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August 28, 1998

Mr. Robert H. Daniell, Director
Division of Waste Management
Kentucky Department for Environmental Protection
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Frankfort, Kentucky 40601

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

Dear Mr. Daniell and Mr. Froede:

WATER POLICY FIVE-YEAR REVIEW (TYPE I) PADUCAH GASEOUS DIFFUSION PLANT, PADUCAH, KENTUCKY (DOE/OR/06-1679&D1)

Enclosed for your information is the subject document. This review was conducted in compliance with the *Engineering Evaluation/Cost Analysis for the Water Policy at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (DOE/OR/06-1142&D3). The review renews the Department of Energy's (DOE) commitment to continue to supply water to those residents and businesses that are currently inside the defined area and to new residents who come into the area. Further, DOE, within reason, intends to extend provision of water to new businesses coming into the area. The determination for what is reasonable for businesses will be made on a case-by-case basis. Additionally, it is anticipated that the proposed Record of Decision for the Groundwater Operable Unit will include a strategy for continuance of the Water Policy.

If you have any questions or require additional information, please call John D. Sheppard at (502) 441-6804.

Sincerely,

A handwritten signature in cursive script that reads "Jimmie C. Hodges".

Jimmie C. Hodges, Site Manager
Paducah Site Office

I-02102-0138



Mr. Daniell and Mr. Froede

2

August 28, 1998

Enclosure

cc w/enclosure:

J. C. Massey, Bechtel Jacobs Company/Kevil

J. Stickney, UKFFOU/Frankfort

T. Taylor, UKFFOU/Frankfort

R. Thomas, UKFFOU/Frankfort

**Five-Year Review (Type I)
Paducah Gaseous Diffusion Plant
Water Policy**



August 1998

Cleared for Public Release

**Five-Year Review (Type I)
Paducah Gaseous Diffusion Plant
Water Policy**

August 1998

Prepared by
Jacobs EM Team
175 Freedom Boulevard • Kevil, KY 42053

Prepared for the
Department of Energy
Office of Environmental Management
Environmental Management Activities at the
Paducah Gaseous Diffusion Plant
Paducah, Kentucky 42001
managed by
Bechtel Jacobs Company LLC
for the
U.S. Department of Energy
under contract DE-AC05-98OR22700

PREFACE

This *Five-Year Review (Type I) Paducah Gaseous Diffusion Plant Water Policy*, DOE/OR/06-1679&D1, was prepared in accordance with requirements of the Comprehensive Environmental Response, Compensation, and Liability Act; the National Oil and Hazardous Substances Pollution Contingency Plan; and the United States Environmental Protection Agency Office of Solid Waste and Emergency Response. The document follows the format suggested in the United States Environmental Protection Agency Office of Solid Waste and Emergency Response Directive 9355.7-02A. This work is performed under Work Breakdown Structure 7.10.01.35 (Activity Data Sheet 5801). This document reviews the Water Policy response action with regard to the effectiveness of the Paducah Gaseous Diffusion Plant Water Policy.

