1.0 PURPOSE AND SCOPE

This standard provides requirements for consistent and acceptable performance of design, specification, installation, and testing of temporary waste transfer lines that employ a primary waste transfer hose encased by a secondary hose. This standard implements requirements of HNF-SD-WM-TSR-006 and RPP-13033, “Tank Farms Documented Safety Analysis,” Chapter 3, Section 3.3.2.3.2, “Defense-in-Depth,” Table 3.3.2.3.2-2, Features 12 and 25, and Chapter 4, Section 4.4.2, “Hose-in-Hose Transfer Line Systems.” This general configuration is referred to as a Hose-in-Hose Transfer Line (HIHTL) and is used by the Tank Operations Contractor (TOC) to establish waste transfer routes for specific mission objectives.

This standard establishes the design requirements, required analyses and evaluations, examination, and testing requirements for HIHTL assemblies in waste transfer system applications. The technical basis for the requirements in this document, and approved deviations, can be found in RPP-RPT-28499, “Hose-in-Hose Transfer Lines.”

2.0 IMPLEMENTATION

This standard is effective on the date shown in the header.

Deviations to any requirements of this standard shall be requested from the standard document owner. Approved deviations shall be documented in the accompanying standard basis document, RPP-RPT-28499.

3.0 STANDARD

3.1 General Requirements

1. HIHTL assemblies shall be designed, fabricated, installed, operated, and disposed of in accordance with the requirements for compliance with environmental regulations implemented in RPP-12711. (5.1.8)

2. Upon initial use, HIHTL assemblies routed outside the fenced boundaries of tank farms shall be incorporated on the appropriate tank farm treatment, storage, and disposal (TSD) unit drawings (H-13-xxxxxx), identifying the origin, destination, direction of flow, and size. (5.1.5)


4. When connected to HIHTL primary hoses, compressed air systems shall employ safety significant pressure relieving devices to prevent the over pressurization of primary containment lines. Compressed air relieving devices shall have a set pressure that limits compressed air pressure to \( \leq 190 \text{ lb/in}^2 \) and be sized for a flow capacity of \( \geq 500 \text{ ft}^3/\text{min.} \) (5.1.6, 5.1.8)
5. Vendor information and vendor product files shall be evaluated for requirements and recommendations (i.e., handling, storage, installation, preventive maintenance, corrective maintenance, operation, item/component/system design, and testing) to determine which requirements and recommendations are necessary for the item/component/system to perform its intended function and to meet the applicable standards. The requirements and recommendations as determined by the evaluation shall be incorporated into applicable controlling documents and design media. The evaluation shall include justification for not incorporating any vendor requirements or recommendations. (5.1.9)

6. Shelf life and Service life of HIHTL assemblies shall be evaluated and identified. The date of manufacture, date of first exposure to process conditions, and date of expiration of service life shall be recorded on drawing H-14-106249. The shelf life is defined by the manufacturer and starts from the date the hose is finished at the manufacturing plant (prior to shipment to the hose assembler). The service life is a function of several factors. Among these are the hose material’s resistance to the chemical effects of process fluids, ambient environmental conditions, exposure to ionizing radiation, and the manufacturer’s stated shelf life. Hose-in-Hose Transfer Line assemblies have an established maximum useable life based on shelf life plus service life as established in RPP-6711, Evaluation of Hose in Hose Transfer Line Service Life. Refer to RPP-6711 for more detail. (5.1.4, 5.1.7, 5.1.8)

7. For HIHTL assemblies that are to be reused in waste transfer applications other than the application for which they were designed, service life shall be evaluated, revised, and documented based on process chemistry, service pressure and temperature, and potential for abrasive damage, as appropriate. The results of this evaluation shall be reflected in changes to the service life expiration date documented on drawing H-14-106249. (5.1.4, 5.1.7)

8. HIHTL assemblies with acceptable remaining service life shall not be reused in services that are not compatible with the HIHTL materials as affected by prior service. (5.1.8)

### 3.2 Materials

1. Primary and encasement hose shall be constructed of ethylene propylene diene monomer (EPDM) rubber in combination with reinforcement, and shall be qualified for use in accordance with the test methods specified in ASTM D380. (5.1.8)

