-site location for waste treatment and disposal, using other waste vitrification and stabilization technologies, and using a different location for the Vortec facility.

2.1 NO ACTION

The no action alternative is considered in accordance with CEQ NEPA regulations (40 CFR 1502.14) and provides a baseline for comparison with the proposed action. Under the no action alternative, DOE would not treat RCRA and TSCA mixed wastes stored at PGDP with the Vortec system or any other treatment technology. Storage of these untreated wastes would continue indefinitely into the future at PGDP, as discussed below.

The continued long-term storage of mixed wastes would require DOE to maintain its management control of the approximately 50,000 drums of legacy wastes currently stored at PGDP. These wastes would be stored at their present PGDP storage locations. Ongoing and future environmental remediation and restoration activities at PGDP would continue to produce such wastes until storage capacity was reached. At that time, additional storage capacity would be developed or waste generation activities would cease. The TSCA FFCA and the STP require DOE to continue to investigate treatment and disposal options. If Vortec was not available, Paducah would continue to investigate options for the wastes as described in the STP Agreed Order.

The continued long-term storage of legacy wastes at PGDP would contradict the terms of the TSCA FFCA between DOE and the EPA, as well as the STP Agreed Order between DOE and the Commonwealth of Kentucky prepared under the FFCAct. These agreements identify waste cleanup plans for PGDP and set definitive schedule milestones. The STP specifies schedules and plans for how RCRA mixed wastes should be managed in accordance with applicable regulations. It requires DOE to complete characterization of mixed wastes and develop a treatment plan by December 31, 2001. It requires DOE to identify treatment strategies and schedule them by December 31, 2005.

2.2 PROPOSED ACTION

The proposed action is to construct and operate the Vortec facility to treat the low-level and mixed wastes currently stored at PGDP in preparation for disposal.

2.2.1 Facility Location

The Vortec facility would be located at the Paducah Site (Figure 1.2) in McCracken County, Kentucky, located approximately 10 mi west of the city of Paducah and about 3.5 mi south of the Ohio River (Figure 1.1). The Paducah Site is a DOE reservation consisting of a 1,437-acre site and a 1,986-acre wildlife management area leased to the Commonwealth of Kentucky. The Paducah Site has been an active uranium enrichment facility since 1951. PGDP occupies a 748-acre complex at the center of the Paducah Site and is surrounded by a security fence. PGDP is now operated by the United States Enrichment Corporation (USEC). (The operation of the uranium enrichment facilities at PGDP was transferred from DOE control to that of USEC, a private corporation, in 1993.) Enriched uranium is currently being produced for the commercial sector as fuel for nuclear power reactors.

2.2.2 Facility Construction

Vortec processing equipment is designed to be skid-mounted and can be installed on concrete foundations. The components are transportable and modular, allowing the facility to be disassembled and moved. The various modules for the Vortec facility would be manufactured and assembled elsewhere and set up outdoors at the Vortec site on concrete pads. The Vortec facility components would not be enclosed in a building. Figure 2.1 is a schematic diagram of the site layout.

The proposed site is an area that was previously cleared and graded to construct a waste storage warehouse that was never built. Since initial grading, site drainage has been improved, and installation of concrete piles and pads has begun. This work was halted as part of the settlement agreement concerning DOE's use of the CXs (see Section 1.3). To complete construction of the Vortec facility, site preparation would be finished, and the various Vortec modules would be delivered and assembled.

The proposed site location is just west of an access gate through the west boundary fence of PGDP. Thus, a new road would not have to be built to transport wastes from the storage areas (Figure 1.2) at PGDP to the Vortec facility. Workers and delivery trucks could have access to the site from the south via the existing Patrol Road. A chain-link fence would be placed around the perimeter of the Vortec facility for property protection.

The Vortec facility would be constructed to comply with the Uniform Building Code. The Vortec facility would be located in Seismic Zone III as defined in this code.

2.2.3 Process Description

The Vortec facility would employ a vitrification process (i.e., conversion of waste material into glass at high temperature) to treat mixed waste. The heart of the facility, the Vortec CMS, was developed and tested in laboratory and pilot-scale settings by Vortec Corporation of Collegeville, Pennsylvania (DOE 1996). The two primary components of the CMS are the counter-rotating vortex (CRV) reactor and cyclone melter.

The Vortec facility would consist of the following major systems: feedstock preparation, vitrification, vitrified product handling, air pollution control, wastewater treatment, and utility systems (DOE 1996). The Vortec flow diagram shown in Figure 2.2 depicts the processing stages, from input (as drums of mixed waste) to final product (as glass).

2.2.3.1 Feed Preparation

The feedstock preparation process would start with an inspection of the incoming drum contents. Two stages of shredding to reduce the size of the material would follow. A rotary dryer operating on propane would dry the soil material after it left the shredders. (A drying stage is required to reduce the moisture level to about 1% to ensure the flow of waste material.) After drying and before the grinding process, plastic and metal would be removed for disposal. Before the vitrification process can occur, the waste material and glass additives must be blended. The blending system consists of a soil storage silo, two glass additive storage silos (limestone and soda ash), and a feedstock blending assembly. Each additive silo has a capacity of 50 tons and would be filled by trucks.

2.2.3.2 Vitrification

The Vortec CMS treats wastes by producing a chemically bonded, inert, vitrified solid from the waste's inorganic components; the high temperatures at which the process operates destroy any organic contaminants. The CMS process combines inorganic waste material with glass-making ingredients, such as limestone (calcium carbonate), sand (silicon dioxide), and soda ash (sodium magnesium carbonate), at temperatures of up to 2,800°F to melt inorganic materials into glass.

The initial phase of the vitrification process to heat the feedstock material involves the following systems: reactor air delivery, blended waste material, CMS, and a recuperator. The CMS consists of a CRV reactor, cyclone melter, and separator reservoir. (These systems are described in detail in DOE's application to the Commonwealth of Kentucky for a Research, Development and Demonstration [RD&D] Permit [DOE 1996]). Air enters the recuperator, where it is preheated to about 1,200°F by the waste heat leaving the separator reservoir. Air then leaves the recuperator and

passes to two inlet arms of the refractory-lined, water-cooled, carbon steel CRV reactor. The upper and lower inlet arms allow propane gas and air to enter tangentially into the reactor, creating opposing vortex motions that allow excellent reaction stability in the upper portions of the CRV. Feedstock material is injected axially through the top of the CRV reactor. Radiant and convective heat transfer bring the feedstock to the proper temperature for melting.

The cyclone melter is also a refractory-lined, water-cooled, carbon steel vessel. A tangential inlet causes a cyclonic flow within the melter. Molten material moves out to the melter walls, where glass-forming reactions initiated in the CRV are completed. The molten glass then enters the separator reservoir and exits to a water quench, resulting in the formation of gravel-sized glass fragments. Water in the quench tank further cools the glass, and a drag conveyor removes glass from the tank to continue to cool to temperatures below 200°F. The glass frit is discharged into the end of the conveyor after it becomes totally dry. For land disposal, the glass frit must meet the LDR criteria for toxicity characteristics for hazardous wastes set forth in 40 CFR Subpart C, Paragraph 261.24. EPA-approved laboratories that follow EPA TCLPs would be used to conduct analyses to assure that the glass frit met these requirements before land disposal (40 CFR 268).

2.2.3.3 Air Pollution Control

The air pollution control systems for feed preparation are designed to collect the particulates generated during crushing, drying, and milling of waste material; silo filling; and feedstock blending. The wet air pollution control system is designed to process various off-gases leaving the CMS. The wet system consists of a venturi scrubber, wet electrostatic precipitator, and high-efficiency particulate air (HEPA) filters. Clean gases leaving the HEPA filters would be released to the atmosphere through a stack that is 50 ft tall and 4.25 ft in diameter. Air emissions from the Vortec facility are described in Section 4.2.2.2.

2.2.3.4 Wastewater Treatment

The wastewater treatment system would receive blowdown from the air pollution control system, backwash from the polishing filters, filtered liquid from the filtrate tank, blowdown from the baghouse condenser tank, and water collected in storm water tanks in three outside areas. The storm water tanks would receive blowdown from the cooling tower, glass quench tanks, and feed material preparation system and rainfall. The rainfall would collect in sumps located within three concrete curbed areas. The system is designed to handle a 25-year recurrence, 24-hour rainfall event.

The wastewater treatment system has two neutralization tanks in series that would process liquids received from the various sources mentioned above. In the first tank, effluent pH would be reduced to 2-3 as a result of the addition of sulfuric acid. A ferrous sulfate solution would be added

to reduce the amount of hexavalent chromium collected by the air pollution control system. Wastewater would then flow to a second tank, where the pH would be adjusted to 8-9 as a result of the addition of sodium hydroxide. After the wastewater flowed to a clarifier, iron and chromium hydroxide would settle out. A polymer would be added to enhance solids removal. Liquid from the clarifier tank would be discharged to the polishing filter feed tanks and subsequently pumped to the polishing filters. Solids from the clarifier would be pumped to a holding tank and then through a filter press for dewatering. Filter cake from the filter press would be returned to the drier inlet for retreatment. The polishing filters would remove suspended solids before the wastewater would enter the ion exchange units. Two sets of ion exchange units would remove any remaining radionuclides from the wastewater. Expended resin chambers within the exchange units would be disposed of, if necessary. Treated effluents would then flow to the effluent tank, which would also serve as a make-up water tank. Blowdown from the wastewater treatment system would be intermittently discharged to the 001 outfall (Figure 1.2) at a rate of 15 gallons per minute (gpm). Wastewater releases are described in Section 4.2.2.2.

2.2.4 Facility Operation

The Vortec system is designed to receive 55-gal drums and drum overpacks containing mud, concrete, plastics, PCB wastes, and other bulk wastes found at PGDP. The Vortec facility would be designed to operate at a throughput of 25 tons/d of dry feedstock. (The system could process about 70 tons/d if it was slightly modified to allow the addition of oxygen to the process air.) An inventory of drums containing wastes would be maintained at the Vortec facility in a temporary storage area to assure an adequate supply for continuous operation.

2.2.4.1 Operational Phases

During the initial phases of operation, the performance of the Vortec facility with Paducah wastes would be tested and evaluated. Thereafter, the facility would treat the remainder of suitable Paducah wastes. The following operational sequence would be followed (Tidwell 1997, personal communication):

1. The first phase of facility operations would consist of two stages. The first stage would involve testing the vitrification unit by using clean soils to ensure that the unit achieves acceptable operational status and performance before any wastes are processed through the system. The second stage would involve the use of wastes that consist of mixed RCRA waste and low-level radioactive wastes that have low (less than 50 parts per million [ppm]) PCB concentrations. The Vortec Corporation and DOE are co-applicants for an RD&D Permit (DOE 1996) that would encompass this initial 30-day research

phase. Operations would include the characterization and quantification of air emissions, wastewater composition, and melted product composition. Following the first phase of operations, the next three phases of operations would occur over a 2-year period.

2. The second phase of facility operations would test the treatment of wastes with higher PCB concentrations (50 ppm and more to less than 74,000 ppm). This phase is not reflected in the RD&D Permit application because PCBs are regulated by the federal government under TSCA. Before this second test phase begins, DOE and the Vortec Corporation will seek and have in place the necessary approvals under TSCA, which may include, if necessary, an amendment of the RD&D Permit. DOE is currently pursuing a TSCA PCB Alternate Technologies Permit for this phase.

3. The third phase of facility operations, which would build on the experience gained in the earlier two phases, would involve making process adjustments to improve performance and/or increase capacity. This phase might include adding and testing an oxygen injection feature. These adjustments and enhancements could result in an increase of the unit's throughput capacity from 1.5 to 3.0 tons/h. Both the RCRA RD&D and TSCA PCB Alternate Technologies Permits issued by the Commonwealth of Kentucky would be amended to include this phase once the results of earlier phases could be collected, analyzed, and incorporated into a design proposal. This phase would be a logical extension of the earlier performance evaluations.

4. At the completion of the research demonstration phase, DOE may decide to continue to use the test unit to process the remaining wastes at PGDP. This portion would be considered the fourth and final phase of the Vortec vitrification program. With respect to processing rates, air emissions, ambient air impacts, and air permitting requirements, this phase of operations would be equivalent to the previous phase. However, this fourth phase would be contingent on receiving authorization under a hazardous waste treatment permit pursuant to state regulations (40 Kentucky Administrative Regulation [KAR] 34.250, Miscellaneous Units).

2.2.4.2 Infrastructure and Materials Required

To produce a feedstock with the proper chemical composition to make glass, low-level waste would be blended with RCRA, PCB, or mixed waste. The low-level waste would consist of clay, sand, and gravel that contain the silicon dioxide needed for glass formation. Trace quantities

of radioactive metals, primarily uranium-238 and technetium-99, occur in the low-level waste soils. DOE would characterize the waste streams to be supplied to the Vortec facility. DOE would also assure that moisture content was less than 30% and that no potentially explosive organics were present by inspecting each barrel before its release. The types and quantities of wastes expected to be treated during operation are discussed in Appendix A.

PGDP would provide water for the Vortec facility at a rate of 50 gpm. This volume would be sufficient to supply the glass quench tank, cooling tower, treated effluent, and sanitary water. The Vortec facility's wastewater treatment system is expected to discharge effluent intermittently to the drainage ditch adjacent to the north boundary just upstream from the Kentucky Pollution Discharge Elimination System (KPDES) monitoring station 001 (Figure 1.2). When blowdown from the cooling towers occurs, total facility water discharges are expected to be approximately 15 gpm.

The Vortec facility would require electrical power at 60 Hz, 1,500-kV amps, and 480/277 volts during full operations. Electrical power would come from the Tennessee Valley Authority (TVA). Emergency auxiliary power would be provided by a diesel generator.

An estimated quantity of 40–50 tons of limestone (representing four to five truck deliveries) would be needed for the initial 30-day evaluation period. Thereafter, about 20–30 tons of soda ash (entailing two to three truck deliveries) would be required during the 30-day evaluation period (Tidwell 1997, personal communication). During full operation of the Vortec facility (following the initial operating periods), regular truck deliveries of limestone and soda ash would be required. On the basis of the assumption that the facility would operate continuously on two 10-hour shifts, 5 days per week for 2 years, about 1,560 tons of limestone and 1,040 tons of soda ash would be needed. This represents about 260 truck deliveries (assuming 20,000 lb/truck), or an average of about 2.5 deliveries per week. Several truck shipments would be necessary to transport the glass additives (i.e., soda ash and limestone) to the Vortec storage silos. Trucks would also deliver the low-level waste and mixed wastes to a waste staging area at the site. No new access roads or road upgrades would be needed to accommodate truck traffic.

2.2.4.3 Disposal of Product

The glass frit is planned to be disposed of at landfill C-746-U, located about 1.5 mi northeast of the proposed Vortec facility on the Paducah Site (DOE 1996) (Figure 1.2). The glass frit would have to meet the LDR criteria for toxicity characteristics for hazardous wastes set forth in 40 CFR Subpart C, Paragraph 261.24 (Table 2.1). EPA-approved laboratories that follow EPA TCLPs would be used to conduct analyses to determine whether the glass frit met these requirements before land disposal (40 CRF 268).

TABLE 2.1 Maximum Concentrations of Contaminants for the Toxicity Characteristic Leaching Procedures[a]

Contaminant	Level (mg/L)
Arsenic	5.0
Barium	100.0
Benzene	0.5
Cadmium	1.0
Carbon tetrachloride	0.5
Chlordane	0.03
Chlorobenzene	100.0
Chloroform	6.0
Chromium	5.0
o-Cresol	200.0
m-Cresol	200.0
p-Cresol	200.0
Cresol	200.0
2,4-D	10.0
1,4-Dichlorobenzene	7.5
1,2-Dichloroethane	0.5
1,1-Dichloroethylene	0.7
2,4-Dinitrotoluene	0.13
Endrin	0.02
Heptachlor (and its epoxide)	0.008
Hexachlorobenzene	0.13
Hexachlorobutadiene	0.5
Hexachloroethane	3.0
Lead	5.0
Lindane	0.4
Mercury	0.2
Methoxychlor	10.0
Methyl ethyl ketone	200.0
Nitrobenzene	2.0
Pentrachlorophenol	100.0
Pyridine	5.0
Selenium	1.0
Silver	5.0
Tetrachloroethylene	0.7
Toxaphene	0.5
Trichloroethylene	0.5
2,4,5-Trichlorophenol	400.0
2,4,6-Trichlorophenol	2.0
2,4,5-TP (Silvex)	1.0
Vinyl chloride	0.2

[a] As specified in 40 CFR Subpart C, Paragraph 261.24.

After product characterization and TCLP tests were completed, the frits passing the tests would be placed in approved containers and transported by truck to landfill C-746-U. The capacity required to accommodate glass frit produced by treating 10-70% of the PGDP mixed waste would be up to 3,000 m^3 (3,925 yd^3). Any frit not meeting LDR requirements would be shipped to an off-site disposal facility or placed in storage until an appropriate off-site disposal facility was available.

2.2.4.4 Monitoring

As part of the proposed action, DOE would require the Vortec Corporation to monitor potential impacts of facility operation by conducting an extensive sampling and evaluation program. Gaseous and liquid effluents would be monitored in accordance with applicable permits to assure that emissions were in compliance with federal and Commonwealth of Kentucky requirements. The vitrified product would be tested to assure it complied with EPA standards for safe disposal. Changes in facility operation would be imposed by DOE on the Vortec Corporation if monitoring and sampling analyses conducted during the initial 30-day period and subsequent 2 years of operation demonstrated that effluents were exceeding permitted levels. A complete list of parameters to be monitored is included in DOE's application to the Commonwealth of Kentucky for an RD&D Permit (DOE 1996).

Monitoring equipment would be used to track how well the various system components functioned. Table 2.2 provides a list of materials and parameters the Vortec facility plans to monitor during the three initial periods of facility operations. Inspections of equipment would be carried out on a daily, weekly, or monthly basis to assure that all Vortec facility systems were operating properly. Data would be recorded on operator log sheets. Inspections would include periodic examinations of waste and additive processing components, the melter, and air pollution control system components. Parameters such as pressures, temperature, flow rates, feedstock preparation data, and storage silo and blending vessel levels would be monitored on a continuing basis during operations.

2.2.5 Schedule and Labor Requirements

DOE anticipates that the remaining construction and assembly work on facility structures would be finished during the spring and summer of 1998, depending on completion of the NEPA process. Until then, already delivered facility components would be stored on the site. During peak construction, an estimated 28 workers would be on site (Tidwell 1997, personal communication). Most of the labor force for construction and assembly would probably come from the Paducah area.

An estimated 30 personnel would be present each day during initial operations. Personnel would evaluate system performance by visually observing individual component operations and

TABLE 2.2 Operational Monitoring Parameters for the Vortec Facility

Material	Purpose/Parameter	Applicable Standard
Mixed waste	Determine oxide, radionuclide, and heavy metal content and presence of organic compounds	EPA-approved methods in SW-846 (*Test Methods Evaluating Solid Wastes, Physical/Chemical Methods*), or American Society for Testing and Materials standards
Feedstock material (waste stream and glass formers)	Determine feedstock ratio; assess performance during operation; determine particle size distribution, radionuclides, heavy metals, and organics anticipated	Same as above
Glass frit	Determine if glass product meets leaching requirements for landfill disposal	EPA TCLPs (40 CFR Subpart C, Paragraph 261.24)
Flue gases	Determine concentrations of flue gases, including periodic monitoring of carbon monoxide, carbon dioxide, oxygen, nitrogen oxides, and radionuclides	401 Kentucky Administrative Regulation (KAR), Chapters 50-65; National Emission Standards for Hazardous Air Pollutants (NESHAPS; 40 CFR Part 61, Part H); EPA methods (40 CFR Part 60)
Wastewater	Currently the KPDES wastewater permit requires testing for the presence of about 280 chemicals during the first year a new facility operates	As specified in KPDES wastewater permit

checking monitoring instrumentation. Because facility performance would be evaluated, equipment would be periodically checked, and samples would be collected, the Vortec facility might not operate on a continuous basis during the early days of operation. Sampling would be conducted in a systematic and statistically valid manner throughout all phases of operation to assess how well each facility system was functioning. It is expected that Vortec would operate for 2 years. The later stages of facility operation would require a work force of 50 during two 10-hour shifts (Tidwell 1997, personal communication).

2.2.6 Facility Closure, Decontamination, and Decommissioning

The Vortec waste vitrification equipment is modular in design and considered transportable. It could be disassembled, and the modules could be moved by truck to another DOE site following

the termination of vitrification activities at the Paducah site. After waste treatment operations were completed, DOE would initiate closure within 90 days of receiving the final waste volumes. Closure activities would be completed within 180 days of receiving the final wastes. Following closure, DOE might decide to ship some vitrification equipment to another DOE installation (DOE 1996).

All vitrification equipment that had come in contact with the various waste streams would be decontaminated. Clean sand or other suitable material would be used to flush out contaminated material remaining from the last waste stream treated. Pipes, hoses, and conveying systems connecting the processing equipment would be flushed before disassembly. Equipment would be cleaned only to the extent necessary for shipment to the next DOE installation. Decontamination activities and end results would comply with U.S. Department of Transportation (DOT) requirements for shipment. Ancillary equipment such as containment dikes, tanks, and surface water removal pumps could be shipped to another DOE installation or used at the PGDP for other hazardous waste operations.

Concrete pads and surface soils in the storage yards are not expected to be contaminated by facility operations. Any spills on concrete pads and surface soils would be cleaned up as part of normal operational procedures. Concrete pads would be visually observed for stains to determine potential contamination. Soils and concrete could be sampled if observations suggested that contamination had occurred. If contamination were detected in the soils, they would be collected and treated in the Vortec facility. Any concrete materials that had been contaminated during operations would be removed by appropriate mechanical means.

2.3 ALTERNATIVES NOT ADDRESSED IN DETAIL

2.3.1 Off-Site Storage, Treatment, or Disposal

The WM PEIS (DOE 1997a) identifies a preferred alternative for PGDP mixed waste: ship it to a regional location for treatment and disposal (although some mixed wastes would be treated on site, consistent with the PGDP STP). Although the WM PEIS has been finalized, a Record of Decision for the mixed wastes portion has not been issued. Some of the mixed waste generated at PGDP is contaminated with PCBs, and no off-site facilities that would accept that type of waste for disposal currently exist, including the TSCA incinerator at Oak Ridge. Current regulatory agreements with the EPA (TSCA FFCA) and the Commonwealth of Kentucky (STP) take precedence over and supersede the WM PEIS alternatives. These agreements do not address off-site shipment of PCB mixed wastes, and such an action could not occur.

Disposal of mixed waste is not permitted until LDRs are met; thus, wastes must be treated prior to disposal. Once LDR restrictions are met, disposal could be accomplished at sites such as

Hanford, the Nevada Test Site, or Envirocare of Utah. Treatment of non-PCB-contaminated mixed waste exists for some treatment forms. The STP includes treatment schemes for those mixed wastes for which Paducah has outlets. Other mixed wastes are more problematic, and the STP requires that treatment be sought.

The TSCA incinerator at Oak Ridge is currently used by Paducah for treatment of liquid wastes, which are not proposed for treatment by Vortec. Vortec is designed to treat solid wastes except for paper and plastic wastes. (Vortec would have to be modified to treat these wastes.). The TSCA incinerator has been considered for treatment of paper and plastic wastes, but the current regulatory climate precludes Paducah from using the TSCA incinerator option for paper and plastics until at least 1999.

2.3.2 Other Treatment Technologies

2.3.2.1 Vitrification

Other treatment technologies that have been proposed or are being used for hazardous and mixed wastes include other vitrification technologies and waste stabilization technologies. Incineration of the mixed wastes was not considered because the product ash would still contain a hazardous component that would require further vitrification or stabilization and solidification prior to disposal. Vitrification technologies are described in Version 5.0 of the Vendor Information System for Innovative Treatment Technologies (VISITT) database. VISITT was developed by the Technology Innovation Office within the EPA's Office of Solid Waste and Emergency Response. It is a PC-based system containing information on 350 innovative remediation technologies offered by 204 vendors. The VISITT database contains technology profiles consolidating performance data from various government sources and provides information on each technology's applications, limitations, costs, and performance and on sites at which each technology has been employed. Vitrification technologies that have progressed to full-scale demonstration are listed in Table 2.3. Of these, none can treat the range of low-level, hazardous, and mixed waste types currently stored at PGDP.

2.3.2.2 Solidification and Stabilization

In solidification and stabilization (S/S) technology, chemical reagents are mixed with waste so that complex chemical and physical reactions can be used to improve physical properties and reduce contaminant solubility, toxicity, and/or mobility (Battelle Pacific Northwest Laboratories 1991). Disadvantages of waste stabilization processes include the large increases in waste volume

TABLE 2.3 Capabilities of Other Vitrification Technologies

Technology	Suitability for Paducah's Wastes
VERT: McNeill Vitrification Process	Unable to treat low-level and PCB wastes
Seiler Pollution Control Systems: High-Temperature Converter	Unable to treat PCB wastes
Electro-Pyrolysis, Inc.: DC Graphite Arc Melter	Would not immobilize radionuclides
Stir-Melter, Inc.: Stir Melter	PCB wastes would require extensive pretreatment
Retech: Plasma ARC Centrifugal Treatment System	Incomplete conversion of PCBs would lead to off-gas concerns

that result from the additives necessary to achieve stabilization and the fact that the final waste form is not as leach-resistant as is glass or slag.

The PGDP waste streams (soils, rocks, sand, and concrete) are contaminated with low-level radioactivity as well as RCRA and TSCA mixed and PCB wastes. Federal PCB disposal regulations (40 CFR 761, 1995) prescribe the method(s) of disposal on the basis of waste type and PCB concentration. The disposal methods listed include high-temperature incineration, landfilling, high-efficiency boilers, and alternative technologies determined by the EPA to be equivalent to high-temperature incinerators or high-efficiency boilers.

The S/S process is generally most effective for inorganic compounds and radionuclides. Specific contaminants or contaminant groups for which S/S is generally effective include volatile and nonvolatile compounds containing metals (with some exceptions, including anionic complexes of metals such as chromium, selenium, and arsenic), cyanides, strong acids, oxidizing agents, reducing agents, other inorganics (inorganic corrosives and inorganic cyanides), asbestos, and radionuclides. Treatment of some semivolatile organic compounds (SVOCs) with S/S has been documented, but treatment of volatile organic compounds (VOCs) is currently the focus of much research and debate. A review of the available literature did not indicate that S/S technology was recommended or used to treat PCBs (Conner and Lear 1991; McCollogh and Dagdigian 1993; Roy 1992; Shin 1988).

2.3.3 Other Vortec Facility Locations

The site for the Vortec facility is located on 5 acres of land just outside and to the west of the PGDP boundary (Figure 1.2). DOE considered five locations for the Vortec facility at the Paducah Site (Tidwell 1997, personal communication). The DOE siting team used the following criteria to evaluate each site for suitability: its (1) size (i.e., at least 4 acres), (2) accessibility from the mixed waste storage facilities at PGDP, and (3) potential to interfere with PGDP activities. The DOE siting team determined that ready access was required to move containers safely and efficiently between the storage facilities and the Vortec facility. The size requirement eliminated three potential sites and the combination of the access and noninterference requirements eliminated a fourth site. The proposed location is big enough for the Vortec facility, easily accessible from the storage facilities, and not expected to interfere with ongoing or future PGDP activities.

3 AFFECTED ENVIRONMENT

The following topics were evaluated and deemed not applicable for inclusion in this EA: wetlands, floodplains, wild and scenic rivers, and prime farmlands. In 1994, during the preparation of an EA for the construction and operation of waste storage facilities at the Paducah Site (DOE 1994), it was determined that the proposed Vortec facility location does not have wetlands and is not within a 100-year floodplain. At that time, it was also determined that no wild and scenic rivers or prime farmlands are present on the site (DOE 1994).

3.1 LAND USE

The Vortec site is adjacent to the western boundary of PGDP, a large industrial facility. The Vortec site had been previously identified by DOE for development to support waste management activities. The land west of the Vortec site is managed by the Kentucky Department of Fish and Wildlife Resources (KDFWR) as part of the West Kentucky Wildlife Management Area (WKWMA) under a 1953 agreement that granted management control of a 1,986-acre parcel to the Commonwealth of Kentucky (Figure 1.1). The U.S. government retained the right to utilize any or all of this land whenever the need arose. Recreational use in McCracken County and the western Kentucky region is predominantly related to hunting, fishing, boating, and camping. The WKWMA, located west of the proposed Vortec facility, is used for hunting bobwhite quail and white-tailed deer and for dog training.

3.2 METEOROLOGY AND AIR QUALITY

3.2.1 Climate

The Paducah area is located in the humid continental zone, characterized by warm summers and moderately cold winters. For the 1961–1990 period, the annual average temperature at the Paducah area was 14.0°C (57.2°F), with the highest monthly average temperature of 26.0°C (78.8°F) in July and the lowest of 0.3°C (32.6°F) in January (Wood 1996). Annual precipitation averages about 125 cm (49.3 in.), mostly as rain. Data for the period 1985–1993 indicate that the average relative humidity is about 86% at 6:00 a.m. and 58% at noon.