FIVE-YEAR REVIEW (TYPE I) PADUCAH GASEOUS DIFFUSION PLANT WATER POLICY

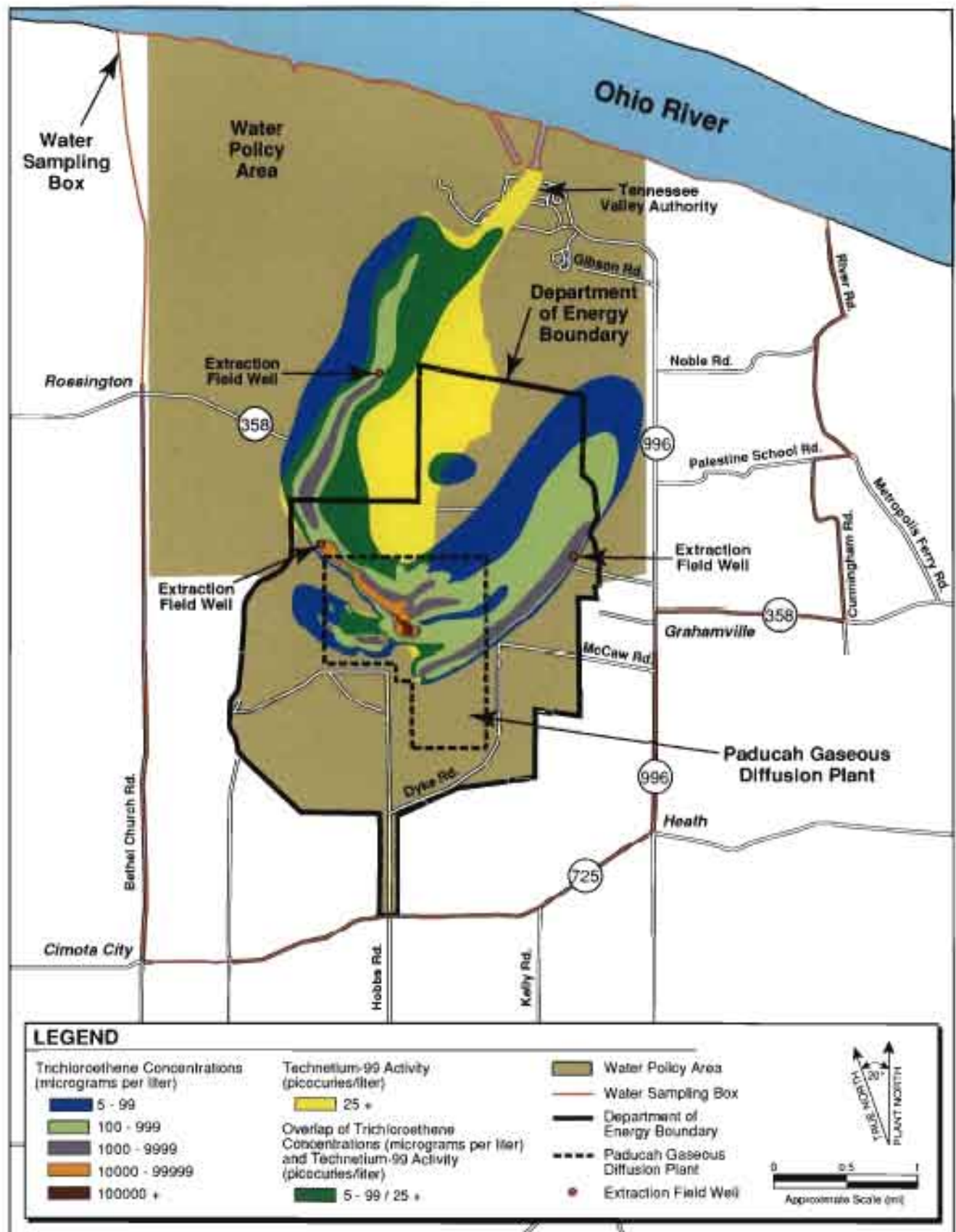
I. Introduction

Purpose. The *Engineering Evaluation/Cost Analysis for the Water Policy at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (DOE, 1993), dated July 1993, stipulates the preparation of a five-year review of the Water Policy. The United States Department of Energy conducted this review pursuant to Comprehensive Environmental Response, Compensation, and Liability Act Section 121(c), National Oil and Hazardous Substances Pollution Contingency Plan Section 300.430(f)(4)(ii), and Office of Solid Waste and Emergency Response Directive 9355.7-02 (May 23, 1991). It is a statutory review. The purpose of a five-year review is to ensure that a response action remains protective of public health and the environment and is functioning as designed. This document will become a part of the Administrative Record. This review (Type I) meets and exceeds requirements listed in United States Environmental Protection Agency guidance for review of a site at which the response action is performing as expected.

Site Characteristics. The Paducah Gaseous Diffusion Plant is a Department of Energy facility located in western Kentucky since 1952. The Paducah Gaseous Diffusion Plant enriches uranium for commercial nuclear power reactors, using the gaseous diffusion process. The process enriches raw material, with 0.7 percent uranium-235, to 2 percent uranium-235 product.