2. O-rings shall be made of EPDM and gaskets shall be made of EDPM or an approved non-metallic material for contact with tank waste as analyzed in TFC-ENG-STD-34 and that also meets other design requirements of the connection point. (5.1.7, 5.1.8)

3. End fittings shall be constructed of stainless steel. (5.1.7, 5.1.8)

4. Reinforcement materials shall be fully encapsulated. (5.1.7)

5. Exposed surfaces of any internal components (such as heat tracing or tape which overwraps it), shall be compatible with the process fluid’s chemical and physical properties. (5.1.7)

6. Where ignition source control requirements apply as classified in HNF-SD-WM-HC-017, primary and encasement hose material shall be of static dissipative design, and qualified in accordance with either the requirements of ASTM D257, with a
demonstrated surface resistivity of between $10^6$ and $10^{12}$ ohms/square, or the requirements of ASTM D991, with a resistance demonstrated as between $10^4$ and $10^{11}$ ohms. (5.1.3)

### 3.3 Design

1. Primary and encasement hose shall be designed to the requirements of RMA IP-2. (5.1.7, 5.1.8)

2. Primary hose minimum burst pressure specified shall not be less than four times the design (maximum working) pressure of the HIHTL primary hose assembly. (5.1.8)

3. Primary hose design pressure shall be determined from the maximum static head for the HIHTL routing and either the shutoff head of the pump pressure source or the maximum pressure setting of any pressure relieving device provided. The pressure and stress limits are determined by analyses identified in TFC-ENG-DESIGN-C-60. (5.1.8)

4. Primary hose design pressure for vacuum conditions shall be for the maximum vacuum condition of the process, but not less than 6 inches water gauge vacuum. (5.1.8)

5. Encasement hose minimum burst pressure specified shall not be less than five times the design (maximum working) pressure of the encasement hose assembly. (5.1.8)

Encasement hose design pressure shall be a minimum of 170 psig and:

- The maximum pressure due to static head for the HIHTL routing and the maximum pressure that can be achieved following primary hose failure (pressure drop in the encasement for open-ended encasements), or

- The maximum pressure due to static head for the HIHTL routing and the pressure setting of any pressure relieving device provided for a closed encasement, or

- The design pressure of the primary hose.

Encasement hose design pressure for vacuum conditions shall be the maximum vacuum condition for the structure, tank, or vessel to which the encasement is connected, but not less than 6 inches water gauge vacuum. (5.1.8)

6. HIHTL assemblies shall be capable of withstanding pressure and temperature cycling between ambient and design conditions without failure. (5.1.7)

7. End fittings shall be swaged. (5.1.7, 5.1.8)

NOTE: Crimped-on, or Internally Expanded Full Flow couplings as defined in RMA IP-2, Chapter 5, may be used to join hose to fittings if qualified to RPP-14859.

8. Primary hose that extends beyond the encasement hose in a waste transfer associated structure- shall be designed to prevent kinking or abrasion due to hose growth. (5.1.7)
9. Where necessary, wall transition supports shall be used to ensure minimum bend radii is not exceeded and to reduce hose abrasion damage as a result of expansion and contraction cycles along pit wall edges. (5.1.7)

10. Changes in direction shall satisfy the manufacturer’s minimum bend radius and twist requirements. Primary hose growth shall be evaluated to ensure that the growth can be accommodated by the encasement hose and hose support system. (5.1.7)

11. Encasement hose movement due to primary hose growth shall be evaluated to determine guide and restraint requirements to accommodate hose growth due to pressure and temperature. (5.1.7)

12. Where HIHTL are required to be placed at outside corners of pits or other structures, the hose shall be protected by inclusion of guards to prevent abrasion of the HIHTL. (5.1.7)

13. HIHTL assemblies shall allow access for connection of both primary and encasement hoses. (5.1.7)

14. HIHTL assemblies, including above-grade hose segment to hose segment connections outside of waste transfer-associated structures, shall maintain leak-tight integrity when subjected to crushing, shear, and impact loading conditions. Above-grade hose segment to hose segment connections may be qualified by evaluation. An acceptable evaluation for specific connection designs is provided in Operability Evaluation OE-07-002, “Operability Evaluation for HIHTL End Fittings.” (5.1.8)

