TANK RISER SUSPENSION SYSTEM
CONCEPTUAL DESIGN (U)

R. F. Fogle

September 15, 2002
This document was prepared in conjunction with work accomplished under Contract No. DE-AC09-96SR18500 with the U. S. Department of Energy.

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APPROVALS

Robert Fogle, Author  9-10-02
SRTC / Advanced Remote Systems

Don Pak, Task Lead  9-10-02
SRTC / Analytical Development

Andrew Tisler  9/19/02
HLW / CST Engineering

Jim Wong, L4 Manager  9/2/02
SRTC / Advanced remote Systems

Joette Sonnenberg, L3 Manager  9/12/02
SRTC / Remote and Specialty Equipment

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September 15, 2002  Page 3 of 27
## TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXECUTIVE SUMMARY</td>
<td>5</td>
</tr>
<tr>
<td>BACKGROUND</td>
<td>5</td>
</tr>
<tr>
<td>CONCEPTUAL DESIGN</td>
<td>6</td>
</tr>
<tr>
<td>CONCLUSION</td>
<td>14</td>
</tr>
<tr>
<td>ACKNOWLEDGEMENTS</td>
<td>14</td>
</tr>
<tr>
<td>REFERENCES</td>
<td>14</td>
</tr>
<tr>
<td>Appendix A</td>
<td>15</td>
</tr>
<tr>
<td>Appendix B</td>
<td>20</td>
</tr>
<tr>
<td>Appendix C</td>
<td>26</td>
</tr>
<tr>
<td>Appendix D</td>
<td>29</td>
</tr>
</tbody>
</table>

## TABLE OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 1</td>
<td>Rail installation in a riser</td>
<td>6</td>
</tr>
<tr>
<td>Figure 2</td>
<td>Riser with 4” tube installed</td>
<td>7</td>
</tr>
<tr>
<td>Figure 3</td>
<td>Sectioning equipment to fit inside tank</td>
<td>8</td>
</tr>
<tr>
<td>Figure 4</td>
<td>Failed equipment completely removed from tank</td>
<td>9</td>
</tr>
<tr>
<td>Figure 5</td>
<td>Inserting failed equipment into a tank using the guide rail system</td>
<td>10</td>
</tr>
<tr>
<td>Figure 6</td>
<td>Lowering failed equipment into the tank</td>
<td>11</td>
</tr>
<tr>
<td>Figure 7</td>
<td>Failed equipment sections hanging inside the tank</td>
<td>12</td>
</tr>
<tr>
<td>Figure 8</td>
<td>New equipment installed</td>
<td>13</td>
</tr>
</tbody>
</table>
EXECUTIVE SUMMARY

A team of engineers from High Level Waste (HLW), the Savannah River Technology Center (SRTC), and Project Engineering and Construction Division (PE&CD) explored ways of more effectively utilizing the HLW tank’s risers during waste removal and closure activities. Currently, some of the risers are being used to store failed and contaminated equipment. To make those risers available for tank operation, failed equipment must be moved out of the tank and relocated or disposed of appropriately. Disposing of contaminated equipment is a time consuming and expensive process. This report describes the Tank Riser Suspension System (TRSS). It will allow failed equipment to be stored inside of the tank while making riser space available for other tank process equipment. In addition, the TRSS will permit disposing of failed equipment in the tank as part of tank closure activities.

BACKGROUND

High-level radioactive liquid wastes are received, stored, and processed in large underground tanks at SRS. Five different types of tanks were built at SRS. Four of the five tanks are shown in Appendix A. Each type is unique and incorporates the lessons learned from past designs. There are risers on or integral with the top of each tank. Each tank type has a unique riser configuration as shown in Appendix B. The risers permit access to the tank and the tank’s annulus. They are used primarily for the installation of pumps, cooling equipment, instrumentation probes, measuring devices, monitoring tools, and samplers. Examples of pumps used in the waste tanks can be found in Appendix C.

Type I Waste tanks have 15 risers, including the center riser. Type II Waste tanks have 28 risers. Type III Waste Tanks and Type IIIA Waste tanks have 40 risers. Type IV Waste tanks have 7 risers, including the center riser. The inside diameter (ID) of typical risers normally ranges between 23” and 42”, but some of them are very large. For example, the ID of the center riser of a Type IV tank is approximately 9 feet. A drawing of the cross section of a typical riser can be found in Appendix D.