In August 1988, trichloroethene, an organic solvent, and technetium-99, a beta-emitting radionuclide, were detected in four private wells north of the Paducah Gaseous Diffusion Plant facility. The resulting response action is documented in the *Action Memorandum for the Water Policy at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (DOE, 1994). In brief, the Department of Energy immediately placed affected residences/businesses on alternate water supplies and began an intensive monitoring and investigation program to define the extent and temporal variations of the groundwater contaminant plumes. The Department of Energy developed an *Engineering Evaluation/Cost Analysis for the Water Policy at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (DOE, 1993), and the above referenced Action Memorandum (DOE, 1994) in support of its Water Policy.

The Water Policy states, "It is the intent of the Paducah Gaseous Diffusion Plant Environmental Restoration Program to offer municipal water service in accordance with this Policy to all existing private residences and businesses within the projected migration area of the contaminated groundwater originating at Paducah Gaseous Diffusion Plant (affected area)." With the adoption of the Water Policy, the Department of Energy focused its groundwater monitoring program on the Water Policy area and adjacent areas potentially downgradient of the contaminant plumes (i.e., water sampling box). Refer to Figure 1 for a map of the groundwater contaminant plumes and definition of the Water Policy area. Figure 1 depicts the technetium-99 plume reaching the intake inlet area of the Tennessee Valley Authority Plant complex. This interpretation is based on hydrogeologic principals. Two monitoring wells located approximately 2,500 feet southwest of the inlet consistently have reported an average of approximately 250 picocuries/liter of technetium-99. As the technetium-99 plume reaches the intake inlet area, the large volume of water dilutes the technetium-99 below detect levels.



Jacobs EM Team, 1999

Figure 1. Water Policy and Groundwater Contamination Area

For all existing residences and businesses within the affected area of the Paducah Gaseous Diffusion Plant, the Department of Energy proposed that the following actions be taken at the Department of Energy's expense.

- Offer to connect all users to municipal water supply lines.
- Offer to pay the reasonable costs of water bills for "users" whose wells currently are contaminated from the plant or whose wells potentially might become contaminated from the plant, as determined by the Department of Energy. Any determination as to the reasonableness of a water bill shall be made by the Department of Energy.
- Provide locks for securing wells in the affected area to control unauthorized use of the wells and to ensure access by Paducah Gaseous Diffusion Plant personnel for sampling or testing. Where wells of substandard construction were present, the Department of Energy paid for capping and abandonment of the wells.
- Continue to monitor the extent of contamination to determine movement of contaminated groundwater.
- Continue to pay reasonable cost of water bills for residences and businesses through December 1997. At that time the Department of Energy will reevaluate this policy and determine whether to continue, modify, or terminate this practice.

The Engineering Evaluation/Cost Analysis (DOE, 1993) specified the preparation of a five-year review in December 1997 to coincide with the reevaluation of the Water Policy. This document serves as both the 5-year review and as the reevaluation of the Water Policy.

Since the initial implementation of the Water Policy, the Department of Energy has initiated two interim remedial actions to address the groundwater contamination that necessitated the Policy. The Northwest Plume Interim Remedial Action was implemented on August 28, 1995, to control the high-concentration zone of contaminants in the Northwest Plume. This action consisted of the installation and maintenance of two extraction wells and construction of a water treatment facility. The downgradient levels of contamination in the groundwater of the Northwest Plume generally have decreased over the two years of operation at the facility. The second action, the Northeast Plume Interim Remedial Action, relies upon an operating evaporation tower for treatment of groundwater from the Northeast Plume. This evaporation tower is part of a non-contact cooling water recirculation system operated by the United States Enrichment Corporation as part of operation of the Paducah Gaseous Diffusion Plant. Sampling at the Northeast Plume Containment System also has indicated decreases in downgradient contamination over its first year of operation. The sampling results indicate that the two facilities effectively are reducing the concentration of the respective contaminants in the groundwater plumes.

II. Remedial Objectives

The primary objective of the Water Policy is to minimize the potential threat to human health and welfare by preventing exposure to the chemical and radioactive contaminants in the groundwater (DOE, 1993).