On the basis of data collected at Barkley Regional Airport near Paducah for the period 1985–1992, average wind speed is about 3.6 m/s (8.1 miles per hour [mph]) (EPA 1997). As shown in Figure 3.1, dominant wind directions are from the south and south-southwest at an average wind speed of about 4.0 m/s (9.0 mph). Meteorological data on wind direction, speed at heights of 10 m

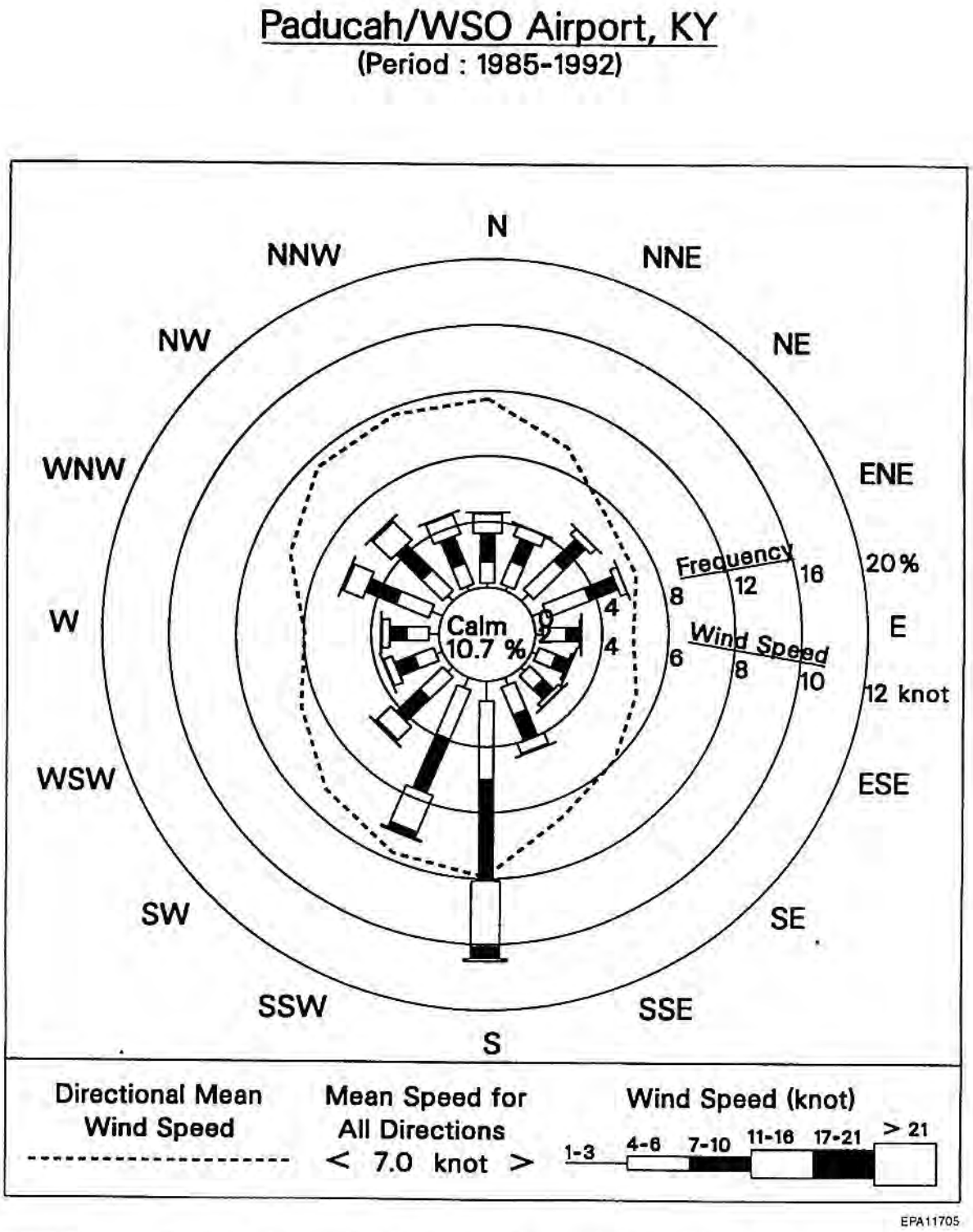

FIGURE 3.1 Wind Rose Patterns of Wind Speed Frequency and Directional Wind Speed for the Paducah Area

and 60 m aboveground, rainfall, temperature, relative humidity, and barometric pressure have also been collected at monitoring stations on PGDP.

3.2.2 Air Quality and Applicable Regulations

The Paducah area is located in the Paducah-Cairo Interstate Air Quality Control Region. The national and state ambient air quality standards for six criteria air pollutants — sulfur oxides (as sulfur dioxide [SO_2]), PM_{10} (particulate matter with an aerodynamic diameter of $\leq$ 10 μm), carbon monoxide (CO), ozone (O_3), nitrogen dioxide (NO_2), and lead (Pb) — are identical (401 Kentucky Administrative Regulation [KAR] 53:010), as shown in Table 3.1. In addition, hydrogen sulfide (H_2S), gaseous and total fluorides, and odors are regulated by the Commonwealth of Kentucky (Table 3.1).

Because PGDP is in a Class II prevention of significant deterioration (PSD) area, any new emission sources must adhere to the incremental standards for a Class II area. These incremental standards are 512, 91, and 20 $\mu g/m^3$ for 3-hour, 24-hour, and annual average emissions of SO_2; 30 and 17 $\mu g/m^3$ for 24-hour and annual average emissions of PM_{10}; and 25 $\mu g/m^3$ for annual average emissions of NO_2. The nearest Class I PSD areas are the Mingo National Wildlife Refuge in Missouri, about 145 km (90 mi) west of PGDP, and Mammoth Cave National Park in Mammoth Cave, Kentucky, 217 km (135 mi) east of PGDP.

In addition to standards for criteria pollutants, the Kentucky Department of Environmental Protection (KDEP) has adopted rules governing new or modified sources emitting toxic air pollutants (401 KAR 63:022). This regulation lists threshold ambient limits (in mg/m^3) and significant emission levels (in lb/h) for more than 700 toxic compounds.

3.2.3 Air Monitoring at Paducah Gaseous Diffusion Plant

Air quality at PGDP is monitored on a regular basis. Twenty-seven air pollutant emission sources at PGDP have permits to operate issued by the Kentucky Division for Air Quality. Two sets of air quality monitors are located in the vicinity of PGDP. The first set, which is operated by PGDP, has 12 monitoring locations that collect data to assess impacts of various contaminants emitted from the on-site source (Argonne National Laboratory [ANL] 1991). The second set, operated by the Commonwealth of Kentucky, is spread over the entire state to collect the data on criteria pollutants.

Table 3.1 also lists the highest background concentrations that can be considered representative of the Paducah area in 1996. As shown in the table, the Paducah area, including the proposed Vortec site, is currently an attainment area for all criteria pollutants. The major air

TABLE 3.1 Commonwealth of Kentucky Ambient Air Quality Standards and 1996 Highest Background Levels Representative of the Paducah Area

Pollutant[a]	Primary Standard[a]	Secondary Standard[a]	Highest Background Level in 1996
Sulfur oxides (sulfur dioxide) ($\mu g/m^3$)			
Annual arithmetic mean	80 (0.03 ppm)	-[c]	13[d]
Maximum 24-hour average	365 (0.14 ppm)[b]	-	55[d]
Maximum 3-hour average	-	1300 (0.50 ppm)[b]	138[d]
Particulate matter, measured as PM_{10} ($\mu g/m^3$)			
Annual arithmetic mean	50[e]	50[e]	24[d]
Maximum 24-hour average	150[f]	150[f]	83[d]
Carbon monoxide (mg/m^3)			
Maximum 8-hour average	10 (9 ppm)[b]	Same as primary	4.9[d]
Maximum 1-hour average	40 (35 ppm)[b]	Same as primary	6.9[d]
Ozone ($\mu g/m^3$)			
Maximum 1-hour average	235 (0.12 ppm)[g]	Same as primary	182[d]
Nitrogen dioxide ($\mu g/m^3$)			
Annual arithmetic mean	100 (0.05 ppm)	Same as primary	24[d]
Lead ($\mu g/m^3$)			
Maximum arithmetic mean averaged over a calendar quarter	1.5	Same as primary	0.04[h]
Hydrogen sulfide ($\mu g/m^3$)			
Maximum 1-hour average	-	14 (0.01 ppm)[b]	i
Gaseous fluorides, expressed as hydrogen fluoride ($\mu g/m^3$)			
Annual arithmetic mean	400 (0.5 ppm)	-	0.16[j]
Maximum 1-month average	-	0.82 (1.00 ppb)[b]	-
Maximum 1-week average	-	1.64 (2.00 ppb)[b]	0.615[j]
Maximum 24-hour average	800 (1.0 ppm)[b]	2.86 (3.50 ppb)[b]	-
Maximum 12-hour average	-	3.68 (4.50 ppb)[b]	-

TABLE 3.1 (Cont.)

Pollutant[a]	Primary Standard[a]	Secondary Standard[a]	Highest Background Level in 1996
Total fluorides (ppm)			
Dry weight basis (as fluoride ion) in and on forage for consumption by grazing ruminants. The following concentrations are not to be exceeded:			
• Average concentration of monthly samples over growing season (not to exceed 6 consecutive months)	-	40 (w/w[k])	-
• 2-month average	-	60 (w/w)	-
• 1-month average	-	80 (w/w)	-
Odors		At any time when 1 volume unit of ambient air is mixed with 7 volume units of odorless air, the mixture must have no detectable odor.	-

[a] Units are in micrograms per cubic meter ($\mu g/m^3$) and milligrams per cubic meter (mg/m^3). In primary and secondary Kentucky standards, parts per million (ppm) values are alternative ways of expressing the concentrations. ppb = parts per billion.

[b] This average is not to be exceeded more than once per year.

[c] - = not applicable.

[d] Measured in Paducah, McCracken County.

[e] The standard is attained when the expected annual arithmetic mean concentration is less than or equal to 50 $\mu g/m^3$.

[f] The standard is attained when the expected number of days per calendar year with a 24-hour average concentration above 150 $\mu g/m^3$ is equal to or less than 1.

[g] The standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm (235 $\mu g/m^3$) is equal to or less than 1.

[h] Highest value measured in Commonwealth of Kentucky, at Versailles, in Woodford County.

[i] Not measured in Commonwealth of Kentucky monitoring system.

[j] Based on PGDP data obtained on site.

[k] w/w = weight of fluoride ion per weight of forage unit.

Source: Kentucky Division for Air Quality (1997).

pollution sources near the Paducah area include PGDP and the TVA's coal-fired Shawnee Power Plant, about 3 mi north-northeast of the Vortec facility. In Illinois, the Joppa Power Plant and the Allied Signal Metropolis Works Uranium Hexafluoride Conversion Plant, located about 6 mi northwest and 5 mi northeast of PGDP, respectively, are major sources across the Ohio River. The actual emission rates for the above four plants and county total emissions of criteria pollutants and VOCs are listed in Table 3.2.

3.3 NOISE

Noise levels in the vicinity of the Paducah Site are relatively low. The location is rural, and no residences are located in the immediate vicinity. Measurements of ambient noise were taken at the residence nearest to the proposed Vortec facility. It is located 0.8 km (0.5 mi) east of the PGDP site boundary along Kentucky State Highway 358 and is about 3.3 km (2 mi) east-northeast of the proposed Vortec facility location. Measurements were taken on July 2, 1991, at 8:30 a.m., when the PGDP Site was in full operation (ANL 1991). The level of noise measured was 44 dB(A). Observers at the residence could not detect noise from PGDP at that time.

TABLE 3.2 Annual Emissions of Criteria Air Pollutants and Volatile Organic Compounds from Major Point Sources around the Vortec Facility[a]

	Actual Emission Rate (tons/yr)					
Major Emission Source	SO_2	PM_{10}	CO	NO_x	VOCs	Pb
Paducah Gaseous Diffusion Plant[b]	444	8.84	7.87	333	1.53	0.0005
TVA Shawnee Plant[b]	40,500	373	1,660	34,700	140	0.176
McCracken County, Ky., total[b]	41,000	445	1,680	35,000	692	0.181
Allied Signal, Inc.[c]	107	6.21	5.42	19.1	1.02	No data
Joppa Electric Energy, Inc.[c]	27,900	501	1,170	10,200	164	0.350
Massac County, Ill., total[c]	33,100	962	2,270	12,300	493	0.400

[a] SO_2 = sulfur dioxide; PM_{10} = particulate matter less than or equal to 10 μm in diameter, CO = carbon monoxide, NO_x = nitrogen oxides, VOCs = volatile organic compounds, Pb = lead.

[b] Actual emissions for 1996.

[c] Actual emissions for 1995.

3.4 WATER RESOURCES

Surface water drains from PGDP to Big Bayou Creek to the west and Little Bayou Creek to the east. The two creeks merge at a point about 0.5 mi from PGDP before entering the Ohio River, approximately 3 mi north of PGDP. The stream flow of both Big Bayou and Little Bayou Creeks rapidly increases after a precipitation event. When plant discharges decline, both creeks are often dry during May, June, October, and November (Saylor et al. 1990). About 85% of the normal flow of Big Bayou Creek is the result of various PGDP discharges.

The proposed Vortec site is located in the Big Bayou Creek drainage area. PGDP discharges to Big Bayou Creek averaged 4 million gal/d during a 1-year period from October 1987 to 1988 (ANL 1991). A surface water monitoring station (station 001) is located on the drainage ditch that parallels the northern perimeter of the proposed Vortec site (Figure 1.2). Data on water quality have been collected at this station since 1987 when the Commonwealth of Kentucky issued a KPDES permit for PGDP (Saylor et al. 1990). Water quality data for this location and two stations downstream on the Big Bayou Creek are presented in Table 3.3 (DOE 1997b).

TABLE 3.3 Water Quality Data from Big Bayou Creek Monitoring Stations during 1995

	Quantity per Liter of Water	
Contaminant	SW1 (Upstream)	SW5 (Downstream)
Cadmium	0.001 mg	0.001 mg
Chloride	14.082 mg	75.067 mg
Chromium	0.0108 mg	0.011 mg
Copper	0.0116 mg	0.1907 mg
Iron	0.9696 mg	0.1907 mg
Lead	0.003 mg	0.003 mg
Nickel	0.05 mg	0.05 mg
Phosphorus	0.0667 mg	0.2667 mg
Zinc	0.0178 mg	0.024 mg
PCB	0.156 µg	0.17 µg
Trichloroethylene	1.0 µg	1.0 µg
Uranium	0.0015 mg	0.0041 mg
Tc-99	8.2941 pCi	11.438 pCi
Np-237	0.1467 pCi	0.0438 pCi
Pu-239	0.0759 pCi	0.0559 pCi
Th-230	0.065 pCi	0.08 pCi

Eighteen Kentucky-permitted outfalls at the PGDP and Paducah Site are monitored for inorganic substances and 45 organic substances, including PCBs. Most substances are monitored two to four times per year. Surface water concentrations of radionuclides are generally lower at the downstream location on Big Bayou Creek below the Paducah Site than they are at the upstream location. However, the concentrations at the two locations are not significantly different. An exception is that concentrations of chloride, phosphorus, and copper were higher in the downstream samples during 1995. No withdrawals of water for domestic, commercial, or industrial purposes have been known to occur from Big Bayou Creek.

Two groundwater systems and one major aquifer have been classified for the Paducah Site. Surficial loess (i.e., material composed of silt particles transported by wind) and Upper Continental deposits make up the shallow groundwater system. Lower Continental deposits form the regional gravel aquifer (ANL 1991). This aquifer is composed of gravel and sand units and extends about 40–50 ft below the ground surface. The saturated aquifer is typically about 25 ft thick. Groundwater from the Paducah site generally flows northward toward the Ohio River.

Groundwater at PGDP and the Paducah Site is contaminated at various locations. However, only the shallow groundwater system is significantly contaminated. Trichloroethylene (TCE) and technetium-99 contamination occurs in the regional gravel aquifer along the northwestern portion of the site, located approximately 1,200 ft north of the proposed Vortec site. A current pump and treatment operation is under way to remove contaminants from the northwest plume of groundwater contamination before water is discharged to the Big Bayou Creek drainage. The discharge enters the drainage ditch near the proposed outfall from the Vortec site.

3.5 BIOTIC RESOURCES

3.5.1 Vegetation

The Paducah Site area is predominantly oak-hickory woodland. Common trees include several species of oak (e.g., white, red, shingle, post, and chestnut) and three hickory species (shagbark, bitternut, and mockernut). The proposed Vortec site is a previously disturbed grassland area adjacent to an upland forest stand located to the immediate south, west, and northwest. Riparian forests occur along the banks of Big Bayou Creek located about 600 ft west of the site at the nearest point. Forest-edge tree species include black locust, persimmon, and sumac (DOE 1994).

- *Lepomis miniatus* (redspotted sunfish, KSNPC threatened);
- *Rana aerolata circulosa* (northern crawfish frog, KSNPC special concern); and
- *Vireo bellii* (Bell's vireo, KSNPC special concern).

Also, *Corvus ossifragus* (fish crow, KSNPC special concern) has been sighted in the site vicinity and may visit the PGDP area.

The KDFWR (Beam 1997, personal communication) identified five federal endangered or threatened species that are known to occur in McCracken County, Kentucky, but indicated that impacts on these species from the Vortec facility would not be expected. The list included the following species:

- *Haliaeetus leucocephalus* (bald eagle, federal threatened, state endangered);
- *Sterna antillarum athalassos* (interior least tern, federal and state endangered);
- *Myotis sodalis* (Indiana bat, federal and state endangered);
- *Lampsilis obrupta* (pink mucket, federal and state endangered); and
- *Obovaria retusa* (ring pink, federal and state endangered).

In a visit to the site by the EA preparers in August 1997, it was determined that suitable habitat does not exist for any state or federal listed species at the proposed site.

3.6 SEISMICITY

PGDP is located in an area with a seismic risk rating of 3 on a scale of 1 through 3, 3 being the most severe risk (DOE 1994). The site is located near the northeastern end of the New Madrid fault zone. Within a 200-mi radius, six additional fault zones have been identified by geologists (Saylor et al. 1990). There is no evidence of an active fault within at least 7 mi of PGDP (DOE 1996b). Several minor tremors have occurred at PGDP since the early 1950s. The most intense earthquake in recent times occurred in 1962 and registered 5.5 on the Richter scale (DOE 1994). There has never been a release or accident as the result of a seismic event at PGDP.

3.7 RADIATION ENVIRONMENT

Operations at PGDP result in radiation exposures to both on-site workers and off-site members of the general public (Table 3.4). Exposures to on-site workers are generally associated with handling radioactive materials used in the on-site facilities and inhaling radionuclides released from processes conducted on site. Members of the off-site general public are exposed to radionuclides discharged from on-site facilities through airborne and/or waterborne emissions.

The total radiation dose to the maximally exposed individual (MEI) of the general public from PGDP operations is estimated to be 1 mrem/yr, which is much lower than the radiation dose limit (100 mrem/yr) set for the general public for operation of a DOE facility (DOE Order 5400.5). The external radiation dose for PGDP radiation workers who are exposed to the same types of waste as those to which Vortec workers would be exposed ranged from zero to 11 mrem/yr (Knaus 1997, personal communication) in the past few years. These doses are well below the DOE administrative procedures dose limit of 2,000 mrem/yr and the regulatory limit of 5,000 mrem/yr set for radiation workers (10 CFR Part 835). All of these exposures are a very small fraction of the 360 mrem/yr dose received by the general public and workers from natural background and medical sources (Table 3.4).

3.8 DEMOGRAPHICS

Federal agencies have been directed by Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations,* to incorporate considerations of environmental justice into their missions. Specifically, federal agencies must identify and address, as appropriate, disproportionately high and adverse health or environmental effects of their programs, policies, and activities on minority and low income populations.

The demographics of the Paducah Site with respect to income level and minority status were evaluated in detail in the WM PEIS (DOE 1997a). The population in a 50-mi radius of the Paducah Site is low income but not minority compared with the national average. Although the minority populations are above the national average in several census tracts to the north and southwest of the Paducah Site, these locations are not near the Vortec site.

TABLE 3.4 Estimated Radiation Doses to Members of the General Public and Workers at the Paducah Gaseous Diffusion Plant

Receptor	Radiation Source	Dose to Individual (mrem/yr)
Maximally exposed individual (MEI)[a]	Routine site operations	1.4[b]
Worker	External radiation	0-11[c]
Member of public or worker	Natural background radiation and medical sources	360[d]
DOE limit for individual member of public		100[e]
DOE limit for worker		2,000[f]

[a] The MEI was assumed to reside at an off-site location that would yield the largest dose. An average person would receive a radiation dose much less than the values shown in this table.

[b] Includes dose contributions from airborne radionuclides, waterborne radionuclides, and direct gamma radiation from Lockheed Martin Energy Systems, Inc. (LMES) and Lockheed Martin Utility Systems (LMUS) operation (LMES 1997; USEC 1996 [NESHAPS report]). Ingestion of surface water was not evaluated because there was no reported use of surface water, and contaminated well water is not used because all residents in the area receive city water.

[c] Range of worker dose for 1996 (Knaus 1997, personal communication). The reported dose range includes workers from the LMUS waste management and environmental support sampling groups as well as the LMES waste sampling group. These workers were used because they are exposed to the same waste type as that to which the Vortec workers are expected to be exposed.

[d] Average dose to a member of the U.S. population as estimated in Report No. 93 of the National Council on Radiation Protection and Measurements (NCRP 1987).

[e] DOE Order 5400.5.

[f] DOE administrative procedures limit DOE workers to 2,000 mrem/yr (DOE 1992), whereas the regulatory dose limit for radiation workers is 5,000 mrem/yr (10 CFR Part 835).

4 ENVIRONMENTAL IMPACTS

4.1 IMPACTS OF NO ACTION ALTERNATIVE

Under the no action alternative, mixed, low-level, and hazardous wastes currently stored at PGDP would not be treated. They would be stored indefinitely at PGDP until a treatment and/or disposal technology became available. However, such continued storage would be in conflict with current agreements with the EPA (TSCA FFCA) and the Commonwealth of Kentucky (STP Agreed Order). Conditions at the Vortec site would remain as described in Section 3 (the affected environment section). Exposures to the public from RCRA and TSCA mixed wastes would continue to be minimal because access to the storage locations at PGDP is restricted. Impacts from a credible accident that would release the entire contents of a waste drum to the air would be the same as those from the proposed action (see the text on accidents in Sections 4.2.2.2 and 4.2.2.6).

Continued storage of wastes includes maintenance of drums, storage yards, and buildings. Wastes stored inside can require repackaging as often as every 5 years. Wastes stored outside can require more frequent repackaging. These activities result in continued exposure of workers to radiation from low-level and mixed wastes.

Proposed revisions to the DOE order governing low-level waste may require indoor storage. This requirement would force construction of new warehouses at PGDP. Little disturbance or loss of ecological habitat would result if these buildings were constructed in existing storage yards.

Drums of wastes stored for long periods of time can build up internal pressure, resulting in an explosion. Such a condition presents a risk to workers, is expensive to clean up, and can generate additional wastes. The drum that exploded in C-476-Q in September 1997 cost $750,000 in cleanup charges and resulted in 40 times more waste volume after cleanup.

4.2 IMPACTS OF PROPOSED ACTION

4.2.1 Impacts from Construction and Assembly

4.2.1.1 Air Quality

Impacts from the exhaust emissions of construction vehicles on air quality are expected to be minimal because only a few vehicles and a very small number of trips per day would be involved. There would be no impacts from particulate emissions due to site disturbance because the site has

already been cleared and graded and the concrete piers and pads have already been installed. Site disturbance would be limited mainly to equipment delivery and setup and final surface preparation. Other construction activities are expected to generate only small amounts of air emissions. Impacts on ambient air quality from construction would not extend to the area just outside the site boundary, which the general public is expected to occupy only infrequently. Construction activities for the Vortec facility would be limited to daytime hours, when air dispersion is most favorable. Also, to minimize potential air quality impacts, fugitive dust would be controlled, where needed, by following established good engineering practices, mainly by watering roadways, disturbed surfaces, and temporary stockpiles. The traffic roads leading to the Vortec facility are currently paved; thus, fugitive road dust emissions are expected to be minor. Therefore, potential air quality impacts associated with construction activities would be minor, local, and temporary.

4.2.1.2 Noise

Noise emitted from construction activities is also expected to be minor, local, and temporary. This type of noise is specially exempted from compliance with Kentucky noise pollution regulations (Kentucky Revised Statute [KRS] 224.30-170). No unusual or serious noise impacts to workers or the public are expected from construction of the proposed Vortec facility. The nearest residence is located about 1,580 m north-northeast of the site. At this distance, construction noise would not be discernable from other background noise.

4.2.1.3 Water Resources

Construction activities would not significantly impact surface water and groundwater in the site area. Best management practices and erosion control would be used to minimize the potential for site runoff. Some temporary resuspension of sediments in the drainage ditch along the north side of the site might occur during installation of the water effluent pipe and diffuser and placement of the rip-rap material along the bank after the pipe was in place. The diffuser design has not been finalized but will be a type that can provide adequate mixing to meet the 85°F water temperature requirement specified in the KPDES permit for monitoring station 001. Water requirements for construction-related activities have not been determined but are expected to be relatively minor when compared with the overall needs of PGDP. The current water supply for the Paducah Site, including PGDP, averages about 18.5 million gal/d. Water would be brought to the site by truck to accommodate construction needs. Minimal amounts are anticipated to be used in preliminary testing of the water treatment system, by sump pumps, and to wash certain items of equipment before final assembly.

4.2.1.4 Biotic Resources

Vegetation

The proposed Vortec facility location is already a disturbed grassland community. The site was cleared of vegetation when concrete pads and footer structures for the various facility modules were being built, before DOE decided to prepare this EA. Completion of construction and assembly activities would not result in any loss of native plant species in either the proposed site or adjacent equipment laydown and assembly area.

Wildlife Habitat

Construction of the Vortec effluent drain pipe and diffuser structure in the drainage ditch and the rip-rap area along the ditch would likely cause a temporary increase in sediment resuspension and sediment content as a result of surface erosion. The current flow rate of the ditch is relatively high, averaging about 1,630 gpm in 1996 (Ashburn 1997, personal communication); the ditch receives input from the pump-and-treat discharges north of the Vortec site and effluent from PGDP. The increase in suspended sediments as a result of construction activities is not expected to adversely impact fish species and benthos inhabiting Big Bayou Creek downstream of the drainage ditch inflow. Fish species inhabiting Big Bayou Creek are not indicative of those that would be found in a high-quality stream (Saylor et al. 1990).

Threatened and Endangered Species

No threatened or endangered species are known to occur at the proposed Vortec site. The FWS did not identify any federal listed species protected under the Endangered Species Act of 1974 that would be likely to occur on the proposed site or in the immediate vicinity (see Appendix B).

The impact assessment team was informed during its site visit that the Indiana bat, a federal listed species, has been captured in mist net surveys conducted in floodplain forests along the Ohio River in the WKWMA, located about 4 mi northwest of the proposed Vortec site (Logsdon 1997, personal communication). Thus, the Indiana bat could inhabit areas closer to the proposed Vortec site. However, individual bats are not expected to be impacted by activities associated with construction, since the site does not contain any large trees with cavities and/or loose bark that the bats might use as roosting and nesting habitat.

4.2.2 Impacts from Routine Operations and Accidents

4.2.2.1 Land Use

Routine Operations

Routine operations are not expected to affect land use of adjacent areas. Noise levels or gaseous emissions from the Vortec facility would not be at levels that would affect recreational use of the WKWMA west and northwest of the proposed site. No impacts on hunting, dog training, or other recreational uses in these areas are expected as a result of normal facility operations.

Accidents

Accidents during Vortec operations are not expected to affect land use of adjacent areas. The Vortec facility has been designed to allow easy cleanup of spills. Minor spills of wastes and other materials should fall on the concrete pads under the waste handling equipment. The wastes would be cleaned up and stored for eventual vitrification. In the case of a more serious accident, in which a waste handling component such as a conveyor belt might fail, wastes might spill on the ground within the Vortec site. These wastes and any contaminated soils would also be cleaned up and stored for eventual vitrification. Should a highly improbable accident or natural disaster occur that would rupture the Vortec CMS, hot and molten wastes might spill on the concrete pads and surrounding soils. After cooling, the spill would be cleaned up and stored for eventual treatment and disposal. In the event of an accident such as a rupture of the air conveying system, contaminated material could be released to the atmosphere. However, instrumentation would indicate an abnormal situation and provide for a safety shutdown of the system. Redundant safety systems and instrumentation in other components of the Vortec facility would reduce the likelihood of contamination outside the site boundaries. In none of these cases would the areas surrounding the site be contaminated such that recreational or other use of the WKWMA would be curtailed or operations of PGDP would be affected.

4.2.2.2 Air Quality

Routine Operations

Air pollutant emissions would include those from the facility stacks and those from vehicles transporting raw materials, vitrified materials, or personnel necessary for Vortec facility operation.

TABLE 4.1 Estimated Maximum Ambient Concentrations of Selected Criteria Pollutants around the Vortec Facility

Pollutant[a]	Averaging Time	NAAQSs ($\mu g/m^3$)[b]		PSD Increments for Class II Area ($\mu g/m^3$)[c]	Concentration ($\mu g/m^3$)		
		Primary	Secondary		Highest Background Level in 1996	Contribution from the Vortec Facility[d]	Background plus Vortec Contribution
SO_2	Annual	80	--[e]	20	13	0.00069 (240 m, N)	13
	24 hours	365	--	91	55	0.0043 (240 m, N)	55
	3 hours	--	1,300	512	138	0.010 (80 m, N)	138
PM_{10}	Annual	50	50	17	24	0.0081 (240 m, N)	24
	24 hours	150	150	30	83	0.049 (240 m, N)	83
CO	8 hours	10,000	10,000	--	4.9	1.7 (80 m, N)	6.6
	1 hour	40,000	40,000		6.9	2.8 (220 m, NW)	9.7
O_3	1 hour	235	235	--	182	ND[f]	ND
NO_x	Annual	100	100	25	24	7.5 (180 m, N)	32
Pb	Calendar quarter	1.5	1.5	--	0.04	ND	ND

[a] SO_2 = sulfur dioxide, PM_{10} = particulate matter less than 10 µm in diameter, CO = carbon monoxide, O_3 = ozone, NO_x = nitrogen oxides, Pb = lead.

[b] NAAQSs = National Ambient Air Quality Standards.

[c] PSD = prevention of significant deterioration.

[d] The first entry in the parentheses is the distance from the boundary of the Vortec facility to the receptor where the maximum concentrations were predicted. The second entry is the direction from the center of the Vortec facility.

[e] -- = No standard exists.

[f] ND = Dispersion modeling was not done.

Stack emissions would include criteria pollutants resulting from the vitrification and loading and unloading of raw materials and toxic air pollutants resulting mainly from vitrification. Vehicular traffic emissions would primarily consist of exhaust-related emissions such as nitrogen oxides (NO_x), VOCs, and CO and fugitive road dust emissions. Impacts associated with vehicular traffic would be minimal because the traffic roads leading to the Vortec facility are paved, and only a few vehicles and a very small number of trips per day would be involved.

