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Remedial Action Report for the Corehole 8 Removal Action at Oak Ridge National Laboratory, Oak Ridge, Tennessee

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Remedial Action Report for the Corehole 8 Removal Action at Oak Ridge National Laboratory, Oak Ridge, Tennessee

Date Issued—July 1995

Prepared by
Energy Division
Oak Ridge National Laboratory

Prepared for
U.S. Department of Energy
Office of Environmental Restoration and Waste Management
under budget and reporting codes EX 20 and EW 20

Environmental Restoration and Waste Management Programs
Oak Ridge National Laboratory
Oak Ridge, Tennessee 37831-6285
managed by
LOCKHEED MARTIN ENERGY SYSTEMS, INC.
for the
U.S. DEPARTMENT OF ENERGY
under contract DE-AC05-84OR21400

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PREFACE

This *Remedial Action Report for the Corehole 8 Removal Action at Oak Ridge National Laboratory, Oak Ridge, Tennessee* (DOE/OR/01-1380&D1) was prepared in accordance with requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (of 1980) for reporting construction actions for public review. This work was performed under Work Breakdown Structure 1.4.12.6.1.01.25 (ADS 3301, "ORNL WAG 1"). Publication of this document meets a Federal Facility Agreement milestone of August 30, 1995. This document provides the Environmental Restoration Program with information regarding the construction activities related to a nontime-critical removal action. It compares the work performed with that which was proposed in the Action Memorandum and provides technical justification for deviations from the original design.

EXECUTIVE SUMMARY

The Corehole 8 plume intercept and transfer system became operational on March 31, 1995. The objectives of the removal action (as described in the Action Memorandum) were achieved, although modifications to the original design were required as unanticipated field conditions were encountered. Before construction of the system, First Creek was estimated to account for about 10% of the ^{90}Sr discharging over White Oak Dam; the Corehole 8 plume was estimated to be the major contributor to First Creek contaminants. The Action Memorandum estimated that the Corehole 8 intercept and transfer system would reduce the levels of contamination in First Creek by 20–50%. However, performance monitoring shows that system operation has reduced ^{90}Sr discharges from First Creek to White Oak Creek by 86%.

1. INTRODUCTION

Remedial investigations in Waste Area Grouping 1 at Oak Ridge National Laboratory (ORNL) have revealed areas of groundwater radiological contamination. In 1991 gross beta contamination, consisting mostly of ^{90}Sr, was detected at a depth of about 50 ft below ground surface during the drilling of Corehole 8. That same year, First Creek was sampled and found to be receiving ^{90}Sr contamination from seeps at approximately the same geologic stratum that had the highest levels of contamination in Corehole 8. Subsequent sampling in nearby storm sewer catch basins, also near the same geologic stratum, determined that ^{90}Sr-contaminated groundwater was seeping into the bottoms of the porous catch basins. These findings lead to the development of the Corehole 8 hypothesis which described a geologic strike-parallel (parallel to the ORNL E-W coordinate grid) ^{90}Sr contaminant plume migrating from the vicinity of Corehole 8 toward First Creek.

Plume seepage entering the storm sewer catch basins ultimately discharges to First Creek via outfalls 341 and 342. The 1991 First Creek sampling results strongly suggested that nearly all of the ^{90}Sr entering the creek was derived from outfalls 341 and 342. Estimates from historic National Pollutant Discharge Elimination System (NPDES) monitoring data indicated that First Creek contributed approximately 10% of the ^{90}Sr measured at White Oak Dam.

The removal action design (Fig. 1) was to passively intercept groundwater seepage into three storm sewer catch basins that lead to outfalls 341 and 342. French drains were used to passively capture and transfer the intercepted water to the ORNL process waste treatment plant (PWTP) pipeline system located in the north tank farm. One catch basin, leading to outfall 342, is located immediately northwest of Building 2016; and two catch basins, leading to outfall 341, are located immediately north of Building 2013. Intercepted water was to gravity drain to a lift station, located northeast of Building 2016, for pumping to the PWTP pipeline system. Field conditions encountered in the course of construction that lead to minor modifications in the original system design are described in Sect. 2.

