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CP2-ER-0012/FR2A

Waste Management Plan for the Pump-and-Treat Operations at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky

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Waste Management Plan for the Pump-and-Treat Operations at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky

Date Issued—June 2021

U.S. DEPARTMENT OF ENERGY
Office of Environmental Management

Prepared by
FOUR RIVERS NUCLEAR PARTNERSHIP, LLC,
managing the
Deactivation and Remediation Project at the
Paducah Gaseous Diffusion Plant
under Contract No. DE-EM0004895

APPROVALS

Waste Management Plan
for the Pump-and-Treat Operations
at the Paducah Gaseous Diffusion Plant,
Paducah, Kentucky

CP2-ER-0012/FR2

June 2021

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REVISION LOG

REVISION NUMBER	DATE	DESCRIPTION OF CHANGES	PAGES AFFECTED
FR0	10/20/17	Bluesheeting	All
FR1	12/11/17	Non-Intent Revision to Incorporate Bluesheeting Changes	All
FR2	6/9/21	Annual Update	All
FR2A	6/26/2024	Periodic Review has been completed with no changes identified in procedure technical content. Nonintent changes have been incorporated per CP3-NS-2001. Date for review cycle has been reset.	All

CONTENTS

ACRONYMS

ARAR	applicable or relevant and appropriate requirement
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DOE	U.S. Department of Energy
FRNP	Four Rivers Nuclear Partnership, LLC
GSA	generator staging area
LLW	low-level waste
NEPCS	Northeast Plume Containment System
NNSS	Nevada National Security Site
NWPGS	Northwest Plume Groundwater System
PTO	Pump-and-Treat Operations
RCRA	Resource Conservation and Recovery Act
RFD	request for disposal
SAA	satellite accumulation area
WAC	waste acceptance criteria
WGP	waste generation plan
WICL	waste item container log
WMP	waste management plan

1. OVERVIEW

This waste management plan (WMP) addresses the management of waste generated by Pump-and-Treat Operations (PTO) at the former Paducah Gaseous Diffusion Plant, Paducah, Kentucky. PTO is comprised of two major operating units, including the Northwest Plume Groundwater System (NWPGS) and Northeast Plume Containment System (NEPCS). PTO facilities are maintained as interim remedial actions in accordance with the most current version of the NWPGS and NEPCS operations and maintenance plans.

This project-specific WMP has been developed to meet the requirements of both Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and non-CERCLA projects. The most current applicable or relevant and appropriate requirements (ARARs) and waste generation forecast, classification, and characterization data will be used to implement this plan. Using this approach will provide consistency for the management of waste generated at the Paducah Site and will meet the requirements of CP2-WM-0001, *Four Rivers Nuclear Partnership, LLC, Paducah Deactivation and Remediation Project Waste Management Plan*.

As required by CP2-WM-0001, waste generated at the Paducah Site must be characterized and managed in accordance with applicable state laws and regulations; federal laws and regulations; and ARARs. These wastes also must be managed in accordance with U.S. Department of Energy (DOE) Orders, and requirements and procedures developed by Four Rivers Nuclear Partnership, LLC, (FRNP) which are written and updated, as necessary, for compliance with the stated requirements. Additionally, the waste must be characterized and managed to meet the waste acceptance criteria (WAC) for receiving facilities.

CP2-WM-0001 addresses the safe and compliant management of wastes through the application of consistent waste management practices at the Paducah Site under the FRNP Paducah Deactivation and Remediation Project and will be used to supplement this project-specific WMP. CP2-WM-0001 sets forth the requirements for managing low-level radioactive, mixed low-level radioactive, Resource Conservation and Recovery Act (RCRA) hazardous, Toxic Substances Control Act, sanitary, classified, and/or transuranic waste at the Paducah Site.