III. Summary of the Water Policy

The intent of the Water Policy is to provide water service comparable to that previously available to and used by residences and businesses in the affected area. The Department of Energy will continue to provide water to those residences and businesses currently in the Water Policy Box. The Department of Energy fully intends to provide payment of water costs for new residents and businesses moving into the Water Policy Box. A determination of what is reasonable for new businesses will be made on a case-by-case basis. It is expected that the anticipated Record of Decision for the Paducah Gaseous Diffusion Plant Groundwater Operable Unit will outline a strategy for continuance of the Water Policy; otherwise, the date for the next Department of Energy assessment of the Water Policy will be December 2002.

IV. Applicable or Relevant and Appropriate Requirements Review

The Comprehensive Environmental Response, Compensation, and Liability Act, as amended by the Superfund Amendments and Reauthorization Act of 1986, requires compliance with applicable or relevant and appropriate requirements for remedial actions (and removal actions to the extent practical within the scope of the action). The applicable or relevant and appropriate requirements for the Water Policy are delineated in the Action Memorandum (DOE, 1994).

The Department of Energy adhered to applicable or relevant and appropriate requirements pertaining to construction activities during the implementation of the removal action. Since these actions already have been completed following the applicable or relevant and appropriate requirements identified in the Action Memorandum (DOE, 1994), there is no need to review them further. Additional applicable or relevant and appropriate requirements pertaining to public health standards for drinking water must be evaluated on a continual basis to ensure protection. The Department of Energy does not operate the water system; however, through this five-year review, the Department of Energy has determined that the West McCracken Water District is in compliance with the Commonwealth of Kentucky's public health standards for operation of a public water system (401 K.A.R. Parts 8:010-8:700). There have been no noncompliances associated with this action.

V. Summary of Site Visit

The Water Policy area is bounded generally by the Ohio River to the north of the Paducah Gaseous Diffusion Plant, Metropolis Lake Road to the east, and Bethel Church Road to the west. South of the plant, the Water Policy area extends to the limits of the Department of Energy property. As of May 31, 1994, 96 residences and businesses were connected to municipal water supply lines by the Department of Energy. Since that time, four additional residences have been added to the water policy by the Department of Energy. A total of 100 residences and businesses currently are provided with municipal water service by the Department of Energy. The West McCracken Water District services the Department of Energy Water Policy area. Pipeline construction details are documented in the *Post-Construction Report for the Water Policy at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (DOE, 1995).

The Department of Energy updates records of changes in residency with billing statements provided by the West McCracken Water District. The Department of Energy has pursued acquisition of licensing agreements with new residents in the Water Policy Box. Currently, owners of only one residence within the Water Policy

Box have declined service by the Water District. Although this residence uses groundwater as its water supply, the residence is located on the extreme western boundary of the Water Policy area and is not within the boundaries of the groundwater contaminant plumes.

Visitation of the Water Policy area revealed the area is settled sparsely, with a greater density of residences on Metropolis Lake Road, as compared to Bethel Church Road and Kentucky Highway 358 (Ogden Landing Road) north of Paducah Gaseous Diffusion Plant (Davis, 1997). There were no visible indications of problems related to water service (e.g., excavated pipeline, pipeline leaks) in the Water Policy area.

An interview of Mr. Bill Tanner of the West McCracken Water District indicated no unusual interruptions of service to the Water Policy area (Tanner, 1997). However, because of low water use, the water lines must be flushed on a frequent basis. The Department of Energy reimburses the Water District for the flush water along with its regular expenses for water supplied to area residents. Mr. Jeff Cummings, supervisor for the Water Division of the Kentucky Natural Resources and Environmental Protection Cabinet, reports the Water District remains in compliance with water supply regulations (Cummings, 1997).

VI. Areas of Noncompliance

There have been no noncompliances associated with this action.

VII. Recommendations

The Department of Energy recommends continuance of the Water Policy as amended within this five-year review. Groundwater remains contaminated within the Water Policy area. The Water Policy protects residents from risks associated with use of the contaminated water. Furthermore, additional costs for replacement of wells that were capped and abandoned as part of the Water Policy action would be incurred by the Department of Energy if the Water Policy were discontinued.