2. CONSTRUCTION OBJECTIVES

The scope of the Corehole 8 plume removal action was to reduce discharges of ^{90}Sr to First Creek via the ORNL storm sewer system and subsequently reduce the amount of ^{90}Sr going off-site over White Oak Dam. The chosen alternative recommended in the *Engineering Evaluation/Cost Analysis* (Jacobs 1994a) was to passively intercept ^{90}Sr contaminated groundwater at three locations in the western part of ORNL, where it was known to be entering the storm sewer system, and to transfer the intercepted water to the ORNL PWTP.

The detailed removal action objectives as described in Foster Wheeler (1994) are as follows:

- Follow Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) guidance to implement a nontime-critical removal action that intercepts ^{90}Sr-contaminated groundwater before it enters First Creek.

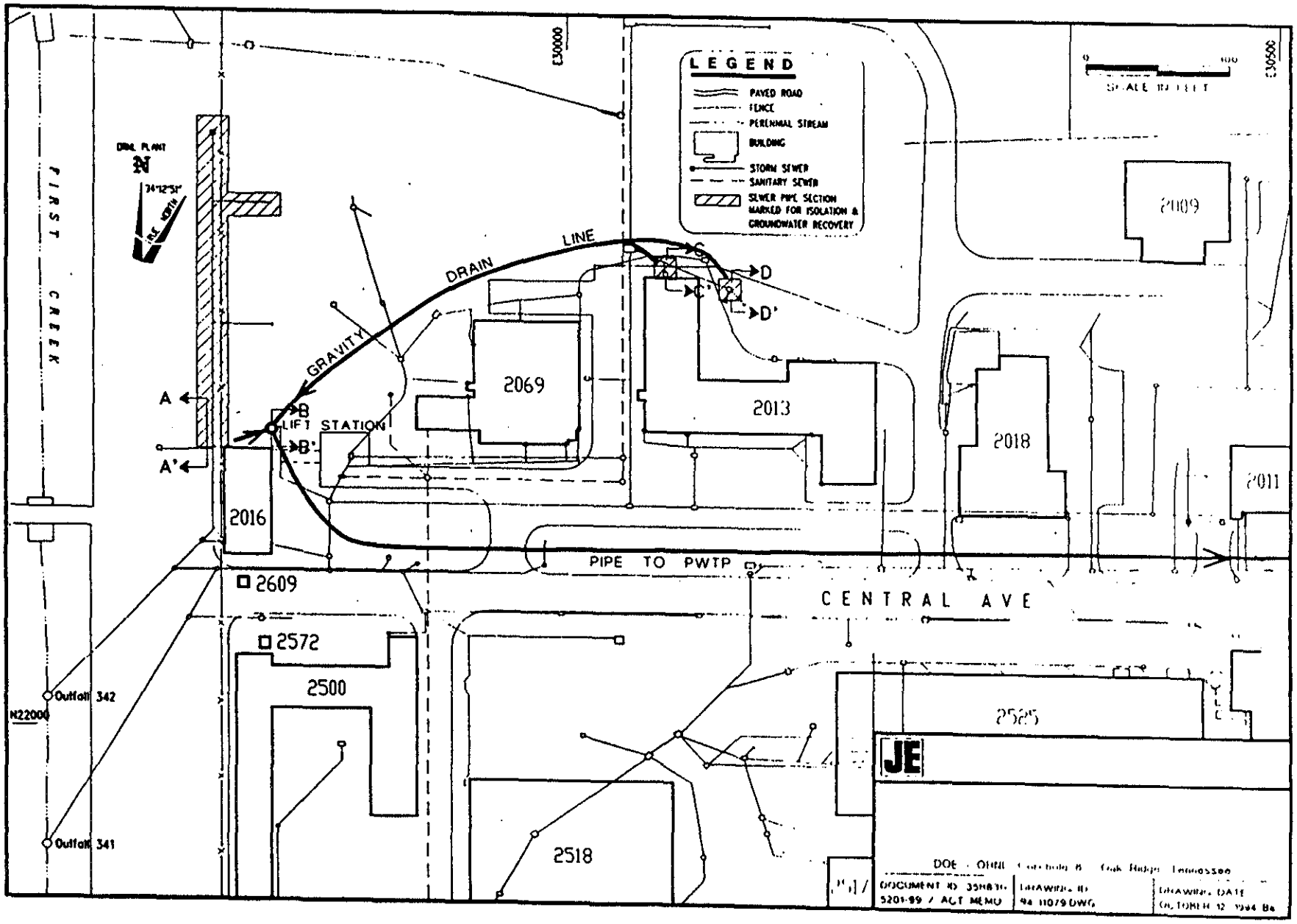

Fig. 1. Corehole 8 plume intercept and transfer system design.

The CERCLA removal action appropriateness criterion most relevant to this action is the potential for direct exposure to the contaminants, the potential for drinking water contamination, soil contamination near the surface with a potential for migration, and weather conditions that may cause contaminants to migrate or be released.

- Collect and treat contaminated water where pathway(s) are known and where contaminated water can be easily interpreted.

  The preferred alternative intercepted groundwater where it was visibly entering the storm sewer system at shallow depths. The flux of contaminant entering the storm sewer system at those locations was estimated to account for the bulk of the flux of contaminant discharging from the storm sewer system to First Creek.

- Maintain and operate a collection and treatment system until it is no longer considered necessary or cost effective.

  The preferred alternative was chosen in part because of the proximity of the intercept locations to the ORNL PWTP, and the PWTP had the capacity to treat the estimated 10–15 gpm flow intercepted by the project. It was assumed that the PWTP would continue to be available to effectively treat the intercepted groundwater for the life of the project.

- Monitor the flux of ^{90}Sr into First Creek and from First Creek to White Oak Creek to measure the effectiveness of the removal action in reducing flux and to use those data in determinations about further action.

  Monitoring locations are available both into First Creek and from First Creek to White Oak Creek. The latter location is also monitored as part of ORNL's NPDES permit.

