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FUNCTIONAL DESIGN CRITERIA
SY TANK FARM CATHODIC PROTECTION, 95G-EWW-430

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for the
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RICHLAND OPERATIONS OFFICE
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1.0 INTRODUCTION

1.1 Background

Corrosion related failures have dominated the history of transfer line problems at Hanford. Failure of transfer lines can interrupt future waste transfers and cause significant repair and cleanup expenses. Engineering study WHC-SD-WM-ES-033, Rev. 1 *Justification for Applying Cathodic Protection to Underground Waste Lines in the 200 Area* (Carlson, 1984) identified a need for corrosion protection on the transfer lines. Moreover, corrosion protection is required by law on buried hazardous waste lines under Washington Administrative Code (WAC) 173-303-640.

Hazardous waste storage systems at Hanford are currently operating under interim status permit from the Washington Department of Ecology (WDOE). Upon passing an upcoming integrity assessment, the Hanford Site will be issued a final status permit from WDOE. At that time the Hanford Site will begin operating as a Permitted Dangerous Waste Storage Facility. Both WAC 173-303-640 and 173-303-400 require adequate corrosion protection for underground hazardous waste lines in Permitted Dangerous Waste Storage Facilities.

Cathodic protection is installed on transfer lines to mitigate external corrosion. Unprotected piping will experience uniform corrosion rates of 3 to 5 mils per year (mpy). However, localized corrosion rates at breaks in the coating may be much faster. Past studies have reported localized corrosion rates of 20 to 30 mpy can occur at breaks in coatings or insulation on pipelines in Hanford soils. These rates are capable of perforating a 6" schedule 40 carbon steel pipe in approximately 14 years. The 241-SY tank farm under consideration in this document is between 19 - 21 years old.

Project W-020H, "Waste Management Facilities Cathodic Protection Upgrade," along with preceding Project B-234, installed cathodic protection on buried carbon and stainless steel transfer lines and catch tanks. The work was divided into five phases or priorities. Priority 2 included the 241-U tank farm, the line from the 241-U tank farm to the 242-S evaporator, the 241-S tank farm complex, and the 241-SY tank farm. All of the Priority 2 work was completed with the exception of the work within the 241-SY tank farm and the cathodic protection installation around the 241-U-152 diversion box.

Some of the 241-SY cathodic protection work was descoped from Project W-020H in 1993 because the hydrogen mitigation work on the 101-SY tank was given higher priority, denying Project W-020H access to the 241-SY tank farm to finish the installation. Because of this, a partially complete cathodic protection system is currently installed in the 241-SY farm. While this is good for the transfer lines and structures that are being protected, there is a potential for accelerated corrosion of nearby transfer lines due to stray currents, and lack of cathodic protection.

The continued operation of the partial cathodic protection system in the 241-SY farm can accelerate corrosion rates to greater than 20 to 30 mpy on unprotected transfer lines near the operating systems. Since the hydrogen mitigation activities in the 241-SY farm have been reduced, the remaining portions of the existing cathodic protection system should be completed.

1.2 Scope

The objective of this project is to complete the installation of the 241-SY tank farm cathodic protection system previously interrupted by the hydrogen mitigation activities. This project does not complete the installation around the 241-U diversion box. Appendix "A" lists the operations needed to complete the remaining 241-SY tank farm cathodic protection system.

Cathodic protection shall be provided for the waste transfer lines identified as protected lines in Appendix "B" of this report. Cathodic protection will not be provided for other buried structures such as concrete encased pipelines, water lines, steam lines, vent lines, and other process lines not listed in the table in Appendix "B". However, all non-protected lines crossing protected lines, or in close proximity to protected lines, shall be bonded to the protected structure and have test leads attached to them. Other nearby structures will have test leads attached which will terminate at test stations so that unprotected structures can be monitored with the protected lines to assure that there are no stray current effects in that area. Bonding the isolated structures to protected structures shall be considered during design and construction.

1.3 Site Location

This document describes work to be completed in the 241-SY tank farm in the 200 West tank farm complex. Completion of the work scope will not result in an expansion or reduction of the existing facility size.

1.4 Project Interfaces

The hydrogen mitigation work within the SY Tank Farm has added a considerable amount of electrical, instrumentation, and structures to the SY Tank Farm, particularly around the 101-SY tank. This congestion could interfere with the designed excavation and augering. There could also be difficulty sustaining mobility for the construction equipment and maintaining operational access to the 101-SY tank. Prior to the startup of Project W-430, relevant personnel from other ongoing projects in areas that could be affected will be properly consulted and notified of the work scope.

The cathodic protection system installed under the scope of this project can produce stray currents that may have deleterious effects on

electrically isolated structures within the field of influence. Underground structures near the cathodically protected equipment shall be identified and, if necessary, shall be electrically bonded to the cathodic protection system. Analysis, post installation tests, and adjustments shall be made during the final energization survey to identify and minimize deleterious effects on electrically isolated structures.

Equipment loading and spark arresting measures will be considered when working over the tanks to install anodes and excavation for test stations and cable trenching. These issues will be addressed in the safety documentation.

All of the excavation in and around the tank farm shall performed by hand with the exception of augering the vertical anodes and the deep reference electrodes. Existing drawings and subsurface geophysical methods of locating underground interferences, such as ground penetration radar, shall be used prior to excavation.

2.0 PROJECT CRITERIA

This project shall utilize an impressed current cathodic protection system. All equipment shall be compatible with Project W-020H design and equipment/material presently installed in the 241-SY tank farm.

2.1 General Requirements

The cathodic protection system is designed and will be operated in accordance with the recommended practices of the NACE International, specifically Recommended Practice RP0169-92, *Control of External Corrosion on Underground or Submerged Metallic Piping Systems*.

Major equipment components have been designed for ease of replacement in the event of failure. Equipment is designed for ease of access during maintenance and data acquisition.

Underground structures shall be inspected at the point of bonding, prior to bonding, to determine the extent of existing corrosion by the cathodic protection cognizant engineer. If the corrosion is severe, the cathodic protection cognizant engineer shall determine if the structure would benefit from cathodic protection and if it can be safely applied.

2.2 Maximum/Minimum Capacities

Past operating experience has indicated that cathodic protection systems at Hanford must be oversized from calculated design to allow for system adjustment during the acceptance test procedure and annual system surveys. The cathodic protection system will be oversized to a degree based on passed operating experience with similar systems.

2.3 Quantities

The type and number of anodes, anode distribution boxes, test stations, cables, and electrical rectifiers for the facility installation has been determined and are shown on the H-2 Drawing 91024. Buried structures requiring cathodic protection that have not been previously identified shall be consistent with the design criteria of Project W-020H.

2.4 Degree of Reliability

The cathodic protection system is designed for continuous operation with a minimum of routine maintenance, exposure to accidental damage, and exposure to environmental damage. Components requiring maintenance shall be located to minimize the attraction or exposure to contaminated particles and to prevent the collection of contaminants in the equipment.

2.5 Intended Useful Life

All equipment and installations shall have a minimum design life of twenty years. Permanent reference electrodes shall be inspected and replaced as needed.

2.6 Number of Operating Personnel

The cathodic protection system is designed for continuous unattended operation. Test station monitoring and data collection in non-radiation zones will require one operator and one maintenance person. In contaminated zones, a health physics technician (HPT) will also be required.