On the basis of DOE's revised air permit application to the Commonwealth of Kentucky (Kenvirons, Inc. 1998), annual total emissions of criteria pollutants and VOCs from the Vortec facility stacks would be as follows: about 0.0049 ton of SO_2, 0.071 ton of PM_{10}, 1.1 tons of CO, 42 tons of NO_x, and 0.087 ton of VOCs. To estimate potential impacts of the stack emissions on air quality, ambient concentrations were estimated on the basis of EPA-recommended Industrial Source Complex (ISC3) dispersion models (EPA 1995), the maximum emission rates, and 1989–1991 meteorological data from the Barkley Regional Airport near Paducah (EPA 1997). Table 4.1 shows the estimated maximum ambient concentrations of selected criteria pollutants around the Vortec facility, along with National Ambient Air Quality Standards (NAAQSs) and PSD increments. Modeling results indicate that at the Vortec facility, the annual average NO_2 concentration would increase by 7.5 $\mu g/m^3$ and the 1-hour and 8-hour average CO concentrations would increase by 2.8 and 1.7 $\mu g/m^3$, respectively. Concentrations of SO_2 and PM_{10} are expected to increase negligibly. Compared with the regional emissions of O_3 precursors (NO_x and VOCs), emissions from the Vortec facility would be relatively minor, and thus their potential impacts on the region's ambient O_3 concentration level would be negligible. These concentrations are well below PSD increment standards for a Class II area (Table 4.1).

Potential emissions of air toxics would be subject to 401 KAR 63:022 if the actual plant-wide emissions were equal to or exceeded the adjusted significant level set forth in the regulation. Table 4.2 summarizes the results and compares the maximum hourly emissions to the adjusted significant levels set forth in 401 KAR 63:022 (Kenvirons, Inc. 1998). As shown in this table, emissions of the potential air toxics, except for hydrogen chloride (HCl), would not equal or exceed the adjusted significant levels and therefore would not be subject to this regulation. Waste that contains PCBs, 1,1,1-trichloroethane, or methylene chloride could, when heated, emit HCl from the stack. The emission rate of HCl from Vortec (taking credit for the venturi scrubber and wet electrostatic precipitator) is estimated to be about 1.087 lb/h, which would be greater than the adjusted significant level of 0.199 lb/h set forth in 401 KAR 63:022. Thus, such Vortec HCl emissions would be subject to this regulation. Pursuant to 401 KAR 63:022, the allowable emission limit for Vortec was determined to be 20.48 lb/h after the application of best available control technology; thus, predicted Vortec HCl emissions of 1.087 lb/h would be in compliance with the regulation.

Some of the waste contains PCBs at a maximum concentration of 74,000 ppm. On the basis of these data, the PCB emissions from the stack are estimated to be 1.76×10^{-6} lb/h. This emission

rate is 12,000 times lower than the adjusted significant level of 2.03×10^{-2} lb/h according to the methodology in 401 KAR 63:022, so this emission would not be subject to the regulation.

Releases of HCl would result in maximum ground concentrations of 8.85 $\mu g/m^3$. This value is well below occupation exposure limits of 7 mg/m^3, but near the reference concentration of 7 $\mu g/m^3$ sometimes suggested for protection of human health from lifetime, chronic exposures. To further control HCl emissions, normal operations of the Vortec facility would employ a caustic solution in the wet electrostatic precipitator to treat the flue gas from the CMS. This would result in an additional 94.6% removal efficiency for HCl. Thus, emissions of HCl during normal Vortec operations are expected to be equal to or less than 0.0587 lb/h. These values would be well within the adjusted significance level for HCl presented in Table 4.2. The values would also result in ground-level concentrations that would be well below any reference concentration for protection of human health (on the order of 7 $\mu g/m^3$) or protection of workers (on the order of 7 mg/m^3).

Pursuant to Title III, Section 301, of the Clean Air Act, a major source can be defined as any stationary source of air pollutants that emits or can emit, considering installed and operating controls, 10 tons/yr or more of any hazardous air pollutant (HAP) or 25 tons/yr or more of any combination of HAPs. Any HAP emissions and the sum of all HAP emissions (0.0022 ton/yr) would be less than 10 tons/yr or 25 tons/yr, respectively. Therefore, the Vortec facility would not be a major source with respect to Title III HAPs.

As a consequence, the impacts on air quality from operation of the proposed facility are not expected to exceed Commonwealth of Kentucky or NAAQSs, nor are they expected to be in violation of PSD or air toxic regulations.

Air emissions will be monitored during operations. When actual estimates of emissions from the proposed facility become available during the first phase of operations, they will be checked against regulatory limits to ensure compliance.

Accidents

According to the EPA's risk management plan approach (EPA 1996), under a worst-case scenario involving the release of flammable gases and volatile flammable liquids (such as that caused by a rupture of the propane gas storage tank), the total quantity of the flammable substance would be assumed to form a vapor cloud within the upper and lower flammability limits, and the cloud would be assumed to detonate. A conservative assumption is that 10% of the flammable vapor in the cloud would participate in the explosion. On the basis of these assumptions, an overpressure could partially demolish buildings, which could seriously injure people; it could also shatter glass windows, and skin lacerations could result from flying glass. On the basis of the given tank condition at the Vortec site (20 pounds per square inch, gauge [psig] and ambient temperature), the distance

TABLE 4.2 Vortec Estimated Air Emissions and Kentucky Significant Emission Levels

Pollutant	Vortec Emissions (lb/h)	Significant Level (M) (lb/h)	Adjusted Significant Level (L) (lb/h)[a]	Exceedance
1,1,1-Trichloroethane	1.07E-09	4.85E-01	7.71E+01	No
2-Butanone (MEK)	1.37E-10	1.51E-01	2.39E+01	No
Acetone	5.95E-10	4.54E-01	7.22E+01	No
Aluminum	1.52E-05	2.55E-03	4.06E-01	No
Antimony	1.60E-08	1.28E-04	2.03E-02	No
Arsenic	8.99E-09	5.10E-05	8.11E-03	No
Barium	5.71E-08	1.28E-04	2.03E-02	No
Benzo(a)pyrene	1.77E-06	5.10E-07	8.11E-05	No
Benzo(a)fluoanthene	1.77E-06	5.10E-07	8.11E-05	No
Beryllium	1.22E-09	5.10E-07	8.11E-05	No
Boron	1.14E-08	2.55E-03	4.06E-01	No
Cadmium	1.68E-08	1.28E-05	2.03E-03	No
Calcium	2.28E-05	5.10E-04	8.11E-02	No
Chromium	3.66E-07	1.28E-05	2.03E-03	No
Copper	2.28E-06	5.10E-05	8.11E-03	No
Cyanide	1.14E-09	1.28E-03	2.03E-01	No
Hydrogen chloride	1.09E+00	1.25E-04	1.99E-02	Yes
Iron	2.16E-05	2.55E-04	4.06E-02	No
Lead	4.57E-06	3.83E-05	6.08E-03	No
Magnesium	3.81E-05	2.55E-03	4.06E-01	No
Manganese	2.70E07	8.96E-04	1.42E-01	No
Mercury	1.37E-09	1.28E-05	2.03E-03	No
Methylene chloride	2.68E-10	8.93E-02	1.42E+01	No
Nickel	7.61E-06	2.55E-05	4.06E-03	No
PCB	1.76E-06	1.28E-04	2.03E-02	No
Phenol	4.53E-05	4.85E-03	7.71E-01	No
Phosphorus	1.52E-06	2.55E-05	4.06E-03	No
Selenium	3.43E-09	5.10E-05	8.11E-03	No
Silver	1.19E-08	2.55E-06	4.06E-04	No
Thorium-230	2.00E-13	5.10E-07	8.11E-05	No
Tin	7.77E-08	5.10E-04	8.11E-02	No
Titanium	4.57E-06	1.28E-03	2.03E-01	No
Toluene	4.23E-11	9.57E-02	1.52E+01	No
Trichloroethene	2.20E-11	6.89E-02	1.10E+01	No
Uranium	5.22E-05	5.10E-05	8.11E-03	No
Vanadium	5.48E-09	1.28E-05	2.03E-03	No
Xylene (total)	1.01E-11	1.11E-01	1.76E+01	No
Zinc	1.13E-06	1.28E-03	2.03E-01	No

[a] $L = M \times K \times (168 / T)$, where K = correction factor for height of release (159 in this analysis) and T = number of hours per week that the substance is emitted from the source (168 in this analysis).

at which such an accident could cause injury is 500 m. All Vortec trailers and the PGDP C-612 pump-and-treat facility are within that distance, but no private residences and none of the PGDP buildings are. Thus, damage from a propane tank accident would be limited to the Vortec site and the C-612 facility.

Control equipment at the Vortec facility would be placed in tandem; thus, it would be a rare event for the control equipment to simultaneously malfunction. The melter must be operated with an automated feed cutoff system that activates when operating conditions deviate from those required to comply with emission standards. During a facility upset, emissions of all criteria pollutants except PM_{10} would not change (Kenvirons, Inc. 1998). On the basis of the assumption that all control equipment is not operational for 24 hours, the maximum 24-hour average PM_{10} concentrations are estimated to be 951 $\mu g/m^3$. Emissions of most toxic chemicals would be well below (by several orders of magnitude) the significant emission levels. In fact, these emissions would not last more than 1–2 hours, so the potential impacts on ambient air quality would be minor and temporary.

The potential impacts of chemical releases on health were evaluated for a credible, but highly unlikely, major accident at the Vortec facility. Details of the accident analysis can be found in Duggan (1997) and are summarized below. Conservative meteorological conditions, the complete release of drum contents, and bounding concentrations of the low-level wastes and low-level mixed wastes to be vitrified at the facility were three assumptions on which the calculations were based.

A highly energetic release of the contents of one low-level mixed waste drum is considered to be a credible, but highly unlikely, major accident. This event, with a probability on the order of 10^{-4} to 10^{-6}, is postulated to occur as the result of a lightning strike on a drum, the mixing of incompatible materials within a drum, spontaneous combustion within a drum, or a localized propane explosion associated with the high-air-flow dryer. The emergency prediction information (EPI) code (Homann Associates, Inc. 1988) was used to determine downwind concentrations of the released chemicals in air, and worst-case meteorological conditions (i.e., Pasquill Class F stability with 1 m/s wind speed) and an instantaneous release scenario were modeled. This release scenario assumed all material in the drum would be instantly released to the air. This is a very conservative and unrealistic assumption, since drummed wastes usually contain a high proportion of debris and soils that would not be released to the air under actual conditions. Bounding concentrations found in a low-level mixed waste (Shaia 1997) were used in the study.

Four substances (2-butanone, phenol, phosphorus, and toluene) were modeled for potential consequences on the basis of Occupational Safety and Health Administration (OSHA) and EPA emergency planning regulations to protect workers (Duggan 1997). Concentration levels were estimated at 100 m, 500 m, and 1,500 m from the release point. These distances can be considered to represent members of the general public standing at the boundary of the Vortec facility, workers outside a PGDP building, and a nearby residence, respectively. Concentration levels would exponentially decrease with distance from the concentration at 100 m, to about 0.4–0.9% of the

100-m concentrations at 500 m and 0.008–0.04% at 1,500 m. At 100 m and 500 m from the source, only phosphorus concentrations might exceed emergency response planning guideline (ERPG) or temporary emergency exposure limit (TEEL) levels that are classified as a level of potentially life-threatening effects for an exposure time of up to 1 hour; at 1,500 m, all of them would be below such levels. These results suggest that a credible, but highly unlikely, waste drum accident might have a lethal effect on a worker, but that such an accident would not be life-threatening to the public. In actuality, exposures to workers and the public are likely to have much less serious consequences, resulting in non-life-threatening effects such as injury, irritation, or odors. The modeled concentrations would exist for only a very short time (i.e., on the order of seconds) given the scenario being modeled (i.e., an instantaneous airborne release of all affected materials). Also, it is unlikely that all of the materials would be released, since they are nonvolatile, inorganic constituents of rubble and soils.

4.2.2.3 Noise

The major types (and sources) of noise associated with the proposed Vortec facility operations include operation-related continuous noise (e.g., induced draft [ID] fan, shredders, conveyors, vibrating screen) and intermittent noise (vehicular traffic traveling in and out of the facility).

All equipment specifications include a clause that requires sound attenuation enclosures if the component being supplied exhibits a sound pressure level greater than 85 dB(A) at any operator location. The ID fan and two shredders are the only pieces of equipment that may require some sort of silencing.

Even if the fan and shredders are operating simultaneously, the noise level from the equipment is expected to decrease to a level indistinguishable from the existing background level within approximately 200 m from the site, considering the divergence (i.e., geometric spreading) of the sound waves only. The nearest residence is located approximately 1,580 m north-northeast of the proposed Vortec facility. Therefore, impacts from noise on nearby residents are expected to be negligible.

Workers could be subjected to noise levels greater than 85 dB(A) near operating equipment. Their risk of hearing loss would be kept within the limits and guidelines regulated by the Occupational Safety and Health Administration by requiring the use of hearing protection, as needed.

4.2.2.4 Water Resources

Routine Operations

The impacts of routine operations on surface water resources are expected to be negligible. The 2,100-ft^2 area used to store mixed waste drums prior to shredding would be underlain with an impermeable synthetic liner to prevent seepage of contaminants to groundwater. Any surface soils contaminated from drum leakage or spills in the storage areas would be processed in the Vortec facility once the final batch of mixed waste was treated. Also, all facility components having direct contact with mixed wastes would be constructed on curbed concrete pads or diked to collect storm water (DOE 1996). Drainage of these areas into sump pumps would allow recycling of contaminated water through the facility's wastewater treatment system. These mitigation measures would assure protection of groundwater during routine operations.

The intermittent discharge of 15 gpm of wastewater effluent would be less than 1% of the current PGDP discharge (2,800 gpm at this location) and would not impact water quality in Big Bayou Creek downstream of the outfall. The volume of effluent discharged would vary as a function of dissolved solids. Concentrations of heavy metals and other substances regulated under the KPDES permit would be monitored on a regular basis. Regular monitoring of blowdown from the wastewater treatment system would be conducted prior to discharge. The discharge of wastewater from the Vortec facility would be regulated by a KPDES permit issued by the Commonwealth of Kentucky. The PGDP KPDES permit would be revised to include the Vortec facility.

No impacts on the water supply would result from facility operation. The Vortec facility would require about 50 gpm of water during normal operations. This volume would be obtained from the PGDP water supply system. This quantity represents a very small percentage of the nearly 13,000 gpm required by PGDP in 1990 (ANL 1991). The PGDP water supply comes from the Ohio River.

Accidents

Accidents during Vortec operations might have a temporary, minor impact on surface water and no impact on groundwater. Malfunction of the wastewater treatment system would result in its being immediately shut down for repairs. Since the system is used only intermittently, wastewater would be held until the system was fixed. Spilled wastes from failure of waste handling equipment or rupture of the CMS would be in solid form. Spilled wastes would be immediately cleaned from the concrete pads under the equipment. If the accident were large enough to spill wastes on soils, both the wastes and any contaminated soils would be cleaned up. Wastes and soils from spills would be stored for eventual vitrification. If a spill were to occur during a heavy rainstorm, wastes spilled

on concrete pads might enter the water collection system. There they would be collected, and any resulting contaminated water would be reused in the Vortec process or treated before being released to the Vortec outfall. This discharge would be monitored to ensure that it met discharge permit standards.

In the case of complete failure of waste storage and handling equipment during a highly improbable natural disaster such as a tornado, up to 50 tons of wastes might spill onto soils. If this event were to occur during a heavy rainstorm, runoff carrying wastes might reach the drainage ditch. Water quality in the drainage ditch would be temporarily affected until the sediments in the drainage ditch could be monitored and any contamination could be cleaned. Since the water in the drainage ditch or in Big Bayou Creek is not used for human consumption, water supplies would not be adversely affected.

4.2.2.5 Biotic Resources

Routine Operations

Human activity and equipment noise during operations might have a minor negative impact on wildlife inhabiting forested areas immediately south and west of the facility. Nesting songbirds immediately adjacent to the site might choose to nest elsewhere because of the noise from equipment and vehicles entering and leaving the proposed site. No impacts to vegetation would be expected from gaseous emissions when released at permitted levels. No state or federal listed species are expected to be impacted by routine operations.

Minor accidents such as spillage of wastes during operations in the immediate area of facility components would be quickly cleaned. Because movement of rabbits and other large mammals would be restricted by the security fence, impacts to these animals are expected to be negligible.

Accidents

Failure of the propane gas storage tank could affect vegetation and wildlife in the immediate area of the Vortec site. If this tank were to fail and ignite, heat or fire might affect areas immediately adjacent to the Vortec site. DOE and local fire protection units would be called to control the fire as soon as possible, and the extent of damage would be limited. Vegetation immediately surrounding the Vortec site might burn, and animals might be killed or driven away. No state or federal listed threatened or endangered species would be impacted by such an accident.

4.2.2.6 Radiological Risk and Human Health

Routine Operations

Three categories of receptors could be subjected to radiological impacts from the vitrification facility: vitrification workers, noninvolved PGDP workers (i.e., other on-site workers not involved in the vitrification processing), and the off-site population.

The packaging requirements and operating procedures for the containers to be handled at the Vortec facility would make the potential for inhaling or ingesting mixed waste negligible under routine conditions (see Section 2.2.5). The effects of airborne releases on the health of a vitrification worker would not exceed the health effects on a noninvolved worker. Therefore, during normal operations, the only potential exposure route to vitrification workers would be external radiation. In this assessment, the annual external doses to occupational workers were estimated on the basis of historical data. The dose to workers at the Vortec facility was based on thermoluminescent dosimeter measurements of workers who currently handle low-level mixed waste and other radioactive materials at PGDP (Knaus 1997). Therefore, the estimated dose to workers from routine operations at the Vortec facility should be similar to the current worker dose.

For routine airborne releases from the Vortec facility (Kenvirons, Inc. 1998), health effects were assessed for noninvolved workers, an MEI who is a member of the public, and the surrounding population within a 50-mi (80-km) radius of the facilities. For these receptors, internal and external doses were estimated by using the GENII code (Napier et al. 1988). A detailed description of the GENII code and the parameters used in this assessment, including source terms, is provided in Appendix C. A brief background on radiation and its effects is also presented in this appendix.

The doses to the noninvolved worker MEI (located 260 m north of the facility) and the off-site MEI (located 1,580 m north-northeast of the facility) were estimated to be 7.5×10^{-5} and 1.3×10^{-4} mrem, respectively. The risks of fatal cancer estimated for the noninvolved worker and off-site MEIs were 3×10^{-11} and 7×10^{-11}, respectively. For comparison, radiation exposure from all other sources (background) is 360 mrem, corresponding to an individual cancer risk of 2×10^{-4}. The off-site population dose within 80 km of the facility was estimated to be 5.1×10^{-4} person-rem, which corresponds to a cancer risk of 3×10^{-7} in the population. For comparison, the annual dose received by the same population (500,000 people) from natural background radiation is approximately 180,000 person-rem, which corresponds to 90 cancer fatalities in the population. The annual doses and associated health risks for members of the public from the Vortec facility are summarized in Table 4.3.

Federal radiation protection limits differ for occupational workers who are monitored for radiation exposure and for unmonitored workers and members of the public. The radiation protection

TABLE 4.3 Radiological Doses and Excess Latent Cancer Fatality Risks Resulting from Routine Operation of the Vortec Facility for One Year

Receptor	Annual Dose	Risk[a] (excess fatal cancer)
Average exposed vitrification worker[b]	0.5 mrem	2×10^{-7}
Maximally exposed vitrification worker[b]	12 mrem	5×10^{-6}
Noninvolved worker[c,d]	7.5×10^{-5} mrem	3×10^{-11}
Off-site general public		
Maximally exposed individual[c,e]	1.3×10^{-4} mrem	7×10^{-11}
Population[c,f]	5.1×10^{-4} person-rem	3×10^{-7}

[a] Health risk conversion factors from ICRP 60 (ICRP 1991); see Appendix C.

[b] Based on worker monitoring data for 1996 (Knaus 1997, personal communication).

[c] Based on GENII calculations; see Appendix C.

[d] The noninvolved worker is located 260 m north of the facility.

[e] The maximally exposed individual is located 1,580 m north-northeast of the facility.

[f] For a population of 500,000 people.

standards and guidelines for occupational protection are given in 10 CFR Part 835. The standards and guidelines for unmonitored workers and the general public are listed in DOE Order 5400.5, proposed 10 CFR Part 834, and 40 CFR Part 61. As demonstrated above, the estimated values from the Vortec facility are well below the 5,000-mrem/yr limit for monitored workers. They are also below the 100-mrem/yr limit from all pathways and the 10-mrem/yr limit from the air pathway only for unmonitored workers and members of the general public.

Accidents

Potential radiological health impacts were evaluated for a reasonably conservative accident: in this case, simultaneous, highly energetic releases of the contents of a drum of low-level mixed waste. No allowance was made for probable mitigative features (e.g., safety-related structures, systems, and components) that would be incorporated in the final facility design and operational procedures. The analysis was performed to illustrate the potential impacts from a maximum credible accident.

The release is postulated to occur as a result of one of four events: lightning striking a drum, mixing of incompatible materials, spontaneous combustion within a drum, or a localized propane explosion associated with the high-air-flow dryer. The radiological doses resulting from the postulated release were calculated on the basis of conservative meteorological conditions, release fractions, and bounding concentrations of the low-level mixed waste to be vitrified at the facility. The primary pathway evaluated was inhalation, which would be the major contributor of the dose. Details of the accident analysis are given in Appendix C and summarized below.

The potential inhalation doses from a release of the contents of a drum containing low-level mixed waste to a noninvolved worker, an MEI who is a member of the public, and the general population within 80 km (50 mi) of the facility are summarized in Table 4.4. The projected dose for the worker is 26 rem, which corresponds to an estimated fatal cancer risk of 0.01 (one in 100). For the MEI, the dose is estimated to be 0.31 rem, corresponding to a lifetime increased fatal cancer risk of approximately two in 10,000. The off-site population dose was estimated for an accident in which the wind blows in the direction of the most populated sector (north-northwest). The off-site population dose in that sector is estimated to be 169 person-rem, corresponding to a 0.08 excess risk of fatal cancer occurring within the population. For comparison, the risk for the same population (61,943 people) from natural background radiation is approximately 11.

TABLE 4.4 Radiological Doses and Excess Cancer Fatality Risks for a Reasonably Conservative Accident at the Vortec Facility[a]

Receptor	Dose	Risk[b] (excess fatal cancer)
Noninvolved worker[c]	26 rem	1×10^{-2}
Maximally exposed individual[d]	0.31 rem	2×10^{-4}
General population[e]	169 person-rem	0.8×10^{-1}

[a] Details of the accident analysis are given in Appendix C.

[b] Excess fatal cancer health risk conversion factors from ICRP (1991); see Appendix C.

[c] The noninvolved worker is located 100 m north of the facility.

[d] The maximally exposed individual is located 1,580 m north-northeast of the facility.

[e] For a population of 61,943 people in the north-northwest sector within an 80-km radius of the facility.

4.2.2.7 Waste Management

Routine Operations

The glass frit produced by the vitrification process would be placed in containers and transported by truck to PGDP landfill C-746-U for disposal. The frit would be tested in EPA-approved laboratories to assure compliance with the EPA's LDR waste acceptance criteria pursuant to the EPA toxicity characteristics for hazardous waste as set forth in 40 CFR Subpart C, Characteristics of Hazardous Waste, Paragraph 261.24 (see Section 2.2.3.2). To date, about 5 acres of the 25-acre landfill has been partially filled, and a capacity of 40,000 yd^3 is expected to remain on October 1, 1998. The Vortec facility would produce a relatively small volume of waste for disposal that could be accommodated at the existing landfill. An estimated volume of 3,925 yd^3 of frit, representing about 10% of landfill capacity, would be produced during the life of facility operations.

Accidents

Accidents during Vortec operations would not generate large volumes of additional wastes, and impacts on waste management would be very small. Quantities of wastes spilled as a result of short-term equipment failure would be limited to 50 to 100 lb/min, even if all the throughput were spilled. These spills would be cleaned up and stored for eventual vitrification. A major accident in which wastes might spill on soils would enhance the waste volume somewhat as a result of soil cleanup. However, since throughput at Vortec is small (only 1.5 to 3.0 tons/h), soil cleanup should increase the total wastes to be treated at Vortec by only a few tons. This impact on waste management would be very small when compared with the 4,000- to 6,400-ton waste volume to be treated by the Vortec process.

4.2.2.8 Environmental Justice

The population within a 50-mi radius of the Paducah Site area is generally low income, but not predominantly minority, when compared with the national average. However, several census tracts to the north and southwest of the Paducah Site are predominantly minority (DOE 1997a). The construction and operation of the Vortec facility would not disproportionately impose high and adverse health or environmental impacts on either low-income or minority populations. The impacts from construction and operation of the Vortec facility, as described in Sections 4.2.1.1 through 4.2.2.7, would be low and within accepted values and guidelines for all affected populations, including low-income and minority populations.

4.2.3 Impacts from Decommissioning

Impacts would result from decontaminating exterior surfaces that had been in contact with various waste streams. Clean sand or other suitable material would be processed through the entire Vortec facility to flush any remaining contaminants from the last waste stream treated. Any contaminants not disposed of in the glass frit as a result of this process would be placed in approved containers for disposal in the landfill. Equipment would be decontaminated, disassembled, and packaged to meet DOT requirements for shipment. The decision on what vitrification equipment to ship and what DOE site will receive the equipment has not been made at this time. DOE will make this determination on the basis of how the Vortec facility performs during the demonstration and subsequent treatment period. No major impacts would occur during decontamination and disassembly. Minor increases in noise levels would occur as more vehicles and equipment entered the site for loading and shipping.

Decontamination of the concrete foundation and pad areas is not likely to be necessary. If needed, grinding or blasting would be used to remove contaminated surface layers. The latter process would use water and or air pressure to propel a solid medium such as steel shot, aluminum oxide grit, or plastic beads. Temporary increases in background noise levels would occur during blasting, but they would not adversely affect workers or wildlife in the forested area beyond the security fence. A complete discussion of the possible technologies used to clean contaminated concrete and metals is included in the RD&D Permit application to the Commonwealth of Kentucky (DOE 1996).

A visual inspection of soils in the storage area would be conducted to assure that contamination was not present. Any contaminated soil discovered in the drum storage area would be treated by the vitrification process prior to facility closure. The storage area liner would be disposed of at the PGDP landfill.

DOE intends to dispose of solid waste and decontamination fluids by either storing them at PGDP or processing fluids at the PGDP wastewater treatment units. All liquids from decontamination are expected to be handled by the PGDP facilities. Solid nonhazardous and nonradioactive material would be transported to the PGDP landfill for disposal. Mixed or hazardous solids and sludges would be managed by one or more of the following options: (1) shipment to the TSCA incinerator in Oak Ridge, Tennessee; (2) placement in containers and transport to DOE-permitted storage at PGDP; or (3) shipment to an off-site commercial facility or DOE treatment or disposal facilities.

4.2.4 Cumulative Impacts

Cumulative impacts are the impacts of the proposed action when added to the impacts of other past, present, and future actions, regardless of the agency responsible for the action. The Vortec

facility is adjacent to the PGDP and near other sources that could have environmental effects. As identified in the previous sections of Chapter 4, the impacts of the Vortec facility would be confined to the immediate site area, with the exception of air emissions, including radionuclides. Thus, this cumulative analysis focuses on air quality and radiological risk. The region for which cumulative impacts are assessed includes the lower Ohio River valley as represented by McCracken County, Kentucky, and Massac County, Illinois.

4.2.4.1 Air Quality

The major sources of air emissions near Vortec include PGDP and the TVA's Shawnee Power Plant. Annual quantities of air pollutants emitted from major point sources around the proposed Vortec facility and estimated from the facility itself are listed in Table 4.5, along with those from Massac and McCracken Counties. In this table, the effects of the emission contributions and their impacts on local air quality are expressed as a percentage of the PGDP totals and county totals.

TABLE 4.5 Annual Emissions of Criteria Air Pollutants and Volatile Organic Compounds from the Vortec Facility and Major Point Sources around It[a]

	Emission Rate (tons/yr)					
Emission Source	SO_2	PM_{10}	CO	NO_x	VOCs	Pb
Vortec facility[b]	0.0049	0.071	1.1	42	0.087	No data
% of PGDP	0.001	0.8	14	13	5.7	No data
% of Massac County, Ill.	<0.001	0.007	0.05	0.3	0.02	No data
% of McCracken County, Ky.	< 0.001	0.02	0.06	0.1	0.01	No data
PGDP[c]	444	8.84	7.87	333	1.53	0.0005
TVA Shawnee Plant[c]	40,500	373	1,660	34,700	140	0.176
McCracken County, Ky., total[c]	41,000	445	1,680	35,000	692	0.181
Allied Signal, Inc.[d]	107	6.21	5.42	19.1	1.02	No data
Joppa Electric Energy, Inc.[d]	27,900	501	1,170	10,200	164	0.350
Massac County, Ill., total[d]	33,100	962	2,270	12,300	493	0.400

[a] SO_2 = sulfur dioxide; PM_{10} = particulate matter less than or equal to 10 μm in diameter, CO = carbon monoxide, NO_x = nitrogen oxides, VOCs = volatile organic compounds, Pb = lead.

[b] Estimated emissions.

[c] Actual emissions for 1996.

[d] Actual emissions for 1995.

The NO_x, CO, VOC, and PM_{10} emissions from the Vortec facility would account for about 13%, 14%, 6%, and 1%, respectively, of PGDP total emissions; about 0.1%, 0.06%, 0.01%, and 0.02% of McCracken County totals; and about 0.3%, 0.05%, 0.02%, and 0.007% of Massac County totals. The SO_2 emissions from the Vortec facility are estimated to be negligible.

Thus, the total annual emissions of SO_2 and PM_{10} from the Vortec facility stacks would be negligible, and those of CO, NO_x, and VOC would be minor, when compared with those from current PGDP operations. Emissions of NO_x from the Vortec facility would be greater than those of other criteria pollutants when compared with their respective PGDP emissions. Air dispersion modeling results indicate that the Vortec facility would contribute up to 7.5 $\mu g/m^3$ to the maximum annual average concentration of NO_x, while other sources would result in a background concentration of 24 $\mu g/m^3$. Accordingly, the total NO_x concentration, including the background concentration, would be 32 $\mu g/m^3$, which is well below the annual standard of 100 $\mu g/m^3$. Ozone precursor emissions from the Vortec facility would be negligible, about 0.1% for NO_x and 0.06% for VOC, when compared with those from the nearby TVA Shawnee Plant, one of the major regional sources. As a consequence, the cumulative impacts of potential releases from the Vortec facility on ambient air quality would not be of any regional concern. The expected operational period for the Vortec facility is 2 years. This means that the small incremental increase in emissions of criteria pollutants from Vortec would be temporary.