This WMP addresses waste management requirements from the point of generation until custody is relinquished from the PTO. PTO personnel are responsible for properly containerizing, packaging, marking, labeling, temporarily storing, and characterizing the waste generated at the operating units. Waste management personnel are responsible for the transportation of waste from the PTO operating units to the appropriate waste management facility. The waste management group is responsible for interim storage of the waste. Standard practices outlined in this WMP comply with CERCLA, RCRA, and DOE requirements.

The approach outlined in this plan emphasizes the following objectives:

- Management of waste in a manner that is protective of human health and the environment;
- Minimization of waste generation, thereby reducing unnecessary costs (e.g., analytical costs) and use of permitted storage and disposal facilities, which are limited in number; and
- Compliance with the requirements of the U.S. Environmental Protection Agency, the Commonwealth of Kentucky, and DOE.

Waste management activities must comply with this WMP and the WAC for treatment, storage, and disposal units presented in CP2-WM-0011, *Waste Acceptance Criteria for the Treatment, Storage, and Disposal Facilities at the Paducah U.S. Department of Energy Site*.

2. MANAGEMENT OF WASTE

2.1 ROLES, RESPONSIBILITIES, AND REQUIRED TRAINING

2.1.1 Roles and Responsibilities

PTO personnel are responsible for properly containerizing, packaging, marking, labeling, temporarily storing, and assisting waste management engineers, who characterize the waste generated at the operating units. Waste management personnel are responsible for the transportation of waste from the PTO operating units to the appropriate waste management facility.

The waste management group is responsible for the management and final disposition of PTO waste, in accordance with applicable regulations, once waste materials have been characterized and custody has been relinquished by PTO. An exception to this is the transportation and regeneration of spent activated carbon from the NWPGS, which is outlined in Section 3 of this document.

Prior to the transfer of waste to the waste management group, PTO personnel are responsible for the proper management of waste generated from PTO. PTO personnel will ensure that waste activities are conducted in accordance with this WMP. PTO personnel will coordinate waste management activities with the waste management group. PTO personnel will ensure that waste containers meet required specifications prior to relinquishing them to the waste management group. Additional responsibilities of PTO personnel include the following:

- Maintaining an adequate supply of labels;
- Maintaining drum inventories;
- Interfacing with waste management;
- Preparing request for disposal (RFD) forms;
- Tracking PTO waste;
- Ensuring that drums and containers are properly labeled;
- Coordinating waste transfers with waste management;
- Coordinating transportation of waste to the appropriate waste management facility;
- Characterizing waste when existing data and process knowledge are insufficient;

- Providing characterization data and process knowledge forms to the waste management group; and
- Ensuring that generator staging areas (GSAs), satellite accumulation areas (SAAs), and 90-day accumulation areas are established in accordance with CP3-WM-1037, *Generation and Temporary Storage of Waste Materials*, and federal and state regulations.

2.1.2 Training

A training and qualification program shall be implemented for PTO personnel managing waste and shall meet federal, state, and local regulations (e.g., 40 *CFR* § 264.16, 49 *CFR* § 172.704).

2.2 WASTE PLANNING

Waste planning will be conducted in accordance with this WMP.

2.2.1 Waste Planning

PTO waste streams and volumes are forecasted annually in a waste generation plan (WGP) per CP2-WM-0001. Typical PTO waste streams and volumes are outlined in the appendix of this WMP.

2.2.2 Point of Generation Control

PTO personnel document waste generated with an RFD form (i.e., CP2-WM-0011-F02) and the Waste Item Container Log (i.e., WICL) form (i.e., CP3-WM-3015-F01). Waste generation is performed and controlled with technical standards, administrative controls, and other hazard controls using approved instructions, procedures, or other means that comply with CP2-SM-1000, *Activity Level Work Planning and Control Program for the Paducah Gaseous Diffusion Plant.* CP3-WM-3015, *Waste Packaging*, provides detailed guidance with respect to the following:

- Roles and responsibilities;
- Container selection and preparation;
- Quality assurance inspections of container integrity and preparation (e.g., receipt inspection, waste generator inspection);
- Waste identification and characterization;
- Waste packaging; and
- Container closure, security, and storage.