2.7 Maintenance and Operation Requirements

Performance data will be collected and evaluated from key test stations by the designated cognizant organization. The entire 200 Area cathodic protection system's performance is reviewed annually. Rectifier operation shall be evaluated every other month for proper output. Equipment shall be replaced or repaired as needed. The annual cathodic protection surveys are performed following Tank Farm Maintenance Procedure 6-TF-357.

2.8 Discussion of Risks

Once installed, the cathodic protection system does not present undue hazards and risks due to fire, heat, explosion, and other industrial hazards. All above-ground equipment shall be installed in non-radiation zones, where possible. Non-PCB rectifier oil shall be used to mitigate personnel hazards.

2.8.1 Radiation Exposure

Installation of the cathodic protection equipment may present radiation and contamination exposure to construction personnel. All aspects of the installation shall limit exposure to radioactive and hazardous substances to As Low As Reasonably Achievable (ALARA). Installation shall not present risks above allowable limits, in accordance with 10 CFR 0835 "Occupational Radiation Protection" or the Hanford Site Radiological Control Manual (HSRCM-1 Rev. 2). The monitoring test stations are designed for installation where personnel safety risks and radiation exposure are minimized during survey activities.

2.8.2 Stray Currents

A potential risk from an operational standpoint of the cathodic protection system, is the possible generation of stray currents, which could subject surrounding metallic structures to accelerated corrosion rates. To minimize the possibility of stray currents affecting unprotected structures, reference drawings are carefully evaluated. Isolated structures are provided test leads so that they may be monitored. Jumper cables are used to electrically bond non-protected piping to the system. Reference electrodes will be placed adjacent to radioactive waste storage tanks and other known structures. The reference electrode cables will be routed to the test stations so that periodic surveys can be made to verify that stray currents are non-existent, or not of sufficient magnitude to cause accelerated corrosion of these structures. Any unknown pipes or metallic structures discovered during excavations will be provided test leads for future monitoring. Discovered structures located close enough to protected structures to be affected by stray current corrosion will be electrically bonded to the nearest protected structure to eliminate the risk of stray current corrosion. The elimination of any stray current corrosion problems will be verified during the Acceptance Test Procedure (ATP).

The impressed current design is a proven flexible system that can be readily adjusted to provide optimum protection and eliminate adverse corrosion conditions detected by monitoring. The type of impressed current design used calls for a distributed anode ground bed, meaning the anodes are installed along the transfer lines to be protected. By design, this type of impressed current system minimizes stray current interference to other adjacent structures that are not electrically common. Following completion of construction, an energization survey will be conducted to verify that the installed systems provide proper levels of cathodic protection. Any stray current problems noted will be identified and eliminated. Past monitoring of completed cathodic protection systems has shown that these systems are functioning as designed.

3.0 PROCESS CRITERIA

3.1 Instrumentation and Control

The project will involve the installation and use of a rectifier and 14 test stations to monitor the performance of the cathodic protection system. Test stations are of a standard design previously purchased for Project W-020 Priority 2. Equipment specifications will be documented in the definitive design.

3.2 Piping and Vessels

Not applicable.

3.3 General Process

Not applicable.

3.4 General Mechanical Processes

Not applicable.

4.0 FACILITY CRITERIA

4.1 Architectural and Civil/Structural

Not applicable.

4.2 Heating, Ventilating, and Air Conditioning

Not applicable.

4.3 Utilities

Existing utilities as defined by the definitive design documentation will be utilized whenever possible for this project.

4.3.1 Electrical

The cathodic protection system shall utilize existing electrical utilities as defined in the definitive design documentation when possible. Emergency power shall not be required for the cathodic protection system.

4.4 Communication Systems

Existing communication systems will be used during system surveys and maintenance when necessary. No new communication systems will be required.

4.5 Automatic Data Processing

Not applicable.

4.6 Energy Conservation

Not applicable.

4.7 Maintenance

Minimal maintenance requirements are involved in the operation of the cathodic protection system. When possible, rectifiers will be located outside of the radiologically controlled area to minimize radiation and contamination hazards to service personnel (ALARA). The rectifier will require bimonthly surveys to verify proper operation and annual surveys will be required on any and/or all test stations. Location of the test stations will consider potential contamination hazards.

4.7.1 Facility

The cathodic protection installation will involve access to the 241-SY tank farm. The existing facility performance will not be affected by the operation of this system.

4.7.2 Equipment

The project will utilize equipment previously procured for Project W-020 Priority 2 whenever possible. The equipment is currently stored in 2101-M. If a stored component has degraded in storage to the point that it can no longer meet the service or design life requirements, a replacement component of equal quality will be procured. Any additional equipment will meet or exceed the requirements spelled out under Project W-020 Priority 2.

4.7.3 Materials

Not applicable.

5.0 GENERAL REQUIREMENTS

5.1 Safety

The hydrogen mitigation work within the SY Tank Farm has added a considerable amount of electrical, instrumentation, and structures to the SY Tank Farm, particularly around the 101-SY tank. This congestion will interfere with the designed excavation and augering. There will be difficulty sustaining mobility for the construction equipment and maintaining operational access to the 101-SY tank.

Equipment loading and spark arresting measures will be considered when working over the tanks to install anodes and excavation for test stations and cable trenching. All of the excavation in and around the tank farm shall be performed by hand with the exception of augering the vertical anodes and the deep reference electrodes. Existing drawings and subsurface geophysical methods, such as ground penetration radar, shall be used to locate underground interferences prior to excavation.

Installation of the cathodic protection equipment may present radiation and contamination exposure to construction personnel. All aspects of the installation shall limit exposure to radioactive and hazardous substances to As Low As Reasonably Achievable (ALARA). Installation shall not present risks above allowable limits, in accordance with 10 CFR 0835 "Occupational Radiation Protection" or the Hanford Site Radiological Control Manual (HSRCM-1 Rev. 2). The monitoring test stations are designed for installation where personnel safety risks and radiation exposure are minimized during survey activities.

Once installed, the cathodic protection system does not present undue hazards and risks due to fire, heat, explosion, and other industrial hazards. All above-ground equipment shall be installed in non-radiation zones, where possible. Non-PCB rectifier oil shall be used to mitigate personnel hazards.

5.1.1 Criticality

Not applicable.

5.1.2 Safety analysis

The safety classification for the cathodic protection system is Safety Class 3. No impact to the hazard classification of existing facilities exists. The installation and operation of the cathodic protection system is within the analyzed bounds of the FSAR.

5.1.3 Contamination control

Not applicable.

5.1.4 Shielding

Installation of the cathodic protection equipment may present radiation and contamination exposure to construction personnel. Temporary shielding shall be used when necessary. All aspects of the installation shall limit exposure to radioactive and hazardous substances to As Low As Reasonably Achievable (ALARA). Installation shall not present risks above allowable limits, in accordance with 10 CFR 0835 "Occupational Radiation Protection" or the Hanford Site Radiological Control Manual (HSRCM-1 Rev. 2).

5.1.5 Industrial safety

Once installed, the cathodic protection system does not present undue hazards and risks due to fire, heat, explosion, and other industrial hazards. All above-ground equipment shall be installed in non-radiation zones, where possible. Non-PCB rectifier oil shall be used to mitigate personnel hazards.

5.1.6 Fire Protection

Not applicable.

5.1.7 Traffic safety

Not applicable.