There are a limited number of risers on a tank top. Efficiently utilizing them is crucial for successful waste removal and tank disclosure operations. Some of the risers are occupied by failed and contaminated equipment. To make those risers available for tank operation, the stored failed equipment must be moved out of the tank and disposed of appropriately. Disposing of contaminated equipment is a time consuming and expensive process. An alternative is the TRSS. It permits storing equipment inside of the tank while making the riser space available for other tank process equipment. This option will allow disposing of failed equipment in the tank during tank closure and may significantly reduce personnel radiation exposure and waste disposal costs.
CONCEPTUAL DESIGN

The TRSS is based on the concept of hanging failed equipment with cables in a riser. The major components of the TRSS include the following:

1. A riser insert with rail guides
2. A clamp and rail attachment device
3. A lifting bail/guide block
4. A remotely detachable crane hook

The TRSS utilizes a riser insert with attached rails for hanging equipment as shown in Figure 1. The insert must be constructed of at least 2 sections with each part having a rail section. Figure 1 shows an insert consisting of 2 halves. The insert is installed into an empty riser using a crane. The rails extend into the tank and curve up to be parallel with the tank ceiling. In this way, the failed equipment can be stored away from the riser opening. By doing this, the riser is available for normal tank activities as well as for storage.

![Figure 1: Rail installation in a riser](image-url)
If a pump or other equipment should fail in a riser, the first step is to remove the equipment from the riser. A clamp and rail attachment device or devices must be designed to grip the various sizes of equipment used in riser. As an example, Figure 2 shows a simple 4-inch tube that is to be stored in the tank as failed and contaminated equipment. A clamping device is shown securing the failed equipment. The lifting bail/guide block assembly is attached to handle the failed equipment. The equipment is removed from the riser by using a crane.

Figure 2: Riser with 4” tube installed
The failed equipment cannot extend into the waste as this may cause an interference with tank closure activities. Equipment that is too long will have to be size-reduced. With the failed equipment held by a crane, the clamping device is loosened. The crane can then remove an appropriate length from the tank. The clamp secures the equipment remaining in the tank. The upper section of the failed device is cut as shown in Figure 3 while the lower section is held firmly in place by the clamp.

Figure 3: Sectioning equipment to fit inside the tank
The removed section is monitored for radioactivity. It may or may not be stored in the tank based on the radiological survey. Assuming it is to be put back in the tank, it is temporarily stored on the tank top. The remaining section in the riser is then lifted out of the tank and is cut into smaller sections and surveyed. Once the equipment removal process is complete, the TRSS is installed in the riser as shown in Figure 4. The sections of failed equipment are then ready to be lifted by the crane and returned to the tank.

Figure 4: Failed equipment completely removed from tank
Relocation into the tank will require a crane hook with a remote de-coupling capability as shown in Figure 5. The equipment to be returned is positioned onto the guide rail and lowered into the tank’s riser.

Figure 5: Inserting failed equipment into a tank using the guide rail system
The guide block must be hinged to allow the equipment to transition the curved part of the TRSS rail as shown in Figure 6.

Figure 6: Lowering failed equipment into the tank
When the returned equipment reaches the end of the curved section of rail, the crane hook de-couples from it as shown in Figure 7. This process is repeated for all sections being stored in the tank.

Figure 7: Failed equipment sections hanging inside the tank
Once the storage process is completed, new process equipment can be lowered into the riser as shown in Figure 8.

Figure 8: New equipment installed
CONCLUSION

The Tank Riser Suspension System would be a great asset to the tank farm operation and is highly recommended. It would allow HLW to store several pieces of equipment and simultaneously use the tank’s riser in closure activities. However, working on tank tops and utilizing riser space for hanging multiple components presents significant engineering challenges:

- Designing the insert and rail system
- Designing a universal clamping device or a suite of clamping devices
- Developing a remotely detachable crane hook

Many factors and safety issues must be addressed during the development of design requirements. They include:

- Performing load limit calculations for riser and tank top support of suspended equipment
- Ensuring that suspended equipment won’t interfere with tank closure efforts
- Ensuring that suspended equipment won’t interfere with existing equipment inside the tanks

ACKNOWLEDGEMENTS

A special thanks to the following team members for their creativity in providing a solution to a problem in HLW tank closure activities:

Don Pak, SRTC
Jonathan Thomas, HLW/Waste Removal Project
Randall Forty, PE&CD/Design Execution
Toby Hess, HLW/FTF Waste Removal Project Liaison
Wade Faires, PE&CD/Structural Mechanics

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Appendix A
Figure 1A: Type I Waste Tank
Figure 2A: Type II Waste Tank
Figure 3A: Type IIIA Waste Tank
Figure 4A: Type IV Waste Tank
Appendix B
Figure 1B: Typical Type I Waste Tank Riser Layout
Figure 2B: Typical Type II Waste Tank Riser Layout
Figure 3B: Typical Type III Waste Tank Riser Layout
Figure 4B: Typical Type IV Waste Tank Riser Layout
Appendix C
Figure 1C: Telescoping Transfer Jet Pump
Figure 2C: Telescoping Transfer Pump
Appendix D
Figure 1D: Typical Type 1 Riser Cross Section