To achieve these objectives, modifications to the original system design were required by field conditions encountered in the course of construction. During construction, it was discovered that a portion of the contaminated groundwater bypassed the storm sewer catch basin located northwest of Building 2016 and continued migrating along a colocated steam system pipeline. The steam pipeline and the migrating contamination continued west, and the contaminants entered a steam system valve pit located adjacent to First Creek. To halt that continued migration along the steam pipeline, the interceptor French drain excavation was extended an additional 2 ft down, and a pump to transfer the water to the lift station was installed.

Similarly, the excavation from Building 2013 to the lift station encountered a former building foundation that necessitated constructing the pipeline above the building foundation. This modification raised the pipeline above the design elevation and again required a pump to be installed in the French drain located at the storm sewer catch basin located immediately north of Building 2013. Appendix A shows the as-built system.

3. APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

In accordance with Section 300.415(8) of the National Contingency Plan, on-site removal actions conducted under CERCLA must meet applicable or relevant and appropriate requirements (ARARs) to the extent practicable, considering the exigencies of the situation. The National Contingency Plan identifies two factors that should be considered in determining whether complying with ARARs is practicable: the urgency of the situation and the scope of the removal action to be taken. Based on the above guidance, ARARs specific to the proposed alternatives for this removal action are presented in Jacobs (1994a). No endangered or threatened species or habitats, or archaeological or historic resources were identified at the site during resource surveys of the ORNL. The project was designed so that no activities will be performed in wetlands or floodplains. No Resource Conservation and Recovery Act (RCRA)-listed or characteristic waste was identified in the groundwater. Any collected groundwater is transferred to PWTP, which is a Clean Water Act NPDES-permitted facility. No soils excavated in the process of implementing the removal action contained RCRA-characteristic or mixed waste. Soils in the vicinity of lift stations 2 and 3 were radiologically contaminated, and U.S. Department of Energy orders for management of radiological waste were followed.