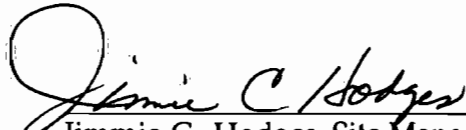
The Department of Energy aggressively is pursuing remediation of contamination resulting from the Paducah Gaseous Diffusion Plant. The long-term plans include restoration of the groundwater quality in the Water Policy area.

VIII. Next Five-Year Review

It is anticipated that the proposed Record of Decision for the Paducah Gaseous Diffusion Plant Groundwater Operable Unit will outline a strategy for review of the Water Policy. Otherwise, the date for the next Department of Energy assessment of the Water Policy will be December 2002.

IX. Statement of Protectiveness

I certify that the remedy selected for this site remains protective of human health and the environment.



Jimmie C. Hodges, Site Manager
United States Department of Energy
Paducah Site Office

APPENDIX

DISTRIBUTION

DISTRIBUTION

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APPENDIX

I. Document Review

Action Memorandum. The *Action Memorandum for the Water Policy at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/OR/06-1201&D2, was signed by the Department of Energy in June 1994, following the discovery of groundwater contamination in residential wells north of the Paducah Gaseous Diffusion Plant in August 1988. The removal action described in the Water Policy Action Memorandum (DOE, 1994) is as follows:

- The Department of Energy formally offered to provide municipal water to all existing residences and businesses within the affected area surrounding the Paducah Gaseous Diffusion Plant. They also offered to pay for connection of those residences that were not yet connected to a public water supply. These residences and businesses were responsible for cooperating and working with the West McCracken Water District to connect the water supply.
- The Department of Energy offered to pay the reasonable costs of water bills in the affected area through December 1997, at which time the Water Policy was to be reevaluated and a determination made regarding whether the Water Policy would continue, undergo modification, or be eliminated. The determination of what constitutes a reasonable cost of water consumption for residents is based on the historical usage of the applicable wells. Water usage costs caused by increases in agricultural water use, livestock water use, or subdivision of property would not be reimbursed under this action.
- After initial implementation of the Water Policy, residences or businesses outside the affected area or those that move into the area may connect into the West McCracken Water District municipal water supply at their own expense. The Department of Energy is not responsible for the water bills of new residents or new businesses.
- The Department of Energy pursued water use agreements, which delineate the respective responsibilities of the residents, businesses, and the Department of Energy, with each household or business that receives free water. Provisions included in the agreements specify that the resident or business may not drill new water supply wells or use existing water wells. Also, Paducah Gaseous Diffusion Plant personnel are permitted property access for groundwater sampling purposes. Locks were installed by Paducah Gaseous Diffusion Plant personnel to prevent unauthorized use of the existing water wells.
- Existing Paducah Gaseous Diffusion Plant monitoring wells continue to be sampled regularly to track migration of groundwater contaminant plumes. Additional monitoring wells have been installed in conjunction with other Department of Energy environmental restoration programs.

A more detailed description of the Water Policy is provided in the Action Memorandum (DOE, 1994). Additional documents describing the remediation of the

source and integrator units at the Paducah Gaseous Diffusion Plant can be found in the Administrative Record.

Water Policy. The settlement agreement for the Water Policy is described in the preceding summary of the Action Memorandum (DOE, 1994). The Department of Energy is revising this policy in these ways.

- The Department of Energy is offering to pay the reasonable costs of water bills in the affected area through December 2002. The determination of what constitutes a reasonable cost will be decided by the Department of Energy. It is anticipated that the Record of Decision for the Paducah Gaseous Diffusion Plant Groundwater Operable Unit will outline a strategy for continuance of the Water Policy. Otherwise, the Water Policy will be re-evaluated in December 2002 and a determination will be made as to whether the Water Policy will continue, undergo modification, or be eliminated.
- As new residents and businesses move into the Water Policy area, the Department of Energy will make decisions on a case-by-case basis about whether to provide water to the new area water user at the Department of Energy's expense.

Operations and Maintenance Information. The Department of Energy paid for some water supply line extensions of the West McCracken Water District into the Water Policy area. Total capital construction costs for implementation of the Water Policy were \$1,027,781. Continuing monthly costs average approximately \$5,000/month for the Department of Energy to supply water to the 100 residences and businesses of the Water Policy area. Table 1 provides a monthly breakdown of water costs for the years 1994 through 1998 (to date). Operations and maintenance of the water supply lines are the responsibility of the West McCracken Water District.