2.2.3 Characterization Strategy

Waste streams are characterized in accordance with CP3-WM-0437, *Waste Characterization and Profiling*.

Characterization strategies vary. Analytical data from samples or the use of historical data and/or process knowledge will be utilized to characterize waste. Verification sampling is used to ensure waste streams remain within the bounded characterization or to recharacterize, as necessary.

The different waste types generated at the PTO operating units are defined in Section 2.2.4 of this document.

2.2.4 Waste Types and Disposal of Plumes Waste

Based on characterization of PTO waste that has been disposed of or will require disposal, waste types can be divided into the following four categories.

- **RCRA-Mixed Waste.** If treatment is required, it will be conducted at an appropriate treatment, storage and disposal facility. Disposal of RCRA-mixed waste that meets landfill disposal restrictions, as identified in 401 *KAR* Chapter 37 (incorporating 40 *CFR* Part 268), will take place at Energy*Solutions*, Nevada National Security Site (NNSS), or another approved off-site disposal facility. The off-site facility selection will be based on cost effectiveness.

- **Low-Level Waste (LLW) (Above Authorized Limits).** Waste of this designation does not meet the C-746-U Landfill authorized limits for radionuclides and will be disposed of at NNSS, Energy*Solutions*, or another approved off-site facility. The off-site facility will be selected based on cost effectiveness.

- **R-Sanitary Waste (Below Authorized Limits).** Waste of this designation is defined as waste that meets C-746-U Landfill authorized limits for radioactive constituents, complies with CP2-WM-0011, and can be disposed of at the C-746-U Landfill, if the requirements of CP3-WM-3025, *Preparation and Processing of Paducah Landfill Packages*, are met.

- **Agreed Order Listed Hazardous Waste (Below Authorized Limits).** Waste of this designation is defined as waste that meets the terms of the Agreed Order with the Commonwealth of Kentucky [i.e., less than 39.2 ppm trichloroethylene (TCE) and less than 2,080 ppm 1,1,1-trichloroethane]. The determination of whether the waste meets the terms of the Agreed Order is made by a waste management engineer and/or environmental field compliance specialist in accordance with CP3-ES-1036, *Waste Management Agreed Order Implementation.* Waste that complies with the Agreed Order can be managed as nonhazardous waste and disposed of in the C-746-U Landfill.

2.2.5 Staging and Storage of Waste

Waste containers generated by PTO will be stored in compliance with CP3-WM-0016, *Waste Handling and Storage in DOE Waste Storage Facilities*, and CP2-WM-0011. Containers will be labeled in accordance with CP2-WM-0011. For temporary storage, waste will be stored in accordance with CP3-WM-1037.

2.3 WASTE FORECAST

As specified in CP2-WM-0001, a WGP is required prior to the generation of waste at the Paducah Site. The PTO WGP is revised annually.

A typical PTO WGP is included in the appendix of this WMP. Information provided for each waste stream includes the following: the waste stream description, volume, container type, number of containers, preliminary waste category, characterization method, analytes, future disposition, schedule, and comments.

2.4 WASTE AREA CLASSIFICATIONS

The methods used to process waste are dependent on the type of waste and the classification of the area where it is generated. Operating units and support trailers used as part of PTO are not radiological areas, radiological buffer areas, radiological material areas, or soil contamination areas based on radiological control requirements.

2.5 WASTE GENERATION

A variety of waste categories (e.g., RCRA-mixed, LLW, R-sanitary, Agreed Order listed hazardous) will be generated during PTO activities. Waste will be segregated, handled, stored, and disposed of in accordance with applicable Commonwealth of Kentucky regulations, federal regulations, DOE Orders/guidelines, and ARARs.

2.5.1 Hazardous, Low-Level, and Mixed Waste

During the course of PTO, various hazardous, LLW, and mixed wastes will be produced. The WGP contained in the appendix of this WMP lists a brief description of PTO wastes that fit these categories. Wastes that contact contaminated groundwater will be considered RCRA-listed waste and carry RCRA waste codes F001, F002, and U228, unless a determination from environmental field compliance specifies otherwise. Certain wastes, such as filter cake, will be classified as mixed wastes due to contact with contaminated groundwater and expected levels of radiological contamination.