The Vortec facility would also produce toxic air emissions over its 2-year life; however, these emissions would represent only a very small incremental addition to other sources. Within Kentucky, emissions of toxic air pollutants have been decreasing. For example, between 1988 and 1994, releases declined 25% (Kentucky Environmental Quality Commission 1996). However, Ballard County, which is adjacent to McCracken County, registered a 32% increase during the same period. In 1994, the 1,062,155-lb release from Ballard County was more than 2,000 times greater than the projected 516-lb/yr (0.258-ton/yr) release from Vortec (Table 4.2), including HCl.

4.2.4.2 Radiological Risk and Human Health

The radioactive releases that would result from Vortec operations would not appreciably increase the radiation dose or the associated number of latent cancer fatalities for the off-site population or the MEI (Table 4.5). All doses and risks would be more than 80 times lower than doses and risks from the operation of existing facilities.

In addition to facility operations, events and decisions in one's life also contribute the radiation doses that an individual receives. Table 4.6 compares radiation doses from various sources. The annual dose of 1.3×10^{-4} mrem/yr (Table 4.7) to the offsite MEI is much less than any dose from these sources. Vortec operations would contribute only a very small amount to any member of the public's lifetime dose of radiation from past, present, and future sources.

TABLE 4.6 Comparison of Radiation Doses from Various Sources

Radiation Source	Dose to an Individual
Annual background radiation — U.S. average	
Total	360 mrem/yr
From natural sources (cosmic, terrestrial, radon)	300 mrem/yr
From man-made sources (medical, consumer products, fallout)	60 mrem/yr
Daily background radiation — U.S. average	1 mrem/d
Increase in cosmic radiation dose as a result of moving to a higher altitude (e.g., from Miami, Florida, to Denver, Colorado)	25 mrem/yr
Chest x-ray	10 mrem
U.S. transcontinental flight (5 hours)	2.5 mrem
Dose from naturally occurring radioactive material in agricultural fertilizer — U.S. average	1 to 2 mrem/yr

Sources: NCRP (1987a,b).

TABLE 4.7 Potential Contribution of the Vortec Facility to Radiological Doses to the Off-Site Maximally Exposed Individual and Off-Site Population

Impact Category	Existing Operations (PGDP)	Vortec Facility		
		No Action[a]	Proposed Action	Cumulative Impacts
Off-site maximally exposed individual				
Annual dose (mrem)	1.4	0	1.3×10^{-4}	1.4
Probability of a latent cancer fatality[b]	7.0×10^{-7}	0	7.0×10^{-11}	7.0×10^{-7}
Off-site population				
Collective dose (person-rem)	2.1[c]	0	5.1×10^{-4}	2.1
Number of latent cancer fatalities from collective dose[b]	1.1×10^{-3}	0	3.0×10^{-7}	1.1×10^{-3}

[a] Incremental dose is zero, if one assumes waste would continue to be stored on site. Any doses from storage are included in the impacts of existing operations.

[b] Assumes 5×10^{-4} latent cancer fatalities per rem.

[c] Includes USEC and DOE operations.

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APPENDIX A:

WASTES AT THE PADUCAH SITE THAT ARE CANDIDATES FOR TREATMENT BY THE VORTEC FACILITY

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APPENDIX A:

WASTES AT THE PADUCAH SITE THAT ARE CANDIDATES FOR TREATMENT BY THE VORTEC FACILITY

This appendix lists wastes that could be treated by the Vortec facility during the initial 30-day operational period and subsequent 2 years. The U.S. Department of Energy (DOE) believes that not all of the wastes listed will be treated by the Vortec process. Characterization of the wastes prior to transport to the Vortec facility will identify those wastes that are unacceptable for processing because of chemical composition or concentration levels.

The list represents legacy wastes produced by DOE during its operation of the Paducah Gaseous Diffusion Plant from the 1950s to 1993, when the United States Enrichment Corporation took over operation of the plant. The list uses Paducah waste stream descriptors and U.S. Environmental Protection Agency code numbers for wastes as defined by the Resource Conservation and Recovery Act.

TABLE A.1 Types and Quantities of Wastes to Be Treated by the Vitrification Process

Waste Stream	Description	Volume (m^3)	Weight (kg)	No. of Drums	EPA Waste Code[a]
Misc. acids and bases	Rust/UF_4	18.44	24,316.1	58	D002
Nickel stripper solid residue — Sludge	Nickel stripper sludge	6.6	4,893.5	21	D039
Ash receivers	Ash receiver residue	458.64	91,679.4	809	D004, D007
Uranium precipitate	Uranium precipitate	0.6	561.5	3	D006
Misc. solid material containing toxic metals	Glass beads	5.81	7,714.6	30	D006, D008
Misc. solid material	Hydrolyzed UF_4	5.01	3246.8	18	D006, D007, D008, D011
Hot water rinse tank — Sludge	Hot water rinse tank — Sludge	2.56	1742.1	8	D008
Misc. lead-bearing waste — Bricks	Fire bricks	14	16194.1	70	D008
Misc. lead-bearing waste — Organic debris	Organic debris with lead	3	1524.7	15	D008
Misc. acids and bases — Plastic debris	Plastic balls from HCl tank	1.4	450.8	7	D002
Magnesium fluoride pellets	Magnesium fluoride pellets	5.16	3,342.9	12	D007
Misc. chromate-bearing waste — Solids	Rad solids	5.02	4102.2	20	D007
Hydrochloric acid tank — Sludge	HCl acid tank sludge	0.64	311.3	2	D002, D006, D007
TCE-HOC organic sludges	Drill cuttings/ piezometers	2.4	2484.2	12	D040
Potassium dichromate filter cake	Potassium dichromate filter cake	0.32	51.2	1	D007
Gold dissolver sludge	Gold dissolver sludge	0.01	2.7	1	D006, D008
Misc. reactive material — Solid lab pack	Lithium compound	0.37	105.4	1	D003
Misc. chromate-bearing waste — Inorganic particulates	Metal powders	0.21	231.4	2	D007
Misc. chromate-bearing waste — Unknown	Orocol chromate waste	1.31	916.8	7	D007
Misc. acids and bases — Inorganic chemicals	Sodium orthosilicate	1.45	512.3	8	D002
Misc. arsenic-bearing waste — Solids	Arsenic-contaminated floor sweep	1.45	512.3	8	D002
Misc. acids and bases — Sodium hydroxide	Caustic soda — Sodium hydroxide	0.22	115.7	2	D002

TABLE A.1 (Cont.)

Waste Stream	Description	Volume (m^3)	Weight (kg)	No. of Drums	EPA Waste Code[a]
Misc TCLP wastes — Inorganic	Inorganic sludges	0.32	293.7	1	D002, D007
Misc. solid material containing toxic metals	Inorganic sludges	0.4	161	2	D005, D007, D010
Misc. flammable materials	Oxidizers	0.72	344.9	3	D001
Cascade vacuum dust	Vacuum dust	1.32	2,406.4	6	D006, D007, D008
Misc solid material containing toxic metals	Zorball	1.64	956.6	7	D004, D007, D008
Misc. TCLP waste	Absorb organic liquid	1.4	742.9	5	D018, D023
Misc. flammable materials — Diesel sludge	Diesel sludge	0.4	495.3	2	D001
Misc. flammable materials — Spill cleanup material	Gasoline spill cleanup	0.2	120.7	1	D001
Misc. acids and bases — Organic chemicals	Oxalic acid	3.84	990	2	D002
Misc. mercury-bearing waste — Inorganic particulates	Floor sweep with Hg	0.2	56	1	D009
Misc. mercury-bearing waste — Soils	Auger cuttings	2.8	3,506.8	14	D009
Misc. lead-bearing waste — Inorganic	Lead oxide	0.01	0.4	1	D002, D006, D008
Misc. TCLP wastes — Sandblasting media	Black beauty	0.2	300	1	D008
Misc. lead-bearing waste — Soil	Auger cuttings	0.21	161.9	2	D008
Misc. chromate-bearing waste — Soils	Auger cuttings	1.2	1,441.3	6	D007
Spent solvents solids — Soils	Cylinder drop test area	0.01	20.4	1	D040
Alkali cleaning tank liquid	Paper cloth debris	0.6	457.5	3	D008, D018, D010
Misc. acids and bases — Other lab packs	Lab residuals	0.56	181.6	2	D002
Misc. acids and bases — Solid lab packs	Collection	0.22	147.9	3	D002
Misc. acids and bases — Unknown	Soldering flux and thinner	0.39	247.4	2	D002
Misc. arsenic-bearing waste — Organic debris	Towels soaked with phenylarsine oxide	0.02	8.5	2	D004

TABLE A.1 (Cont.)

Waste Stream	Description	Volume (m^3)	Weight (kg)	No. of Drums	EPA Waste Code[a]
Misc. chromate-bearing waste — Composite filters	Respirator cartridges	0.6	206.2	3	D007
Misc. chromate-bearing waste — Lab packs	Chromium-contaminated solid waste	1.04	1,116.1	4	D007
Misc. chromate-bearing waste — Paper/cloth debris	Ventilation duct gaskets	3.06	905.6	4	D007
Misc. discarded laboratory chemicals — Asbestos debris	Asbestos debris	0.2	123	1	U080
Misc. discarded laboratory chemicals — Cleanup debris	Cleanup debris	0.2	40.8	5	U080
Misc. discarded laboratory chemicals — Lab waste	Lab waste	0.323	103	1	U228, D040
Misc. discarded laboratory chemicals — Unknown solid	Unused chemical solids	0.04	27.5	4	D002
Misc. flammable materials — Paints	Paint wastes	5.17	3,515.2	32	D001
Misc. flammable materials — Paper/cloth debris	Organic debris	0.2	89.8	1	D001
Misc. lead-bearing waste — Filters	Lead filters	0.8	321.2	4	D008
Misc. lead-bearing waste — Heterogeneous debris	Lead-based flux	0.03	26.6	3	D008
Misc. lead-bearing waste — Lab waste samples	Lab waste samples	1.2	768.4	6	D008
Misc. mercury-bearing waste — Heterogeneous debris	Silver nitrate/mercury	0.81	304.5	4	D009, D011
Misc. mercury-bearing waste — Lab packs	Mercury-contaminated solids	0.2	82.5	1	D009
Misc. mercury-bearing waste — Lab packs	Liquid mercury	0.47	159.4	5	U151, D009
Misc. mercury-bearing waste — Organic debris	Organic debris	0.51	136.4	6	D009
Misc. mercury-bearing waste — Plastic debris	Organic debris	0.6	181.5	3	D009
Misc. selenium-bearing waste	Organic debris	0.6	174.7	3	D010

TABLE A.1 (Cont.)

Waste Stream	Description	Volume (m^3)	Weight (kg)	No. of Drums	EPA Waste Code[a]
Misc. solid material containing toxic metal — Organic debris	Floor sweep	1.43	614	7	D004, D008, D009, D011
Misc. solid material containing toxic metal — Organic debris	Organic debris	0.2	103.5	1	D006
Misc. solid material containing toxic metal — Paper/cloth debris	Uranium-contaminated solid lab waste	0.65	177.3	3	D006, D007, D008, D011
Misc. solid material containing toxic metal — Plastic debris	Film negatives	0.2	33.1	1	D011
Misc. TCLP wastes — Inorganic sludges	Lab waste/sludge samples	0.97	799.3	2	D008
Misc. TCLP wastes — Organic chemicals	Cresol	0.07	35.8	3	D026
Misc. TCLP wastes — Salt waste	Potassium permanganate	0.01	0.9	1	D001
Misc. TCLP wastes	Lab packs	1.68	1,419.6	10	D006, D007, D008, D009, D011, D040
Misc. TCLP wastes — Organic debris	Organic debris	1.12	441.9	7	D006, D007, D008, D009, D011, D040
Misc. TCLP wastes — Paper/cloth debris	Misc. oil-bearing solids	0.8	216.9	4	D011
Nickel stripper solid residue — Composite filters	Nickel stripper sludge	1.6	436.1	3	D002, D006, D007, D008
Nickel stripper solid residue — Organic debris	Nickel stripper sludge	0.2	74.9	1	D002, D006, D007, D008
Spent solvent solids — Absorbed organic liquids	Spill cleanup debris	0.72	345	3	F001
Spent solvent solids — Glass debris	Sample bottles with oily residue	0.2	74.4	1	F001
Spent solvent solids — Heterogeneous debris	PPE/metal/absorbent	0.6	214.5	3	F001
Spent solvent solids — HOC organic sludge	Contaminated TCE	3.71	2,531.2	16	F001
Spent solvent solids — Inorganic sludges	Inorganic sludges	0.4	265.1	2	F001

TABLE A.1 (Cont.)

Waste Stream	Description	Volume (m^3)	Weight (kg)	No. of Drums	EPA Waste Code[a]
Spent solvent solids — Lab packs	Lab packs	0.2	84.6	1	F001, D007, D009
Spent solvent solids — Organic debris	Contaminated TCE	44.31	23,469.8	211	F001
Spent solvent solids — Organic homogeneous solids	PVC cement and solvent solids	0.02	44	1	F005, D001
Spent solvent solids — Paint-related solvents	Paint waste	0.72	388.5	3	D001, F005
Spent solvent solids — Paper\cloth debris	Contaminated TCE	7	3,670.1	63	F001
Spent solvent solids — Plastic debris	Organic debris	1	230	5	F001
Spent solvent solids — Wood	Contaminated TCE	8	3645.2	40	F001
Technetium waste — Solid	Solid Tc-99 waste	1.35	1,594.4	4	D007
Trichloroethylene — HOC organic sludges	Rust/rags/sludge	5	3,614.6	16	F001
Waste mineral spirits — Paint waste	Paint waste	8.12	6,320.6	26	D001
PCB-contaminated soils, concrete, gravel	Soils, concrete, gravel	TBD[b]	TBD	TBD	TBD
Low-level waste, soils, concrete, gravel	Soils, concrete, gravel	TBD	TBD	TBD	TBD

Footnotes on next page.

TABLE A.1 (Cont.)

[a] D001	Ignitable waste
D002	Corrosive waste
D004	Arsenic
D005	Barium
D006	Cadmium
D007	Chromium
D008	Lead
D009	Mercury
D010	Selenium
D011	Silver
D018	Benzene
D023	o-Cresol
D026	Cresol
D039	Tetrachloroethylene
D040	Trichloroethylene
F001	Spent halogenated solvents used in degreasing: Tetrachloroethylene, trichloroethylene, methylene chloride, 1,1,1-trichloroethane, carbon tetrachloride and chlorinated fluorocarbons; all spent solvent mixtures/blends used in degreasing containing, before use, a total of 10% or more (by volume) of one or more of the above halogenated solvents or those solvents listed in F002, F004, and F005; and still bottoms from the recovery of these spent solvents and spent solvent mixtures
F005	Spent nonhalogenated solvents: toluene, methyl ethyl ketone, carbon disulfide, isobutanol, pyridine, benzene, 2-ethoxyethanol, and 2-nitropropane; all spent solvent mixtures/blends containing, before use, a total of 10% or more (by volume) of one or more of the above nonhalogenated solvents or those solvents listed in F001, F002, or F004; and still bottoms from the recovery of these spent solvents and spent solvent mixtures
U080	Methylene chloride
U151	Mercury
U228	Trichloroethene

[b] To be determined.

[Intentionally left blank]

APPENDIX B:

LETTERS OF CONSULTATION

[Intentionally left blank]

Education and Humanities Cabinet

KENTUCKY HERITAGE COUNCIL
The State Historic Preservation Office

Brereton C. Jones
Governor
Sherry K. Jelsma
Cabinet Secretary

David L. Morgan
Executive Director
and SHPO

November 16, 1992

Mr. John D. Young, Project Manager
CDM Federal Programs Corporation
800 Oak Ridge Turnpike, Suite 500
Oak Ridge, Tennessee 37830

Re: **Mixed Waste Storage Facilities at the Paducah Gaseous Diffusion Plant**
McCracken County, Kentucky

Dear Mr. Young:

Thank you for your letter concerning the above referenced project. Our review of this project indicates that an archaeological survey will not be required. The proposed project will have no effect on any property listed in or eligible for listing in the National Register of Historic Places. Therefore, I have no objections.

If you have any questions concerning this project please feel free to contact David Pollack of my staff at 502-564-7005.

Sincerely,

David L. Morgan

David L. Morgan, Director
Kentucky Heritage Council and
State Historic Preservation Officer

300 Washington Street
Frankfort, Kentucky 40601

Telephone (502) 564-7005
FAX (502) 564-5820

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Department of Energy

Oak Ridge Operations Office
P.O. Box 2001
Oak Ridge, Tennessee 37831—

September 12, 1997

Dr. Lee A. Barclay, Field Supervisor
Fish and Wildlife Service
U.S. Department of Interior
446 Neal Street
Cookeville, TN 38501

Dear Dr. Barclay:

REQUEST FOR INFORMAL CONSULTATION UNDER SECTION 7 OF THE ENDANGERED SPECIES ACT RE: PROPOSED TREATMENT OF MIXED WASTES USING THE VORTEC VITRIFICATION TECHNOLOGY AT THE PADUCAH (KENTUCKY) GASEOUS DIFFUSION PLANT

The U.S. Department of Energy (DOE), Oak Ridge Operations Office, is preparing an environmental assessment (EA) for the proposed treatment of mixed wastes stored at the Paducah Gaseous Diffusion Plant (PGDP) in Paducah, Kentucky, using the Vortec Corporation vitrification process. Background information on the proposed project and treatment process is provided in enclosure 1. DOE plans to conduct a 30-day testing of the facility, followed by operation to treat up to 80% of the mixed waste in storage at the PGDP. Startup is tentatively scheduled for the spring of 1998.

The general location of PGDP in Kentucky, 10 miles west of Paducah and 3.5 miles south of the Ohio River in McCracken County, and the proposed site for the vitrification facility at the PGDP are shown on enclosures 2 and 3. A general vegetation map of PGDP is provided in enclosure 4. Please note that the proposed site for the facility is the same site that DOE evaluated in a 1994 EA when it was the proposed location for mixed waste storage facilities. During preparation of the EA in 1993, DOE informally consulted with your office about potential impacts to protected species. At your request, DOE submitted a Biological Assessment of the Summer Habitat of the federally endangered Indiana bat (*Myotis sodalis)* (enclosure 5). Subsequently, your office provided DOE with a determination of no effect (enclosure 6) for proposed mixed waste storage at the site.

This letter is a request for informal consultation under Section 7 of the Endangered Species Act regarding the newly proposed use of this site to treat mixed wastes. For our EA analysis, we need a current inventory of federally listed threatened and endangered species and those species proposed for listing for the PGDP and vicinity. Also, we request that the Fish and Wildlife Service review the enclosed materials and advise us of any issues that you foresee if this project is implemented at the proposed site.

Dr. Lee A. Barclay -2-

Based on available information and your previous determination, DOE believes that federally listed or proposed threatened or endangered species are unlikely to occur in the area potentially affected by the proposed action. If you concur, please check the appropriate box, sign below, and fax your response to me at 423-576-0746. Please direct questions about the proposed project to Mr. David Tidwell, DOE-PGDP, at 502-441-6807. Questions about the NEPA process may be directed to me at 423-576-9578.

Thank you in advance for your prompt response to this request.

Sincerely,

Andrea W. Campbell

Andrea Wargo Campbell
Technical Support Division

☐ The proposed treatment of mixed wastes at PGDP using the Vortec vitrification process would *not* be expected to adversely impact federally listed or proposed species and/or habitat. With this letter, DOE has satisfied consultation requirements of Section 7 of the Endangered Species Act.

☐ The information provided by DOE is insufficient to support the conclusion that the proposed treatment of mixed wastes at PGDP using the Vortec vitrification process would not adversely impact federally listed or proposed species and/or habitat. DOE has *not* satisfied consultation requirements of Section 7 of the Endangered Species Act. Further consultation is needed.

_____

Signature Date

Enclosure:
cc w/enclosure:
D. R. Allen, Acting ORO NEPA Compliance Officer
W. D. Tidwell, Paducah Site Office

Department of Energy

Oak Ridge Operations Office
P.O. Box 2001
Oak Ridge, Tennessee 37831—

September 12, 1997

Mr. Robert McCance, Jr.
Director, Kentucky State Nature Preserves Commission
801 Schenkel Lane
Frankfort, KY 40601

Dear Mr. McCance:

INFORMATION REQUEST: SPECIES PROTECTED BY THE COMMONWEALTH OF KENTUCKY

The U.S. Department of Energy (DOE), Oak Ridge Operations Office, is preparing an environmental assessment (EA) for the proposed treatment of mixed wastes stored at the Paducah Gaseous Diffusion Plant (PGDP) in Paducah, Kentucky, using the Vortec Corporation vitrification process. Background information on the proposed project and treatment process is provided in enclosure 1. DOE plans to conduct a 30-day testing of the facility, followed by operation to treat up to 80% of the mixed waste in storage at the PGDP. Startup is tentatively scheduled for the spring of 1998.

The general location of PGDP in Kentucky, 10 miles west of Paducah and 3.5 miles south of the Ohio River in McCracken County, and the proposed site for the vitrification facility at the PGDP are shown on enclosures 2 and 3. A map of the general vegetation at the PGDP is provided in enclosure 4. Please note that the proposed site for the facility is the same site that DOE evaluated in a 1994 EA when it was the proposed location for mixed waste storage facilities. During preparation of the EA in 1993, DOE consulted with the U.S. Fish and Wildlife Service (FWS) about potential impacts to protected species. At the request of the FWS, DOE submitted a Biological Assessment of the Summer Habitat of the federally endangered Indiana bat (*Myotis sodalis)* (enclosure 5). Subsequently, FWS provided DOE with a determination of no effect (enclosure 6) for proposed mixed waste storage at the site.

Mr. Robert McCance, Jr. -2-

This letter is a request for a current inventory of state-listed T&E species in the Paducah East and Joppa quadrangles. Also, please review the enclosed materials and advise us of any environmental issues that you foresee if this project is implemented at the proposed site. Based on available information, DOE believes that federal- and state-listed or proposed T&E species are unlikely to occur in the area potentially affected by the proposed action.

Please direct questions about the proposed project to Mr. David Tidwell, DOE-PGDP, at 502-441-6807. Questions about the NEPA process may be directed to me at 423-576-9578. Thank you in advance for your prompt response to this request.

Sincerely,

Andrea W. Campbell

Andrea Wargo Campbell
Technical Support Division

Enclosure

cc w/enclosure:
D. R. Allen, Acting ORO NEPA Compliance Officer
W. D. Tidwell, Paducah Site Office

Department of Energy

Oak Ridge Operations Office
P.O. Box 2001
Oak Ridge, Tennessee 37831—

September 12, 1997

Mr. Timothy Slone
Endangered Species Coordinator
Commonwealth of Kentucky
Department of Fish and Wildlife Resources
#1 Game Farm Road
Frankfort, KY 40601

Dear Mr. Slone:

INFORMATION REQUEST: ANIMAL SPECIES PROTECTED BY THE COMMONWEALTH OF KENTUCKY

The U.S. Department of Energy (DOE), Oak Ridge Operations Office, is preparing an environmental assessment (EA) for the proposed treatment of mixed wastes stored at the Paducah Gaseous Diffusion Plant (PGDP) in Paducah, Kentucky, using the Vortec Corporation vitrification process. Background information on the proposed project and treatment process is provided in enclosure 1. DOE plans to conduct a 30-day testing of the facility, followed by operation to treat up to 80% of the mixed waste in storage at the PGDP. Startup is tentatively scheduled for the spring of 1998.

The general location of PGDP in Kentucky, 10 miles west of Paducah and 3.5 miles south of the Ohio River in McCracken County, and the proposed site for the vitrification facility at the PGDP are shown on enclosures 2 and 3. A map of the general vegetation at the PGDP is provided in enclosure 4. Please note that the proposed site for the facility is the same site that DOE evaluated in a 1994 EA when it was the proposed location for mixed waste storage facilities. During preparation of the EA in 1993, DOE consulted with the U.S. Fish and Wildlife Service (FWS) and with your office about potential impacts to protected species. Your office provided us with information on threatened and endangered (T&E) animal species in the Paducah East and Joppa U.S. Geological Survey topographic quadrangles (enclosure 5). At the request of the FWS, DOE submitted a Biological Assessment of the Summer Habitat of the federally endangered Indiana bat (*Myotis sodalis)* (enclosure 6). Subsequently, FWS provided DOE with a determination of no effect (enclosure 7) for proposed mixed waste storage at the site.

Mr. Timothy Slone -2-

This letter is a request for a current inventory of state-listed T&E animal species in the Paducah East and Joppa quadrangles. Also, please review the enclosed materials and advise us of any environmental issues that you foresee if this project is implemented at the proposed site. Based on available information, DOE believes that federal- and state-listed or proposed T&E species are unlikely to occur in the area potentially affected by the proposed action.

Please direct questions about the proposed project to Mr. David Tidwell, DOE-PGDP, at 502-441-6807. Questions about the NEPA process may be directed to me at 423-576-9578. Thank you in advance for your prompt response to this request.

Sincerely,

Andrea W. Campbell

Andrea Wargo Campbell
Technical Support Division

Enclosure

cc w/enclosure:
D. R. Allen, Acting ORO NEPA Compliance Officer
W. D. Tidwell, Paducah Site Office

United States Department of the Interior

TAKE PRIDE IN AMERICA

FISH AND WILDLIFE SERVICE
446 Neal Street
Cookeville, TN 38501

TELEPHONE 615/528-6481
FAX 615/528-7075

TO: U.S. Dept. of Energy

ATTENTION: Ms. Andrea Wango Campbell

RECEIVER'S FAX NUMBER: 423-576-0746

FROM: Lee Barclay / Allen Robison

SUBJECT: Treatment of Mixed Wastes at PGDP with Vortec Vitrification

Per your request dated 9-12-97

DATE: 9/24/97 TIME: 7 pm

NUMBER OF PAGES 1 plus cover

Dr. Lee A. Barclay -2-

Based on available information and your previous determination, DOE believes that federally listed or proposed threatened or endangered species are unlikely to occur in the area potentially affected by the proposed action. If you concur, please check the appropriate box, sign below, and fax your response to me at 423-576-0746. Please direct questions about the proposed project to Mr. David Tidwell, DOE-PGDP, at 502-441-6807. Questions about the NEPA process may be directed to me at 423-576-9578.

Thank you in advance for your prompt response to this request.

Sincerely,

Andrea W. Campbell

Andrea Wargo Campbell
Technical Support Division

☑ The proposed treatment of mixed wastes at PGDP using the Vortec vitrification process would *not* be expected to adversely impact federally listed or proposed species and/or habitat. With this letter, DOE has satisfied consultation requirements of Section 7 of the Endangered Species Act.

☐ The information provided by DOE is insufficient to support the conclusion that the proposed treatment of mixed wastes at PGDP using the Vortec vitrification process would not adversely impact federally listed or proposed species and/or habitat. DOE has *not* satisfied consultation requirements of Section 7 of the Endangered Species Act. Further consultation is needed.

Lee A. Barclay 9/23/97

Signature Date

Enclosure:
cc w/enclosure:
D. R. Allen, Acting ORO NEPA Compliance Officer
W. D. Tidwell, Paducah Site Office

ROBERT MCCANCE, JR.
DIRECTOR

PAUL E. PATTON
GOVERNOR

COMMONWEALTH OF KENTUCKY
KENTUCKY STATE NATURE PRESERVES COMMISSION
801 SCHENKEL LANE
FRANKFORT, KENTUCKY 40601-1403
(502) 573-2886 VOICE
(502) 573-2355 FAX

October 6, 1997

Andrea Campbell
United States Department of Energy
P.O. Box 2001
Oak Ridge, TN 37831

Data Request 98-74

Dear Ms. Campbell:

This letter is in response to your data request of September 25, 1997 for the Treatment of Mixed Wastes at Paducah Gaseous Diffusion Plant project. We have reviewed our Natural Heritage Program Database to determine if any of the endangered, threatened, or special concern plants and animals or exemplary natural communities monitored by the Kentucky State Nature Preserves Commission occur on the Heath, Ky. and Joppa, Il.-Ky. USGS 7.5" series quadrangles. Several known monitored occurrences occur on West Kentucky Wildlife Management Area lands in close proximity to the project area. A data report is attached to this response listing all occurrences on the quadrangles.

The following is a list of monitored species that are known to occur within a 1.5 mile radius of the project site on West Kentucky WMA lands:

- *Baptisia bracteata* var. *leucophaea* (Cream Wild Indigo, no federal status, KSNPC special concern);
- *Ictobus niger* (Black Buffalo, no federal status, KSNPC special concern);
- *Lepomis miniatus* (Redspotted Sunfish, no federal status, KSNPC threatened);
- *Rana areolata circulosa* (Northern Crawfish Frog, no federal status, KSNPC special concern);
- *Silphium laciniatum* var. *robinsonii* (Compassplant, no federal status, KSNPC threatened); and
- *Vireo bellii* (Bell's Vireo, no federal status, KSNPC special concern).

Also, *Corvus ossifragus* (Fish Crow, no federal status, KSNPC special concern) has been reported as occurring on the Heath, Ky. quadrangle. It is possible that this species can occur in the

project area in suitable habitat. Outlines of typical habitats for this and the aforementioned species can be found in the attached standard occurrence report. KSNPC recommends that if any of the habitat types would be disturbed by project activities, then the project area should be surveyed by a qualified biologist prior to initiation of construction as to thoroughly evaluate the impact on monitored species.

Please note that the quantity and quality of data collected by the Kentucky Natural Heritage Program are dependent on the research and observations of many individuals and organizations. In most cases, this information is not the result of comprehensive or site-specific field surveys; many natural areas in Kentucky have never been thoroughly surveyed, and new plants and animals are still being discovered. For these reasons, the Kentucky Natural Heritage Program cannot provide a definitive statement on the presence, absence, or condition of biological elements in any part of Kentucky. Heritage reports summarize the existing information known to the Kentucky Natural Heritage Program at the time of the request regarding the biological elements or locations in question. They should never be regarded as final statements on the elements or areas being considered, nor should they be substituted for on-site surveys required for environmental assessments. We would greatly appreciate receiving any pertinent information obtained as a result of on-site surveys.

If you have any questions or I can be of further assistance, please do not hesitate to contact me.