4. SCHEDULE

The removal action schedule provided in the Action Memorandum (Jacobs 1994b) is as follows; actual completion dates are added:

Action	Complete date	Actual complete date
Collection/piping system in operation	3/31/95	3/31/95
Follow-up monitoring	5/1/95	4/27/95
Monitoring data analysis	6/30/95	5/1/95
Decision about follow-up action	7/7/95	

5. COSTS

The cost for design and construction of the interceptor system was estimated at $1.23 million (Jacobs 1994b). Actual design and construction costs were $1.2 million. Treatment costs at the PWTP and system maintenance costs are estimated to be approximately $31,000 per year.

6. MONITORING

Jacobs (1994a) states that the interceptor system design was estimated to reduce the amount of contaminated groundwater discharging to First Creek by 20–50%. Accordingly, a 30-day

performance monitoring period followed construction to determine if an additional follow-up action was required to further reduce contaminant discharges.

6.1 SYSTEM PERFORMANCE MONITORING

System performance monitoring has been conducted at the interceptor locations and at the First Creek weir both before and after construction. For 7 weeks prior to construction, total weekly flow data were obtained from outfalls 341 and 342 and from the First Creek weir; weekly grab samples were also obtained from each of these locations. Because the contaminant flux calculation is obtained by multiplying flow and concentration, preconstruction monitoring sought to obtain a wide range of flow conditions for use in comparison with the postconstruction data. After construction, similar data were obtained from the First Creek weir and from the lift station delivering contaminants to the PWTP.

Table 1 contains the performance monitoring data from the First Creek weir. To most accurately describe system performance, similar pre- and postconstruction flow conditions were compared. The comparison indicates that interceptor system operation has reduced average weekly gross beta flux at the First Creek weir by 86%. The data indicate that residual contamination remains in storm sewer bedding material and is flushed to First Creek during rain events. It is anticipated that as this flushing progresses, further contaminant flux reduction at the First Creek weir will occur in the future. During the performance monitoring period, an average of 9.5 gal/minute were sent to the PWTP.

Table 1. Corehole 8 removal action performance monitoring, First Creek weir

Date	Flow (gal/week)	Gross beta (pCi/L)	Flux (mCi/week)
	Preconstruction		
11/8/94	1,243,348	370	1.74
11/15/94	1,652,142	370	2.31
11/22/94	1,158,117	360	1.58
11/29/94	4,833,226	140	2.56
12/6/94	3,301,862	210	2.62
12/13/94	5,292,030	160	3.20
12/20/94	2,317,847	270	2.37
	Postconstruction		
4/6/95	2,251,779	27	0.23
4/13/95	1,968,353	29	0.22
4/20/95	1,870,032	80	0.57
4/27/95	3,339,834	26	0.33

6.2 LONG-TERM MONITORING

As part of ORNL's NPDES permit, the First Creek weir is monitored monthly. Total monthly flow and a grab sample are obtained to derive a monthly contaminant flux value. Similarly, outfalls 341 and 342, from which contaminants previously discharged to First Creek, are monitored quarterly. Monthly reporting of these monitoring activities is contained in the Discharge Monitoring Report and provided to the Tennessee Department of Environment and Conservation.

7. CONCLUSIONS

The Corehole 8 plume intercept and transfer system effectively reduces groundwater contaminant discharges from entering First Creek and negates the need for a Phase II action as described in Jacobs (1994a). ORNL's NPDES monitoring provides an effective long-term monitoring program to evaluate system performance. Unforeseeable subsurface conditions suggest that flexibility is needed in future remediation efforts and may preclude the need for detailed designs prior to construction.