Monitoring Information. The off-site extent of the Paducah Gaseous Diffusion Plant's groundwater contamination plumes was established in 1992 in the *Report of the Paducah Gaseous Diffusion Plant Groundwater Investigation Phase III, KY/E-150*. The extent of the plumes was revised in 1998 (Figure 1). Cores of high concentrations of dissolved contaminants exit the facility in three distinct plumes: the Northeast Plume, the Technetium-99 Plume, and the Northwest Plume. Trichloroethene is the primary contaminant in both the Northeast and Northwest Plumes. Technetium-99 is a secondary contaminant of concern in the Northwest Plume. The technetium-99 Plume is defined primarily by a distinct zone of technetium-99 activity located east of the core of the Northwest Plume.

Regular groundwater sampling of residential and monitoring wells in the area north of the Paducah Gaseous Diffusion Plant began in 1988. At that time, the Department of Energy regularly was sampling water from 50 residential wells. With the development of the Water Policy, the number of residential wells sampled on a regular basis was reduced to 24, while ensuring the protection of area residents. The interval of sampling of each well within the Water Policy area has been adjusted to characterize temporal variation within the plumes and to detect the further spread of contaminants.

Table 1. The Department of Energy Water Policy Cost

	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	Totals
October		\$3,971.50	\$6,682.72	\$6,741.74	\$4,882.59	\$22,278.55
November	\$2,654.48	\$4,319.34	\$6,337.99	\$5,551.08	\$5,105.45	\$23,968.34
December	\$2,008.86	\$4,398.02	\$6,758.64	\$5,420.37	\$5,275.80	\$23,861.69
January	\$1,963.59	\$4,592.52	\$6,465.59	\$5,172.77	\$5,354.59	\$23,549.06
February	\$4,239.08	\$3,783.38	\$6,728.37	\$4,693.76	\$5,535.44	\$24,980.03
March	\$2,635.14	\$3,831.28	\$5,962.90	\$4,830.01	\$4,803.76	\$22,063.09
April	\$2,219.78	\$4,587.98	\$5,998.25	\$5,356.64	\$4,572.66	\$22,735.31
May	\$3,053.41	\$4,498.77	\$5,716.44	\$4,514.00	\$4,588.05	\$22,370.67
June	\$5,291.49	\$4,588.00	\$6,884.54	\$4,902.98	\$6,256.11	\$27,923.12
July	\$4,366.00	\$5,077.33	\$8,399.28	\$4,991.71	\$6,314.82	\$29,149.14
August	\$5,353.13	\$4,783.75	\$6,418.89	\$8,024.92		\$24,580.69
September	\$4,319.34	\$7,064.29	\$7,789.08	\$6,413.81		\$25,586.52
Totals	\$38,104.30	\$55,496.16	\$80,142.69	\$66,613.79	\$52,689.27	\$293,046.21

Monthly groundwater monitoring detected trichloroethene at two parts per billion in single samples during both 1996 and 1997 from the same residential well on the eastern edge of the Water Policy area. Although this contamination likely is not associated with the Paducah Gaseous Diffusion Plant (the well is south of a buried terrace that controls groundwater flow from the facility), beginning in 1997, the Department of Energy expanded the number of wells sampled on an annual basis along the eastern edge of the Water Policy area. No additional detection of trichloroethene has resulted from the expanded monitoring network.

The Action Memorandum (DOE, 1994) and the annual revision to the Paducah Gaseous Diffusion Plant's groundwater sampling and analysis plans document the wells to be sampled and sampling frequencies for the Department of Energy's Water Policy. All Paducah Gaseous Diffusion Plant groundwater monitoring data is maintained in the Department of Energy's computer data base, the Oak Ridge Environmental Information System. The Department of Energy reports the results of groundwater monitoring in its annual series of Paducah Gaseous Diffusion Plant site environmental reports.