Sincerely,

Sandy Vasenda

Sandy Vasenda
Data Manager

SKV/BDF

Enclosures: Data Interpretation Key(s)
Endangered, Threatened, and Special Concern Plants and Animals of Kentucky
Plants and Animals Presumed Extinct or Extirpated from Kentucky
Monitored Natural Communities of Kentucky

Endangered, Threatened, Special Concern, and Historic Plants and Animals of Kentucky

Kentucky State Nature Preserves Commission
July, 1997

	STATUS KSNPC	STATUS US
NONVASCULAR PLANTS		
Sphagnum quinquefarium A sphagnum moss	E	
Tortula norvegica Tortula	E	
VASCULAR PLANTS		
Acer spicatum Mountain maple	E	
Aconitum uncinatum Blue monkshood	T	
Adiantum capillus-veneris Southern maidenhair-fern	T	
Adlumia fungosa Climbing fumitory	E	
Aesculus pavia Red buckeye	T	
Agalinis obtusifolia Ten-lobe false foxglove	E	
Agalinis skinneriana Pale false foxglove	E	
Ageratina luciae-brauniae Lucy Braun's white snakeroot	S	
Agrimonia gryposepala Tall hairy groovebur	T	
Amianthium muscitoxicum Fly-poison	T	
Amsonia tabernaemontana var. *gattingeri* Eastern blue-star	T	
Anemone canadensis Canada anemone	H	
Angelica triquinata Filmy angelica	E	
Apios priceana Price's potato-bean	E	LT
Arabis missouriensis Missouri rock cress	E	
Arabis perstellata Braun's rock cress	T	LE
Aristida ramosissima Branched three-awn grass	H	
Armoracia lacustris Lake cress	T	
Aster concolor Eastern silvery aster	T	
Aster drummondii var. *texanus* Texas aster	T	
Aster hemisphericus Tennessee aster	E	
Aster phyllolepis Western silky aster	S	
Aster pilosus var. *priceae* White heath aster	T	
Aster saxicastellii Rockcastle aster	T	
Aureolaria patula Spreading false foxglove	S	
Baptisia australis var. *minor* Blue wild indigo	S	
Baptisia bracteata var. *leucophaea* Cream wild indigo	S	
Baptisia tinctoria Yellow wild indigo	T	
Bartonia virginica Yellow screwstem	T	
Berberis canadensis American barberry	E	
Berchemia scandens Supplejack	T	
Botrychium matricariifolium Matricary grapefern	E	
Botrychium oneidense Blunt-lobe grapefern	E	
Boykinia aconitifolia Brook saxifrage	T	
Cabomba caroliniana Carolina fanwort	T	
Calamagrostis canadensis var. *macouniana* Blue-joint reed grass	E	
Calamagrostis porteri ssp. *insperata* Reed bent grass	E	

Endangered, Threatened, Special Concern, and Historic Plants and Animals of Kentucky (July, 1997)

	STATUS KSNPC	STATUS US
Calamagrostis porteri ssp. *porteri* Porter's reed grass	T	
Callirhoe alcaeoides Clustered poppy-mallow	H	
Calopogon tuberosus Grass-pink	E	
Calycanthus floridus var. *glaucus* Sweetshrub	T	
Calylophus serrulatus Yellow evening primrose	H	
Carex aestivalis Summer sedge	E	
Carex alata Broadwing sedge	T	
Carex atlantica ssp. *capillacea* Prickly bog sedge	E	
Carex austrocaroliniana Tarheel sedge	S	
Carex buxbaumii Brown bog sedge	E	
Carex comosa Bristly sedge	H	
Carex crawei Crawe's sedge	S	
Carex crebriflora Coastal plain sedge	T	
Carex decomposita Epiphytic sedge	T	
Carex gigantea Large sedge	T	
Carex hystericina Porcupine sedge	H	
Carex joorii Cypress-swamp sedge	E	
Carex juniperorum Cedar sedge	E	
Carex lanuginosa Woolly sedge	E	
Carex leptonervia Finely-nerved sedge	E	
Carya aquatica Water hickory	T	
Castanea dentata American chestnut	E	
Castanea pumila Allegheny chinkapin	T	
Castilleja coccinea Scarlet Indian paintbrush	E	
Ceanothus herbaceus Prairie redroot	T	
Cheilanthes alabamensis Alabama lip fern	E	
Cheilanthes feei Fee's lip fern	E	
Chelone obliqua var. *obliqua* Red turtlehead	E	
Chelone obliqua var. *speciosa* Rose turtlehead	S	
Chrysogonum virginianum Green-and-gold	E	
Chrysosplenium americanum American golden-saxifrage	E	
Cimicifuga rubifolia Appalachian bugbane	T	
Circaea alpina Small enchanter's-nightshade	S	
Clematis crispa Blue jasmine leather-flower	T	
Coeloglossum viride var. *virescens* Long-bract green orchis	H	
Collinsonia verticillata Whorled horse-balm	E	
Comptonia peregrina Sweet-fern	E	
Conradina verticillata Cumberland-rosemary	E	LT
Convallaria montana American lily-of-the-valley	E	
Corallorrhiza maculata Spotted coralroot	E	
Coreopsis pubescens Star tickseed	S	
Crataegus engelmannii Engelmann's hawthorn	H	
Cymophyllus fraserianus Fraser's sedge	E	
Cyperus plukenetii Plukenet's cyperus	H	
Cypripedium candidum Small white lady's-slipper	E	
Cypripedium kentuckiense Kentucky lady's-slipper	S	

Endangered, Threatened, Special Concern, and Historic Plants and Animals of Kentucky (July, 1997)

	STATUS KSNPC	STATUS US
Cypripedium parviflorum Small yellow lady's-slipper	T	
Cypripedium reginae Showy lady's-slipper	H	
Delphinium carolinianum Carolina larkspur	T	
Deschampsia cespitosa ssp. *glauca* Tufted hair grass	E	
Deschampsia flexuosa Crinkled hair grass	T	
Dichanthelium boreale Northern witch grass	S	
Didiplis diandra Water-purslane	S	
Dodecatheon frenchii French's shooting-star	S	
Draba cuneifolia Wedge-leaf whitlow-grass	E	
Drosera brevifolia Dwarf sundew	E	
Drosera intermedia Spoon-leaved sundew	H	
Dryopteris carthusiana Spinulose wood fern	S	
Dryopteris ludoviciana Southern shield wood fern	H	
Echinodorus berteroi Burhead	T	
Echinodorus parvulus Dwarf burhead	E	
Eleocharis olivacea Olivaceous sedge	S	
Elodea nuttallii Waterweed	T	
Elymus svensonii Svenson's wild rye	S	
Eriophorum virginicum Tawny cotton-grass	E	
Eryngium integrifolium Blue-flower coyote-thistle	E	
Erythronium rostratum Golden-star	S	
Eupatorium maculatum Spotted joe-pye-weed	H	
Eupatorium semiserratum Small-flowered thoroughwort	E	
Eupatorium steelei Steele's joe-pye-weed	E	
Euphorbia mercurialina Mercury spurge	T	
Fimbristylis puberula Hairy fimbristylis	T	
Forestiera ligustrina Upland privet	S	
Gentiana decora Showy gentian	S	
Gentiana flavida Yellow gentian	E	
Gentiana puberulenta Prairie gentian	E	
Glandularia canadensis Rose verbena	T	
Glyceria acutiflora Sharp-scaled manna grass	T	
Gnaphalium helleri var. *micradenium* Small rabbit-tobacco	H	
Gratiola pilosa Shaggy hedge-hyssop	T	
Gratiola viscidula Short's hedge-hyssop	S	
Gymnopogon ambiguus Bearded skeleton grass	S	
Gymnopogon brevifolius Shortleaf skeleton grass	E	
Halesia tetraptera Common silverbell	T	
Hedeoma hispidum Rough pennyroyal	T	
Helianthemum bicknellii Plains frostweed	T	
Helianthemum canadense Canada frostweed	E	
Helianthus eggertii Eggert's sunflower	T	PT
Helianthus silphioides Silphium sunflower	E	
Heracleum lanatum Cow-parsnip	E	
Heteranthera dubia Grassleaf mud-plantain	S	
Heteranthera limosa Blue mud-plantain	S	

Endangered, Threatened, Special Concern, and Historic Plants and Animals of Kentucky (July, 1997)

	STATUS KSNPC	US
Heterotheca subaxillaris var. *latifolia* Broad-leaf golden-aster	T	
Hexastylis contracta Southern heartleaf	E	
Hexastylis heterophylla Variable-leaved heartleaf	S	
Hieracium longipilum Hairy hawkweed	T	
Houstonia serpyllifolia Michaux's bluets	E	
Hydrocotyle americana American water-pennywort	E	
Hydrolea ovata Ovate fiddleleaf	E	
Hydrophyllum virginianum Virginia waterleaf	S	
Hypericum adpressum Creeping St. John's-wort	H	
Hypericum crux-andreae St. Peter's-wort	T	
Hypericum nudiflorum Pretty St. John's-wort	H	
Hypericum pseudomaculatum Large spotted St. John's-wort	H	
Iris fulva Copper iris	E	
Isoetes butleri Butler'squillwort	E	
Isoetes melanopoda Blackfoot quillwort	E	
Juglans cinerea White walnut	S	
Juncus articulatus Jointed rush	S	
Juncus elliottii Bog rush	E	
Juncus filipendulus Long-styled rush	T	
Juniperus communis var. *depressa* Ground juniper	T	
Koeleria macrantha June grass	E	
Lathyrus palustris Vetchling peavine	T	
Lathyrus venosus Smooth veiny peavine	S	
Leavenworthia exigua var. *laciniata* Glade cress	T	
Leavenworthia torulosa Necklace glade cress	T	
Leiophyllum buxifolium Sand-myrtle	H	
Lesquerella globosa Lesquereux's bladderpod	T	
Lesquerella lescurii Lescur's bladderpod	S	
Leucothoe recurva Fetterbush	E	
Liatris cylindracea Slender blazingstar	T	
Lilium philadelphicum Wood lily	T	
Lilium superbum Turk's cap lily	T	
Limnobium spongia American frog's-bit	T	
Liparis loeselii Loesel's twayblade	T	
Listera australis Southern twayblade	E	
Listera smallii Kidney-leaf twayblade	T	
Lobelia appendiculata var. *gattingeri* Gattinger's lobelia	E	
Lobelia nuttallii Nuttall's lobelia	T	
Lonicera dioica var. *orientalis* Wild honeysuckle	E	
Lonicera reticulata Grape honeysuckle	E	
Ludwigia hirtella Hairy ludwigia	E	
Lycopodiella appressa Southern bog club-moss	E	
Lycopodiella clavatum Running-pine	E	
Lycopodiella inundatum Northern bog club-moss	E	
Lysimachia fraseri Fraser's loosestrife	E	
Lysimachia radicans Trailing loosestrife	H	

Endangered, Threatened, Special Concern, and Historic Plants and Animals of Kentucky (July, 1997)

	STATUS KSNPC	STATUS US
Lysimachia terrestris Swamp-candles	E	
Maianthemum canadense Wild lily-of-the-valley	T	
Maianthemum stellatum Starflower false solomon's-seal	E	
Malus angustifolia Southern crabapple	S	
Malvastrum hispidum Hispid false mallow	T	
Marshallia grandiflora Barbara's-buttons	E	
Matelea carolinensis Carolina anglepod	E	
Melampyrum lineare var. *latifolium* American cow-wheat	T	
Melampyrum lineare var. *pectinatum* American cow-wheat	E	
Melanthium parviflorum Small-flowered false hellebore	E	
Melanthium virginicum Virginia bunchflower	E	
Melanthium woodii False hellebore	T	
Minuartia cumberlandensis Cumberland sandwort	E	LE
Minuartia glabra Appalachian sandwort	T	
Mirabilis albida Pale umbrella-wort	E	
Monarda punctata Spotted beebalm	E	
Monotropsis odorata Sweet pinesap	T	
Muhlenbergia bushii Bush's muhly	E	
Muhlenbergia cuspidata Plains muhly	T	
Muhlenbergia glabrifloris Hair grass	S	
Myriophyllum heterophyllum Broadleaf water-milfoil	S	
Myriophyllum pinnatum Cutleaf water-milfoil	T	
Najas gracillima Thread-like naiad	S	
Nemophila aphylla Small-flower baby-blue-eyes	T	
Nestronia umbellula Conjurer's-nut	E	
Oenothera linifolia Thread-leaf sundrops	E	
Oenothera oakesiana Evening primrose	H	
Oenothera perennis Small sundrops	E	
Oenothera triloba Stemless evening-primrose	T	
Oldenlandia uniflora Clustered bluets	E	
Onosmodium molle ssp. *hispidissimum* Hairy false gromwell	E	
Onosmodium molle ssp. *molle* Soft false gromwell	E	
Onosmodium molle ssp. *occidentale* Western false gromwell	E	
Orobanche ludoviciana Louisiana broomrape	H	
Orontium aquaticum Goldenclub	T	
Oxalis priceae Price's yellow wood sorrel	H	
Parnassia asarifolia Kidney-leaf grass-of-parnassus	E	
Parnassia grandifolia Largeleaf grass-of-parnassus	E	
Paronychia argyrocoma Silverling	E	
Paspalum boscianum Bull paspalum	S	
Paxistima canbyi Canby's mountain-lover	T	
Pedicularis lanceolata Swamp lousewort	H	
Perideridia americana Eastern eulophus	T	
Phacelia ranunculacea Blue scorpion-weed	S	
Philadelphus inodorus Mock orange	T	
Philadelphus pubescens Hoary mock orange	E	

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	STATUS KSNPC US
Phlox bifida ssp. *bifida* Cleft phlox	T
Phlox bifida ssp. *stellaria* Starry cleft phlox	T
Plantago cordata Heartleaf plantain	H
Platanthera cristata Yellow-crested orchid	T
Platanthera integrilabia White fringeless orchid	T
Platanthera psycodes Small purple-fringed orchid	E
Poa saltuensis Drooping blue grass	E
Podostemum ceratophyllum Threadfoot	S
Pogonia ophioglossoides Rose pogonia	E
Polygala cruciata Cross-leaf milkwort	E
Polygala nuttallii Nuttall's milkwort	H
Polygala polygama Racemed milkwort	T
Polymnia laevigata Tennessee leafcup	E
Pontederia cordata Pickerel-weed	T
Potamogeton illinoensis Illinois pondweed	S
Potamogeton pulcher Spotted pondweed	T
Prenanthes alba White rattlesnake-root	E
Prenanthes aspera Rough rattlesnake-root	E
Prenanthes barbata Barbed rattlesnake-root	E
Prenanthes crepidinea Nodding rattlesnake-root	T
Psoralidium tenuiflorum Few-flowered scurf-pea	E
Ptilimnium capillaceum Mock bishop's-weed	T
Ptilimnium nuttallii Nuttall's mock bishop's-weed	E
Pycnanthemum albescens White-leaved mountain-mint	E
Pyrola americana American wintergreen	H
Ranunculus ambigens Water-plantain	S
Rhododendron canescens Hoary azalea	E
Rhynchosia tomentosa Hairy snout-bean	E
Rhynchospora globularis Globe beaked-rush	S
Rhynchospora macrostachya Tall beaked-rush	E
Rubus canadensis Smooth blackberry	E
Rubus whartoniae Wharton's dewberry	T
Rudbeckia subtomentosa Sweet coneflower	E
Sabatia campanulata Slender marsh-pink	E
Sagittaria graminea Grass-leaf arrowhead	T
Sagittaria rigida Sessile-fruit arrowhead	E
Salix amygdaloides Peachleaf willow	H
Salix discolor Pussy willow	H
Salvia urticifolia Nettle-leaf sage	E
Sambucus racemosa ssp. *pubens* Red elderberry	E
Sanguisorba canadensis Canada burnet	E
Saxifraga michauxii Michaux's saxifrage	T
Saxifraga micranthidifolia Lettuce-leaf saxifrage	E
Saxifraga pensylvanica Swamp saxifrage	H
Schisandra glabra Bay starvine	E
Schizachne purpurascens Purple-oat	T

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	STATUS KSNPC	STATUS US
Schwalbea americana Chaffseed	H	LE
Scirpus expansus Woodland beak-rush	E	
Scirpus fluviatilis River bul-rush	E	
Scirpus hallii Hall's bul-rush	E	
Scirpus heterochaetus Slender bul-rush	E	
Scirpus microcarpus Small-fruit bul-rush	E	
Scirpus verecundus Bashful bul-rush	E	
Scleria ciliata var. *ciliata* Fringed nut-rush	E	
Scleria muelenbergii Pitted nut-rush	H	
Scutellaria saxatilis Rock skullcap	T	
Sedum telephioides Allegheny stonecrop	T	
Sida hermaphrodita Virginia-mallow	S	
Silene ovata Ovate catchfly	E	
Silene regia Royal catchfly	E	
Silphium laciniatum var. *laciniatum* Compassplant	E	
Silphium laciniatum var. *robinsonii* Compassplant	T	
Solidago albopilosa White-haired goldenrod	T	LT
Solidago buckleyi Buckley's goldenrod	S	
Solidago caesia var. *curtisii* Curtis' goldenrod	T	
Solidago puberula Downy goldenrod	S	
Solidago roanensis Roan mountain goldenrod	T	
Solidago shortii Short's goldenrod	E	LE
Solidago simplex ssp. *randii* Rand's goldenrod	S	
Solidago squarrosa Squarrose goldenrod	H	
Sparganium eurycarpum Large bur-reed	E	
Sphenopholis pensylvanica Swamp wedgescale	S	
Spiraea alba Narrow-leaved meadowsweet	E	
Spiraea virginiana Virginia spiraea	T	LT
Spiranthes lucida Shining ladies'-tresses	T	
Spiranthes magnicamporum Great plains ladies'-tresses	T	
Spiranthes odorata Sweetscent ladies'-tresses	E	
Sporobolus clandestinus Rough dropseed	T	
Sporobolus heterolepis Northern dropseed	E	
Stachys eplingii Epling's hedge-nettle	E	
Stellaria fontinalis Water stichwort	T	
Stellaria longifolia Longleaf stitchwort	S	
Streptopus roseus var. *perspectus* Rosy twistedstalk	E	
Symphoricarpos albus Snowberry	E	
Talinum calcaricum Limestone fameflower	E	
Talinum teretifolium Roundleaf fameflower	T	
Taxus canadensis Canadian yew	T	
Tephrosia spicata Spiked hoary-pea	E	
Thaspium pinnatifidum Cutleaf meadow-parsnip	T	
Thermopsis mollis Soft-haired thermopsis	E	
Thuja occidentalis Northern white-cedar	T	
Torreyochloa pallida Pale manna grass	E	

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	STATUS KSNPC	US
Toxicodendron vernix Poison sumac	E	
Tragia urticifolia Nettle-leaf noseburn	E	
Trepocarpus aethusae Trepocarpus	T	
Trichostema setaceum Narrow-leaved bluecurls	E	
Trientalis borealis Northern starflower	E	
Trifolium reflexum Buffalo clover	E	
Trifolium stoloniferum Running buffalo clover	T	LE
Trillium nivale Snow trillium	E	
Trillium pusillum var. *ozarkanum* Ozark least trillium	E	
Trillium pusillum var. *pusillum* Least trillium	E	
Trillium undulatum Painted trillium	T	
Triplasis purpurea Purple sand grass	H	
Ulmus serotina September elm	S	
Utricularia macrorhiza Greater bladderwort	E	
Vallisneria americana Eel-grass	S	
Vernonia noveboracensis New York ironweed	S	
Veronica americana American speedwell	H	
Viburnum molle Missouri arrow-wood	T	
Viburnum nudum Possum haw viburnum	E	
Viola septemloba var. *egglestonii* Eggleston's violet	S	
Viola walteri Walter's violet	T	
Vitis rupestris Sand grape	T	
Woodsia appalachiana Mountain woodsia	E	
Xerophyllum asphodeloides Eastern turkeybeard	H	
Xyris difformis Carolina yellow-eye-grass	E	
Zizania palustris var. *interior* Indian wild rice	H	
Zizaniopsis miliacea Southern wild rice	T	

ANIMALS

Gastropods

	STATUS KSNPC	US
Anguispira rugoderma Pine Mountain disc	T	
Antroselatus spiralis Shaggy cavesnail	S	
Glyphyalinia raderi Maryland glyph	S	
Glyphyalinia rhoadsi Sculpted glyph	T	
Helicodiscus notius specus A snail	T	
Helicodiscus punctatellus Punctate coil	S	
Leptoxis praerosa Onyx rocksnail	S	
Lithasia armigera Armored rocksnail	S	
Lithasia geniculata Ornate rocksnail	S	
Lithasia salebrosa Muddy rocksnail	S	
Lithasia verrucosa Varicose rocksnail	S	
Mesodon chilhoweensis Queen crater	S	
Mesodon panselenus Virginia bladetooth	S	
Mesodon wetherbyi Clifty covert	S	
Mesomphix rugeli Wrinkled button	T	
Pilsbryna sp. 1 A snail (undescribed)	E	
Pleurocera alveare Rugged hornsnail	S	

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	STATUS KSNPC	STATUS US
Pleurocera curta Shortspire hornsnail	S	
Rabdotus dealbatus Whitewashed rabdotus	T	
Rhodacme elatior Domed ancylid	S	
Triodopsis dentifera Big-tooth whitelip	T	
Triodopsis multilineata Striped whitelip	T	
Vertigo bollesiana Delicate vertigo	E	
Vertigo clappi Cupped vertigo	E	
Vitrinizonites latissimus Glassy grapeskin	T	
Unionids (Mussels)		
Alasmidonta atropurpurea Cumberland elktoe	E	LE
Alasmidonta marginata Elktoe	T	
Anodontoides denigratus Cumberland papershell	E	
Cumberlandia monodonta Spectaclecase	E	
Cyprogenia stegaria Fanshell	E	LE
Epioblasma brevidens Cumberlandian combshell	E	LE
Epioblasma capsaeformis Oyster mussel	E	LE
Epioblasma obliquata obliquata Catspaw	E	LE
Epioblasma torulosa rangiana Northern riffleshell	E	LE
Epioblasma triquetra Snuffbox	S	
Fusconaia subrotunda subrotunda Long-solid	T	
Lampsilis abrupta Pink mucket	E	LE
Lampsilis ovata Pocketbook	E	
Lasmigona compressa Creek heelsplitter	E	
Lasmigona subviridis Green floater	E	
Lexingtonia dolabelloides Slabside pearlymussel	H	
Obovaria retusa Ring pink	E	LE
Pegias fabula Little-wing pearlymussel	E	LE
Plethobasus cooperianus Orange-foot pimpleback	E	LE
Plethobasus cyphyus Sheepnose	S	
Pleurobema clava Clubshell	E	LE
Pleurobema oviforme Tennessee clubshell	E	
Pleurobema plenum Rough pigtoe	E	LE
Pleurobema pyramidatum Pyramid pigtoe	E	
Potamilus capax Fat pocketbook	E	LE
Potamilus purpuratus Bleufer	E	
Ptychobranchus subtentum Fluted kidneyshell	T	
Quadrula cylindrica cylindrica Rabbitsfoot	T	
Simpsonaias ambigua Salamander mussel	T	
Toxolasma lividum Purple lilliput	E	
Toxolasma texasensis Texas lilliput	E	
Villosa fabalis Rayed bean	E	
Villosa lienosa Little spectaclecase	S	
Villosa ortmanni Kentucky creekshell	T	
Villosa trabalis Cumberland bean	E	LE
Villosa vanuxemensis Mountain creekshell	T	

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	STATUS KSNPC	STATUS US
Crustaceans		
Barbicambarus cornutus Bottlebrush crayfish	S	
Bryocamptus morrisoni elegans A copepod	T	
Caecidotea barri Clifton Cave isopod	E	
Cambarellus puer A dwarf crayfish	E	
Cambarellus shufeldtii Cajun dwarf crayfish	S	
Cambarus parvoculus A crayfish	E	
Cambarus veteranus A crayfish	S	
Gammarus bousfieldi Bousfield's amphipod	E	
Macrobrachium ohione Ohio shrimp	E	
Orconectes australis A crayfish	T	
Orconectes bisectus Crittenden crayfish	T	
Orconectes inermis A crayfish	S	
Orconectes jeffersoni Louisville crayfish	E	
Orconectes lancifer A crayfish	E	
Orconectes palmeri A crayfish	E	
Orconectes pellucidus A crayfish	S	
Palaemonias ganteri Mammoth Cave shrimp	E	LE
Procambarus viaeviridis A crayfish	T	
Stygobromus vitreus An amphipod	S	
Insects		
Celithemis verna Double-ringed pennant	S	
Cheumatopsyche helma Helma's net-spinning caddisfly	H	
Dryobius sexnotatus Sixbanded longhorn beetle	T	
Litobrancha recurvata A burrowing mayfly	S	
Lordithon niger Black lordithon rove beetle	H	
Lytrosis permagnaria A geometrid moth	E	
Manophylax butleri A limnephilid caddisfly	S	
Nicrophorus americanus American burying beetle	T	LE
Ophiogomphus howei Pygmy snaketail	S	
Papaipema eryngii Rattlesnake-master borer moth	E	
Phyciodes batesii Tawny crescent	T	
Pseudanophthalmus abditus Concealed cave beetle	T	
Pseudanophthalmus audax Bold cave beetle	T	
Pseudanophthalmus caecus Clifton Cave beetle	T	
Pseudanophthalmus calcareus Limestone Cave beetle	T	
Pseudanophthalmus catoryctos Lesser Adams Cave beetle	E	
Pseudanophthalmus conditus Hidden cave beetle	T	
Pseudanophthalmus exoticus Exotic cave beetle	H	
Pseudanophthalmus frigidus Icebox Cave beetle	T	
Pseudanophthalmus globiceps Round-headed cave beetle	T	
Pseudanophthalmus horni Garman's cave beetle	S	
Pseudanophthalmus hypolithos Ashcamp cave beetle	T	
Pseudanophthalmus inexpectatus Suprising cave beetle	T	
Pseudanophthalmus major Beaver Cave beetle	T	
Pseudanophthalmus parvus Tatum Cave beetle	T	

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	STATUS KSNPC	STATUS US
Pseudanophthalmus pholeter Greater Adams Cave beetle	E	
Pseudanophthalmus pubescens intrepidus A cave beetle	T	
Pseudanophthalmus puteanus Old Well Cave beetle	T	
Pseudanophthalmus rogersae Rogers' cave beetle	T	
Pseudanophthalmus scholasticus Scholarly Cave beetle	T	
Pseudanophthalmus simulans Cub Run Cave beetle	T	
Pseudanophthalmus tenebrosus Stevens Creek Cave beetle	T	
Pseudanophthalmus troglodytes Louisville cave beetle	T	
Pyrgus wyandot Appalachian grizzled skipper	T	
Speyeria idalia Regal fritillary	H	
Stenonema bednariki A heptageniid mayfly	S	
Stylurus notatus Elusive clubtail	H	
Fishes		
Acipenser fulvescens Lake sturgeon	E	
Alosa alabamae Alabama shad	E	
Amblyopsis spelaea Northern cavefish	S	
Ammocrypta clara Western sand darter	E	
Ammocrypta pellucida Eastern sand darter	S	
Atractosteus spatula Alligator gar	E	
Clinostomus funduloides Rosyside dace	S	
Cyprinella camura Bluntface shiner	S	
Cyprinella venusta Blacktail shiner	S	
Erimystax insignis Blotched chub	E	
Erimyzon sucetta Lake chubsucker	T	
Esox niger Chain pickerel	S	
Etheostoma chienense Relict darter	E	LE
Etheostoma cinereum Ashy darter	S	
Etheostoma fusiforme Swamp darter	E	
Etheostoma lynceum Brighteye darter	S	
Etheostoma maculatum Spotted darter	T	
Etheostoma microlepidum Smallscale darter	E	
Etheostoma nigrum susanae Johnny darter	T	
Etheostoma parvipinne Goldstripe darter	S	
Etheostoma percnurum Duskytail darter	E	LE
Etheostoma proeliare Cypress darter	T	
Etheostoma pyrrhogaster Firebelly darter	S	
Etheostoma sagitta spilotum Arrow darter	S	
Etheostoma swaini Gulf darter	S	
Fundulus chrysotus Golden topminnow	E	
Fundulus dispar Starhead topminnow	E	
Hybognathus hayi Cypress minnow	E	
Hybognathus placitus Plains minnow	S	
Hybopsis amnis Pallid shiner	H	
Ichthyomyzon castaneus Chestnut lamprey	S	
Ichthyomyzon fossor Northern brook lamprey	T	

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	STATUS KSNPC	STATUS US
Ichthyomyzon gagei Southern brook lamprey	H	
Ichthyomyzon greeleyi Mountain brook lamprey	T	
Ictiobus niger Black buffalo	S	
Lampetra appendix American brook lamprey	T	
Lepomis marginatus Dollar sunfish	E	
Lepomis miniatus Redspotted sunfish	T	
Lota lota Burbot	S	
Macrhybopsis gelida Sturgeon chub	H	C
Macrhybopsis meeki Sicklefin chub	H	C
Menidia beryllina Inland silverside	T	
Moxostoma poecilurum Blacktail redhorse	S	
Nocomis biguttatus Hornyhead chub	S	
Notropis albizonatus Palezone shiner	E	LE
Notropis hudsonius Spottail shiner	S	
Notropis maculatus Taillight shiner	T	
Notropis sp. Sawfin shiner (undescribed)	E	
Noturus exilis Slender madtom	E	
Noturus hildebrandi Least madtom	S	
Noturus phaeus Brown madtom	S	
Noturus stigmosus Northern madtom	S	
Percina macrocephala Longhead darter	T	
Percina squamata Olive darter	E	
Percopsis omiscomaycus Trout-perch	S	
Phenacobius uranops Stargazing minnow	S	
Phoxinus cumberlandensis Blackside dace	T	LT
Platygobio gracilis Flathead chub	S	
Rhinichthys cataractae Longnose dace	E	
Scaphirhynchus albus Pallid sturgeon	E	LE
Thoburnia atripinnis Blackfin sucker	S	
Typhlichthys subterraneus Southern cavefish	S	
Umbra limi Central mudminnow	T	
Amphibians		
Amphiuma tridactylum Three-toed Amphiuma	E	
Eurycea longicauda guttolineata Three-lined Salamander	T	
Hyla avivoca Bird-voiced Treefrog	T	
Hyla cinerea Green Treefrog	S	
Hyla gratiosa Barking Treefrog	S	
Hyla versicolor Gray Treefrog	S	
Plethodon cinereus Redback Salamander	S	
Plethodon wehrlei Wehrle's Salamander	E	
Rana areolata circulosa Northern Crawfish Frog	S	
Rana pipiens Northern Leopard Frog	S	
Reptiles		
Apalone mutica mutica Midland Smooth Softshell	S	
Chrysemys picta dorsalis Southern Painted Turtle	S	