2.5.2 General Waste

PTO produces general waste, which is considered nonhazardous and non-low-level. General wastes include such items as food waste, paper, trash, and plastic. These wastes are generated in the operating units. The radiological control group has reviewed waste streams generated by PTO and has determined that general wastes can be released off-site without radiological screening. These wastes are disposed of using a commercial waste disposal vendor. Controls are in place to ensure that radioactively-contaminated waste, such as ion exchange resin, can be released for off-site disposal.

2.6 WASTE CHARACTERIZATION

Most wastes generated as part of PTO have been fully characterized based on process knowledge and historical data. PTO completes the necessary process knowledge forms and provides historical data, as required, to the waste management engineer to verify the characterization of the waste.

2.7 CONTAINERIZATION, REQUEST FOR DISPOSAL, LABELING, AND TEMPORARY STORAGE

Waste management activities must comply with this WMP and CP2-WM-0011.

2.7.1 Containerization

Containerization of wastes will be performed by PTO personnel. The selection, procurement, and filling of containers will be performed in accordance with Section 5 of CP2-WM-0011 and CP3-WM-3015, *Waste Packaging*. Containers used for PTO wastes are identified in the WGP in the appendix of this document.

2.7.2 RFD Forms

The PTO Project Manager will complete the generation portion of the RFD form prior to transferring waste to the waste management group. The RFD form is used as an internal tracking system. It is used in addition to supporting documentation (e.g., WICLs, radiological surveys, analytical data, process knowledge forms, LLW forms, RCRA-mixed or polychlorinated biphenyls/radioactive waste forms, industrial landfill waste forms, waste variance forms) to provide a record of the waste generation activity and to compare it to the applicable WMP and WGP. An example RFD form and supporting documentation forms can be found in Appendix B of CP2-WM-0011.

2.7.3 Labels

PTO personnel will label and mark containers; waste containers will have the following labels and marking:

- Hazardous waste label (if applicable);
- DOE waste label (if applicable);
- Appropriate waste labels, which will include RFD number, container bar code, waste generation date, waste hazard(s) (e.g., ignitable, corrosive, reactive, toxic);
- Description of contents written on the container label in permanent marker; and
- Radiological survey tag (if applicable).

If subsequent characterization reveals that the initial labeling was incorrect, then labels will be corrected.

2.7.4 Temporary Storage

Waste management will establish and manage SAAs, GSAs, and 90-day accumulation areas (if required) in accordance with CP3-WM-1037. Long-term storage and disposal is the responsibility of the waste management group. Waste entering storage shall comply with the requirements detailed in the latest revision of CP2-WM-0006, *Facility Safety Basis Inventory Control Plan for the Paducah Waste Storage Facilities*. If a 90-Day accumulation area is established, waste management personnel will set up additional training on web module 28366, which will be required training for PTO personnel.

2.8 TRANSPORTATION OF PTO WASTE

The waste management group is responsible for the transportation of hazardous, LLW, and mixed PTO wastes to appropriate disposal or storage facilities, with the exception of spent activated carbon. Disposition of activated carbon is discussed in Section 3 of this document. PTO waste transportation between on-site facilities shall comply with the requirements of CP2-WM-0661*, Four Rivers Nuclear Partnership, LLC, Paducah Deactivation and Remediation Project Transportation Safety Document for On-Site Transport*, and PHS-RM-0000000-174/R1, *Preliminary Hazard Screening for the On-Site Transfer and Movement of Hazardous Materials That Include Radiological Constituents at Quantities Less Than Nuclear Hazard Category 3, Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (LATA Kentucky 2013).