15. Hose at entries into structures and above-grade hose segment to hose segment connections, shall be protected from vehicles to maintain confinement of contained waste. (5.1.6, 5.1.7)

16. Leak detection shall be provided for the annular space between the primary and encasement hoses of HIHTL. Minimum acceptable leak detection shall be provided by waste transfer-associated structure leak detector(s) in the structure(s) to which the encasement hose drains. (5.1.10)

17. HIHTL routing shall not be in proximity to potable water, raw water, and service water lines as defined in TFC-ESHQ-ENV_RM-C-12. (5.1.1)

18. HIHTL routing shall minimize low points or dead legs. The volume of the annular space between the primary hose and secondary hose that is not self-draining shall be determined and documented in Table A-2 of RPP-12711. (5.1.8)

19. Leak detection methods, limitations, and sensitivity (i.e., the minimum leak rate which may be detected by in-pit leak detectors within a twenty-four hour period and the period required to detect a postulated leak rate of 2 GPM) shall be determined as defined in RPP-12711, Appendix A, and documented in RPP-12711, Tables A-1 and A-2. If the specified sensitivity is deemed not compliant with the requirements of Washington Administrative Code (WAC) Section 173-303-640(4) (c) (iii) by the Environmental Protection Officer, encasement leak detection for the undrained portion of the annular space shall be provided. (5.1.10)

20. HIHTL assembly and installation design shall incorporate a means to remove any accumulated liquids from the encasement, in the event of a primary hose failure, and a
means to remove accumulated liquids and residual waste from primary and encasement hoses. (5.1.7, 5.1.10)

21. Methods of installation, operation, and retrieval (including relocation of hose assemblies and methods for removing accumulated liquids) shall be evaluated to determine mechanical loads which may act on HIHTL hose/fitting joints. A means of ensuring the HIHTL system leak-tight integrity shall be provided when subjected to these mechanical loads. (5.1.7)

22. HIHTL assemblies shall be analyzed for freeze protection requirements (see TFC-ENG-STD-02). HIHTL operating temperature shall be suitable for process conditions (potential waste precipitation or gelation conditions). (5.1.6, 5.1.7)

23. Where required, heat tracing shall be of self-limiting design, with maximum temperature not exceeding the maximum temperature permitted for direct contact with the hose material. (5.1.7)

24. If ignition source control requirements apply as classified in HNF-SD-WM-HC-017, HIHTL design and installation shall meet the requirements of TFC-ENG-STD-45. (5.1.3)

25. To prevent exceeding the design temperature rating of safety-significant HIHTL, routing shall not be in proximity to in-pit heater nozzle discharge as defined on drawing H-14-110255, sheet 1. This requirement is only applicable to HIHTL installed in pits listed on drawing H-14-110255, sheet 1 and when the in-pit heaters are physically installed. HIHTL also shall not be installed in the AP-01A pit because safety-significant components installed in this pit must have a design temperature ≥ 200 degrees Fahrenheit to protect the assumptions in RPP-CALC-60536, “In-Pit Heater Bulk Temperature Calculation,” and RPP-CALC-61486, “In-Pit Heater Discharge Temperature and Exclusion Zone.” (5.1.7)

3.4 Examination and Testing

1. Inspection and examination of all pressure-retaining welds associated with HIHTL assemblies shall be performed in accordance with the requirements of ASME B31.3 specified for normal fluid service. Volumetric examination [radiographic test (RT) or ultrasonic test (UT)] of welds where specified by ASME B31.3 shall be performed where possible (i.e., in-process examination shall not be specified). In those cases where volumetric examination is not possible (e.g., orientation of the weld), the subject welds shall have documented in-process examination in accordance with ASME B31.3, paragraph 344.7 with liquid penetrant or magnetic particle examination specified for the root pass [see paragraph 344.7.1(e)] and shall be identified as such on the fabrication drawings. Fabrication drawings shall be approved by WRPS Engineering prior to fabrication. The determination of whether a volumetric inspection is possible shall be made by the WRPS welding SME or WRPS NDE SME as defined by the Engineering Programs Manager and appearing in the WRPS Engineering Toolbox webpage SME list. Individual items described in paragraph 344.7.1 shall be documented (e.g., checklist format) for each in-process examination. The in-process examinations shall not be used to meet the required representation of the welder’s or the welding operator’s work unless necessary to meet the required representation of work. (5.1.7)

