CONFIRMATORY SURVEY PLAN FOR THE GROUP E EFFLUENT DISCHARGE PATHWAY AREAS FORT ST. VRAIN NUCLEAR STATION PUBLIC SERVICE COMPANY OF COLORADO PLATTEVILLE, COLORADO

INTRODUCTION

The Public Service Company of Colorado (PSC) operated a 330 MWe High Temperature Gas Cooled Reactor (HTGR) from July 1979 until August 1989. The plant, designated as the Fort St. Vrain Nuclear Station (FSV), was authorized for construction on September 17, 1969 when the U.S. Nuclear Regulatory Commission (NRC) issued a provisional construction permit. Construction was completed in December 1973 and a facility operating license, License No. DPR-34, Docket No 50-267, was granted on December 21, 1973. Initial fuel loading commenced on December 26, 1973 and initial criticality was achieved January 31, 1974. After a prolonged period of startup testing, low-power operation and plant modifications, the plant was committed for commercial operation on July 1, 1979. Full power was achieved November 6, 1981 (PSC 1995a).

In the nuclear steam supply system for FSV, heat was produced by fission in the HTGR utilizing a uranium-thorium fuel cycle. Graphite was used for the moderator, core structure, and reflector. High temperature helium was used as the primary coolant to produce superheated and reheated steam at a temperature of 1,000 degrees F to match conventional thermal station conditions. The entire nuclear steam supply system, including the reactor core, graphite moderator and reflector, steam generators and helium circulators, was contained within a Prestressed Concrete Reactor Vessel (PCRV).

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Prepared by the Environmental Survey and Site Assessment Program, Environmental and Health Sciences Division, Oak Ridge Institute for Science and Education, under interagency agreement (NRC FIN No. A-9093) between the U.S. Nuclear Regulatory Commission and the U.S. Department of Energy.

During the operational period, FSV operated for approximately 890 effective full-power days; FSV was shut down on August 18, 1989. The PSC Board of Directors reviewed and confirmed the Executive Management decision that FSV would not be restarted, and that PSC would pursue decommissioning of FSV. The decision to permanently shut down and decommission FSV was based on related technical and financial considerations. Problems were identified with the control rod drive assemblies and the steam generator steam ring headers that presented significant technical obstacles which could be overcome, but at a significant financial cost and time commitment. In addition, due to the uniqueness of the HGTR fuel cycle, the cost to purchase new fuel was prohibitive. This, in conjunction with low plant availability and correspondingly high operating costs, made continued operation of FSV impractical.

In May 1991, the NRC granted PSC a 10 CFR 50 Possession Only License. On November 23, 1992, the NRC issued the Order to Authorize Decommissioning of Fort St. Vrain and Amendment No. 85 to Possession Only License No. DPR-34 (PSC 1995b). PSC's objective was the dismantlement and decommissioning of FSV to release all site areas for unrestricted use. To accomplish this, a portion of the PCRV structure and the radioactive balance-of-plant equipment that exceeded the limits for unrestricted use were decontaminated or removed as described in the Fort St. Vrain Decommissioning Plan.

The <u>status</u> of the FSV environs was evaluated in the FSV Initial Radiological Site Characterization Report in order to provide information pertinent to the decommissioning and final survey of FSV (PSC 1992). There were no spills or accidents during operation of FSV which had the potential of contaminating the site. The Radiological Environmental Monitoring Program (REMP) was continued throughout the decommissioning to ensure that any contamination of the site environs which could have occurred as a result of decommissioning activities was detected.

The FSV facility was largely left intact following decommissioning; dismantlement of structures was confined to the PCRV, and portions of the Reactor Building, Turbine Building, and Liquid Waste System. Following defueling, the PCRV contained the majority of the remaining radioactive inventory. The radioactive source term at FSV was primarily a result of neutron activation of both metallic and concrete components, and impurities contained in graphite components of the PCRV.

These activation products included beta-gamma emitters such as Co-60, Eu-152, and Eu-154, and low-energy beta and x-ray emitters such as H-3, C-14, and Fe-55, with H-3 and Fe-55 the largest contributors to the total radionuclide inventory (PSC 1995a).

