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Project Information (Check Applicable Box)

☐ Balance of Facilities ☐ HLW Vitrification ☐ Analytical Laboratory ☐ Across all areas

☒ Pretreatment ☐ LAW Vitrification ☐ External Interfaces

Document is applicable to ALARA (as determined by the originator)? ☐ Yes ☒ No

Applicability to ALARA means that the item has the potential to affect doses, contamination levels, or releases to the environment. (See 24590-WTP-GPP-SRAD-002, *Application of ALARA in the Design Process*, sections 4.1 and 4.2 for more information.)

Subject code(s): _____ (for correspondence only)

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Author(s): JR Divine
Certified Corrosion Specialist, #867

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Approver signature:

STEVEN WAKEMAN VAIL
STATE OF WASHINGTON
39250
REGISTERED
PROFESSIONAL ENGINEER
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River Protection Project
Waste Treatment Plant
2435 Stevens Center Place
Richland, WA 99352
United States of America
Tel: 509 371 2000

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History Sheet

Rev	Date	Reason for revision	Revised by
0	10/28/02	Issued for Permitting	JR Divine
1	7/31/03	Added AEA statement, updated regulatory citation, added clarification, clarifications per CCN 065377, and reissued for permitting use	JR Divine

Contents

1 Introduction

The Waste Treatment and Immobilization Plant (WTP) meets the intent of the requirements of the Washington Administrative Code (WAC), Chapter 173-303-640(3)(a)(iii) to mitigate pipeline corrosion and to protect the environment. The WAC requires a determination, by a corrosion expert, of factors affecting the potential for corrosion where the tank or tank system components are in direct contact with soil or water. This requirement is satisfied by the determination of the WTP corrosion expert that the WTP Project shall use cathodic protection, as appropriate, for underground lines containing dangerous waste. This determination is based on both experience and personal knowledge of the 200 Areas.

An independent corrosion expert (ICE) will review this report, as well as design documentation, to determine whether additional corrosion protection may be required. The owner or operator is required to provide the type and degree of corrosion protection recommended by the ICE. The field installation of all corrosion protection systems will be supervised by an ICE (WAC 173-303-640(3)(g)).

2 Applicable Documents

- Washington Administrative Code (as amended) (WAC) 173-303. *Dangerous Waste Regulations.*
- NACE RP-0169. 1996. Standard Recommended Practice: *Control of External Corrosion on Underground or Submerged Metallic Piping Systems*, NACE International, Houston, Texas, USA
- NACE RP-0285. 1995. Standard Recommended Practice: *Corrosion Control of Underground Storage Tank Systems by Cathodic Protection*, NACE International, Houston, Texas, USA
- API Recommended Practice 1632. 1996. *Cathodic Protection of Underground Petroleum Storage Tanks and Piping Systems*, American Petroleum Institute, Washington, District of Columbia, USA

3 Description

The following design details are used to provide the corrosion protection needed to mitigate potential corrosion factors:

- The primary containment pipe is 304L stainless steel for the line from the Hanford Tank Farms. The primary containment pipe for interplant pipelines will use 316L stainless steel to provide added corrosion resistance when less alkaline solutions are being transported. These material selections were made to provide the necessary corrosion resistance to the proposed fluid contents. The primary pipelines shall be flushed with inhibited water after each use.
- The secondary containment piping and associated leak detection system provides the means to detect leaks from the primary line and contain them. Further, it is sufficiently corrosion resistant to ensure that a leak can be detected and isolated during its 40 year design life.
- The interplant secondary containment pipe, which contacts the soil, will be coated and cathodically protected, using an impressed current system, in accordance with NACE International Recommended Practices.

Considerations:
The following factors, taken from WAC 173-303-640(3)(a)(iii)(A)(I-VIII), are used in determining the corrosion protection needed to protect waste process piping in contact with soil.
"(A) Factors affecting the potential for corrosion, including but not limited to:

I. Soil moisture content;
II. Soil pH;
III. Soil sulfides level;
IV. Soil resistivity;
V. Structure to soil potential;
VI. Influence of nearby underground metal structures (e.g., piping);
VII. Existence of stray electric current;
VIII. Existing corrosion-protection methods (e.g., coating, cathodic protection)."

Discussion:
The above 8 factors are used when the corrosion expert is determining the type of corrosion protection needed. Because the WTP Project shall use coatings and cathodic protection, or equivalent, for the underground metal piping system corrosion protection and because the WTP Project is located in a remote area with no unknown underground structures or stray currents, the certified corrosion staff have determined further evaluation of the above factors is not required.

There are 2 designs for underground pipelines that will be connected to, or are within, the WTP's facilities that contain a dangerous waste. Both designs have an inner stainless steel pipe and an outer fusion bonded epoxy (FBE) coated carbon steel secondary pipe. In one design, the FBE coated carbon steel directly contacts the "soil" (duplex). The duplex pipe has cathodic protection. In the second design, the secondary pipe is also surrounded by a layer of insulation (1 to 2 inches thick) and a protective polymer outer shell (triplex). Because of its isolation from water intrusion, the triplex pipe does not need to be cathodically protected; however, it is connected to cathodically protected piping at both ends and therefore may receive some cathodic protection within those areas termed the "zone of influence".

The likelihood of significant corrosion of the secondary containment pipe due to liquid in the annular space is small because the leak detection system will quickly detect and allow isolation of leaks, reducing exposure time. Similarly, the use of the tertiary barrier in the triplex line isolates the secondary containment from external sources of moisture; therefore corrosion of the secondary will not occur.

The following items can impact the long-term effectiveness of the protective coating:

- *Temperature* – The underground waste transfer lines will operate at 200°F or lower.
- *Radiation* - Details of the 40 year lifetime gamma radiation doses are being evaluated. However, the highest expected 40 year transfer line dose is between the pretreatment facility and high-level waste facility. The estimate 40 year dose for this line is less than 60,000,000 rad and assumes the line is full of waste at all times.
- *pH* - The pH of the Hanford soil is expected to be 6 to 8. Additionally, a controlled density backfill, which has a high pH, is used to bed the line.

The coating to be used on the outer carbon steel pipe is epoxy based. Epoxies are available that have a design temperature of approximately 300°F and are rated for a lifetime dose of approximately 200,000,000 rad. The coating provides corrosion protection and reduces the current requirement of the cathodic protection system.

4 Conclusions

- The WTP will use standard industry practice of coating the pipe exposed to the soil and applying cathodic protection.
- The use of cathodic protection applied to duplex underground piping in accordance with NACE standards reduces the corrosion rate to essentially zero with or without coatings.
- Triplex underground piping does not require cathodic protection because its secondary containment, carbon steel pipe, is isolated from soil moisture. However, because the triplex line from the Hanford Double-Shell Tanks will be attached to cathodically protected components in the WTP, it will have cathodic protection within the zone of influence. This feature will have no useful function and will not reduce the corrosion protection of the system.
- The use of coatings on the duplex piping, combined with cathodic protection, reduces the current requirements and ensures a more uniform current distribution.
- The epoxy coating has sufficient resistance to the radiation and temperature conditions.
- No external corrosion of either the primary or secondary containment is anticipated.

MASTER DISTRIBUTION SCHEDULE

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Stephen Vail	MS4-B2		X						X	
Jeff Markillie	MS4-C1		X						X	
Jan Brown	MS12-2A		X						X	

Approver D.L. Adler *Print Name* *Signature* 7/31/03 *Date*