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	STATUS KSNPC	STATUS US
Clonophis kirtlandii Kirtland's Snake	E	
Elaphe guttata guttata Corn Snake	S	
Eumeces anthracinus anthracinus Northern Coal Skink	T	
Eumeces anthracinus pluvialis Southern Coal Skink	E	
Eumeces inexpectatus Southeastern Five-lined Skink	S	
Farancia abacura reinwardtii Western Mud Snake	S	
Lampropeltis triangulum elapsoides Scarlet Kingsnake	S	
Macroclemys temminckii Alligator Snapping Turtle	T	
Nerodia cyclopion Mississippi Green Water Snake	E	
Nerodia erythrogaster neglecta Copperbelly Water Snake	S	PT
Nerodia fasciata confluens Broad-banded Water Snake	E	
Ophisaurus attenuatus longicaudus Eastern Slender Glass Lizard	T	
Pituophis melanoleucus melanoleucus Northern Pine Snake	T	
Sistrurus miliarius streckeri Western Pigmy Rattlesnake	T	
Thamnophis proximus proximus Western Ribbon Snake	T	
Thamnophis sauritus sauritus Eastern Ribbon Snake	S	
Birds		
Accipiter striatus Sharp-shinned Hawk	S	
Actitis macularia Spotted Sandpiper	E	
Aimophila aestivalis Bachman's Sparrow	E	
Ammodramus henslowii Henslow's Sparrow	S	
Anas discors Blue-winged Teal	E	
Ardea alba Great Egret	E	
Ardea herodias Great Blue Heron	S	
Asio flammeus Short-eared Owl	E	
Asio otus Long-eared Owl	E	
Bartramia longicauda Upland Sandpiper	H	
Botaurus lentiginosus American Bittern	H	
Bubulcus ibis Cattle Egret	S	
Certhia americana Brown Creeper	E	
Chondestes grammacus Lark Sparrow	T	
Circus cyaneus Northern Harrier	T	
Cistothorus platensis Sedge Wren	S	
Corvus corax Common Raven	E	
Corvus ossifragus Fish Crow	S	
Dendroica fusca Blackburnian Warbler	T	
Dolichonyx oryzivorus Bobolink	S	
Egretta caerulea Little Blue Heron	E	
Empidonax minimus Least Flycatcher	E	
Fulica americana American Coot	H	
Gallinula chloropus Common Moorhen	T	
Haliaeetus leucocephalus Bald Eagle	E	LE
Ictinia mississippiensis Mississippi Kite	S	
Ixobrychus exilis Least Bittern	T	
Junco hyemalis Dark-eyed Junco	S	
Lophodytes cucullatus Hooded Merganser	T	

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	STATUS KSNPC	STATUS US
Nyctanassa violacea Yellow-crowned Night-Heron	T	
Nycticorax nycticorax Black-crowned Night-Heron	T	
Pandion haliaetus Osprey	T	
Passerculus sandwichensis Savannah Sparrow	S	
Phalacrocorax auritus Double-crested Cormorant	H	
Pheucticus ludoviciamus Rose-breasted Grosbeak	S	
Picoides borealis Red-cockaded Woodpecker	E	LE
Podilymbus podiceps Pied-billed Grebe	E	
Pooecetes gramineus Vesper Sparrow	E	
Rallus elegans King Rail	E	
Riparia riparia Bank Swallow	S	
Sterna antillarum athalassos Interior Least Tern	E	LE
Thryomanes bewickii Bewick's Wren	S	
Tyto alba Barn Owl	S	
Vermivora chrysoptera Golden-winged Warbler	T	
Vireo bellii Bell's Vireo	S	
Wilsonia canadensis Canada Warbler	S	
Mammals		
Clethrionomys gapperi maurus Kentucky Red-backed Vole	S	
Corynorhinus rafinesquii Rafinesque's Big-eared Bat	T	
Corynorhinus townsendii virginianus Virginia Big-eared Bat	E	LE
Mustela nivalis Least Weasel	S	
Myotis austroriparius Southeastern Myotis	E	
Myotis grisescens Gray Myotis	E	LE
Myotis leibii Eastern Small-footed Myotis	E	
Myotis sodalis Indiana Myotis	E	LE
Nycticeius humeralis Evening Bat	T	
Peromyscus gossypinus Cotton Mouse	T	
Sorex cinereus Masked Shrew	S	
Sorex dispar blitchi Long-tailed Shrew	E	
Spilogale putorius Eastern Spotted Skunk	S	
Ursus americanus Black Bear	S	

Key to Status Categories

(KSNPC) Kentucky State Nature Preserves Commission

E: Endangered. A taxon in danger of extirpation and/or extinction throughout all or a significant part of its range in Kentucky.

T: Threatened. A taxon likely to become endangered within the foreseeable future throughout all or a significant part of its range in Kentucky.

S: Special Concern. A taxon that should be monitored because (a) it exists in a limited geographic area, (b) it may become threatened or endangered due to modification or destruction of habitat, (c) certain characteristics or requirements make it especially vulnerable to specific pressures, (d) experienced researchers have identified other factors that may jeopardize it, or (e) it is thought to be rare or declining but insufficient information exists for assignment to the threatened or endangered status categories.

H: Historic. A taxon documented from Kentucky but not observed reliably since 1975.

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(US) Endangered Species Act of 1973

For status category definitions see:

United States Fish and Wildlife Service. 1992. Endangered Species Act of 1973 as amended through the 100th Congress. United States Government Printing Office, Washington, District of Columbia;

United States Fish and Wildlife Service. 1993. Endangered and threatened wildlife and plants; review of plant taxa for listing as endangered or threatened species. Federal Register 58:51144-51190; and

United States Fish and Wildlife Service. 1996. Endangered and threatened wildlife and plants; review of plant and animal taxa that are candidates for listing as endangered or threatened species. Federal Register 61:7596-7613.

US statuses were taken from:

United States Fish and Wildlife Service. 1996. Endangered and threatened wildlife and plants. United States Government Printing Office, Washington, District of Columbia;

United States Fish and Wildlife Service. 1996. Endangered and threatened wildlife and plants; review of plant and animal taxa that are candidates for listing as endangered or threatened species. Federal Register 61:7596-7613; and

United States Fish and Wildlife Service. 1997. Endangered and threatened wildlife and plants; determination of endangered status for the Cumberland elktoe, Oyster mussel, Cumberlandian combshell, Purple bean, and Rough rabbitsfoot. Federal Register 62:1647-1658.

LE: Listed Endangered
LT: Listed Threatened
PT: Proposed Threatened
C: Candidate

Kentucky State Nature Preserves Commission
801 Schenkel Lane
Frankfort, KY 40601-1403
(502) 573-2886 phone
(502) 573-2355 fax

Plants and Animals Presumed Extinct or Extirpated from Kentucky

Kentucky State Nature Preserves Commission
July, 1997

	US STATUS
PLANTS	
Caltha palustris var. *palustris* Marsh Marigold	
Orbexilum stipulatum Stipuled Scurf-pea	3A
Physostegia intermedia Slender Dragon-head	
Polytaenia nuttallii Prairie Parsley	
ANIMALS	
Unionids (Mussels)	
Dromus dromas Dromedary pearlymussel	LE
Epioblasma arcaeformis Sugarspoon	3A
Epioblasma biemarginata Angled riffleshell	3A
Epioblasma flexuosa Leafshell	3A
Epioblasma florentina florentina Yellow blossom	LE
Epioblasma florentina walkeri Tan riffleshell	LE
Epioblasma haysiana Acornshell	3A
Epioblasma lewisii Forkshell	3A
Epioblasma obliquata perobliqua White catspaw	LE
Epioblasma personata Round combshell	3A
Epioblasma propinqua Tennessee riffleshell	3A
Epioblasma sampsonii Wabash riffleshell	
Epioblasma stewardsoni Cumberland leafshell	3A
Epioblasma torulosa torulosa Tubercled blossom	LE
Hemistena lata Cracking pearlymussel	LE
Leptodea leptodon Scaleshell	
Plethobasus cicatricosus White wartyback	LE
Quadrula fragosa Winged mapleleaf	LE
Quadrula tuberosa Rough rockshell	
Insects	
Pentagenia robusta Robust pentagenian burrowing mayfly	3A
Fishes	
Ammocrypta vivax Scaly sand darter	
Crystallaria asprella Crystal darter	
Erimystax x-punctatus Gravel chub	
Etheostoma microperca Least darter	
Hemitremia flammea Flame chub	
Moxostoma lacerum Harelip sucker	
Moxostoma valenciennesi Greater redhorse	
Percina burtoni Blotchside logperch	
Reptiles	
Masticophis flagellum flagellum Eastern Coachwhip	
Birds (* extirpated as nesting species)	
Anhinga anhinga Anhinga	
Campephilus principalis Ivory-billed Woodpecker	LE

Plants and Animals Presumed Extinct or Extirpated from Kentucky (July, 1997)

	US STATUS		US STATUS
Chlidonias niger *		**Mammals**	
Black Tern			
Conuropsis carolinensis		*Bos bison*	
Carolina Parakeet		American Bison	
Ectopistes migratorius		*Canis lupus*	LE
Passenger Pigeon		Gray Wolf	
Elanoides forficatus forficatus		*Canis rufus*	LE
Swallow-tailed Kite		Red Wolf	
Falco peregrinus *	LE	*Cervus elaphus*	
Peregrine Falcon		Elk	
Tympanuchus cupido		*Felis concolor cougar*	LE
Greater Prairie-chicken		Eastern Cougar	
Vermivora bachmanii	LE		
Bachman's Warbler			

Key to Status Categories

(US) Endangered Species Act of 1973

For status category definitions see:

United States Fish and Wildlife Service. 1992. Endangered Species Act of 1973 as amended through the 100th Congress. United States Government Printing Office, Washington, District of Columbia; and

United States Fish and Wildlife Service. 1993. Plant taxa for listing as endangered or threatened species; notice of review. Federal Register 58:51144-51190.

US statuses were taken from:

United States Fish and Wildlife Service. 1989. Endangered and threatened wildlife and plants; animal notice of review. Federal Register 54:554-579;

United States Fish and Wildlife Service. 1993. Endangered and threatened wildlife and plants; review of plant taxa for listing as endangered or threatened species. Federal Register 58:51144-51190; and

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Plants and Animals Presumed Extinct or Extirpated from Kentucky

Kentucky State Nature Preserves Commission
July, 1997

	US STATUS
PLANTS	
Caltha palustris var. *palustris* Marsh Marigold	
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Epioblasma florentina walkeri Tan riffleshell	LE
Epioblasma haysiana Acornshell	3A
Epioblasma lewisii Forkshell	3A
Epioblasma obliquata perobliqua White catspaw	LE
Epioblasma personata Round combshell	3A
Epioblasma propinqua Tennessee riffleshell	3A
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Epioblasma stewardsoni Cumberland leafshell	3A
Epioblasma torulosa torulosa Tubercled blossom	LE
Hemistena lata Cracking pearlymussel	LE
Leptodea leptodon Scaleshell	
Plethobasus cicatricosus White wartyback	LE
Quadrula fragosa Winged mapleleaf	LE
Quadrula tuberosa Rough rockshell	
Insects	
Pentagenia robusta Robust pentagenian burrowing mayfly	3A
Fishes	
Ammocrypta vivax Scaly sand darter	
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Reptiles	
Masticophis flagellum flagellum Eastern Coachwhip	
Birds (* extirpated as nesting species)	
Anhinga anhinga Anhinga	
Campephilus principalis Ivory-billed Woodpecker	LE

Plants and Animals Presumed Extinct or Extirpated from Kentucky (July, 1997)

	US STATUS		US STATUS
Chlidonias niger * Black Tern		**Mammals**	
Conuropsis carolinensis Carolina Parakeet		*Bos bison* American Bison	
Ectopistes migratorius Passenger Pigeon		*Canis lupus* Gray Wolf	LE
Elanoides forficatus forficatus Swallow-tailed Kite		*Canis rufus* Red Wolf	LE
Falco peregrinus * Peregrine Falcon	LE	*Cervus elaphus* Elk	
Tympanuchus cupido Greater Prairie-chicken		*Felis concolor cougar* Eastern Cougar	LE
Vermivora bachmanii Bachman's Warbler	LE		

Key to Status Categories

(US) Endangered Species Act of 1973

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Monitored Natural Communities of Kentucky

Kentucky State Nature Preserves Commission
April, 1994

The Kentucky State Nature Preserves Commission monitors exemplary examples of the following natural communities. Exemplary natural communities are relatively undisturbed or have recovered sufficiently from previous disturbances and have the flora and fauna that represents, to the best of our knowledge, the natural communities that existed in Kentucky at the time of European colonization.

LACUSTRINE COMMUNITY

Floodplain lake

PALUSTRINE COMMUNITIES

Riparian forest
Alluvial forest
Floodplain ridge/terrace forest
Bottomland hardwood forest
Wet prairie
Bottomland marsh
Sinkhole/depression marsh
Sinkhole/depression pond
Floodplain slough
Coastal plain slough
Acid seep
Calcareous seep
Cretaceous hills forested acid seep
Appalachian acid seep
Depression swamp
Cypress swamp
Shrub swamp
Bottomland hardwood swamp

RIVERINE COMMUNITIES

Sand bar
Mud flat
Typic gravel/cobble bar
Cumberland plateau gravel/cobble bar

TERRESTRIAL COMMUNITIES

Deep soil mesophytic forest
Acidic mesophytic forest
Calcareous mesophytic forest
Acidic sub-xeric forest
Calcareous sub-xeric forest
Xeric acidic forest
Xeric calcareous forest
Xerohydric flatwoods
Appalachian mesophytic forest
Appalachian sub-xeric forest
Cumberland highlands forest
Coastal plain mesophytic cane forest
Bluegrass mesophytic cane forest
Appalachian pine-oak forest
Redcedar-oak forest
Hemlock-mixed forest
Virginia pine forest
Siltstone/shale glade
Limestone slope glade
Limestone flat rock glade
Dolomite glade
Cumberland plateau sandstone glade
Shawnee hills sandstone glade
Sandstone prairie
Limestone prairie
Tallgrass prairie
Sandstone barrens
Knobs shale barrens
Limestone barrens
Bluegrass savanna-woodland
Pine savanna-woodland

Kentucky State Nature Preserves Commission
Natural Heritage Program Data Services
Data Key for Element and Occurrence Reports (v 2.95)

Many of the data fields on the enclosed report are easily understood. Other fields, however, use abbreviations and formats that are not always self-explanatory. A key to these fields follows. Your report may contain some or all of the following data fields.

BEARING: Bearing in degrees from a center point to an occurrence's latitude and longitude. This field is masked for sensitive occurrences; contact KSNPC in these cases. Omitted for G, U, and Q precision occurrence records.

BESTSOURCE: Best available reference to the occurrence: literature citation, collector, collection number, museum or herbarium code, etc.

COMMENTS: Additional information about the occurrence including identification, taxonomy, or date of occurrence.

DIRECTIONS: Directions to an occurrence. This field is masked for sensitive occurrences; contact KSNPC in these cases.

DISTANCE: Distance from a center point to an occurrence's latitude and longitude. Units coded as M (miles), K (kilometers), and F (feet). This field is masked for sensitive occurrences; contact KSNPC in these cases. Omitted for G, U, and Q precision occurrence records.

ELCODE: Element (species) code.

EOCODE: Element (species) code, occurrence number (last three digits), and state.

EODATA: Occurrence population data: date of observation, number of individuals, health, size of colony, flowering data, etc.

EORANK: Judgement of occurrence quality: A = excellent, B = good, C = marginal, D = poor, E = verified extant but quality not judged, O = obscure (not found at reported site but more searching needed), H = historically known from site but no known observation or collection since 1975, X = extirpated from site.

FIRSTOBS: Year of first known observation or collection.

GENDESC: Description of an occurrence's habitat.

GRANK: Estimate of element abundance on a global scale: G1 = extremely rare, G2 = rare, G3 = uncommon, G4 = common, G5 = very common, GH = historically known and expected to be rediscovered, GU = uncertain, GX = extinct. Subspecies and variety abundances are coded with a 'T' suffix; the 'G' portion of the rank then refers to the entire species.

HABITAT: General description of the element's habitat across its range.

IDENT: Whether the identification has been checked by a reliable individual and is believed to be correctly identified: Y = identification confirmed and believed correct, N = No, identification determined to be wrong despite reports to the contrary, ? = Whether identification is correct or not is confusing or disputed, blank or U = unknown whether identification correct or not, assumed correct.

KSNPC: Kentucky State Nature Preserves Commission status: N or blank = none, E = endangered, T = threatened, S = special concern, H = historic, X = extirpated.

LASTOBS: Year(-month-date) of most recent known observation or collection.

LAT: Latitude. This field is masked for sensitive occurrences; contact KSNPC in these cases. Omitted for G, U and Q precision occurrences.

LONG: Longitude. This field is masked for sensitive occurrences; contact KSNPC in these cases. Omitted for G, U and Q precision occurrences.

MAP NUMBER: Number used to location the element on KSNPC Heritage maps.

MARGNUM: See MAP NUMBER.

PREC: See PRECISION.

PRECISION: Precision of the latitude, longitude, directions, and plotted location: S = location accurate to within three seconds of latitude-longitude, M = location accurate to within one minute of latitude-longitude, G = location plotted according to general locality information and accurate to one USGS 7.5 minute quadrangle, Q = element known from the quadrangle but site-specific locations are not recorded by KSNPC because the species may be relatively frequent on the quadrangle or is known to frequently move, U or blank = accuracy of location unknown or not specified.

The accuracy of an occurrence's location is designated by the precision code assigned to the record. Only 'S' precision occurrence records are reliably mapped at or near their precise locations. While an attempt is made to map 'M' precision occurrences as accurately as possible, the plotted locations, lat, long, directions, bearing, and distance data fields may or may not be correct. 'G' and 'Q' precision occurrence locations are very unreliable and only should be used to indicate the possibility that the

species is in the area.

SPROT: See KSNPC.

SRANK: Estimate of element abundance in Kentucky: S1 = extremely rare, S2 = rare, S3 = uncommon, S4 = many occurrences, S5 = very common, SA = accidental in state, SE = exotic, SH = historically known in state, SN = migratory or nonbreeding, SR = reported but without persuasive documentation, SRF = reported falsely in literature, SU = uncertain, SX = extirpated.

USESA: U.S. Fish and Wildlife Service status: N or blank = none, C1 = category 1 status review, C2 = category 2 status review, 3A = considered to be extinct, 3B = not considered a species under the Endangered Species Act, 3C = considered to be more abundant than previously thought, LT = listed as threatened, LE = listed as endangered, PT = proposed as threatened, PE = proposed as endangered.

WATERBODY: Name of the the EPA Waterbody in which the occurrence is plotted. Codes used are: D--downstream, M--mainstem, T--tributary.

WATERSHED: See WATERBODY.

ENDANGERED, THREATENED, AND SPECIAL CONCERN PLANTS, ANIMALS, AND NATURAL COMMUNITIES REPORTED AS OCCURRING ON THE HEATH, KY. USGS 7.5' QUADRANGLE:
PROVIDED TO ANDREA CAMPBELL, UNITED STATES DEPARTMENT OF ENERGY
STATE NATURE PRESERVES COMMISSION NATURAL HERITAGE PROGRAM
PAGE 1 29 SEP 1997

EOCODE	SCIENTIFIC NAME / COMMON NAME	GRANK / SRANK	ESHPC / USESA	IDENTITY / LASTOBS	FORMAT / PREC	COUNTY	7.5 MINUTE QUADRANGLE	LAT / LONG	EPA WATERBODY	DIRECTIONS	HABITAT
100 VASCULAR PLANTS											
PDFAB0G0410013KY	BAPTISIA BRACTEATA VAR LEUCOPHAEA ..CREAM WILD INDIGO	G4G5T? S2S3	S	T 1997-05-11	C S	McCracken	HEATH, KY.	370403N 0881818W	BAYOU CREEK BASIN	WEST KY UNIV, RD AROUND NUCLEAR PLANT (DYER RD).	PRAIRIES AND OPEN WOODS ON SANDY SOIL.
PDAST5D0B080036KY	RUDBECKIA SUBTOMENTOSA ..SWEET CONEFLOWER	G5 S1	E	T 1991-08-22	C S	McCracken	HEATH, KY.	370408N 0885558	NASSAU CREEK BASIN	BARKLEY AIRPORT, 9.55 MI N OF PADUCAH ON US 60, 1500 FT N OF JCT KY 724 ON S SIDE OF RD ALONG INTERMITTENT STREAM.	PRAIRIES AND LOW GROUNDS SUCH AS OPEN STREAM TERRACE WOODLANDS.
PDAST0L0920080KY	SILPHIUM LACINIATUM VAR ROBINSONII ..COMPASS PLANT	G5T? S2	T	T 1993-07	D S	McCracken	HEATH, KY.	370413N 0850500	BAYOU CREEK BASIN	WEST FUTURE CITY, ALONG US 60 AT SE CORNER OF JCT WITH KINGS WAY, CA 2.0 MI N OF WEST FUTURE CITY (HARGNUM 3), IN JUNKYARD JUST S OF KINGS WAY RD (HARGNUM 26, 370404N, 0850519W). SE CORNER OF US 60 AND HARRIS RD (HARGNUM 33, 370407N, 0850320).	PRAIRIES INCL. REMNANTS OF THIS FLORA ON ROADSIDES AND FIELDS.
PDAST0L0920150KY	SILPHIUM LACINIATUM VAR ROBINSONII ..COMPASS PLANT	G5T? S2	T	T 1993-07	D S	McCracken	HEATH, KY.	370503N 0849519W	BAYOU CREEK BASIN	WEST KENTUCKY WILDLIFE MANAGEMENT AREA, N OF KY 725 BETWEEN KY 724 AND KY 1154 (HARGNUM 34, 370505N, 0849310W), (HARGNUM 35, 370513N, 0849519W), (HARGNUM 36, 370521N, 0849640), (HARGNUM 37, 370515N, 0849800), (HARGNUM 38, 370517N, 0849140); JCT OF HAGRODER RD AND ILL CENTRAL RR TRACKS (HARGNUM 22); S SIDE OF KY 725, CA 0.3 RD MI E OF KY 1154 (HARGNUM 39, 370513N, 0849130).	PRAIRIES INCL. REMNANTS OF THIS FLORA ON ROADSIDES AND FIELDS.
PDAST0L0920160KY	SILPHIUM LACINIATUM VAR ROBINSONII ..COMPASS PLANT	G5T? S2	T	T 1993-07	A S	McCracken	HEATH, KY.	370401N 0849490	BAYOU CREEK BASIN	WEST KENTUCKY WILDLIFE MANAGEMENT AREA, ALONG BOTH SIDES OF UNNAMED GRAVEL RD, CA 0.1 AIR MI S OF SOUTH ACID RD (HARGNUM 23), (HARGNUM 32, 370410N, 0849350), (HARGNUM 40, 370553N, 0849490), (HARGNUM 41, 370540N, 0849520), (HARGNUM 42, 370544N, 0849450), (HARGNUM 43, 370540N, 0849530), (HARGNUM 44, 370541N, 0849570).	PRAIRIES INCL. REMNANTS OF THIS FLORA ON ROADSIDES AND FIELDS.
PDAST0L0920180KY	SILPHIUM LACINIATUM VAR ROBINSONII ..COMPASS PLANT	G5T? S2	T	T 1993-07	D S	McCracken	HEATH, KY.	370419N 0847540	NASSAU CREEK BASIN	0.6 RD MI N OF FUTURE CITY ON W SIDE OF KY 996 (METROPOLIS LAKE RD) AT NW CORNER OF KY 996 AND SMALL DEAD-END RD.	PRAIRIES INCL. REMNANTS OF THIS FLORA ON ROADSIDES AND FIELDS.
PDAST0L0920250KY	SILPHIUM LACINIATUM VAR ROBINSONII ..COMPASS PLANT	G5T? S2	T	T 1993-07	C S	McCracken	HEATH, KY.	370543N 0849470	BAYOU CREEK BASIN	WEST KENTUCKY WILDLIFE MANAGEMENT AREA BETWEEN SPRING BAYOU (BAYOU CREEK) AND ACID RD, CA 0.5 AIR MI NNW OF SPRING BAYOU CHURCH.	PRAIRIES INCL. REMNANTS OF THIS FLORA ON ROADSIDES AND FIELDS.
400 FISHES											
AFCDB11200032001Y	LEPOMIS MINIATUS ..REDSPOTTED SUNFISH	G5 S2	T	T 1995-09	D S	McCracken	HEATH, KY.	370650N 0847100	BAYOU CREEK BASIN	LITTLE BAYOU CR (CA 0.2 AIR MI N OF KY 350).	OCCURS IN WELL-VEGETATED SWAMPS, SLOUGHS, BOTTOMLAND LAKES, AND LOW GRADIENT STREAMS (MOYER AND MAYDEN 1979, PFLIEGER 1975, SMITH 1979, BURR AND WARREN 1986, ETNIER AND STARNES 1993).

THESE DATA ARE VALID ONLY ON THE DATE ON WHICH THE REPORT WAS GENERATED. THESE DATA MAY BE USED ONLY FOR THE PROJECT NAMED ABOVE.

ENDANGERED, THREATENED, AND SPECIAL CONCERN PLANTS, ANIMALS, AND NATURAL COMMUNITIES REPORTED AS OCCURRING ON THE HEATH, KY. USGS 7.5' QUADRANGLE
PROVIDED TO ANDREA CAMPBELL, UNITED STATES DEPARTMENT OF ENERGY
STATE NATURE PRESERVES COMMISSION NATURAL HERITAGE PROGRAM
PAGE 2 29 SEP 1997

EOCODE	SCIENTIFIC NAME / COMMON NAME	GRANK / SRANK	USESA	KSNPC IDENTITY / LASTOBS	EGRANK / PREC	COUNTY	7.5 MINUTE QUADRANGLE	LAT / LONG	EPA WATERBODY	DIRECTIONS	HABITAT
100 AMPHIBIANS											
AAAAHB01040001KKY	RANA AREOLATA CIRCULOSA ..NORTHERN CRAWFISH FROG	G4T4 S3	S	T 1991-03-22	C B.	McCracken	HEATH, KY.	370320N 0846140	MASSAC CREEK BASIN	NORTH SIDE OF AIRPORT TOWER RD, CA 0.15 AIR MI W OF KY 724 (MARGHUR 4). S SIDE AIRPORT TOWER RD, CA 0.15 AIR MI W OF KY 724 (MARGHUR 27, 370324N, 0846159W).	BREEDS IN PONDS IN FARMLAND AND EDGE. REMAINS UNDERGROUND THROUGHOUT MOST OF THE YEAR, USING CRAYFISH BURROWS IN MOIST GRASSLANDS AND MEADOWS.
AAAAHB01040002KKY	RANA AREOLATA CIRCULOSA ..NORTHERN CRAWFISH FROG	G4T4 S3	S	T 1991-03-22	C S	McCracken	HEATH, KY.	370250N 0847070	MASSAC CREEK BASIN	CIRCA 1.3 MI NI W OF JCT CHILDRESS RD AND SHOLSAW RD. POND AT END OF DRIVWAY.	BREEDS IN PONDS IN FARMLAND AND EDGE. REMAINS UNDERGROUND THROUGHOUT MOST OF THE YEAR, USING CRAYFISH BURROWS IN MOIST GRASSLANDS AND MEADOWS.
AAAAHB01040003KKY	RANA AREOLATA CIRCULOSA ..NORTHERN CRAWFISH FROG	G4T4 S3	S	T 1991-03-22	C S	McCracken	HEATH, KY.	370124N 0846470	MASSAC CREEK BASIN	BACK OF MT ZION CHURCH CEMETERY. CA 0.30 MI NI W OF JCT KY 724 AND US 62.	BREEDS IN PONDS IN FARMLAND AND EDGE. REMAINS UNDERGROUND THROUGHOUT MOST OF THE YEAR, USING CRAYFISH BURROWS IN MOIST GRASSLANDS AND MEADOWS.
AAAAHB01040004KKY	RANA AREOLATA CIRCULOSA ..NORTHERN CRAWFISH FROG	G4T4 S3	S	T 1991-03-22	C S	Ballard	HEATH, KY.	370022N 0850270	MASSAC CREEK BASIN	NORTH SIDE OF KY 286. CA 0.2 MI W OF BALLARD/MCCRACKEN COUNTY LINE. CA 0.4 MI E OF JCT KY 286 AND KY 1347.	BREEDS IN PONDS IN FARMLAND AND EDGE. REMAINS UNDERGROUND THROUGHOUT MOST OF THE YEAR, USING CRAYFISH BURROWS IN MOIST GRASSLANDS AND MEADOWS.
AAAAHB01040005KKY	RANA AREOLATA CIRCULOSA ..NORTHERN CRAWFISH FROG	G4T4 S3	S	T 1991-03-22	C S	Ballard	HEATH, KY.	370022N 0851840	HUMPHREY CREEK BASIN	JUST NE OF JCT KY 286 AND KY-1347 (MARGHUR 25). N SIDE OF KY 286 CA 0.1 MI NI W OF KY 1347 JCT (MARGHUR 8, 370022N, 0851130).	BREEDS IN PONDS IN FARMLAND AND EDGE. REMAINS UNDERGROUND THROUGHOUT MOST OF THE YEAR, USING CRAYFISH BURROWS IN MOIST GRASSLANDS AND MEADOWS.
AAAAHB01040006KKY	RANA AREOLATA CIRCULOSA ..NORTHERN CRAWFISH FROG	G4T4 S3	S	T 1991-03-22	C S	Ballard	HEATH, KY.	370011N 0852240	HUMPHREY CREEK BASIN	NORTHWEST SIDE OF KY 286 CA 0.3 MI NI E OF BETHEL CUMBERLAND CHURCH (LACENTER ROAD).	BREEDS IN PONDS IN FARMLAND AND EDGE. REMAINS UNDERGROUND THROUGHOUT MOST OF THE YEAR, USING CRAYFISH BURROWS IN MOIST GRASSLANDS AND MEADOWS.
AAAAHB01040007KKY	RANA AREOLATA CIRCULOSA ..NORTHERN CRAWFISH FROG	G4T4 S3	S	T 1991-03-20	C S	McCracken	HEATH, KY.	370453N 0849300	BAYOU CREEK BASIN	CIRCA 0.2 AIR MI E OF KY 1154. CA 1.2 MI NI W OF 375 JCT W/ US 60.	BREEDS IN PONDS IN FARMLAND AND EDGE. REMAINS UNDERGROUND THROUGHOUT MOST OF THE YEAR, USING CRAYFISH BURROWS IN MOIST GRASSLANDS AND MEADOWS.
AAAAHB01040008KKY	RANA AREOLATA CIRCULOSA ..NORTHERN CRAWFISH FROG	G4T4 S3	S	T 1991-03-20	C S	McCracken	HEATH, KY.	370550N 0850020	BAYOU CREEK BASIN	CIRCA 0.4 AIR MI NW OF SPRING BAYOU CHURCH ON KY 725 (MARGHUR 11). CA 0.7 MI NI W OF SPRING BAYOU CHURCH ON KY 725 ON N SIDE OF RD (MARGHUR 12, 370524N, 0850300).	BREEDS IN PONDS IN FARMLAND AND EDGE. REMAINS UNDERGROUND THROUGHOUT MOST OF THE YEAR, USING CRAYFISH BURROWS IN MOIST GRASSLANDS AND MEADOWS.
AAAAHB01040009KKY	RANA AREOLATA CIRCULOSA ..NORTHERN CRAWFISH FROG	G4T4 S3	S	T 1991-03-18	C S	McCracken	HEATH, KY.	370640N 0849440	BAYOU CREEK BASIN	WEST KENTUCKY WILDLIFE MANAGEMENT AREA. N SIDE WATER WORKS RD JUST W OF FILTRATION PLANT.	BREEDS IN PONDS IN FARMLAND AND EDGE. REMAINS UNDERGROUND THROUGHOUT MOST OF THE YEAR, USING CRAYFISH BURROWS IN MOIST GRASSLANDS AND MEADOWS.
AAAAHB01040010KKY	RANA AREOLATA CIRCULOSA ..NORTHERN CRAWFISH FROG	G4T4 S3	S	T 1991-03-20	C S	McCracken	HEATH, KY.	370710N 0847200	BAYOU CREEK BASIN	WEST KENTUCKY WILDLIFE MANAGEMENT AREA. CA 0.3 MI NI NW JCT KY 350 AND BEHEN LANDING RD (MARGHUR 14). WEST ON WMA. CA 1.3 MI NI W JCT KY 996 AND KY 350 ON N SIDE KY 350 (MARGHUR 15, 370723N, 0847340). WEST ON WMA, 1.5 MI NI W OF JCT KY 996 AND KY 350, 0.15 AIR MI S OF KY 350 (MARGHUR 16, 370750N, 0847550). WEST ON WMA, CA 1.7 MI NI W OF JCT KY 350 AND KY 996. CA 0.10 AIR MI S OF KY 350 (MARGHUR 17, 370725N, 0848050).	BREEDS IN PONDS IN FARMLAND AND EDGE. REMAINS UNDERGROUND THROUGHOUT MOST OF THE YEAR, USING CRAYFISH BURROWS IN MOIST GRASSLANDS AND MEADOWS.
AAAAHB01040011KKY	RANA AREOLATA CIRCULOSA ..NORTHERN CRAWFISH FROG	G4T4 S3	S	T 1964-03-13	H S	McCracken	HEATH, KY.	370413N 0849440	BAYOU CREEK BASIN	IN NI W PADUCAH, E SIDE OF MACBRUDER RD. 1.2 MI S OF HODGVILLE RD, CA 0.5 MI W OF US 60.	BREEDS IN PONDS IN FARMLAND AND EDGE. REMAINS UNDERGROUND THROUGHOUT MOST OF THE YEAR, USING CRAYFISH BURROWS IN MOIST GRASSLANDS AND MEADOWS.