FSV's final survey included all pertinent structures, surfaces, systems and components, concentrating on those previously identified as contaminated or potentially contaminated during the dismantlement/decommissioning phases. At the request of the NRC's Division of Waste Management, the Environmental Survey and Site Assessment Program (ESSAP) of the Oak Ridge Institute for Science and Education (ORISE) performed an independent confirmatory survey of the repower area in March 1995 at the Fort St. Vrain site (ORISE 1995a). Subsequent independent survey activities at FSV included licensee survey package reviews, confirmatory surface scans, and comparison surface activity measurements (e.g., side-by-side measurements) performed from September 25 through 27, 1995 (ORISE 1996a). During the period January 22 through 25, 1996. ESSAP performed instrument comparison activities-including side-by-side surface activity measurements and surface scans----and reviews of the licensee's embedded piping program and use of in situ gamma spectrometry for determining the licensed material contribution to exposure rate (ORISE 1996b). Most recently, ESSAP performed independent confirmatory surveys during the period September 30 through October 3, 1996. Specifically, ESSA P performed surface scans, surface activity measurements, and exposure rate measurements; and reviews of the licensee's hard to detect nuclide (HTDN) assessment program. ... it ft report describing these activities was prepared and submitted to the NRC for comment on Januar, 30, 1997 (ORISE 1997).

In October 1996, PSC completed final survey activities for the Group E Effluent Discharge Pathway areas at FSV and issued Volume 6 of the Final Survey Report (PSC 1996). The effluent discharge pathway consists of open land areas, storage and evaporation ponds and basins, concrete-lined ditches, unlined ditches, and the 10.1 hectare (25 acre) Farm Pond. Water from both ditches was routinely used for irrigation of the surrounding fields and pastures. It is also known that water would leak from the Goose Quill Ditch providing a means of transport of radioactive materials to the

surrounding soil. Additionally, the ditches were periodically dredged to maintain flow rates and avoid overflow. The removed vegetation and sediment was routinely deposited on the banks adjacent to the ditches (PSC 1996).

The NRC's Division of Waste Management has requested that ESSAP perform independent confirmation survey activities of the Liquid Effluent Pathway areas at Fort St. Vrain.

SITE DESCRIPTION

The FSV facility is located approximately 56 kilometers [km(35 miles)] north of Denver and 5.6 km northwest of the town of Platteville, in Weld County, Colorado. The site is located in an agricultural area of gently rolling hills. Grade elevation at the plant is 1,460 meters (4,790 feet) above sea level. The site consists of 6995 hectares owned by PSC, identified as the Owner-Controlled Area, of which approximately 260 hectares were designated as the exclusion area during plant operation. Farming has been continued on Owner-Controlled areas of the site, but there are no farming operations or permanent residences located within the Restricted Area. The Restricted Area is surrounded by a security fence, and access is controlled for purposes of protection of individuals from exposure to radiation.

The station is located on the east side of county road 19 ½ approximately 3.2 km south of the confluence of the South Platte River and the St. Vrain River. Neither of the rivers is considered navigable. Cooling for the plant was provided by mechanical draft cooling towers. Make-up to the cooling towers was provided from the rivers, and supplemented by shallow well water. Nineteen shallow wells are located on the site. The licensee also owns rights to surface water in four irrigation ditches which traverse portions of the site.

Effluent from the plant was discharged to a point west of the plant and County Road 19 ¹/₂, where it entered the concrete-lined Goose Quill Ditch. The Goose Quill Ditch runs north and east approximately 2,135 meters (m) before terminating at the Jay Thomas Ditch. The Jay Thomas Ditch flows north approximately 700 m from the confluence with the Goose Quill Ditch where it empties into the Farm Pond. Outfall from the pond eventually terminated at the South Platte River.

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PSC divided the Liquid Effluent Pathway a. 18 into fourteen survey units, designated E001 through E014, and classified the units into two categor. 28 based on the potential for residual contamination. The two categories, referred to as affected or unaffected are defined as follows: Affected areas are those areas that have potential radioactive contamination or known radioactive contamination; unaffected areas are all areas not classified as affected and are not expected to contain residual radioactivity. Area classification was determined by plant operating history and the results of previous radiological surveys. PSC designated eleven of the survey units as affected to include the Goose Quill Ditch and its banks (E001 and 002), the Farm Pond and its outfall (E003), the Jay Thomas Ditch and its banks (E004 and 006), irrigation ditches 1 through 6 and the North and South Marshes (E008 and 010), permanent pasture and farmland both east and west of County Road 19 ½ (E011 through 013), and a sediment storage area (E014). All affected survey units are outside the FSV restricted area. Three survey units within the restricted are were classified unaffected and include the East and West Settling Basins and Storage Basins (E005), Sewage Lagoons 1 and 2 and East and West Evaporation Ponds (E007), and the South Evaporation Pond (E009).

OBJECTIVES

The objectives of the confirmatory survey are to provide independent contractor field data reviews and radiological data for use by the NRC in evaluating the adequacy and accuracy of the licensee's procedures and final status survey results.