5.2 Environmental Protection and Compliance

Not applicable.

5.3 Safeguards and Security

Existing safeguards and security measures will not be impacted by this project. Construction personnel requiring access to limited and protected areas will require security clearance and/or a cleared escort, as required.

5.4 Natural Forces

The upgrades provided by this project shall be designed in accordance with SDC 4.1, "Design Loads for Facilities," for non-Category I facilities.

5.5 Design Format

Test station sketches shall be as-built as installations are completed. These sketches shall be included into a supporting document that will be used to present the as-built condition. Sketches will also show the location of jumper cables and negative return cable attachments.

A schematic cathodic protection system drawing will be created, which will be identified as H-14. This system drawing will include Tank Waste Remediation System equipment identification numbers.

5.6 Quality Assurance

Quality assurance/control activities for all contractors involved in design, construction, and acceptance testing shall be executed in accordance with the project specific Quality Assurance Program Plan

(QAPP). The QAPP shall be developed during conceptual design. It shall be used by the design contractor to develop verification criteria in design documents (i.e., drawings, specifications, test procedures) and by all contractors to define quality assurance interfaces and specific quality requirements/responsibilities on the project.

The QAPP shall require compliance with the quality criteria of DOE Orders 5700.6C, 6430.1A, Section 0140, and RLIP 4700.1A.

The basis for establishing Quality Assurance Program requirements is Safety Classification as defined in MRP 5.46 "Safety Classifications of Systems, Components and Structures." The safety classifications of items provides a graded approach to application of quality requirements. This graded approach assigns requirements to items commensurate with the function of each system, component and structure in preventing or mitigating the consequences of hazards and postulated design basis accidents.

5.7 Decontamination and Decommissioning

This FDC covers the installation of a cathodic protection system in the 241-SY tank farm. Equipment will be installed and left in place. No decontamination or decommissioning operations will be necessary.

5.7.1 DOE Regulations

Not applicable.

5.7.2 Miscellaneous Design Features

Not applicable.

5.8 Operating Personnel and Services

System will be operated, surveyed and maintained by existing tank farm operations and maintenance personnel under the direction of the cathodic protection cognizant engineer.

5.9 Testing

Complete cathodic protection system will be surveyed annually and adjusted as necessary by appropriate tank farm operations and maintenance personnel under the direction of the cathodic protection cognizant engineer. Rectifiers shall be checked for proper operation on a bi-monthly basis by appropriate tank farm operations or maintenance personnel under the direction of the cathodic protection cognizant engineer.

6.0 CODES AND STANDARDS

Design was originally performed in accordance with the listed standards under Project W-020H, "Waste Management Facilities Cathodic Protection System." Subsequent design, engineering, and construction shall be in accordance with the latest codes and standards.

- a. 10-CFR-0835, "Occupational Radiation Protection," *Code of Federal Regulations*
- b. DOE Order 5480.1B, "Environmental Protection, Safety, and Health Protection Program for Department of Energy Operations"
- c. DOE Order 5480.2, "Radioactive Waste Management"
- d. DOE Order 5480.21, *Unreviewed Safety Questions*
- e. DOE Order 5480.22, *Technical Safety Requirements*
- f. DOE Order 5480.23, "Nuclear Safety Analysis Reports"
- g. DOE Order 5480.4, *Environmental Protection, Safety, and Health Protection Standards*
- h. DOE Order 5483.1A, *Occupational Safety and Health Program for DOE Contractor Employees at Government-Owned Contractor-Operated Facilities*
- i. DOE-RL Order 4700.1A, *Project Management System*
- j. DOE-RL Order 5700.6C, *Quality Assurance*
- k. DOE Order 6430.1A, *General Design Criteria*
- l. Hanford A/E Standards - The interfacing of this project with other Hanford projects, facilities, and operations can best be accomplished by use of Hanford A/E Standards, and where such interfacing is required these standards shall be followed. Where ALARA or OSHA standards are more applicable, they shall be used. Hanford A/E Standards shall be used as guides and other Hanford Plant Standards shall be used as reference.
- m. HSRCM-1, *Hanford Site Radiological Control Manual*
- n. NACE International Standard RP0169-92 Recommended Practice, *Control of External Corrosion on Underground and Submerged Metallic Piping Systems*
- o. SDC-1.2 "Hanford Plant Standards and National Codes and Standards"
- p. SDC-1.3 "Preparation and Control of Engineering and Fabrication Drawings"
- q. SDC-4.1, "Design Loads for Facilities"
- r. WAC 173-303-400, "Interim Status Facility Standards," *Washington Administrative Code*
- s. WAC 173-303-640, "Tank Systems," *Washington Administrative Code*
- t. WHC Maintenance Technical Services Preventive Maintenance Procedure 6-TF-357, *Testing of Cathodic Protection System*

In addition to the above standards, applicable OSHA and ALARA standards will be used when necessary as defined by the cathodic protection cognizant engineer. The latest applicable edition of all codes and standards shall be used.

7.0 REFERENCES

Carlson, T. A. and R. F. Jimenez, 1984, *Justification for Applying Cathodic Protection to Underground Waste Lines in the 200 Areas*, WHC-SD-WM-ES-033, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

DeWeese, G. C., 1989, *Functional Design Criteria, Waste Management Facilities Cathodic Protection System, Project W-020*, WHC-SD-W020-FDC-001, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

APPENDIXES

APPENDIX A: RECTIFIER #36 SYSTEM

THIS APPENDIX IS FOR ARCHITECT-ENGINEER INFORMATION ONLY

Completion of the remaining 241-SY tank farm cathodic protection system involves the following operations:

- . Install Rectifier #36, including concrete pad.
- . Install 14 test stations.
- . Install 14 horizontal anodes at a depth of four feet, using hand excavation.
- . Install 10 vertical anodes each into a separate 12-inch diameter hole to a depth of 12 feet.
- . Install six deep-reference electrodes (requires augering to a depth of 25 feet within 3 feet of the outside perimeter of the waste tanks). This will permit stray current monitoring of the tank.
- . Excavate approximately 500 feet of trenching and install anode feeder and loop cable. Attach newly-installed anodes (24) and previously installed anodes (35) to the anode feeder cable.
- . Excavate around the perimeter of 241 SY-A and B Valve Pits. Attach jumper cables to all of the piping to assure the piping is electrically continuous.
- . Prepare and perform an Acceptance Test Procedure and Final Energization Survey.

APPENDIX B: TRANSFER LINES TO BE PROTECTED

THIS APPENDIX IS FOR ARCHITECT-ENGINEER INFORMATION ONLY

The following table of transfer lines indicates the principle lines for protection only. Other structures and lines, such as drain lines and process water piping, within the current flow field of the anodes will be electrically bonded to the principle pipes for protection. This includes both known lines and unknown lines excavated during installation.