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EOCODE	SCIENTIFIC NAME / COMMON NAME	GRANK / SRANK	KSNPC / USESA	IDENTITY / LASTOBS	EORANK / PREC	COUNTY	7.5 MINUTE / QUADRANGLE	LAT / LONG	EPA / WATERBODY	DIRECTIONS	HABITAT
AAADH01014050XXX	RANA AREOLATA CIRCULOSA	G4T4	S	Y	O	McCracken	HEATH, KY.	370347N	MASSAC CREEK BASIN	US 60, 0.6 MI E OF FUTURE CITY, 10 MI W	BREEDS IN PONDS IN FARMLAND AND EDGE. REMAINS UNDERGROUND
	..NORTHERN CRAWFISH FROG	S3		1964-03-13	M			084729W		OF PADUCAH.	THROUGHOUT MOST OF THE YEAR, USING CRAYFISH BURROWS IN MOIST GRASSLANDS AND MEADOWS.
*** PALUSTRINE COMMUNITIES											
CPGRS00500000XXX	WET PRAIRIE		N	Y	C	McCracken	HEATH, KY.	370406N	MASSAC CREEK BASIN	BARKLEY PRAIRIE STATE NATURAL AREA, N OF	
	..	S1		1991-04-12	S			084555W		RUNWAY AT BARKLEY AIRPORT, DIRECTLY S OF	
										US 60.	

21 Records Processed

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ENCODE	SCIENTIFIC NAME / COMMON NAME	GRANK / SRANK	ESMPC / USESA	IDENTITY / LASTOBS	EORANK / PREC	COUNTY	7.5 MINUTE QUADRANGLE	LAT / LONG	EPA WATERBODY	DIRECTIONS	HABITAT
*** VASCULAR PLANTS											
PDJUG01010000201Y	CARYA AQUATICA	G5	T		H	McCracken	JOPPA, ILL.-KY.	370840N	METROPOLIS LAKE	METROPOLIS LAKE.	BOTTOMLANDS AND FLOODPLAIN SWAMPS.
	..WATER HICKORY	S2S3			B			0845540			
PDSTY01020000150Y	HALESIA TETRAPTERA	G5	E	T	A	McCracken	JOPPA, ILL.-KY.	371002N	BAYOU CREEK BASIN	CIRCA 1.8 MI NI NWR OF N CORNER OF SETTLING PONDS FOR SHAWNEE STEAM PLANT ALONG RIDGE ABOVE OHIO RIVER.	
	..MOUNTAIN SILVER-BELL	S1S2		1991-06-20	S			0840370			
PMPOA4005000025Y	MUHLENBERGIA GLABRIFLORIS	G4?	S		E	McCracken	JOPPA, ILL.-KY.	370830N	METROPOLIS LAKE	ALONG METROPOLIS FERRY ROAD, OFF OF US-1420.	DRY, DESSICCATED OR BAKED SOILS, PRAIRIES, GRAVELS, OR ROCKY GLADES AND HEDLEY REPORTS WET WOODS, MARSH EDGES AND FIELDS.
	..HAIR GRASS	S3		1977-09-21	H			0845400			
*** GASTROPODS											
IMGAS05100000001Y	LEPTOXIS PRAEROSA	G1G3	S	T	C	McCracken	JOPPA, ILL.-KY.	371042N	OHIO RIVER,R,B OF TENNESSEE RIVER-MISSISSIPPI RIVER	OHIO RIVER AT MILE 940.8, LITTLE CHAIN BAR.	CALL (1895) INDICATED THAT IN THE OHIO RIVER AT THE FALLS IT OCCURRED IN THE GREATEST PROFUSION WHERE THE BOTTOM IS CLEAN ROCK OR ROCK WITH ABUNDANT "CONFERVOID" VEGETATION.
	..ONYX ROCKSNAIL	S3S4		1980-10-10	S			0847460			
IMGAS03010002300Y	LITHASIA VERRUCOSA	G?	S	T	A	McCracken	JOPPA, ILL.-KY.	371042N	OHIO RIVER,R,B OF TENNESSEE RIVER-MISSISSIPPI RIVER	OHIO RIVER AT MILE 940.8, LITTLE CHAIN BAR.	OBSERVATIONS ON THE HABITAT INCLUDE SPECIMENS TAKEN FROM RECENTLY EXPOSED BARS AND POOLS WITH SAND, GRAVEL, AND ROCK SUBSTRATES (HAAG AND PALMER-BALL, PERS COMM).
	..VARICOSE ROCKSNAIL	S3S4		1980-10-08	S			0847460			
*** BIVALVES											
IMBIV21130802500Y	LAMPSILIS OVATA	G5	E		H	McCracken	JOPPA, ILL.-KY.		OHIO RIVER,R,B OF TENNESSEE RIVER-MISSISSIPPI RIVER	OHIO RIVER BETWEEN METROPOLIS AND JOPPA (PLOTTED AT MIDPOINT).	CONSIDERED A LARGE RIVER SPECIES (CLENCH AND VAN DER SCHALIE 1944, PARMALEE 1967, STANSBERY 1976), BUT OCCURS IN MEDIUM-SIZED STREAMS IN GRAVEL, SAND, OR EVEN MUD (PARMALEE 1967, JOHNSON 1978, GORDON AND LAYZER 1989). IN THE LOWER
	..POCKETBOOK	S1		1954-06-30	G						
IMBIV34020005100Y	PLETHOBASUS COOPERIANUS	G1	E	T	B	McCracken	JOPPA, ILL.-KY.	371117N	OHIO RIVER,R,B OF TENNESSEE RIVER-MISSISSIPPI RIVER	OHIO RIVER MI 949.2 (SITE 2), CA 150 M FROM ILLINOIS SHORELINE NEAR THE NAVIGATION CHANNEL.	WABASH AND OHIO RIVERS SPECIMENS WERE TAKEN IN DEEP WATER (6-10 FEET OR MORE) IN CURRENT FROM SAND OR GRAVEL. USUALLY FOUND IN LARGE RIVERS IN SAND AND GRAVEL SUBSTRATES
	..ORANGE-FOOT PIMPLEBACK	S1	LE	1992-07	S			0847010			(AMLSTEDT 1983, BOGAN AND PARMALEE 1983, MILLER, A.C. ET AL. 1984).
IMBIV34030100020Y	PLETHOBASUS CYPHYUS	G2G3	S	T	H	McCracken	JOPPA, ILL.-KY.		OHIO RIVER,R,B OF TENNESSEE RIVER-MISSISSIPPI RIVER	OHIO RIVER AT JOPPA.	USUALLY FOUND IN LARGE RIVERS IN CURRENT ON MUD, SAND, OR GRAVEL BOTTOMS AT DEPTH OF 1-2 METERS OR MORE (BAKER 1928, PARMALEE 1967, GORDON AND LAYZER 1989).
	..SHEEPNOSE	S3S4		1955-05-17	G						
IMBIV34030100020Y	PLETHOBASUS CYPHYUS	G2G3	S	T	H	McCracken	JOPPA, ILL.-KY.		OHIO RIVER,R,B OF TENNESSEE RIVER-MISSISSIPPI RIVER	OHIO RIVER BETWEEN METROPOLIS AND JOPPA (PLOTTED AT MIDPOINT).	USUALLY FOUND IN LARGE RIVERS IN CURRENT ON MUD, SAND, OR GRAVEL BOTTOMS AT DEPTH OF 1-2 METERS OR MORE (BAKER 1928, PARMALEE 1967, GORDON AND LAYZER 1989).
	..SHEEPNOSE	S3S4		1954-06-30	G						
IMBIV39041002010Y	QUADRULA CYLINDRICA CYLINDRICA	G3T3	T	T	B	McCracken	JOPPA, ILL.-KY.	370852N	OHIO RIVER,R,B OF TENNESSEE RIVER-MISSISSIPPI RIVER	OHIO RIVER, BRD 945, AT END OF ROAD THAT PASSES E SIDE OF METROPOLIS LAKE, 10 MI NW OF PADUCAH.	SMALL TO LARGE RIVERS WITH SAND, GRAVEL, AND PEBBLE AND MODERATE TO SWIFT CURRENT, SOMETIMES IN DEEP WATER (PARMALEE 1967, BOGAN AND PARMALEE 1983).
	..RABBITSFOOT	S2		1987-05-21	S			0845270			
*** CRUSTACEANS											
ICMAL01010000040Y	ORCONECTES LANCIFER	G5	E	T	A	McCracken	JOPPA, ILL.-KY.	370840N	METROPOLIS LAKE	METROPOLIS LAKE 4.0 KM N BRAGGANVILLE NEAR END OF HWY 303 (ACTUALLY END OF HWY 1985), 996 AND DRIVEWAY TO LAKE).	OXBOW LAKES AND STREAMS ON THE GULF COASTAL PLAIN (PAGE 1985), WHERE IT LIVES AMONG ORGANIC DEBRIS, USUALLY NEAR BALD CYPRESS (BURR AND NOBLES 1984).
	..A CRAYFISH	S1		1975-06-24	H			0845540			
*** FISHES											
AFCDA01050000020Y	ATRACTOSTEUS SPATULA	G5	E		B	McCracken	JOPPA, ILL.-KY.		OHIO RIVER,R,B OF TENNESSEE RIVER-MISSISSIPPI RIVER	OHIO RIVER AT SHAWNEE STEAM PLANT, NEAR PADUCAH.	BLUGEON POOLS AND BACKWATERS OF LARGE RIVERS, BACKWATERS, AND OXBOW LAKES (MUNZ AND WARREN 1996, PAGE AND BURR 1991, EMMIER AND STARNES 1993).
	..ALLIGATOR GAR	S1		1975-06-27	H						

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AFCJC05020000001	ERIMYZON SUCETTA ..LAKE CHUBSUCKER	G5 S2	T	Y	H G	McCracken	JOPPA, ILL.-KY.		OHIO RIVER,N,O OF TENNESSEE RIVER-MISSISSIPPI RIVER	OHIO RIVER, SHAWNEE STEAM PLANT W OF PADUCAH.	LOWLAND LENTIC HABITATS (WETLANDS AND FLOODPLAIN LAKES) WITH SUBMERGENT AND FLOATING VEGETATION (BURR AND WARREN 1986, ETNIER AND STARNES 1993).
AFCKD01040000101	ESOX NIGER ..CHAIN PICKEREL	G5 S2	S	1972-05-28	E N	McCracken	JOPPA, ILL.-KY.	370852N 0845400	METROPOLIS LAKE	METROPOLIS LAKE, 4.0 KM N GRAHAMVILLE.	COASTAL PLAIN WETLANDS, STREAMS, AND VEGETATED OXBOW LAKE SHORELINES. AND IT ALSO TOLERATES RESERVOIR CONDITIONS (BURR AND WARREN 1986, ETNIER AND STARNES 1993).
AFCJB16030000401	HYBOGNATHUS HAYI ..CYPRESS MINNOW	G5 S2	C	Y 1993-07-21	D S	McCracken	JOPPA, ILL.-KY.	370842N 0845400	METROPOLIS LAKE	METROPOLIS LAKE, 3 MI N GRAHAMVILLE.	OXBOW LAKES AND QUIET WATER OF LOW GRADIENT STREAMS ON THE COASTAL PLAIN AND SHAWNEE HILLS. USUALLY OVER MUD OR SAND BOTTOMS, BUT OCCASIONALLY ASSOCIATED WITH SUBMERGED AQUATIC VEGETATION OR OTHER COVER (BURR AND WARREN 1986, PFLIEGER 1975, SMITH 1979, GILBERT 1980, BURR ET AL. 1980). NEEDS WETLANDS ADJACENT TO STREAMS/LAKES FOR REPRODUCTION/NURSERY AREAS (D.H. BURR, PERS COMM).
AFDAAB10201000001	ICHTHYOMYZON CASTANEUS ..CHESTNUT LAMPREY	G4 S2	S	1951	N U	McCracken	JOPPA, ILL.-KY.		OHIO RIVER,N,O OF TENNESSEE RIVER-MISSISSIPPI RIVER	OHIO RIVER AT JOPPA, ILLINOIS.	MODERATE-SIZE CREEKS, LARGE RIVERS, AND RESERVOIRS. SUBSTRATE CONSISTS OF GRAVEL AND RUBBLE WITH AREAS OF SAND AND SILT. LARVAE REQUIRE CLEAR STREAMS WITH STABLE BARS OF SILT, SAND AND ORGANIC DETRITIS (DECKER 1983, PFLIEGER 1975, ROHDE AND LANTEIGNE-COURCHERE 1980, SCOTT AND CROSSMAN 1973, SMITH 1979).
AFDAAB10201010001	ICHTHYOMYZON CASTANEUS ..CHESTNUT LAMPREY	G4 S2	S	1974-04-17	E U	McCracken	JOPPA, ILL.-KY.		OHIO RIVER,N,O OF TENNESSEE RIVER-MISSISSIPPI RIVER	OHIO RIVER, AT SHAWNEE STEAM PLANT.	MODERATE-SIZE CREEKS, LARGE RIVERS, AND RESERVOIRS. SUBSTRATE CONSISTS OF GRAVEL AND RUBBLE WITH AREAS OF SAND AND SILT. LARVAE REQUIRE CLEAR STREAMS WITH STABLE BARS OF SILT, SAND AND ORGANIC DETRITIS (DECKER 1983, PFLIEGER 1975, ROHDE AND LANTEIGNE-COURCHERE 1980, SCOTT AND CROSSMAN 1973, SMITH 1979).
AFCJC07030001601	ICTIOBUS NIGER ..BLACK BUFFALO	G5 S2	S	Y 1991-10-17	C N	McCracken	JOPPA, ILL.-KY.	370943N 0846240	OHIO RIVER,N,O OF TENNESSEE RIVER-MISSISSIPPI RIVER	OHIO RIVER, SHAWNEE STEAM PLANT, NW OF PADUCAH.	RESERVOIRS AND MEDIUM TO LARGE RIVERS WITH MODERATE TO LOW GRADIENT AND SOMETIME SWIFT CURRENT (DECKER 1983, PFLIEGER 1975, SMITH 1979, TRAUTMAN 1981, AND BURR AND WARREN 1986).
AFCJC07030002601	ICTIOBUS NIGER ..BLACK BUFFALO	G5 S2	S	Y 1994-03-22	D S	McCracken	JOPPA, ILL.-KY.	370823N 0847240	BAYOU CREEK BASIN	LITTLE BAYOU CREEK (AT UNNAMED RD NR HOOPER CEMETERY CA 2.0 MIR ER NW OF TT 994-KY 1420 JCT).	RESERVOIRS AND MEDIUM TO LARGE RIVERS WITH MODERATE TO LOW GRADIENT AND SOMETIME SWIFT CURRENT (DECKER 1983, PFLIEGER 1975, SMITH 1979, TRAUTMAN 1981, AND BURR AND WARREN 1986).
AFCJC07030002701	ICTIOBUS NIGER ..BLACK BUFFALO	G5 S2	S	Y 1995-11-14	D S	McCracken	JOPPA, ILL.-KY.	370736N 0849280	BAYOU CREEK BASIN	BIG BAYOU CREEK (CA 0.4 STREAM KM S OF WEST BOONE RD CROSSING).	RESERVOIRS AND MEDIUM TO LARGE RIVERS WITH MODERATE TO LOW GRADIENT AND SOMETIME SWIFT CURRENT (DECKER 1983, PFLIEGER 1975, SMITH 1979, TRAUTMAN 1981, AND BURR AND WARREN 1986).
AFCGS11120000701	LEPOMIS MINIATUS ..REDSPOTTED SUNFISH	G5 S2	T	Y 1980-05-24	A S	McCracken	JOPPA, ILL.-KY.	370842N 0845400	METROPOLIS LAKE	METROPOLIS LAKE, 4.0 KM N OF GRAHAMVILLE.	OCCURS IN WELL-VEGETATED SWAMPS, SLOUGHS, BOTTOMLAND LAKES, AND LOW GRADIENT STREAMS (BURR AND MAYDEN 1979, PFLIEGER 1975, SMITH 1979, BURR AND WARREN 1986, ETNIER AND STARNES 1993).
AFCNB02010000701	MENIDIA BERYLLINA ..INLAND SILVERSIDE	G5 S1	T	Y 1992-08-04	C N	McCracken	JOPPA, ILL.-KY.	371143N 0849520	OHIO RIVER,N,O OF TENNESSEE RIVER-MISSISSIPPI RIVER	OHIO RIVER NEAR JOPPA.	SCHOOLING SURFACE FISH THAT OCCURS IN THE MISSISSIPPI RIVER AND FLOODPLAIN LAKES (BURR AND WARREN 1986, ETNIER AND STARNES 1993).
AFCNB02010000901	MENIDIA BERYLLINA ..INLAND SILVERSIDE	G5 S1	T	Y 1992-09-25	C N	McCracken	JOPPA, ILL.-KY.	370852N 0845270	OHIO RIVER,N,O OF TENNESSEE RIVER-MISSISSIPPI RIVER	OHIO RIVER MILE 944-948, NEAR SHAWNEE STEAM PLANT.	SCHOOLING SURFACE FISH THAT OCCURS IN THE MISSISSIPPI RIVER AND FLOODPLAIN LAKES (BURR AND WARREN 1986, ETNIER AND STARNES 1993).
AFCNB02010001201	MENIDIA BERYLLINA ..INLAND SILVERSIDE	G5 S1	T	Y 1993-07-21	A N	McCracken	JOPPA, ILL.-KY.	370840N 0845540	METROPOLIS LAKE,T	METROPOLIS LAKE AT BOAT RAMP.	SCHOOLING SURFACE FISH THAT OCCURS IN THE MISSISSIPPI RIVER AND FLOODPLAIN LAKES (BURR AND WARREN 1986, ETNIER AND STARNES 1993).

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AFCJX20450000201XX	NOTROPIS MACULATUS	G5	T	T	A	McCracken	JOPPA, ILL.-KY.	370842N	METROPOLIS LAKE	METROPOLIS LAKE, 5 MI N GRAHAMVILLE.	LOW GRADIENT STREAMS, OXBOW LAKES, AND SLOUGHS IN AND AROUND
	..TAILLIGHT SHINER	S2S3		1993-07-21	S			0845400			CYPRESS KNEES, AQUATIC VEGETATION, AND ACCUMULATIONS OF STICKS AND DETRITUS (BURR AND PAGE 1975, [illegible] AND WARREN 1986, ETNIER AND STARNES 1993).
AFCAA02220001400XX	MOXUS STIGMOSUS	G3	S		N	McCracken	JOPPA, ILL.-KY.		OHIO RIVER,M.O OF TENNESSEE RIVER-MISSISSIPPI RIVER	OHIO RIVER AT SHAWNEE STEAM PLANT, NW OF PADUCAH.	LARGE STREAMS AND RIVERS IN MODERATE TO SWIFT CURRENT OVER GRAVEL AND SAND, AND SOMETIMES DEBRIS OR PONDWEED FOR COVER (BURR AND WARREN 1986, ETNIER AND STARNES 1993).
		S1			G						
100 AMPHIBIANS											
AAABC02010030400XX	HYLA CINEREA	G5	S	T	B	McCracken	JOPPA, ILL.-KY.	371013N	BAYOU CREEK BASIN	WEST KENTUCKY WILDLIFE MANAGEMENT AREA	FLOODPLAIN WETLANDS, PARTICULARLY THOSE DOMINATED BY
	..GREEN TREEFROG	S3S4		1991-04-25	S			0849000		CA 1.4 AIR MI NNW OF THE N TIP OF THE N-MOST SHAWNEE STEAM PLANT SETTLING POND.	BUTTONBUSH AND HERBACEOUS EMERGENT VEGETATION.
AAABC02010030350XX	HYLA CINEREA	G5	S	T	B	McCracken	JOPPA, ILL.-KY.	370940N	BAYOU CREEK BASIN	CIRCA 0.3 AIR MI SW OF N TIP OF SHAWNEE STEAM PLANT SETTLING PONDS.	FLOODPLAIN WETLANDS, PARTICULARLY THOSE DOMINATED BY BUTTONBUSH AND HERBACEOUS EMERGENT VEGETATION.
	..GREEN TREEFROG	S3S4		1991-04-28	B			0840050			
AAAHM01014001100XX	RANA AREOLATA CIRCULOSA	G4T4	S	T	C	McCracken	JOPPA, ILL.-KY.	370827N	BAYOU CREEK BASIN	BARTON CEMETERY. S SIDE RY 350 CA 0.4 RD MI E JCT BETHEL CHURCH RD.	BREEDS IN PONDS IN FARMLAND AND EDGE. REMAINS UNDERGROUND THROUGHOUT MOST OF THE YEAR, USING CRAYFISH BURROWS IN MOIST GRASSLANDS AND MEADOWS.
	..NORTHERN CRAWFISH FROG	S3		1991-03-10	S			0849230			
AAAHM01014001200XX	RANA AREOLATA CIRCULOSA	G4T4	S	T	C	McCracken	JOPPA, ILL.-KY.	370901N	OHIO RIVER,I.O OF TENNESSEE RIVER-MISSISSIPPI RIVER	SOUTH SIDE RY 350, 0.4 RD MI W JCT RY 723 AND RY 350 (MARSHUN 30). S SIDE RY 350, CA 0.2 RD MI E JCT RY 350 AND JOPPA LANDING RD (MARSHUN 31, 370900N, 0852840). S SIDE RY 350 CA 0.05 AIR MI SSW OF JCT RY 350 AND JOPPA LANDING RD (MARSHUN 32, 370913N, 0852150).	BREEDS IN PONDS IN FARMLAND AND EDGE. REMAINS UNDERGROUND THROUGHOUT MOST OF THE YEAR, USING CRAYFISH BURROWS IN MOIST GRASSLANDS AND MEADOWS.
	..NORTHERN CRAWFISH FROG	S3		1991-03-10	S						
AAAHM01014001300XX	RANA AREOLATA CIRCULOSA	G4T4	S	T	C	McCracken	JOPPA, ILL.-KY.	370749N	BAYOU CREEK BASIN	CIRCA 0.2 RD MI E OF BETHEL CHURCH RD, CA 1.0 RD MI S JCT RY 350 (MARSHUN 33). CA 1.0 AIR MI SSE JCT RY 350 AND BETHEL CHURCH ROAD (MARSHUN 34, 370740N, 0849410).	BREEDS IN PONDS IN FARMLAND AND EDGE. REMAINS UNDERGROUND THROUGHOUT MOST OF THE YEAR, USING CRAYFISH BURROWS IN MOIST GRASSLANDS AND MEADOWS.
	..NORTHERN CRAWFISH FROG	S3		1991-03-10	S			0849170			
AAAHM01014001400XX	RANA AREOLATA CIRCULOSA	G4T4	S	T	C	McCracken	JOPPA, ILL.-KY.	370757N	BAYOU CREEK BASIN	WEST KENTUCKY WILDLIFE MANAGEMENT AREA. CA 0.6 RD MI SW OF JCT RY 995 AND RY 350, CA 0.15 AIR MI W OF RY 995, CA 0.5 RD MI SW OF AREA OFFICE (LODGE).	BREEDS IN PONDS IN FARMLAND AND EDGE. REMAINS UNDERGROUND THROUGHOUT MOST OF THE YEAR, USING CRAYFISH BURROWS IN MOIST GRASSLANDS AND MEADOWS.
	..NORTHERN CRAWFISH FROG	S3		1991-03-21	S			0848450			
AAAHM01014001500XX	RANA AREOLATA CIRCULOSA	G4T4	S	T	C	McCracken	JOPPA, ILL.-KY.	370757N	BAYOU CREEK BASIN	WEST KENTUCKY WILDLIFE MANAGEMENT AREA. CA 0.1 RD MI NW OF JCT RY 350 AND RY 995, DOWN ROAD JUST SE OF LODGE.	BREEDS IN PONDS IN FARMLAND AND EDGE. REMAINS UNDERGROUND THROUGHOUT MOST OF THE YEAR, USING CRAYFISH BURROWS IN MOIST GRASSLANDS AND MEADOWS.
	..NORTHERN CRAWFISH FROG	S3		1991-03-21	S			0848450			
100 BIRDS											
ABPAV08080010400XX	CORVUS OSSIFRAGUS	G5	S	T	E	McCracken	JOPPA, ILL.-KY.			SOMEWHERE ON QUADRANGLE OUTSIDE OF SW BLOCK.	BEACHES, BAYS, LAGOONS, INLETS, SWAMPS, MEAD MARSHES, AND, LESS FREQUENTLY, DECIDUOUS OR CONIFEROUS WOODLAND, IN INLAND SITUATIONS PRIMARILY IN BALDCYPRESS SWAMPS AND ALONG MAJOR WATERCOURSES. ALSO GARBAGE DUMPS.
	..FISH CROW	S3B		1988-06-27	B						
ANMJD20010000404XX	LOPHODYTES CUCULLATUS	G5	T	T	B	McCracken	JOPPA, ILL.-KY.	370943N	BAYOU CREEK BASIN	WEST KENTUCKY WILDLIFE MANAGEMENT AREA, 3.9 MI NNW OF GRAHAMVILLE.	STREAMS, LAKES, SWAMPS, MARSHES, AND ESTUARIES; WINTERS MOSTLY IN FRESHWATER BUT ALSO REGULARLY IN ESTUARIES AND SHELTERED BAYS (BRYCHOWSKI).
	..HOODED MERGANSER	S1S2B,		1988-05-08	S			0848000			

THESE DATA ARE VALID ONLY ON THE DATE ON WHICH THE REPORT WAS GENERATED. THESE DATA MAY BE USED ONLY FOR THE PROJECT NAMED ABOVE.