RESPONSIBILITY

Work described in this survey plan will be performed under the direction of William L. (Jack) Reck, Program Director and Eric W. Abelquist, Assistant Program Director with ESSAP. The cognizant site supervisor has the authority to make appropriate changes to the survey procedures as deemed necessary. After consultation with the NRC site representative, the scope of the survey may be altered based on findings as the survey progresses. Any changes to survey procedures and/or alterations to the survey plan will be noted in the site logbook.

DOCUMENT REVIEW

ESSAP has reviewed the licensee's final status survey documentation for those survey units contained within Volume 6 (PSC 1996). Documents were reviewed for adequacy, accuracy, completeness, and consistency. Data were reviewed for appropriateness of calculations and interpretations relative to the guidelines.

PROCEDURES

A survey team from ESSAP will perform independent visual inspections, surface scans, and sampling of selected affected and unaffected survey units in the Liquid Effluent Pathway areas, and other areas designated by the NRC. Field survey activities will be conducted in accordance with the applicable sections of the ESSAP Survey Procedures and Quality Assurance Manuals (ORISE 1995b and c). Specific procedures are listed on pages 8 and 9 of this plan.

SURVEY PROCEDURES

The following procedures apply to survey units selected for independent confirmatory activities.

Reference System

Measurement and sampling locations will be referenced to prominent site features and recorded on site drawings.

Surface Scans

Surface scans for gamma activity will be performed in selected survey units using NaI scintillation detectors coupled to ratemeters with audible indicators. The percent of scan coverage in each survey unit will be based on findings as the survey progresses. Locations of elevated direct radiation identified by scans will be marked for further investigation.

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Soil Sampling

Surface soil samples (0-15 cm) will be collected at each location of elevated direct radiation identified by surface scans and other biased locations. Subsurface soil samples (greater than 15 cm depth) may be collected if the gamma count rate at the 15 cm depth indicates that subsurface contamination is present.

Sediment Sampling

Sediment samples will be collected at each location of elevated direct radiation identified by surface scans.

SAMPLE ANALYSIS AND DATA INTERPRETATION

Samples and data will be returned to ORISE's ESSAP laboratory in Oak Ridge, Tennessee for analysis and interpretation. Soil samples will be analyzed by gamma spectrometry. The radionuclides of interest are Co-60 and Cs-137, however, spectra will be reviewed for other identifiable photopeaks. Sample analysis will be performed in accordance with the ORISE/ESSAP Laboratory Procedures Manual (ORISE 1995d). Gamma spectrometry data will be reported in units of picocuries per gram (pCi/g). Results will be compared with the licensee's documentation and NRC guidelines established for release for unrestricted use. Results will be presented in a report and provided to the NRC.

GUIDELINES

The primary contaminants of concern are beta-gamma emitters resulting from the operation of the FSV facility. The applicable soil concentration guidelines are radionuclide specific and are as follows (PSC 1996):

Radionuclide	Concentration Guideline Value		
Co-60	5.59 pCi/g		
Cs-134	7.87 pCi/g		
Cs-137	18.7 pCi/g		
Eu-152	13.2 pCi/g		
Eu-154	12.1 pCi/g		
Eu-155	439 pCi/g		

TENTATIVE SCHEDULE

Confirmatory Survey	March 31 to April 3, 1997		
Sample Analysis	April 1997		
Draft Report	May 1997		

LIST OF CURRENT PROCEDURES

Applicable procedures from ORISE/ESSAP Survey Procedures Manual (Revision 9; April 30, 1995) include:

- Section 5.0 Instrument Calibration and Operational Check-Out
 - 5.1 General Information
 - 5.2 Electronic Calibration of Ratemeters
 - 5.3 Gamma Scintillation Detector Check-Out and Cross-Calibration

Section 6.0 Site Preparation

- 6.2 Reference Grid System
- Section 7.0 Scanning and Measurement Techniques
 - 7.1 Surface Scanning
- Section 8.0 Sampling Procedure
 - 8.1 Surface Soil Sampling
 - 8.2 Subsurface Soil Sampling
 - 8.3 Sediment Sampling
 - 8.8 Miscellaneous Sampling
 - 8.9 Sample Identification and Labeling
- Section 9.0 Integrated Survey Procedures
 - 9.2 General Survey Approaches and Strategies
- Section 10.0 Health and Safety Control of Cross-Contamination

Section 11.0 Quality Assurance and Quality Control

Applicable procedures from the ORISE/ESSAP Quality Assurance Manual (Revision 7; January 31, 1995) include:

- Section 5 Training and Certification
- Section 6 Equipment and Instrumentation
- Section 7 Quality Control
- Section 8 Sample Chain-of-Custody
- Section 9 Data Management
- Section 10 Data Review and Validation
- Section 11 Records Handling and Storage

REFERENCES

Oak Ridge Institute for Science and Education (ORISE). Confirmatory Survey for the Repower Area, Fort St. Vrain, Platteville, Colorado. Oak Ridge, TN; June 1995a.