Continuing groundwater monitoring has confirmed the extent of off-site groundwater contamination. Highest off-site concentrations of trichloroethene range between 10 and 20 parts per million in the Northwest Plume. Trichloroethene levels in the Northeast Plume are significantly lower, with the highest off-site concentrations of less than 3 parts per million. Off-site technetium-99 activities range up to 3,800 picocuries/liter in the Northwest Plume, 425 picocuries/liter in the Technetium-99 Plume, and 58 picocuries/liter in a limited area adjacent to the facility boundary in the Northeast Plume. Monitoring, both within and surrounding the Water Policy area, has indicated few occurrences of groundwater contaminants related to the Paducah Gaseous Diffusion Plant outside the extent of the known plumes. All occurrences of off-site groundwater contamination related to the Paducah Gaseous Diffusion Plant have occurred within the Water Policy area.

II. Standards Applicable or Relevant and Appropriate Requirement Review

Risk Evaluation. During the Phase II Site Investigation, two contaminants of concern, trichloroethene and technetium-99, were identified in groundwater of the Regional Gravel Aquifer (i.e., shallow aquifer underlying the facility) above their respective maximum contaminant levels in samples obtained from monitoring and residential wells located north of the Paducah Gaseous Diffusion Plant (CH2M HILL, 1991). These contaminants continue to be identified at elevated levels in the wells north of the Paducah Gaseous Diffusion Plant. Consequently, the potential for ingestion, inhalation, or direct contact with contaminated groundwater must continue to be eliminated by providing municipal water services to private residences and businesses within the affected area.

III. Site Visit

Visual Inspection. The inspection of the Water Policy area was accomplished by an automobile tour of Bethel Church Road, Metropolis Lake Road, and Kentucky Highway 358 (Ogden Landing Road) north of the Paducah Gaseous Diffusion Plant (Davis, 1997). The area is settled sparsely with a greater density of residences on Metropolis Lake Road, as compared to Bethel Church Road and Ogden Landing Road. There were no visible indications of problems related to water service (e.g., excavated pipeline, pipeline leaks) in the Water Policy area.

Interviews. Nearest Neighbors. Six residents of the Water Policy area were interviewed in person or by telephone on October 29, 1997, for this five-year review. Each resident was asked the following questions:

- (1) Are you aware of the intent of the Department of Energy's Water Policy?
- (2) When did the Department of Energy assume payment of your water bill?
- (3) Have there been any long-term/unusual interruptions with your water service?
- (4) Are you satisfied with the water service?
- (5) If you have a problem, do you get a satisfactory response?
- (6) Do you have any suggestions for improving the way the Department of Energy implements the Water Policy?

All residents were aware that the Department of Energy was providing water service to the Water Policy area to prevent exposure to contaminated groundwater. Of the six residents, one had declined the Department of Energy's offer to pay the cost of connection and monthly water usage bills but had connected to the Water District supply line at their own expense when it became available. The other five residents were being supplied water at the Department of Energy's expense.

Few residents recalled the date when their homes were connected to the water supply line, but all interviewed residents have received service from the Water District for several years. None of the residents reported any long-term or unusual interruptions with the water service and all were satisfied with the water service for

their homes. One resident remarked that the water supply had proven inadequate for irrigation of a farm field this summer. None of the residents reported any problems with the Water District service and none had any recommendations for improvement to the way the Department of Energy implements the Water Policy.

State Contacts. Mr. Jeff Cummings, Supervisor for the Water Division of the Kentucky Natural Resources and Environmental Protection Cabinet [(502) 898-8468], was contacted to inquire about the service of the West McCracken Water District. After explaining the purpose of the call, to review service by the Water District for residents affected by the Department of Energy's Water Policy, Mr. Cummings was asked if the Water District had remained in compliance with regulations. Mr. Cummings responded that the Water District is in compliance and that there are no general concerns.

Operations and Maintenance Contractors. Mr. Bill Tanner, West McCracken Water District [(502) 442-3337], reported on the condition and operation of the water lines and service provided to customers within the Department of Energy's Water Policy area. Mr. Tanner indicated there have been no problems with the water lines or water plant that have caused major disruptions in service to the area. Mr. Tanner did indicate that some of the water lines require more flushing than normal in order to maintain water quality, due to the low water usage.

REFERENCES

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