2.9 WASTE MINIMIZATION

Waste minimization requirements will be implemented. Waste minimization activities include segregation and recycling of waste paper, recycling of spent printer/copier cartridges, segregation and recycling of aluminum cans, optimizing the use of activated carbon to reduce unnecessary changeouts, minimizing the volume of filter cakes by removing water, and recycling/reactivation of spent carbon.

3. SPENT ACTIVATED CARBON

Since the initial startup of NWPGS operations, off-gasses from the NWPGS air stripper have been treated by vapor phase activated carbon. The NWPGS removes TCE and technetium-99 (Tc-99) from contaminated groundwater; therefore, spent activated carbon initially was classified as a RCRA-mixed waste because the potential existed for it to contain both hazardous (i.e., TCE) and low-level (i.e., Tc-99) contamination. This prevented the spent carbon from being transported off-site for reactivation; therefore, it was initially stored on-site.

In an effort to minimize waste, a study was initiated to analyze the spent carbon. The results of the study are reported in *Paducah Gaseous Diffusion Plant C-612 Spent Activated Carbon Evaluation Report for Determining "No Rad Added" Status* (BJC 1999). The study concluded that the spent carbon could be classified as RCRA "No Rad Added" waste and could be sent off-site for reactivation without radiological concerns. DOE and the Commonwealth of Kentucky concurred with this classification and granted approval for off-site reactivation of the spent carbon.

Spent carbon is analyzed and, if the results meet the "No Rad Added" criteria concurred on by DOE, it is sent off-site for reactivation. If the carbon is reactivated, it is returned to the NWPGS for reuse. If the analysis of spent carbon does not reveal a "No Rad Added" determination, then the carbon is transported to an approved off-site treatment facility. After treatment, the spent carbon is transported to an approved off-site disposal facility. The shipping is performed by the waste management group with the assistance of PTO personnel. The spent carbon is packaged and transported in accordance with CP3-WM-3028, *Off-Site Shipping*.

4. REFERENCES

BJC (Bechtel Jacobs Company, LLC) 1999, *Paducah Gaseous Diffusion Plant C-612 Spent Activated Carbon Evaluation Report for Determining "No Rad Added" Status*, Bechtel Jacobs Company, LLC, Kevil, KY, March 31.

CP2-SM-1000, *Activity Level Work Planning and Control Program for the Paducah Gaseous Diffusion Plant*

CP2-WM-0001, *Four Rivers Nuclear Partnership, LLC, Paducah Deactivation and Remediation Project Waste Management Plan*

CP2-WM-0006, *Facility Safety Basis Inventory Control Plan for the Paducah Waste Storage Facilities*

CP2-WM-0011, *Waste Acceptance Criteria for the Treatment, Storage, and Disposal Facilities at the Paducah U.S. Department of Energy Site*

CP2-WM-0661, *Four Rivers Nuclear Partnership, LLC, Paducah Deactivation and Remediation Project Transportation Safety Document for On-Site Transport*

CP3-ES-1036, *Waste Management Agreed Order Implementation*

CP3-WM-0016, *Waste Handling and Storage in DOE Waste Storage Facilities*

CP3-WM-0437, *Waste Characterization and Profiling*

CP3-WM-1037, *Generation and Temporary Storage of Waste Materials*

CP3-WM-3015, *Waste Packaging*

CP3-WM-3025, *Preparation and Processing of Paducah Landfill Packages*

CP3-WM-3028, *Off-Site Shipping*

LATA Kentucky (LATA Environmental Services of Kentucky, LLC) 2013. *Preliminary Hazard Screening for the On-Site Transfer and Movement of Hazardous Materials That Include Radiological Constituents at Quantities Less Than Nuclear Hazard Category 3, Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, PHS-RM-0000000-174/R1, LATA Environmental Services of Kentucky, LLC, Kevil, KY, March.