Transfer Line	Function	Test Station
SL-175	242-S TO SY-A	T24-7
SL-177	SY FARM PROCESS	T24-8
SL-178	SY FARM PROCESS	T24-13
SL-179	SY FARM PROCESS	T24-15
SL-180	SY FARM PROCESS	T24-5
SN-277	SY FARM PROCESS	T24-9
SN-278	SY FARM PROCESS	T24-14
SN-279	SY FARM PROCESS	T24-16
SN-280	SY FARM PROCESS	T24-6
SN-282	241-S-152/SY-B PIT	T24-11
SN-283	242-S TO SY-B	
SN-284	242-S TO SY-B	
SN-285	SY FARM PROCESS	T24-10
SN-286	SY FARM PROCESS	T24-12
V561	SY-A, SY-B TO 244-S	T24-3
V562	SY-A, SY-B TO 244-S	T24-4
W DR 327	241-U TO 241-SY	

APPENDIX C: PROJECT W-020H FUNCTIONAL DESIGN CRITERIA

THIS APPENDIX IS FOR ARCHITECT-ENGINEER INFORMATION ONLY

Attached is a copy of *Functional Design Criteria, Waste Management Facilities Cathodic Protection System, Project W-020H*, WHC-SD-W020-FDC-001, Rev. 0.

REV 0

FUNCTIONAL DESIGN CRITERIA
WASTE MANAGEMENT FACILITIES CATHODIC PROTECTION SYSTEM
PROJECT W-020

Prepared by:

DEFENSE WASTE MANAGEMENT DIVISION
WESTINGHOUSE HANFORD COMPANY

for

UNITED STATES DEPARTMENT OF ENERGY
RICHLAND OPERATIONS OFFICE

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1.0 INTRODUCTION

1.1 Background

Westinghouse Hanford Company (WHC) operates facilities in the 200 Areas that utilize buried carbon and stainless steel pipelines and catch tanks to transfer radioactively contaminated solutions. The pipelines form a vast network connecting process plants, underground tank farms, and evaporators. The steels are subject to external galvanic corrosion due to chemical activity with elements in the soil. The objectives of this project are to provide waste management facilities with a cathodic protection system that will minimize the impact to Hanford waste management operations caused by waste line failure and ensure safe and environmentally sound waste management operating conditions. This document provides the Functional Design Criteria (FDC) for upgrading the cathodic protection system for specific facilities in the 200 East and West Areas.

Project B-234, "Upgrade of Hanford Site 200 Areas Cathodic Protection Systems," was originally intended to complete the upgrades in the 200 Areas cathodic protection system. Because of funding constraints, only high priority lines were completed under the scope of Project B-234.

This upgrading program will provide a cathodic protection system for galvanic corrosion protection of the next higher priority buried carbon and stainless steel process piping systems and catch tanks that are used to transfer radioactive and/or hazardous materials. This cathodic protection system will protect the underground piping and equipment against future galvanic corrosion in accordance with the recommended practices of the National Association of Corrosion Engineers.

1.2 Scope

Cathodic protection shall be provided for buried process waste lines and catch tanks identified for use beyond the end of the stabilization and isolation program. Cathodic protection will not be provided for other buried structures such as concrete encased pipelines, water lines, steam lines, vent lines, and process lines not discussed below or listed in the Appendix. The waste management facilities identified to receive cathodic protection are grouped according to the area of location. These groups are identified in Table 1 below.

Structures within the effective current flow field not bonded to protected facilities are subject to accelerated rates of corrosion. Bonding of electrically isolated facilities to protected structures shall be considered during the design, construction, and test/adjustment phases to preclude deleterious effects.

Table 1 Waste Management Facilities Groups to be Cathodically Protected

GROUP	AREA DESCRIPTION
I	A, AN, AX, AY, AZ Tank Farms AR Vault
II	SY Tank Farm, 241-U-151 Areas
III	B Plant Area
IV	T Plant, 202-S, 241-TX-152, PFP Areas
V	PUREX Area

See Appendix I for a listing of specific facilities identified to be cathodically protected.

The cathodic protection system designed under Project B-234 utilized an impressed current cathodic protection system. This project shall utilize an impressed current cathodic protection system and all equipment shall be compatible with Project B-234 design.

1.3 Justification

Carbon steel line encasements act as a barrier to the environment in the event of an inner line leak. Underground waste transfer line encasements and tanks are subject to corrosive attack by elements in the soil. The expected life of carbon steel pipelines under conditions at the Hanford Site is limited by the effects of external galvanic corrosion. Without corrosion protection, the expected life of new carbon steel encasement lines is 15 years or less (see reference 2).

The expected life of new cathodically protected carbon steel encasement lines is approximately 100 years based on external galvanic corrosion considerations only. Cathodic protection increases the life expectancy of underground steel structures and enhances safe operating conditions by minimizing environmental impacts and exposure to personnel caused by releases due to corrosive failure. Corrosion prevention is in keeping with DOE commitments to ensure integrity of encasement lines.

2.0 FUNCTIONS

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2.1 Maximum/Minimum Capacities

The cathodic protection system shall be designed to provide for system changes and growth provisions. Growth provision capacity shall not exceed 50% of design requirements.

2.2 Quantities

The type and number of anodes, test stations, and electrical rectifiers for the majority of the facilities included in the scope of this project have been determined and are shown on the Project B-234 definitive design drawings. Equipment quantities and types for lines requiring cathodic protection that have not been designed shall be consistent with Project B-234.

2.3 Degree of Reliability

The upgraded cathodic protection system shall be designed and installed for a minimum of routine maintenance, exposure to accidental damage, or exposure to environmental damage. Maintained equipment shall be located to minimize the attraction or exposure to contaminated particles and to prevent the collection of contaminants in the equipment.

2.4 Intended Useful Life

All equipment and installations with the exception of the permanent reference electrodes shall have a minimum design life of twenty years. Permanent reference electrodes shall be inspected and replaced as needed.

3.0 DESIGN PARAMETERS

3.1 General Requirements

The cathodic protection system shall be designed to maintain a -0.85 volt differential between the anode and the protected equipment. Design and bonding of protected lines and structures shall be in accordance with the recommended practices of the National Association of Corrosion Engineers (NACE).

Major equipment components shall be designed for ease of replacement in the event of failure. Equipment shall be designed for ease of access during maintenance and data acquisition. The cathodic protection system installed under the scope of this project can produce stray currents that may have deleterious effects on electrically isolated structures within the current

flow field. Underground structures near cathodically protected equipment shall be identified and if necessary, shall be electrically connected to the cathodic protection system. Analysis, post installation tests, and adjustments shall be made to identify and minimize deleterious effects on electrically isolated structures.

Underground structures shall be inspected prior to bonding to determine the extent of existing corrosion. If the corrosion is severe, the designated user representative shall determine if the structure would benefit from cathodic protection.

3.2 Number of Operating Personnel

The cathodic protection system shall be designed for unattended operation. Test station monitoring and data collection in non-radiation zones will require one operator and one maintenance person in each of the 200 Areas. In radiation zones, a radiation protection technologist (RPT) will also be required.

3.3 Maintenance and Operation Requirements

Performance and maintenance data will be collected and evaluated from key monitor test stations at least quarterly by the designated user organization. The entire cathodic protection system's performance shall be reviewed annually. Rectifiers shall be reviewed every other month for proper output. Performance and maintenance data shall be in accordance with the Project B-234 Operation and Maintenance Manual, Reference 5. Equipment shall be replaced or repaired as needed.

3.4 Communications Services

No new communication services will be required.

3.5 Utilities Requirements

The cathodic protection system shall utilize existing electrical utilities when possible. Emergency power shall not be required for the cathodic protection system under the scope of this project.

3.6 Site Location

The upgrade cathodic protection system shall be located in the 200 East and 200 West Areas.