2. The extent of examination specified in paragraph 341.4.1 b (1) of ASME B31.3 shall be 100% of circumferential butt and miter groove welds in primary hose assembly fittings. (5.1.7)
3. Encasement hose fitting welds shall have 100% magnetic particle or liquid penetrant examination of pressure-retaining welds in addition to examinations required by ASME B31.3. (5.1.7)

4. The exterior surfaces of HIHTL assemblies that are reused shall be visually examined for abrasion or other damage prior to reuse. (5.1.7)

5. For HIHTL assemblies where no supplemental protection from mechanical damage is provided, the HIHTL design shall be tested to verify that no credible crushing loads or mechanical impacts can compromise the pressure integrity of the encasement hose. Load testing shall be performed on a firm base such as compacted soil covered by a compacted 2" thick layer of 5/8” minus crushed rock.

Testing shall be performed for the following load conditions:

- A rollover crushing load of at least 158 pounds per square inch imposed by pneumatic tires shall be applied across the flattened width of each of three hose assemblies for forty cycles.

- A crushing load of at least 400 pounds per square inch acting on a rigid steel plate (e.g., crane outrigger) that is no more than 17 inches on a side shall be applied to each of three hose assemblies for twenty cycles.

- An impact (and shear) load equivalent to the impact load imparted by a ten foot by four foot piece of two-inch thick plate steel (3260 pounds) dropped edgewise from a height of at least 5 feet shall be applied to each of three hose assemblies for twenty cycles.

After applying the load conditions, each test assembly primary hose and encasement hose shall be successfully tested to the rated working pressure of the hose.

RPP-7756, “Engineering Test Plan for Testing Hose-in-Hose Design,” provides an acceptable plan for conduct of these load tests. (5.1.8)

6. A prototypical cyclic test shall be performed on two samples of the primary hose with end fittings and joint installed. The test shall consist of at least 300 cycles of pressure testing. Each cycle shall consist of two one minute working pressure tests – one test following heat-up with water as a test media at 170 to 180 degrees Fahrenheit for 5 minutes to heat the hose sample, followed by one test following cool-down using test media at 80 degrees Fahrenheit for five minutes to cool the hose sample. There shall be no detectable leakage during these tests.

After cyclic testing is completed, the primary hose samples shall be maintained at 650-700 psig and 170 to 180 degrees Fahrenheit for at least 12 hours. There shall be no detectable leakage during this test. (5.1.8)

7. A tensile strength test shall be performed on short specimens of HIHTL assemblies to verify the design can be subjected to the mechanical loads determined for installation, operation, and retrieval (including removal of accumulated liquids) without
compromising pressure integrity. At least one tensile strength test shall be performed on a sample that has undergone the prototypical cyclic test. (5.1.8)

- 2 in. diameter hose tensile loads shall equal or exceed 3,140 lbs
- 4 in. diameter hose tensile loads shall equal or exceed 10,240 lbs.

8. Primary and encasement hose assemblies that constitute HIHTL assemblies shall be tested in accordance with RMA IP-2, Chapter 6. (5.1.7)

9. A vacuum test shall be performed on primary and encasement hoses when the hose will be used under vacuum. The hoses shall be subjected to an internal vacuum equal to or greater than the service requirement. Hoses shall be deemed acceptable if they withstand such an internal vacuum without collapse. (5.1.7)

10. Destructive tests (burst pressure tests) as specified in RMA IP-2 shall be conducted on short specimens of HIHTL assemblies. Minimum burst pressure of primary hose assemblies, as determined by testing, shall be at least 4 times the design pressure. At least one primary hose burst pressure test shall be performed on a sample that has undergone the prototypical cyclic test. Minimum burst pressure of encasement hose assemblies, as determined by testing, shall be at least 5 times the design pressure. (5.1.7)