ENDANGERED, THREATENED, AND SPECIAL CONCERN PLANTS, ANIMALS, AND NATURAL COMMUNITIES REPORTED AS OCCURRING ON THE JOPPA, IL.-KY. USGS 7.5' QUADRANGLES
PROVIDED TO AUDREA CAMPBELL, UNITED STATES DEPARTMENT OF ENERGY
STATE NATURE PRESERVES COMMISSION NATURAL HERITAGE PROGRAM
PAGE 4 26 SEP 1997

EOCODE	SCIENTIFIC NAME / COMMON NAME	GRANK / SRANK	USESA	IDENTITY / LASTOBS	EORANK / PREC	COUNTY	7.5 MINUTE / QUADRANGLE	LAT / LONG	EPA / WATERBODY	DIRECTIONS	HABITAT
ADPBV011100001KY	VIREO BELLII ..BELL'S VIREO	G5 S2S3B	S	Y 1980-06-27	C N	McCracken	JOPPA, ILL.-KY.	370916N 0847410	BAYOU CREEK BASIN	ALONG LITTLE BAYOU CREEK, ADJACENT TO THE W SIDE OF THE ASH SETTLING POND AT THE SHAWNEE STEAM PLANT, 6 MI NNW OF GRAHAMVILLE.	DENSE BRUSH, MESQUITE, STREAMSIDE THICKETS, AND SCRUB OAK, IN ARID REGIONS BUT OFTEN NEAR WATER (DOSCOMBINA); MOIST WOODLAND, BOTTOMLANDS, WOODLAND EDGE, SCATTERED COVER AND HEDGEROWS IN CULTIVATED AREAS. OPEN WOODLAND, BRUSH IN WINT.
ADPBV011100002KY	VIREO BELLII ..BELL'S VIREO	G5 S2S3B	S	Y 1985-05-26	C N	McCracken	JOPPA, ILL.-KY.	370735N 0849050	BAYOU CREEK BASIN	WEST KENTUCKY WMA, ABOUT 1.0 MI S OF ENTRANCE ON SR-350.	DENSE BRUSH, MESQUITE, STREAMSIDE THICKETS, AND SCRUB OAK, IN ARID REGIONS BUT OFTEN NEAR WATER (DOSCOMBINA); MOIST WOODLAND, BOTTOMLANDS, WOODLAND EDGE, SCATTERED COVER AND HEDGEROWS IN CULTIVATED AREAS. OPEN WOODLAND, BRUSH IN WINT.
*** MAMMALS											
AMACC01100101KY	MYOTIS SODALIS ..INDIANA MYOTIS	G2 S1S2	E LE	Y 1991-06-25	E S	McCracken	JOPPA, ILL.-KY.	371039N 0849010	OHIO RIVER,M,D OF TENNESSEE RIVER-MISSISSIPPI RIVER OHIO RIVER,T,D OF TENNESSEE RIVER-MISSISSIPPI RIVER	WEST KENTUCKY WILDLIFE MANAGEMENT AREA, W OF BAYOU CREEK RIDGE SWA, CA 0.1 AIR MI SE OF END OF RD.	INDIANA BATS USE PRIMARILY CAVES FOR HIBERNACULA, ALTHOUGH THEY ARE OCCASIONALLY FOUND IN OLD MINE PORTALS.
AMACC06010015KY	NYCTICEIUS HUMERALIS ..EVENING BAT	G5 S2S3	T	Y 1992-07-13	E S	McCracken	JOPPA, ILL.-KY.	371025N 0849050	BAYOU CREEK BASIN OHIO RIVER,M,D OF TENNESSEE RIVER-MISSISSIPPI RIVER OHIO RIVER,T,D OF TENNESSEE RIVER-MISSISSIPPI RIVER	BAYOU CREEK RIDGE SWA, W END ON N SIDE OF CREEK, CA 0.4 AIR MI SSE OF END OF RD TO OHIO RIVER (MARGHUM 26) AND W OF BAYOU CR RIDGE, CA 0.1 AIR MI SE OF N END OF AREA ROAD TO THE OHIO RIVER (MARGHUM 20).	THE EVENING BAT IS A COLONIAL SPECIES THAT ROOSTS IN TREES AND HOUSES. IT APPARENTLY MIGRATES SOUTHWARD IN WINTER.
*** PALUSTRINE COMMUNITIES											
CPFOR00005X001KY	FLOODPLAIN RIDGE/TERRACE FOREST	S1	W	Y 1991-06	D S	McCracken	JOPPA, ILL.-KY.	371026N 0848370	BAYOU CREEK BASIN	WEST KY WILDLIFE MANAGEMENT AREA, BAYOU CREEK WOODS, CA 2.0 AIR MI NW OF SHAWNEE STEAM PLANT.	

40 Records Processed

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Kentucky State Nature Preserves Commission
Kentucky Natural Heritage Program Data Services
Data License (ver 10.95)

Project Title: _____

Project Description: _____

Requester: _____

Affiliation: _____

Address to send data: _____ Address to send bill (if different): _____

Phone: _____

When is response needed? _____

Do you need 24 hour service? Yes No (note the higher fee)

For KSNPC use:

Number: _____

Date received: _____

Date sent: _____

Mode of delivery (check one)

____ U.S. Mail
____ Fax Number: _____
____ Other: _____

Services requested (check all that apply--report descriptions are on the reverse side)

____ Standard Occurrence Report ____ Standard Element Report ____ County List Report (free of charge)
____ Standard Managed Area Report ____ Copy of the KSNPC monitored plant and animal list (free of charge).
____ Custom Data Services (contact KSNPC first) _____

Geographic extent of request (check one)

____ Map provided
____ County. Name: _____
____ 7.5 minute quadrangle. Name: _____
____ EPA waterbody. Name: _____
____ Radius: ____ mile(s). Center latitude: _____ Center longitude: _____
____ Rectangle. N latitude: _____ S latitude: _____ E longitude: _____ W longitude: _____

Format desired (check one)

____ Paper ____ ASCII Diskette size: _____

Map production (complete only if you want KSNPC to manually map locations on a 7.5 minute topographic map)

____ Element occurrence locations marked on 7.5 minute topographic maps (does not apply for standard element report).
____ Managed area boundaries marked on 7.5 minute topographic maps.
____ Maps provided by requester (must be 7.5 minute topographic map or smaller scale).
____ Have KSNPC purchase necessary maps (billed to requester).

Fees

Data services cost $45.00 per hour. There is a one hour minimum charge and an additional fee is assessed for the actual costs of maps. Standard requests require an average of one to two hours. It normally takes less than two weeks to answer a request. Twenty-four hour service is available for $90.00 per hour. Fax charges are $2 per page. Government agencies, non-profit organizations, students, and researchers are provided two hours of data services a month free of charge.

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3. When such information is used the following disclaimer and waiver of liability shall be included and displayed prominently so as to alert any person viewing or utilizing this information:

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5. Documents incorporating Kentucky State Nature Preserves Commission data and data products shall include explicit reference to the Commission as a source to be cited as follows: "Information provided by the Kentucky State Nature Preserves Commission. Further information is available by contacting the Data Manager, KSNPC."
6. Any use, display or incorporation of Commission data or information products shall include the date on which such information was provided.

ACCEPTANCE: I hereby certify that the above stipulations are understood and accepted, and I declare that I am authorized to execute this statement on behalf of the Agency or Company identified below:

Requester Signature	Agency or Company	Date Signed

Send request to: Data Manager, KSNPC, 801 Schenkel Lane, Frankfort, KY, 40601. Phone: (502) 573-2886. Fax: (502) 573-2355.

Kentucky State Nature Preserves Commission

Natural Heritage Program Data Services

Information on rare and sensitive plants, animals, and other natural features of Kentucky is maintained as part of a computer data management system known as the Kentucky Natural Heritage Program. Operated by the Kentucky State Nature Preserves Commission, the data in this program are used to identify areas of ecological significance.

Commission biologists continually gather this information during their field work and from contacts with other Kentucky biologists. As a result, the Kentucky Natural Heritage Program is the most complete and current biological database of its kind available.

Available Data

The Nature Preserves Commission currently monitors the statuses of over 650 plant, animal, and natural community elements of Kentucky's natural diversity that are considered rare or endangered. Data are stored in the Commission's Element Occurrence Database. Computer retrieval capabilities allow a nearly infinite number of data subsets to be assembled. Data can be organized and retrieved in many different ways, and detailed information about each element occurrence also is available. Taxonomic, biological, and legal information about each element are continually updated. Data searches and reports can be tailored to fit the needs of most agencies, institutions, and individuals.

The Managed Area Database contains biological, management, legal, and locational information on over 400 areas in Kentucky, including lands managed for conservation purposes by federal, state, and local governments, private individuals, foundations, and corporations, and other large tracts of publicly managed land.

Uses for the Data

* Compliance with endangered species laws & regulations. The databases can be consulted to review permit applications required by endangered species, wetlands, mining or clean water legislation.
* Prevention of disputes over development. Development projects can avoid exemplary natural areas and imperiled species during planning stages, thereby precluding disputes over possible environmental impacts.
* Conservation planning. Critical areas can be identified and protected, and conservation priorities established, on a regional, national, or global basis.
* Management of parks and protected areas. These data can help improve management practices on public and private lands.
* Research and education. Scientific research, especially long-term environmental monitoring, and education can find Heritage data useful.

Available Services

1. Standard Occurrence Report: Data for rare species and exemplary natural community occurrences are available for a 7.5 minute quadrangle, county, EPA waterbody, or user-defined circle or rectangle. For each occurrence the following information is provided:

Scientific and common names
Federal and state statuses, global and state ranks
Quadrangle, county, and EPA waterbody name
Directions, latitude, longitude, and mapping precision
Occurrence quality, date last observed, and assurance of identification
Normal habitat for the element
Distance and bearing to center (radius-based reports only)

2. Standard Element Report: A list of rare species and exemplary natural community elements are available for a 7.5 minute quadrangle, county, EPA waterbody, or user-defined circle or rectangle. For each element the following information is provided:

Scientific and common names
Federal and status statuses, global and state ranks
Normal habitat

3. County List Report: A list of rare species and exemplary natural community elements reported from each county, and the number of occurrences of each element in a county. For each element the following information is provided:

Scientific and common names
Federal and state statuses, global and state ranks
Number of extant, historic, obscure, extirpated, and unmappable occurrences in a county

4. Standard Managed Area Report: Data on managed areas are available for a 7.5 minute quadrangle or county. For each managed area the following information is provided:

Area name, type, acreage, and owner
Quadrangle and county name
Centrum latitude and longitude, and least rectangle coordinates
Manager name, phone, and agency

5. Custom data searches and reports can be created by KSNPC data management staff.

Standard and custom data reports (services 1-4) can be provided in printed or digital (ASCII) format.

A cover letter that summarizes data search results and comments on the possible occurrence of federally listed elements is provided with standard and custom data reports (services 1-4).

The Data License describes restrictions placed on the use of data for more than one project and the reporting of sensitive element locations.

Fees

Standard and customized data requests (services 1-above) cost $45.00 per hour. There is a one hou minimum for all requests, and time is logged in one quarter hour increments after the first hour. Standar requests require an average of one to two hour Government agencies, non-profit organizatio students, and researchers are provided two hours of da services a month free of charge.

Data can be transcribed onto topographic maps for th $45.00 per hour fee and the cost to KSNPC topographic maps (user may provide these).

It normally takes less than two weeks to receive you response. Data can be provided in 24 hours (excludin weekends and holidays) for $90 per hour and $2 p page fax charges.

Obtaining Data

Standard data reports can be obtained by completing a signing a Data License (see other side).

Users interested in data exchanges, custom data repor or annual subscriptions should contact the KSNPC Da Manager.

Send all Data Licenses and direct all inquiries to: Da Manager, Kentucky State Nature Preserv Commission, 801 Schenkel Lane, Frankfort, K 40601; Phone: (502) 573-2886; Fax: (502) 573-235

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Revised 10/16/95

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COMMONWEALTH OF KENTUCKY
DEPARTMENT OF FISH AND WILDLIFE RESOURCES
C. THOMAS BENNETT, COMMISSIONER

October 15, 1997

Andrea W. Campbell
Technical Support Division
Oak Ridge Operations Office
P.O. Box 2001
Oak Ridge, TN 37831

RE: Endangered/threatened species review for the Proposed Treatment of Mixed Wastes Stored at the Paducah Gaseous Diffusion Plant, McCracken County, Kentucky

Dear Ms. Campbell:

The Kentucky Department of Fish and Wildlife Resources (KDFWR) has received your request for the above-referenced information. Please find enclosed the printout from our Kentucky Fish and Wildlife Information System (KFWIS) listing the known federal and state endangered/threatened fish and wildlife for **McCracken** County. Please be aware that our system is a dynamic one and that it only represents our current knowledge of the various species distributions.

Due to the nature of this project, KDFWR does not anticipate any significant impacts to federally threatened or endangered species.

I hope this information will be helpful to you. Should you require additional information, feel free to contact the Environmental Section at (502) 564-5448.

Sincerely,

Steven T. Beam

Steven T. Beam
Wildlife Biologist

Enclosure

xc: Environmental Section Files

Federally Threatened and Endangered Species Reported from MCCRACKEN County

Common Name	Scientific Name	Status Code	Reference
Eagle, bald	Haliaeetus leucocephalus	223,101,121,601,102	
Tern, interior least	Sterna antillarum athalassos	223,101,121,601	
Myotis, Indiana	Myotis sodalis	223, 101, 108, 601	95020N
Mucket, pink	Lampsilis abrupta	601,101,223	
Pink, ring	Obovaria retusa	101,601,223	15001
Pink, ring	Obovaria retusa	101,601,223	15007

This list was created through the Kentucky Fish and Wildlife Information System.

Species Status Codes

Code	Status	Description
000	Unclassified	(null)
101	Federal Endangered.	Those species in danger of extinction throughout all or a significant portion of their range.
102	Federal Threatened.	Those species that are likely to become endangered within the foreseeable future throughout all or a significant portion of their range.
103	Federal proposed: Endangered	(null)
104	Federal proposed: Threatened	(null)
105	Fed. status review: C1:	Substantial information is on hand to support the biological appropriateness of proposing to list.
106	Fed. status review: C2:	Possibly appropriate to list, but inconclusive data at present
107	Fed. status review: C3:	Species is no longer receiving consideration.
108	Critical habitat determined	(null)
109	Federal candidate	(null)
111	Plan approved by Director	(null)
112	Draft plan received	(null)
113	Plan in preparation	(null)
114	Status unknown	(null)
115	Under notice of review	(null)
116	Federal delisted	(null)
117	Federal downlisted	(null)
121	Federal Migratory	(null)
122	Marine Mammal	(null)
131	EPA Indicator	(null)
142	USFS Indicator	(null)
201	KDFWR - State Endangered	(null)
202	KDFWR - State Threatened	(null)
203	KDFWR - State High Interest(null)	
204	KDFWR - State Proposed	(null)
205	KDFWR - State status undetermined	(null)
206	KDFWR - State downlisted	(null)
207	KDFWR - State delisted	(null)
210	Depleted:	Commercial species that are depressed from former abundance by over-harvesting.

http://www.kfwis.state.ky.us/scripts/kfwisbeta/countylists/getstatuscodes.i

221	Protected: Game. Consumptive Recreational.	A species that is harvested recreationally for flesh or trophy value and so designated by State or Federal law (does not include Game Fish, see Protected: Sport Fish, code 224). An open season has been designated.
222	Protected: Furbearer.	A species that is harvested for fur value and so designated by State or Federal law. An open season has been designated.
223	Protected: Nongame.	A species in which protection is provided because a closed season has been designated officially by State or Federal law, or in which method of take is regulated, but the species is not considered Game.
224	Protected: Sport Fish.	A species harvested recreationally for flesh or trophy value and so designated by State or Federal law. An open season has been designated.
225	Unprotected: Nongame.	No protection (e.g. limits) is provided for this species and may taken year-round except during a specified time depending on the year.
226	Non-consumptive recreational	(null)
301	Sensitive.	A species that is especially susceptible to environmental perturbation.
302	Biological Indicator.	A species whose occurrence indicates environmental quality (high or low quality).
401	Commercial.	A species that is commercially harvested for fur or flesh or similar value.
410	Pest	(null)
411	Pest/Nuisance	A species that is considered a pest or nuisance to humans but does not cause livestock or crop losses.
412	Pest/Livestock	A species that causes livestock losses.
413	Pest/Crops	A species that cause agricultural or crop losses.
501	Probably extirpated (or extinct)	The species has been reported in Kentucky historically but has probably been extirpated from Kentucky.
502	Accidental:	A species for which there may be too few records of the species in Kentucky to classify it to another status category.
503	Migrant	A species that moves between two areas a distance which is greater than its normal home range.
504	Anadromous Fish	(null)
505	Catadromous Fish	(null)
601	KSNPC - State endangered.	A species which is in danger of extirpation and/or extinction thoughout all or a significant portion of its range in Kentucky.
602	KSNPC - State threatened.	A species which is likely to become endangered within the foreseeable future throughout all or a significant portion of its range in Kentucky.

http://www.kfwis.state.ky.us/scripts/kfwisbeta/countylists/getstatuscodes.i

603	KSNPC - State special concern.	A species that should be continually monitored because a) it exists in a limited geographic area, b) it may become threatened or endangered due to modification or destruction of habitat, c) certain characteristics or requirements make it especially vulnerable to specific pressures, or d) experienced researchers have identified other factors.
604	KSNPC - State proposed	(null)
605	KSNPC - State status undetermined.	A species that has been suggested as threatened or endangered or extirpated but insufficient information exists for assignment to Special Concern or Threatened or Endangered.
606	KSNPC - State downlisted	(null)
607	KSNPC - State delisted	(null)
608	KSNPC - Historic	(null)
609	KSNPC - Federal candidate	Animals that are not monitored in Kentucky by KSNPC because of their reported abundance.
701	Existing FMP exists	(null)
702	Pending FMP is currently in preparation	(null)
703	Other no FMP or PMP exists	(null)
704	Only PMP exists	(null)
711	Commercial/consumption	(null)
712	Commercial/industrial	(null)
713	Commercial/bait	(null)
714	Subsistence	(null)
715	International treaty	(null)
801	Economic Importance: High	(null)
802	Economic Importance: Moderate	(null)
803	Economic Importance: Low	(null)
999	See Comments significant portion of their range.	(null)

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APPENDIX C:

DETAILS OF RADIOLOGICAL ANALYSIS

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APPENDIX C:

DETAILS OF RADIOLOGICAL ANALYSIS

C.1 INTRODUCTION

This appendix presents detailed information on the radiological impacts that could result from both the incident-free operation of the Vortec vitrification facility and accident scenarios. This information is intended to support the impact evaluations discussed in Section 4.2.2.6 of the main text of this environmental assessment (EA). A brief background on radiation and its effects is presented in Section C.2. Section C.3 describes the method used to project the impacts from both normal and accident conditions, emphasizing the use of the GENII computer code in this process.

C.2 RADIATION EFFECTS

The effect of ionizing radiation on humans depends on the type of radiation (alpha or beta particles or gamma or x-rays) emitted and the total amount of radiation energy absorbed by the body. The amount of energy absorbed per unit mass of tissue is referred to as the absorbed dose. Although different types of radiation may yield the same dose, the biological effects of the different types of radiation can vary. The quantity used to describe the biological effects of the different types of radiation is the dose equivalent. It is the product of the absorbed dose and a quality factor that is a measure of the biological effectiveness of a particular type of radiation.

An individual may be exposed to ionizing radiation externally, from a radioactive source outside the body, or internally, from ingesting or inhaling radioactive material. External radiation exists only when a radiation field is present, whereas an internal dose is delivered continuously as long as the radioactive material remains in the body. Therefore, the internal dose is typically reported in terms of a committed dose equivalent, which is the total dose equivalent for 50 years after the initial intake of the radionuclide. Because the sensitivities of different organs to radiation exposures are different with regard to adverse health effects, comparing the dose equivalents from external radiation for different organs is not appropriate. To facilitate a valid comparison, the International Commission on Radiological Protection (ICRP) recommends that radiation dose equivalents be calculated on the basis of a whole-body exposure. This effective dose equivalent is the sum of the 50-year committed effective dose equivalents from internal organs multiplied by organ weighting factors and the dose equivalent from external sources. The common units for the total effective dose equivalent (or dose) are the sievert (Sv) and rem (100 rem = 1 Sv, 1,000 mrem = 1 rem).

In the United States, the average dose from background radiation is about 360 mrem/yr per person, of which about 300 mrem is from natural sources (National Council on Radiation Protection and Measurements [NCRP] 1987a,b). For perspective, the radiation doses resulting from a number of common activities are provided in Table C.1. The total dose to an individual member of the general public from the U.S. Department of Energy (DOE) and other federal activities is limited by law (DOE Order 5400.5) to 100 mrem/yr (in addition to background radiation), and the dose to a member of the public from airborne emissions released from DOE facilities must be below 10 mrem/yr (*Code of Federal Regulations*, Title 10, Part 61 [10 CFR Part 61]).

Exposure to large quantities of radiation can cause a variety of adverse health effects in people. The primary health effect from exposure to low levels of radiation (as is the case for the Vortec vitrification facility) is the potential induction of latent fatal cancers. The term "latent" is used because it may take many years for cancers to develop and for death to occur. The factors used by this EA to relate a dose to its potential effect are 0.0004 latent cancer fatalities per person-rem for workers and 0.0005 latent cancer fatalities per person-rem for individuals among the general population and noninvolved workers. These health risk conversion factors are based on recommendations from ICRP Publication 60 (ICRP 1991). The latter factor is slightly higher because

TABLE C.1 Comparison of Radiation Doses from Various Sources

Radiation Source	Dose to an Individual
Annual background radiation — U.S. average	
Total	360 mrem/yr
From natural sources (cosmic, terrestrial, radon)	300 mrem/yr
From man-made sources (medical, consumer products, fallout)	60 mrem/yr
Daily background radiation — U.S. average	1 mrem/d
Increase in cosmic radiation dose as a result of moving to a higher altitude (e.g., from Miami, Florida, to Denver, Colorado)	25 mrem/yr
Chest x-ray	10 mrem
U.S. transcontinental flight (5 hours)	2.5 mrem
Dose from naturally occurring radioactive material in agricultural fertilizer — U.S. average	1 to 2 mrem/yr
Dose from standing 6 ft (2 m) from a full depleted UF_6 cylinder for 5 hours	1 mrem

Sources: NCRP (1987a,b).

some individuals in the general public (such as infants) may be more sensitive to radiation than workers.

C.3 METHODOLOGY FOR ESTIMATING THE RADIOLOGICAL IMPACTS OF NORMAL AND ACCIDENT CONDITIONS

For this EA, the annual external doses to occupational workers were estimated on the basis of readings from thermoluminescent dosimeters. For routine and accidental airborne releases from the Vortec facility, health effects were assessed for noninvolved workers, maximally exposed individuals (MEIs) among the general population, and the surrounding population within a 50-mi (80-km) radius of the facility. The GENII code, Version 1.485 (Napier et al. 1988), was used for the assessment. The radiological impacts are presented in terms of the total effective dose equivalent and associated health effects.

C.3.1 GENII and Input Data

The GENII computer code (Napier et al. 1988) was originally developed for the Hanford Environmental Dosimetry Upgrade Project to assess human radiation exposures for the Hanford Site. The methods implemented in the code can also be applied to address general contamination situations, and they have been used to assess human exposures for other sites and projects. The code was recently applied in assessments for the *Final Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste* (WM PEIS; DOE 1997).

The GENII code is used to model both acute (accident) and chronic (incident-free) releases. It uses a multiple exposure pathway model that estimates radiation exposures resulting from discharges of radionuclides to the atmosphere, surface water, or soil. The code implements internal dosimetry models recommended in ICRP Publication 26 (ICRP 1977) and Publication 30 (ICRP 1979). Population doses are calculated up to a distance of 50 mi (80 km) from the release point. Ten downwind distances and 16 wind directions are applied in the code for dispersion and air concentration calculations.

The off-site population files required for the collective population dose estimates were obtained from the 1990 census of population and housing (U.S. Bureau of the Census 1992). Approximately 500,000 people are estimated to live within 50 mi (80 km) of the Vortec facility. The meteorological data used for the incident-free impact assessment were obtained from U.S. Environmental Protection Agency (EPA 1997). To bound the consequences of accidental releases, a 95% meteorological condition was assumed. This is defined as any meteorological condition that is not exceeded more than 5% of the time or as the worst combination of atmospheric

stability class and wind speed. To simulate these conditions, the wind was assumed to be blowing into the most populated sector at a speed of 3.3 ft/s (1 m/s) under very atmospherically stable conditions (Pasquill Class F) for the duration of the release.

Table C.2 lists the exposure parameters used in calculating the dose assessment from an annual exposure. The inhalation rate used to estimate the inhalation dose to noninvolved workers and the general public was 1.2 m^3/h (ICRP 1994). The exposure duration was derived from the assumption that the noninvolved worker would be exposed for 8 hours per day for 250 days per year with no respiratory protection. The noninvolved worker was assumed to be located where the airborne activity concentration was the greatest. For members of the public, the exposure duration is 24 hours per day for 365 days per year. Shielding factors were not used to mitigate the potential dose. Food production rates were based on site-specific data collected to support the WM PEIS (DOE 1997). Ingestion rates for members of the public were modeled on the assumption that 10% of the food and 33% of the milk consumed were obtained locally.

C.3.2 Source Term Data

Effluents from the soil vitrification process demonstration facility would be vented to the atmosphere through seven exhaust stacks. Only three stacks (stacks 1, 2, and 7) have the potential for releasing radionuclides to the atmosphere. Most of the airborne radioactivity released to the atmosphere during soil vitrification would come from uranium-238 and technetium-99. A comprehensive list of source terms for the three stacks during normal operations is presented in Table C.3.

Under accident conditions, it was assumed that a 55-gal drum of soil containing low-level mixed waste would be dispersed into the atmosphere. The event was postulated to occur as the result of either a lightning strike on a drum, the mixing of incompatible materials within a drum, spontaneous combustion within a drum, or a localized propane explosion associated with the high-air-flow dryer (Duggan 1997). The source terms for the low-level mixed waste are provided in Table C.4. The airborne release fraction of the dispersed material was derived from a DOE handbook on values and bases for airborne release fractions and rates and respirable fractions (DOE 1993). On the basis of the soil type, an airborne release fraction of 0.21 was used.

TABLE C.2 Annual Values of Exposure Parameters Used in GENII Calculations to Estimate Radiological Impacts from Airborne Emissions for Normal Operations and Bounding Accident Scenario

GENII Input Parameter	Receptor	
	General Public	Noninvolved Workers
Pathways evaluated		
Inhalation	Evaluated	Evaluated
Incidental ingestion of soil	Evaluated	Evaluated
External	Evaluated	Evaluated
Ingestion of food crops	Evaluated	Not evaluated
Ingestion of animal products	Evaluated	Not evaluated
Inhalation rate (m^3/h)	1.2	1.2
Incidental soil ingestion rate (mg/d)	60[a]	50
Exposure duration (h/yr)	8760	2000
Terrestrial food ingestion rate (kg/yr)		
Leafy vegetables	1.8[b]	NA[c]
Root vegetables	7.3[b]	NA
Fruit	6.8[b]	NA
Grain	3.54[b]	NA
Animal product ingestion rate (kg/yr)		
Beef	8.5[b]	NA
Poultry	1[b]	NA
Milk	33.6[d]	NA
Eggs	1.5[b]	NA
Food crops consumed by humans[e]		
Terrestrial food yield (kg/m^2)		
Leafy vegetables	1.4	NA
Root vegetables	0.86	NA
Fruit	0.79	NA
Grains	0.24	NA
Forage consumed by livestock[e]		
Dietary fraction		
Stored forage	0.3	NA
Fresh forage	0.7	NA
Forage yield		
Stored forage (kg/m^2)	0.48	NA
Fresh forage (kg/m^2)	0.28	NA

[a] Value derived by considering different exposure rates for children and adults as well as different dust levels indoors and outdoors.

[b] Ingestion rate of contaminated food or animal product, which was assumed to be 10% of the total ingestion rate.

[c] NA = not applicable.

[d] Ingestion rate of contaminated milk, which was assumed to be 30% of the total ingestion rate.

[e] Site-specific data for Paducah were obtained from Oak Ridge National Laboratory.

TABLE C.3 Source Characteristics and Source Terms Used in the Normal Operations Impact Analysis for the Vortec Facility

Source Characteristics

Source	Type	Height (m)	Diameter (m)	Gas Exit Velocity (m/s)	Gas Exit Temperature (°C)
Stack 1	Point	15.2	0.897	16.7	25.0
Stack 2	Point	15.2	0.744	19.9	25.0
Stack 7	Point	15.2	0.762	4.18	66.1

Source Terms

	Release Rate (Ci/yr)		
Radionuclide	Stack 1	Stack 2	Stack 7
Neptunium-237	2.066×10^{-9}	2.105×10^{-8}	1.576×10^{-9}
Plutonium-239	1.639×10^{-9}	1.670×10^{-8}	1.250×10^{-9}
Technetium-99	6.209×10^{-7}	6.324×10^{-6}	4.737×10^{-7}
Thorium-230	6.085×10^{-9}	6.197×10^{-8}	4.642×10^{-9}
Uranium-234	3.626×10^{-8}	3.693×10^{-7}	2.766×10^{-8}
Uranium-235	1.167×10^{-8}	1.189×10^{-7}	8.905×10^{-9}
Uranium-238	2.325×10^{-7}	2.368×10^{-6}	1.773×10^{-7}

Source: Kenvirons, Inc. (1998).

TABLE C.4 Source Terms Used in the Accident Impact Analysis for the Vortec Facility

Radionuclide	Amount of Low-Level Mixed Waste Released from a 55-gal Drum (Ci)	Radionuclide	Amount of Low-Level Mixed Waste Released from a 55-gal Drum (Ci)
Americium-241	4.2×10^{-4}	Niobium-95	1.1×10^{-4}
Antimony-122	3.5×10^{-5}	Plutonium-239	1.0×10^{-3}
Barium-133	6.1×10^{-7}	Potassium-40	1.2×10^{-6}
Beryllium-7	7.6×10^{-6}	Promethium-149	1.2×10^{-3}
Bismuth-207	3.9×10^{-6}	Protactinium-231	5.3×10^{-5}
Cadmium-109	1.1×10^{-3}	Protactinium-233	1.1×10^{-4}
Cerium-141	2.7×10^{-4}	Radium-226	4.1×10^{-6}
Cerium-144	2.5×10^{-6}	Scandium-46	8.2×10^{-7}
Cesium-135	2.9×10^{-5}	Sodium-22	1.8×10^{-6}
Cesium-137	6.1×10^{-5}	Strontium-85	6.1×10^{-7}
Cobalt-57	6.3×10^{-6}	Technetium-99	5.1×10^{-2}
Cobalt-60	4.1×10^{-6}	Tellurium-132	1.0×10^{-4}
Curium-242	7.4×10^{-4}	Thorium-230	3.0×10^{-3}
Curium-244	1.4×10^{-3}	Thorium-232	8.2×10^{-4}
Europium-152	9.8×10^{-6}	Thorium-234	4.6×10^{-3}
Europium-155	6.3×10^{-5}	Uranium-234	1.0×10^{-2}
Iodine-126	9.6×10^{-6}	Uranium-235	9.6×10^{-4}
Iodine-129	1.9×10^{-5}	Uranium-236	6.5×10^{-4}
Krypton-85	1.2×10^{-4}	Uranium-238	6.6×10^{-2}
Mercury-203	5.5×10^{-6}	Xenon-131M	5.7×10^{-3}
Molybdenum-99	1.4×10^{-4}	Xenon-133	3.1×10^{-4}
Neptunium-237	1.4×10^{-3}	Xenon-133M	2.7×10^{-4}
Neptunium-239	6.1×10^{-3}	Zirconium-89	1.0×10^{-5}

Source: Duggan (1997).

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