4.0 SAFETY REQUIREMENTS

4.1 Discussion of Risks

Installation of the cathodic protection equipment may present radiation exposure risks to construction personnel. All construction operations to install the cathodic protection system shall limit exposure to radioactive and hazardous substances to as low as reasonably achievable (ALARA). Construction operations shall not present risks above allowable limits and shall be in accordance with DOE Order 5480.1A. The monitor test stations shall be designed for installation where personnel safety risks and radiation exposure are minimized during testing and monitoring activities.

Once installed, the cathodic protection system does not present hazards and risks due to fire, heat, explosion, and other industrial hazards. All above ground equipment shall be installed in non-radiation zones, where possible. A discussion of safety issues and operational risks is attached as Appendix V.

4.2 Impact Level

An Impact Level indicator as defined in DOE-RL Order 5700.2A, "Project Management," of Impact Level 3 is assigned for this project. Failure of this system could impact normal facility operations and services if undetected for extended periods by exposing piping to corrosive soil conditions, but would not expose personnel to radioactive, hazardous, or toxic materials above established limits.

4.3 Natural Forces Criteria

The upgrades provided by this project shall be designed in accordance with SDC 4.1, "Design Loads for Facilities," for non-Category I facilities.

5.0 SECURITY AND SAFEGUARDS

Existing safeguards and security measures will not be impacted by this project. Construction personnel requiring access to limited and protected areas will require security clearance and/or a cleared escort as required.

6.0 QUALITY ASSURANCE

Quality Assurance (QA) activities for all contractors involved in design, construction, and testing of the project shall be formulated and executed in accordance with the construction project specific Quality Assurance Plan. Program requirements established in the specific Quality Assurance Plan shall be consistent with DOE-RL Order 5700.6B "Quality Assurance."

7.0 CODES AND STANDARDS

Design was originally performed in accordance with the listed standards under Project B-234, "Upgrade of Cathodic Protection Systems - 200 Areas." However, later issuances of some of these standards are now in use. Construction and subsequent design and engineering shall be in accordance with the latest codes and standards.

- (a) DOE-RL Order 5700.2A, "Project Management Systems"
- (b) DOE-RL Order 5700.6B, "Quality Assurance"
- (c) DOE Order 6430.1A, "Facilities General Design Criteria"
- (d) DOE Order 5480.1B, "Environmental Protection, Safety, and Health Protection Program for Department of Energy Operations"
- (e) DOE Order 5480.4 "Environmental Protection, Safety and Health Protection Standards"
- (f) DOE Order 5820.2, "Radioactive Waste Management"
- (g) DOE Order 5483.1A, "Occupational Safety and Health Program for DOE Contractor Employees at Government-Owned Contractor-Operated Facilities"
- (h) NACE-RP-01-69, "Control of External Corrosion on Underground and Submerged Metallic Piping Systems"
- (i) Hanford A/E Standards - The interfacing of this project with other Hanford projects, facilities, and operations can best be accomplished by use of Hanford A/E Standards, and where such interfacing is required these standards shall be followed. Where National "Consensus Codes" are more applicable, they shall be used. Hanford A/E Standards shall be used as guides and other Hanford Plant Standards shall be used as reference.

SDC 1.1 "Design Criteria, Specifications, Acceptance Test Procedures and Certified Vendor Information Files"

- SDC 1.2 "Hanford A/E Standards and National Codes and Standards"
- SDC 1.3 "Preparation and Control of Engineering and Architectural Drawings"
- SDC 7.10 "Corrosion Protection"

In addition to the above standards, the Occupational Safety and Health Act Standards and the "National Consensus" codes and standards, as developed by organizations such as the American Society of Mechanical Engineers, American National Standards Institute, and the Institute of Electrical and Electronic Engineers, shall be used as necessary. The latest applicable edition of all codes and standards shall be used.

APPENDICES

- Appendix I: Waste Management Lines and Facilities to be Cathodically Protected
- Appendix II: Waste Management Lines and Facilities Deleted From Scope
- Appendix III: Reference Drawings
- Appendix IV: Reference Documentation
- Appendix V: Discussion of Safety Issues

(These Appendices Are Provided For A/E Information Only)

APPENDIX I

Waste Management Facilities to be Cathodically Protected

Lines and facilities identified to be protected under the scope of Project W-020 are listed below. Several of the lines were not identified under Project B-693. Additions are identified by an asterisk (*) following the facility or line number. A portion of the lines have not been identified with unique numbers and are identified by the pipe specification on existing drawings. These lines shall not be numbered during the conceptual or definitive design for identification purposes. Non-numbered lines are identified with "NONUM" and/or the size and piping specification.

The lines and facilities were evaluated to determine the need for cathodic protection. The need for cathodic protection is based on the following considerations; (1) past and future use, (2) operational and environmental impact in the event of failure, and (3) age. The facilities were given priorities based primarily on the considerations above. Priorities vary from 1 to 5, with 1 as the highest priority item. Highest priority lines and facilities shall be protected first. These priorities shall be used to outlay design and construction budget and schedule design and construction activities.

Failure of the process lines would have the greatest impact to both operations and the environment. Failure of the process line encasements may also lower leak detection capabilities. Failed encasements would not act as a second barrier to the environment in accordance with DOE commitments. These lines transfer the more radioactive liquids as compared to the remaining lines. For these reasons process lines were assigned the highest priorities.

It is planned that discharges to soil columns will be discontinued by 1995. The environmental impact of a crib line failure is insignificant and the lines could be more easily repaired than process lines. Cathodic protection of these lines is not technically defensible. Therefore, the transfer lines and associated equipment for the B Plant and PUREX cribs were deleted from the scope of the project. A detailed list of lines is provided in Appendix II.

Older lines may not benefit from cathodic protection once corrosion has progressed and line integrity is in jeopardy. Therefore, older lines were assigned slightly lower priorities compared to the newer lines. Past use was also considered, as residual wastes in the lines could affect the degree of contamination of solutions being transferred.

Facilities to be cathodically protected are listed in Appendix I below. Individual facilities are grouped according to their location. Priorities and comments are also provided.

LINE/FACILITY	FUNCTION	PRIORITY	COMMENT	H-2 DWG
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Group I Lines and Facilities

4608/4550	101-AY TRANSFER	1		91041
DR370	AX-A TO 102-AY	1		91041
PW4522	AY TO 241-AX-152	1		91041
PW4523	AY LEAK DETECTION	1		91041
PW4526	241-AX-152-TO LEAK DETECTION	1		91041
PW4532	102-AY ANNULUS PIT	1		91041
SL504	102-AY TO 101-AY	1		91041
SL505	101-AY	1		91041
DR314	TO AX-B PIT	1		91041
DR314	TO 241-A FARM	1		91042
DR326	AX-A PIT	1		91041
DR327	AX-B PIT	1		91041
DR336	AX DRAIN	1		91041
DR337	AX FARM LEAK DETECTOR	1		91041
SL100	TO AX-A PIT	1		91041
SL100	241-A-B	1		91042
SL101	TO AX-A PIT	1		91041
SL101	241-A-A	1		91042
SL160	AN PROCESS LINE	1		91040
SL161	AN PROCESS LINE	1		91040
SL162	AN PROCESS LINE	1		91040
SL163	AN PROCESS LINE	1		91040
SL164	AN PROCESS LINE	1		91040
SL165	AN PROCESS LINE	1		91040
SL166	AN PROCESS LINE	1		91040
SL167	AN PROCESS LINE	1		91040
SL168	241-AN-A TO 241-AN-B	1		71989
SL500	TO 102-AZ	1		91040
SL500	TO 241-AX-A PIT	1		91041
SL502	102-AY TO AX-B PIT	1		91041
SL503	102-AY	1		91041
SN260	AN PROCESS LINE	1		91040
SN261	AN PROCESS LINE	1		91040
SN262	AN PROCESS LINE	1		91040
SN263	AN PROCESS LINE	1		91040
SN264	AN PROCESS LINE	1		91040
SN265	AN PROCESS LINE	1		91040
SN266	AN PROCESS LINE	1		91040
SN267	AN PROCESS LINE	1		91040
SN268	AN PROCESS LINE	1		71989
SN600	TO 102-AZ	1		91040
SN600	TO 241-AX-B PIT	1		91041
AN02	101-AN TO 241-A-401	1	ALSO ON DWGS 91041,42	91040

Waste Management Facilities to be Cathodically Protected (cont.)