11. Non-destructive tests shall be performed on all finished HIHTL production assemblies to verify their pressure integrity. Testing shall include a proof pressure test as specified in RMA IP-2 using water as test media. Test pressure range shall be a maximum of 50% of the minimum burst pressures specified, less a suitable margin for instrument accuracy. (5.1.7)

12. To prevent exceeding the design pressure of safety-significant HIHTL systems (and connected safety-significant waste transfer primary piping systems and safety-significant isolation valves for double valve isolation), pneumatic testing of HIHTL primary and encasement hose assembly connections in Tank Farms shall require an ASME code-compliant pressure relieving device with a setpoint that limits the pneumatic pressure in the HIHTL primary hose assemblies, HIHTL encasement hose assemblies, connected waste transfer primary piping assemblies and isolation valves for double valve isolation below their design pressures. (5.1.1, 5.1.8)

NOTE: Pneumatic testing is only allowed if the HIHTL and waste transfer primary piping systems have never been used and are not connected to HIHTL or waste transfer piping systems that have been used.

13. HIHTL primary hose assembly connections (i.e., end and intermediate connections) on the planned waste transfer route shall be leak tested. Connections that are leak tested during installation (e.g., system hydrostatic leak test) do not require additional connection leak testing unless the connection is unmade and remade.

Leak testing of the HIHTL primary hose assembly connections shall be performed by visual observation. The connection leak testing shall be performed with water at the interfacing water system pressure except when (a) there is no waste transfer system valve downstream of the connection, or (b) closing the valve with water flowing causes a flow transient (water hammer) that could damage safety-significant waste transfer system structures, systems, or components (SSCs). For this leak test, the interfacing water system pressure is maintained at the connection for at least 10 min. If there is no valve
downstream of the connection or closing the valve causes an unacceptable water hammer, leak testing is allowed with water flowing through the connection. This leak test requires a minimum water flow of 200 gal through the connection after flow is established in the line. If leak testing with water is not practical (i.e., no available water source), leak testing may be performed at the beginning of the initial waste transfer through the connection. This leak test also requires a minimum waste flow of 200 gal through the connection after flow is established in the line.

Leakage observed at the HIHTL primary hose assembly connections during the leak test shall be eliminated. Subsequent leak testing of HIHTL primary hose assembly connections is not required unless the connection is unmade and remade.

Evaluate case (b) above (closing the valve with water flowing) per TFC-ENG-FACSUP-C-27. (5.1.6)

4.0 DEFINITIONS

No terms or phrases unique to this standard are used.

5.0 SOURCES

5.1 Requirements

1. 10 CFR 851, “Worker Safety and Health Program.”

2. DOE O 252.1A, “Technical Standards Program.”


9. TFC-PLN-02, “Quality Assurance Program Description.”

5.2 References


7. H-14-110255, Sheet 1, “In Pit Heating Mechanical Fabrication”.

8. HNF-SD-WM-HC-017, “NFPA Flammable Vapor and Gas Hazard Classification for the Tank Farms.”


15. RPP-14859, “Specification for Hose-In-Hose Transfer Line and Hose Jumpers.”

16. RPP-CALC-60536, “In-Pit Heater Bulk Temperature Calculation.”

17. RPP-CALC-61486, “In-Pit Heater Discharge Temperature and Exclusion Zone.”

18. TFC-ENG-DESIGN-C-60, “Preparation of Piping Analyses for Waste Transfer Systems.”

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ENGINEERING</strong></td>
<td><strong>Document</strong></td>
<td><strong>TFC-ENG-STD-21, REV D-11</strong></td>
</tr>
<tr>
<td><strong>HOSE-IN-HOSE TRANSFER LINES</strong></td>
<td><strong>Page</strong></td>
<td><strong>10 of 10</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Issue Date</strong></td>
<td><strong>June 29, 2017</strong></td>
</tr>
</tbody>
</table>