APPENDIX

TYPICAL PUMP-AND-TREAT OPERATIONS WASTE GENERATION PLAN

TYPICAL PUMP-AND-TREAT OPERATIONS
WASTE GENERATION PLAN

Waste Stream (1)	Volume (2)	Container [number] (3)	Preliminary Category (4)	Characterization Method (5)	Analytes (6)	Future Disposition (7)	Schedule (8)	Comments (9)
Filter Cake—Produced by filter press after solids dewatering	14 ft^3	[2] 55-gal drum (1A2/X400S)	RCRA-mixed—F001, F002, and U228	Historical data and process knowledge	Volatiles and radionuclides	Off-site or Landfill (meeting Agreed Order)		
Ion Exchange Resin—Spent ion exchange resin removed during resin changeouts	130 ft^3	[2] ST-90 box	Low-level or Landfill (Authorized Limits)	Historical data and process knowledge	Volatiles and radionuclides	Off-site or Landfill (meeting Authorized Limits)		
Activated Carbon—Spent vapor phase activated carbon produced during carbon changeouts	550 ft^3	[2] Carbon Vessel	Hazardous—RCRA listed waste F001, F002, and U228, "No Rad Added" Status	Historical data and process knowledge	Volatiles	Carbon is recycled at off-site vendor for reuse in the Northwest Plume Groundwater System (NWPGS)		This waste is removed from the system in predesigned vessels, and the vessel and carbon are shipped off-site and reactivated by a carbon vendor. The reactivated carbon then is returned to the NWPGS for reuse.
Oil and Grease—Produced during routine operations and maintenance (O&M) activities	.5 ft^3	[1] 5-gal drum (1A2/Y1.5)		Historical data and process knowledge	Radionuclides	Toxic Substances Control Act (TSCA) Incinerator		
Oil Soaked Rags	.5 ft^3	[1] 5-gal drum (1A2/Y1.5)	Low-level	Process knowledge	Radionuclides	Landfill		
Personal Protective Equipment (PPE)—Produced during routine O&M activities	20 ft^3	[3] 55-gal drum (1A2/X400S)	Low-level	Historical data and process knowledge	Volatiles and radionuclides	Landfill		
PPE—Produced during routine O&M activities	2 ft^3	[1] 55-gal drum (1A2/X400S)	RCRA-mixed—F001, F002, and U228	Historical data and process knowledge	Volatiles and radionuclides	Off-site or Landfill (meeting Agreed Order)		

Waste Stream (1)	Volume (2)	Container [number] (3)	Preliminary Category (4)	Characterization Method (5)	Analytes (6)	Future Disposition (7)	Schedule (8)	Comments (9)
Bag Filters—Produced during maintenance activities	7 ft^3	[1] 55-gal drum (1A2/X400S)	RCRA-mixed—F001, F002, and U228	Historical data and process knowledge	Volatiles and radionuclides	Off-site or Landfill (meeting Agreed Order)		Assumes two changeouts per year.
Groundwater Sampling Residue—Excess groundwater sample volume not needed by laboratory for analysis	20 ft^3	N/A	RCRA-mixed—F001, F002, and U228 or Low-level	Historical data and process knowledge	Volatiles and radionuclides	Wastewater is treated by the NWPGS		This waste is treated at the NWPGS facility (i.e., C-612). The waste is returned in the original sample container.
Glass Bottleware—Produced by field sampling activities	58 ft^3	[8] 55-gal drum (1A2/X400S)	Low-level	Historical data and process knowledge	Volatiles and radionuclides	Landfill		
Poly Bottles—Produced by field sampling activities	88 ft^3	[12] 55-gal drum (1A2/X400S)	Low-level	Historical data and process knowledge	Volatiles and radionuclides	Landfill		
Debris; Polyvinyl Chloride Piping and Associated Parts—Produced during maintenance activities. Decontaminated per debris treatment regulation 40 *CFR* § 268.45, Table 1	14 ft^3	[2] 55-gal drum (1A2/X400S)	Low-level	Process knowledge	Volatiles and radionuclides	Landfill		

Note: This table documents the packaging requirements, forecasted quantities, and characterization requirements for the waste generated by PTO. Requirements for labeling, transportation, generator staging area and satellite accumulation area management, etc. must be followed to insure proper waste management.