LINE/FACILITY	FUNCTION	PRIORITY	COMMENT	H-2 DWG
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Group I Lines and Facilities (cont.)

AN92	101-AN	1		91040
AN92	101-AN TO 241-A-401	1		91041
AN92	241-A-401	1		91042
SN247	TO 101-AN	1		91040
SN247	TO 241-AX-B PIT	1		91041
SN234*	244-A LIFT STA.	1	NEW LINE, LEADS INST.	91043
	TO 241-ER-153		TIE INTO NEAREST TEST STA.	
3"DR M19	244-A TO 241-ER-153	1		91043
SN232	244-A TO 241-ER-153	1		91043
SN233	244-A TO 241-ER-153	1		91043
SN215	244-A TO 241-AA	1	ALSO ON 91042	91043
SN216	244-A TO 241-AB	1	ALSO ON 91042	91043
ANNULUS VENT LINES*	101 AND 102-AY TANKS	1	NEWLY REPLACED, ANODES REQUIRED, TEST STATIONS INSTALLED	71989
PW4531	101-AY	1	TEST STATIONS INSTALLED	91041
4"DR M5	AR VAULT	1	TEST STATIONS INSTALLED	77152
4"DR M5	AR VAULT	1	TEST STATIONS INSTALLED	77152
8"RW M5	AR VAULT	1	TEST STATIONS INSTALLED	77152
4"CRW M5	AR VAULT	1	TEST STATIONS INSTALLED	77152
4"CWS M5	AR VAULT	1	TEST STATIONS INSTALLED	77152

Group II Lines and Facilities

478-1	U-151 DIVERSION BOX	2		91022
SL101*	U-D PIT TO	2		91022
	241-S-152			
SN264*	U-D PIT TO 244-U	2		91022
SN265*	U-D PIT TO 244-U	2		91022
SN266*	U-D PIT TO 244-U	2		91022
V452/422*	241-U-151 TO	2		91022
	241-U-152			
V453/421*	241-U-151 TO	2		91022
	241-U-152			
V455	U-151 DIVERSION BOX	2		91022
V456	U-151 DIVERSION BOX	2		91022
241-S-302A	CATCH TANK	2		91024
V456	244-S	2		91024
V522	241-S-151 TO	2		91024
	244-S			

Waste Management Facilities to be Cathodically Protected (cont.)

LINE/FACILITY	FUNCTION	PRIORITY	COMMENT	H-2 DWG
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Group II Lines and Facilities (cont.)

V543	S-151 DIVERSION BOX TO S-302A CATCH TANK	2		91024
V560	241-S-151 TO 244-S	2		91024
V594	241-S-151 TO 244-S	2		91024
SN216	244-U TO SY-B PIT	2		91022
SN216	TO 241-S-152	2		91023
SN282	241-S-152	2		91023
SN282	SY-B PIT	2	TIED INTO SN216	91024
W DR327*	241-U	2		91022
W DR327*	244-U TO 241-SY	2		91023
V561	SY-A, SY-B TO 244-S	2		91024
V562	SY-A, SY-B TO 244-S	2		91024
SL-177	SY FARM PROCESS	2		91024
SL-178	SY FARM PROCESS	2		91024
SL-179	SY FARM PROCESS	2		91024
SL-180	SY FARM PROCESS	2		91024
SN277	SY FARM PROCESS	2		91024
SN278	SY FARM PROCESS	2		91024
SN279	SY FARM PROCESS	2		91024
SN280	SY FARM PROCESS	2		91024
SN285	SY FARM PROCESS	2		91024
SN286	SY FARM PROCESS	2		91024
SL-175/138*	242-S TO SY-A	2	SL-175 TIED INTO SL-138 ADD TEST STATION	91023
SN-283, 284*	242-S TO SY-B	2	ADD TEST STATIONS	91024
V404	241-U-152	2		91022
V398	241-U-152	2		91022

Group III Lines and Facilities

1" M9 SST	EXHAUST STACK 291-B	3		91039
2" M8 DRAIN	EXHAUST STACK 291-B	3		91039
3/4" M9 DRAIN	EXHAUST STACK 291-B	3		91039
BCP107	221-B8 TO CRIB	3	PROTECT UPSTREAM OF 221-BF, ALSO ON 91038	91039
4" PCD M2	221-B CONF. BLDG	3	SEE ABOVE (BCP107)	91039
4" PCD M35	B-PLANT CRIB 221-B8	3	SEE ABOVE	91039
8" SCD M35	TO 221-B8	3	SEE ABOVE	91039
BCP101	221-BF EFFLUENT CONTROL	3	SEE ABOVE	91038

Waste Management Facilities to be Cathodically Protected (cont.)

LINE/FACILITY	FUNCTION	PRIORITY	COMMENT	H-2 DWG
Group III Lines and Facilities (cont.)				
BCP105	221-BF EFFLUENT CONTROL	3	PROTECT NEAR 221-BF	91038
BCP106	221-BF EFFLUENT CONTROL	3	PROTECT NEAR 221-BF	91038
BCS201	221-BF EFFLUENT CONTROL	3	PROTECT UPSTREAM OF 221-BF	91038
34" UG DUCT	225-BD BLDG TO K-1-1 FILTER	3		91038
4" CDH M9	225-BD BLDG TO K-1-1 FILTER	3		91038
CDH3018	ER-152 TO K-3 AND K-1-1 FILTERS	3		91038
DR9219	ER-152 TO K-3 AND K-1-1 FILTERS	3		91038
DR9220	ER-152 TO K-3 AND K-1-1 FILTERS	3		91038
DR9221	ER-152 TO K-3 AND K-1-1 FILTERS	3		91038
18" DRAIN*	291-BA TO VALVE PIT	3	INSTALL TEST STAS. BOND TO NEW 8" DRAIN	91039
DR9253	K-3, K-1-1 FILTERS TO ER-152	3		91038
LLW4002	ER-152 TO K-3 AND K-1-1 FILTERS	3		91038
LLW4076	ER-152 TO K-3 AND K-1-1 FILTERS	3		91038
241-ER-311	CATCH TANK	3		91037
V224	ER-152 TO ER-311	3		91037
V226	ER-151 TO ER-311	3		91037
V226-1	ER-151 TO ER-311	3		91037
V229	ER-152 TO ER-151	3		91037
V244	ER-152 TO K-3 AND K-1-1 FILTERS	3		91038
V8912	ER-152 TO K-3 AND K-1-1 FILTERS	3		91038
Group IV Lines and Facilities				
DR820	241-TX-152 DIVERSION BOX	4		91025
V387	241-TX-152	4		91025
V398	241-TX-152	4		91025
V404	241-TX-152	4		91025
241-UX-302	CATCH TANK	4		91025

Waste Management Facilities to be Cathodically Protected (cont.)