Oak Ridge Institute for Science and Education. Survey Procedures Manual for the Energy/Environment Systems Division, Environmental Survey and Site Assessment Program, Revision 7. Oak Ridge, Tennessee; April 30, 1995b.

Oak Ridge Institute for Science and Education. Quality Assurance Manual for the Energy/Environment Systems Division, Environmental Survey and Site Assessment Program, Revision 7. Oak Ridge, Tennessee; January 31, 1995c.

Oak Ridge Institute for Science and Education. Laboratory Procedures Manual for the Energy/Environment Systems Division, Environmental Survey and Site Assessment Program, Revision 9. Oak Ridge, Tennessee; January 31, 1995d.

Oak Ridge Institute for Science and Education Final Report-ORISE Support of NRC License Inspection at Fort St. Vrain on September 25 to 27, 1995. Oak Ridge, TN; March 1996a.

Oak Ridge Institute for Science and Education. Final Report-ORISE Support of NRC License Inspection at Fort St. Vrain on January 22 to 25, 1996. Oak Ridge, TN; March 1996b.

Oak Ridge Institute for Science and Education. Confirmatory Survey for the Fort St. Vrain Nuclear Station, Public Service Company of Colorado, Platteville, Colorado. Oak Ridge, TN; January 1997.

Public Service Company of Colorado (PSC). Fort St. Vrain Initial Radiological Site Characterization Report. April 30, 1992.

Public Service Company of Colorado, Final Survey Plan for Site Release, Revision 1. May 25, 1995a.

Public Service Company of Colorado. Final Survey Report for Release of Repower Area. March 2, 1995b.

Public Service Company of Colorado. Fort St. Vrain Nuclear Station Decommissioning Project, Final Survey Report (Volume 6). October 29, 1996.

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	PERFORMANCE PERIOD			
FY 97 SPE	From	То		
Name of Laboratory:	Mar-97	Jun-97		
Oak Ridge Institute for Science and I	Education	1. A. M. M. M. M.		
	RFTA	Est. Project Cost		
Title of Project: #TBD	TBD	\$31,800.00		
FSV-Liquid Effluent Pathway, Platter	ville, CO			
Fee or Non-Fee Recoverable:	NRC Fin Number	ORISE Number		
TAC Number:			A9093	TBD
COST ELEMENTS	Oct-96	Nov-96	Dec-96	Jan-97
Direct Costs	\$0.00	\$0.00	\$0.00	\$0.00
Indirect Costs- (G&A, DOE Factor)	\$0.00	\$0.00	\$0.00	\$0.00
Total Estimate Costs	\$0.00	\$0.00	\$0.00	\$0.00
Project Completion	0.00%	0.00%	0.00%	0.00%
COST ELEMENTS	Feb-97	Mar-97	Apr-97	May-97
Direct Costs	\$0.00	\$10,841.00	\$9,636.00	\$2,409.00
Indirect Costs- (G&A, DOE Factor)	\$0.00	\$3,469.00	\$3,084.00	\$771.00
Total Estimate Costs	\$0.00	\$14,310.00	\$12,720.00	\$3,180.00
Project Completion	0.00%	45.00%	85.00%	95.00%
COST ELEMENTS	Jun-97	Jul-97	Aug-97	Sep-97
Direct Costs	\$1,205.00	\$0.00	\$0.00	\$0.00
Indirect Costs- (G&A, DOE Factor)	\$385.00	\$0.00	\$0.00	\$0.00
Total Estimate Costs	\$1,590.00	\$0.00	\$0.00	\$0.00
Project Completion	100.00%	100.00%	100.00%	100.00%
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ACTIVITY INFORMATION	Hours	Estimated Cost		
Site Visit	0.0	\$0.00		
Document Review	0.0	\$0.00		
Presurvey	33.0	\$3,600.00		
Travel- Labor	36.0	\$3,900.00		
Travel- Other Expenses		\$5,800.00		
Survey Activities	84.0	\$9,900.00		
Report Preparation	54.0	\$6,300.00		
Sample Analysis	22.5	\$2,300.00		
Other	0.0	\$0.00		
Total	229.5	\$31,800.00		

ATTACHMENT A