REFERENCES

Foster Wheeler 1994. *Removal Action Work Plan for Corehole 8 in Waste Area Grouping 1 at Oak Ridge National Laboratory, Oak Ridge, Tennessee*, ORNL/ER-283, November.

Jacobs 1994a. *Engineering Evaluation/Cost Analysis for the Waste Area Grouping 1 Corehole 8 Removal Action at the Oak Ridge National Laboratory Oak Ridge, Tennessee*, DOE/OR/02-1303&D2, September.

Jacobs 1994b. *Action Memorandum for the Waste Area Grouping 1 Corehole 8 Removal Action at Oak Ridge National Laboratory, Oak Ridge, Tennessee*, DOE/OR/02-1317&D2, October.

APPENDIX A

MARTIN MARIETTA ENERGY SYSTEMS, INC.

OAK RIDGE, TN - PADUCAH, KY

ENGINEERING TRANSMITTAL

XMTL NO: CH8	ISSUE DATE: 6/1/95
PROCUREMENT BY *: LMES	FIELD WORK BY: MK-F
PROJECT TITLE: Corehole 8 Removal Action	PROJECT NO: ADS 3301
	E.S.O.(W.O.)NO.: P-X964A-01
JOB TITLE: Core Hole 8 As-built drawings	BUILDING: WAG 1 / PLANT: ORNL
	PROJECT RECORD NO. (PRN): X1995-0052

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	Principal Engr. (PE)		W. C. Stone, Jr.	K1037	7346	1	1/ 0			
	System Engr. (SE)									
	Project Tech. Lead		R. R. Lee	4500N	6190	1	1/ 1			
	Plant Div. Rep.		L. S. Hawk	6556A	6402	1	1/ 0			
	A-E Coordinator									
	Constr. Engr. (CE)		R. C. Williams	1000	6338	1	1/ 0			
	Constr. Planning									
	Est./Sch/ Engr. (ES)									
	Procur. Coord.									
	Contract Coord. (SC)									
	Report/Analysis (RP)									
	QA Specialist		M. A. Woody	1000	6331	1				
DESIGN	Struct. & Architect									
	Comp. Aided Design									
	CAD Operations									
	Electrical Engr.		J. A. Burgess	1000	6334	1	1/ 0			
	Engr. Mechanics									
	Environ. Control									
	General Mech. Engr.									
	Instrument Engr.									
	Mach./Tool Design									
	Mech. Design									
	Mech. Equip. Design									
	Process Engr.									
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SPECIAL	L & G Waste Ops		C. B. Scott	3130	6058	1	2/ 1			
	Class. & Information									
	Environ. Protection									
	Fire Protection									
	Health Physics									
	Industrial Hygiene									
	Utilities									
	Criticality Safety									
	Safety									
	Security									
	Test & Inspection									
	Maintenance									
	Plant QA									
OTHER	DOE - ORO		G. R. Hudson	Maxima	8710	1	1/ 0			
	MK-F									
	Engineering Records		D. Stair	1000	6331	1	0/ 1			
	ERDC		J. A. Carr	7078F	6402	1	1/ 0			
	Retain PWF									
					TOTALS	12	31/ 3			

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LIST OF ATTACHMENTS & INFORMATION

[X] RC [ ] NoRC

As-built drawings for the Core Hole 8 Removal Action Project.

Drawing Numbers:
C3E020154A014 REV A
C3E020154A015 REV A
C3E020154A016 REV A
E3E020154D014 REV A
E3E020154D015 REV A
E3E020154D016 REV 0

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Originated By	Section (Group)	Division(Department)	Principal Engineer	Project Engr.(Manager)
C. A. Taylor	D. L. Garrett	E. H. Krieg. Jr.	W. C. Stone, Jr.	C. A. Taylor

UCN-1201 (12356C 9-91)

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