LINE/FACILITY	FUNCTION	PRIORITY	COMMENT	H-2 DWG
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Group IV Lines and Facilities (cont.)

241-TX-302C	CATCH TANK	4		91025
V402	241-TY-153 TO	4		91021
	244-TX			
V406	241-TY-153 TO	4		91021
	244-TX			
V408	241-TY-153 TO	4		91021
	244-TX			
202	FROM 241-Z PITS	4	ALSO ON DWGS 91019,	91018
	TO 244-TX		91020 AND 91021	
203	FROM 241-Z PITS	4	ALSO ON DWGS 91019,	91018
	TO 244-TX		91020, AND 91021	

Group V Lines and Facilities

3"DR M8 NONUM	291-A FILTER #2	5	LINE NOT NUMBERED	91035
3" M21 NONUM	202A CATCH TANK TO	5	TEST STATIONS INSTALLED	91035
	302-A CATCH TANK		ANODES NEEDED, NO NUMBER	
DP-1...DP-22	291-A FILTER #2	5		91035
T020	291-A FILTER #1 TO	5		91035
	STACK SAMPLING			
T021	PUREX CRIB LINE	5		91035
T022	FILTER TO STACK	5		91035
	SAMPLING			
T127	FAN PLENUM TO 216-A	5		91035
	SAMPLE PIT			
T160	SAMPLE PIT TO	5		91035
	216-A-TK-2			
T168	SAMPLE PIT TO	5		91035
	216-A-TK-2			
U285	LAB WASTE	5		91035
V027	302A CATCH TANK TO	5		91035
	151-A DIVERSION BOX			
V028	302A CATCH TANK TO	5		91035
	151-A DIVERSION BOX			
X101	PUREX TUNNEL TO	5		91035
	202A			

APPENDIX II

Waste Management Lines and Facilities Deleted from Scope

Several lines and facilities identified under Project B-234 are no longer used, and therefore, shall not receive cathodic protection. These facilities are identified in Appendix II below. These facilities were deleted because they are no longer used, have developed leaks, are planned to be removed from service in the near future, or do not meet the criteria to be cathodically protected.

LINE/FACILITY	FUNCTION	PRIORITY	COMMENT
240-S-302	CATCH TANK	N/A	LEAKING, ELIMINATES ONE RECTIFIER, GROUP II TANK
V388	241-TX-152	N/A	NO LONGER USED, NEAR V387
V457	DIVERSION BOX	N/A	GROUP II LINE
6" M8 NONUM	241-U-152	N/A	NO LONGER NEEDED, NEAR 455/456, GROUP IV LINE
SN281	DIVERSION BOX	N/A	NO LONGER USED
SN281	202A TO CRIB	N/A	GROUP VI LINE
SN281	216-A-36-A	N/A	NO LONGER TIED INTO SN216, GROUP IV LINE
T014	TO 241-S-152	N/A	NO LONGER USED
8" SCH 10	SY-A PIT	N/A	NOT UNDERGROUND
4" PCD M2	OVERHEAD AIR	N/A	CRIB NO LONGER USED
4" PCD M35	216-A-10	N/A	CRIB LINE GROUP VI
BCP106	216-B-55	N/A	B PLANT CRIB LINE TO BE DISCONTINUED
BCP111	B-PLANT CRIB	N/A	CRIB TO BE DISCONTINUED
BCP112	221-BF EFFLUENT CONTROL	N/A	CRIB TO BE DISCONTINUED
BCP213	DIVERTER VALVE PIT	N/A	CRIB TO BE DISCONTINUED
BCP214	TO CRIB 216-B-55	N/A	CRIB TO BE DISCONTINUED
BCP215	DIVERTER VALVE PIT	N/A	CRIB TO BE DISCONTINUED
BCS211	TO CRIB 216-B-55	N/A	CRIB TO BE DISCONTINUED
BCS212	B-PLANT CRIB LINE	N/A	CRIB TO BE DISCONTINUED
	TO PUMP PIT 216-B-64	N/A	CRIB TO BE DISCONTINUED
	TO 216-B-64 PIT	N/A	CRIB TO BE DISCONTINUED
	B-PLANT TO 216-B-64	N/A	CRIB TO BE DISCONTINUED
	RETENTION BASIN	N/A	CRIB TO BE DISCONTINUED
	B-PLANT TO 216-B-64	N/A	CRIB TO BE DISCONTINUED
	RETENTION BASIN	N/A	CRIB TO BE DISCONTINUED
	B-PLANT CRIB LINE	N/A	CRIB TO BE DISCONTINUED
	B-PLANT TO 216-B-55	N/A	CRIB TO BE DISCONTINUED

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Waste Management Lines and Facilities Deleted from Scope

LINE/FACILITY	FUNCTION	PRIORITY	COMMENT
4" BCP M35	B PLANT TO CRIBS	N/A	CRIB TO BE DISCONTINUED
BCS217	B-PLANT TO 216-B-62	N/A	CRIB TO BE DISCONTINUED
BCS218	B-PLANT TO CRIBS	N/A	CRIB TO BE DISCONTINUED
	216-B-55 AND 216-B-62		
T075	PUREX CRIB LINE	N/A	CRIB TO BE DISCONTINUED
T167	SAMPLE PIT TO	N/A	CRIB TO BE DISCONTINUED
	A-4 CRIB		
V014	PUREX CRIB LINE TO	N/A	CRIB TO BE DISCONTINUED
	A-4		
7717	SAMPLE PIT 216-A-5	N/A	TRANSFER LINE TO CRIBS
7718	SAMPLE PIT 216-A-5	N/A	TRANSFER LINE TO CRIBS
8" M9 NONUM	CRIB 216-A-38-1	N/A	CRIB TO BE DISCONTINUED
8" M9 NONUM	TO 216-A-38-1	N/A	CRIB TO BE DISCONTINUED

APPENDIX III

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Reference Drawings

DRAWING	TITLE	PRIORITY GROUP
H-2-91017, Sheet 1 of 1	Cathodic Protection Area Maps	General
H-2-91018, Sheet 5 of 7	Cathodic Protection Plot Plan	2
H-2-91019, Sheet 5 of 7	Cathodic Protection Plot Plan	2
H-2-91020, Sheet 5 of 7	Cathodic Protection Plot Plan	2
H-2-91021, Sheet 4,5 of 7	Cathodic Protection Plot Plan	2
H-2-91022, Sheet 4,7 of 7	Cathodic Protection Plot Plan	4
H-2-91023, Sheet 7 of 7	Cathodic Protection Plot Plan	1
H-2-91024, Sheet 4,7 of 7	Cathodic Protection Plot Plan	4,1
H-2-91025, Sheet 4,7 of 7	Cathodic Protection Plot Plan	4
H-2-91026, Sheet 1 of 1	Cathodic Protection Installation, Splice & Connection Details	General
H-2-91027, Sheet 1 of 1	Cathodic Protection Inst. Details	General
H-2-91028, Sheet 1 of 1	Typical Cathodic Protection Test Station Details	General
H-2-91029, Sheet 1 of 1	Cathodic Protection Details AC Feed to Rectifiers	General
H-2-91032, Sheet 1 of 1	Reference Drawings Symbols & Notes for 200 West Area	General
H-2-91035, Sheet 1,2 of 14	Cathodic Protection Plot Plan	5
H-2-91036, Sheet 7 of 14	Cathodic Protection Plot Plan	5
H-2-91037, Sheet 7 of 7	Cathodic Protection Plot Plan	2
H-2-91038, Sheet 7 of 7	Cathodic Protection Plot Plan	2,5
H-2-91039, Sheet 7 of 7	Cathodic Protection Plot Plan	2
H-2-91040, Sheet 1,2 of 14	Cathodic Protection Plot Plan	1
H-2-91041, Sheet 1,2 of 14	Cathodic Protection Plot Plan	1
H-2-91042, Sheet 1,2 of 14	Cathodic Protection Plot Plan	1
H-2-91043, Sheet 1 of 7	Cathodic Protection Plot Plan	1
H-2-91044, Sheet 1 of 1	Cathodic Protection Installation Details	General
H-2-91045, Sheet 1 of 1	Cathodic Protection Installation Details	General
H-2-91046, Sheet 1 of 1	Cathodic Protection Details Test Station Wiring	General
H-2-91049, Sheet 1,2 of 2	Cathodic Protection Details AC Feed to Rectifiers	General
H-2-91050, Sheet 1,2 of 2	Cathodic Protection Traceability Drawings, Symbols and Notes	General
H-2-91051, Sheet 1 of 1	Cathodic Protection Installation Details	General
H-2-91052, Sheet 1,2 of 7	Cathodic Protection Anode Locations	General
H-2-71989	Piping Plan Valve Pits 241-AN-A & B	1
H-2-77152, Sheet 1 of 1	Electrical Cathodic Protection Test Stations	1

REFERENCE DOCUMENTATION

1. EBASCO Services Incorporated, "Upgrade of Hanford 200 Areas Cathodic Protection System, Project B-234, Corrosion Field Survey," April, 1982.
2. SD-WM-ES-033, "Justification for Applying Cathodic Protection to Underground Waste Lines in the 200 Areas," Rev. 1, T. A. Carlson, and R. F. Jimenez, April, 1984.
3. Battelle Columbus Laboratories, "Analysis of Complex Corrosion Conditions - Project B-234," April, 1984.
4. "Upgrade of Hanford Site 200 Areas Cathodic Protection Systems, Project B-234, Construction Specifications B-234-C1, Revision 2," August, 1986.
5. SD-WM-OMM-001, "Project B-234 Operation and Maintenance Manual," October, 1986.

APPENDIX V

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DISCUSSION OF SAFETY ISSUES PROJECT W-020 WASTE MANAGEMENT FACILITIES CATHODIC PROTECTION SYSTEM

Prepared by J. A. Neely
February 9, 1989

INTRODUCTION

This discussion documents an initial assessment of safety issues associated with Project W-020, Waste Management Facilities Cathodic Protection System, formerly designated Project B-693. The Project W-020 Conceptual Design Report (CDR) (Reference 1) was completed and approved on April 21, 1987. This discussion will address all significant safety questions with respect to Project W-020. The facility Safety Analysis Reports (SAR), will be revised prior to operating the cathodic protection systems. The cathodic protection systems to be installed under Project W-020 will enhance the integrity and safety of those piping systems, by providing protection against galvanic corrosion in accordance with recommended standards.

SCOPE

Project W-020 completes the work originally scoped under Project B-234, "Upgrade of Hanford Site 200 Areas Cathodic Protection Systems," designed to cathodically protect essential process lines and utilities in the 200 East and 200 West Areas. The work completed on Project B-234 consists of the installation of cathodic protection systems for several process piping systems in the 200 East Area. Project W-020 involves additional process piping systems in the 200 East and 200 West Area. A list of the piping systems designated for protection under Project W-020 can be found in the Project W-020 Functional Design Criteria (FDC). The scope of this discussion is to evaluate the potential risks to the operation of facilities adjacent to the process piping systems to receive cathodic protection under Project W-020.

SUMMARY

As stated in the FDC, Project W-020 will extend the life of carbon steel encasement piping well beyond the minimum design life of the facilities. This will enhance safe operating conditions by minimizing environmental impacts and exposure to personnel caused by releases due to corrosive failure. Failure of radioactive process line encasements would adversely impact both the environment and operations by eliminating a second barrier to the environment and lowering leak detection capabilities. There are no unacceptable risks associated with the operation of the proposed cathodic protection system.

DISCUSSION

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A potential risk, from an operational safety standpoint, is the possible effect of the Project W-020 cathodic protection system generating stray currents and subjecting surrounding facilities to accelerated corrosion rates. To minimize the possibility of a deleterious stray current effect on unprotected pipes and structures in the near vicinity of the protected pipes, reference drawings are carefully checked and these pipes and structures are connected into the system with test leads so that they may be monitored. Jumper cables are used to bond non-protected piping into the system. Reference electrodes will be placed adjacent to radioactive waste storage tanks and other known structures. The reference electrode cables will be terminated in test stations so that periodic maintenance checks can be made to verify that stray currents are non-existent, or not of sufficient magnitude to cause accelerated corrosion of these structures. Any unknown pipes which are discovered during excavations will be connected by test leads into the system for future monitoring. The impressed current design used for Project W-020 is a proven flexible system that can be readily adjusted to provide optimum protection and eliminate adverse corrosion conditions detected by monitoring. The type of impressed current design used calls for a closely coupled distributed anode ground bed, meaning the anodes are installed along the pipes to be protected. By design this type of impressed current system minimizes stray current interference to adjacent facilities. Following completion of construction, an energization survey will be conducted to verify that the installed systems provide proper levels of cathodic protection. Any stray current problems noted are readily identified and eliminated. Over two years of monitoring the completed B-234 cathodic protection systems has shown that these systems are functioning as designed.

CONCLUSION

The Project W-020 definitive design is the definitive design completed in 1984 for Project B-234, which, with modifications to reflect the Project W-020 FDC changes, will be used for construction of the project. There are no unacceptable risks to operating any of the process piping systems or facilities affected by Project W-020. The applicable SAR(s) will be updated to reflect the configuration changes made by Project W-020.

CONCURRENCES

JH 2-10-89
Nuclear Facilities Safety

JRP JRP Parsons 3-7-89
Waste Management
Construction Projects

JRP 2-9-89
Waste Management Technology

REFERENCES

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1. "Conceptual Design Report, Waste Management Facilities Cathodic Protection System, B-693, "SD-693," SD-693-CDR-001, Revision 0, Rockwell Hanford Operations, June, 1987.
2. Letter, B. H. Noordhoff to L. C. Williams, "Project Preliminary Safety Analysis," November 1, 1988.
3. Internal Memo, J. A. Neely to L. E. Thomas, "Request for Determination of Safety Analysis Requirements," September 20, 1988.
4. Internal Memo, L. E. Thomas to J. A. Neely, "Safety Documentation for Project W-020," November 17, 1988.