



Memorandum

Date: 01 February 2022

To: Captain Troy Gronberg

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Project: 220064.00-REDH – Red Hill Underground Fuel Storage Independent
Assessment

Subject: Supplemental Work Plan to Assess the Facility Operations and System Integrity to
Safely Defuel the Bulk Fuel Storage Tanks

1. INTRODUCTION

This memorandum contains a preliminary list of assessment tasks that we will undertake in support of defueling the Red Hill Underground Fuel Storage Facility. The discussion below is preliminary based on our current knowledge and does not constitute an exhaustive list or final road map for the potential improvements at the facility.

2. ASSESSMENT PROCESS

The assessment process to be followed for the defueling of the Red Hill Facility is summarized below.

1) Review Document and Data. This step is foundational to understanding the existing facility and highlighting design and operational vulnerabilities. This step includes data collection arising from site visits by our subject matter experts (SMEs), review of historical documents, design calculations, drawings, and inspection reports.

2) Conduct Hazard and Operability Study. A team of facility personnel and our SMEs will discuss and evaluate the defueling operation as part of the upcoming OSHA process safety management (PSM) Hazard and Operability (HAZOP) Study. This step collects first-hand knowledge from operators through workshops aimed at capturing the decision-making process

of individuals to determine the sensitivity of the system to different decisions in "what-if" scenarios. We will evaluate the potential outcomes and provide as-needed recommendations.

- 3) Review EPA Spill Prevention, Control and Countermeasure (SPCC) Checklist. This will be completed to evaluate the facility's spill response preparedness.
- 4) Conduct interviews to evaluate the overall training of operations staff. These on-site interviews will indicate the level of understanding of the systems they have in place and their approach to risk assessment for any workarounds. If there is a degree of misunderstanding of how systems operate, this will need to be evaluated for defueling of the facility. Depending on our assessment, we may recommend additional detailed training for all systems related to defueling.
- 5) Review Defueling Procedure. Based on a review of the defueling procedures we may recommend re-writing the procedures in a format that is single step-by-step and which allows for sign-off for all steps with accompanying risk assessment and dry runs as needed. There may also be a need to require specific training for the Operations staff including a walkthrough of the procedures.
- 6) Perform a risk assessment from an emergency response perspective including a review of the facility's emergency response manual. This may require response training by all staff involved, specific to the defueling, and addressing identified scenarios.
- 7) Evaluate the need for stopping all non-essential work and clearing the tunnels of all material not associated with defueling.
- 8) Evaluate emergency systems prior to defueling and determine whether an emergency response team should be on standby. This may include spill response with specific scenarios tested and personnel/equipment on standby.
- 9) Evaluate the need for sealing of penetrations, holes, cracks, etc. which have the potential for allowing fuel spillage to leak out of the tunnels.
- 10) Determine the need for engagement of third parties to monitor defueling activities.
- 11) Determine the need for installation of additional instrumentation as well as mitigation of observed deficiencies prior to defueling. In order to mitigate escalation risks, the facility Operators should provide us with a list of their observations regardless of their perceived criticality.
- 12) Perform Tank Finite Element Analysis (FEA). While this analysis is more geared towards existing operations, it may also be instructive to perform our tank structural analysis (since tank fill levels change during defueling operations) in order to evaluate the integrity of the existing

tanks for various loading conditions, i.e., considering different fill levels, loading demands, and degradation of the tank materials, to quantify the risk of leakage to the surrounding rock and underlying aquifer.

13) Perform Pipeline FEA. This structural analysis will evaluate the integrity of the piping systems specifically used between the underground fuel tanks and Hotel Pier, through which the fuel would be transported during defueling.

14) Perform Non-Destructive Testing. SGH on-site personnel will spot check the thickness of the fuel pipelines and the steel tank liners using an ultrasonic thickness (UT) gauge and the tank interior and pipeline exterior protective paint coating, if accessible, using a dry film thickness (DFT) gauge to verify reported material conditions from historic data based on UFC 3-460-003.

15) Develop Repair, Retrofit, and Maintenance Requirements. Our FE analyses, document reviews, and site walkdown observations may highlight structural integrity vulnerabilities in the tanks and piping systems. Repair and retrofit strategies may include but are not limited to:

a) Piping and pipe supports:

- i. Evaluate the need for lateral restraints to the fuel lines at each of the offtakes at the tanks (i.e., at 19/20, 18/17, 16/15, etc.) so that in the event of a transient pressure surge during defueling, the fuel lines are laterally restrained to prevent significant movements from occurring.
- ii. Evaluate the need for adding a bypass line around the outboard main fuel block valves with a double block and bleed valve arrangement before defueling. This may allow the fuel team to remove the vacuum without operating a main block valve and be able to control the rate that fuel is entering the product line to clear the vacuum/void and mitigate a "surge" event.
- iii. Evaluate adding a differential pressure measurement at each of the main block valves at the storage tanks and the valves that are located along the product lines before defueling so that the fuel team can monitor valve differential pressure before opening a valve.
- iv. Evaluate the option of adding pressure measurement at key points along the product lines before defueling.
- v. Evaluate the need to replace the valves on the product lines that are allowing the vacuum to occur with valves that have block and bleed capability. Also, evaluate the need to replace the valves at the "end" of the product lines just as they enter

the underground valve/pump station with properly designed control and shut-off valves that can be safely opened with full differential pressure.

b) Instrumentation plan:

- i. Recommend a plan, as needed, to monitor pipeline movement during defueling.



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PROJECT NO. 220064-00-REDH

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CLIENT NAVSUP
 SUBJECT Supplemental Implementation Schedule (Plan of Actions and Milestones) to Assess the Facility Operations and System Integrity to Safely Defuel the Bulk Fuel Storage Tanks

Objective:

- Assess the Facility operations and system integrity to safely defuel the Bulk Fuel Storage Facility.

This implementation schedule presents a preliminary list of assessment tasks that we will undertake in support of defueling the Red Hill Underground Fuel Storage Facility. The discussion below is preliminary based on our current knowledge and does not constitute an exhaustive list or final road map for the potential improvements at the Facility.

No.	Activity	Start	End	Objectives / Outcomes	Status
1	Assessment Preparation	1/17/2022	2/4/2022	Gather data and become familiar with the facility	
1.1	Initial Facility Walkdown	1/18/2022	1/28/2022	Develop an understanding of the facility and document observations	Complete
1.2	Review Document and Data	1/17/2022	2/4/2022	This step is foundational to understanding the existing facility and highlighting design and operational vulnerabilities. This step includes data collection arising from site visits by our subject matter experts (SMEs), review of historical documents, design calculations, drawings, and inspection reports.	In progress
1.3	Supplemental POAM (Implementation Schedule)	1/17/2022	2/1/2022	Develop a supplemental POAM to assess operations and systems integrity to safely defuel	Complete
2	Operations, Safety and Risk Management	1/31/2022	3/25/2022	Safety and operational risk assessment	
2.1	Conduct Hazard and Operability Study	2/7/2022	2/18/2022	A team of facility personnel and our SMEs will discuss and evaluate the defueling operation as part of the upcoming OSHA process safety management (PSM) Hazard and Operability (HAZOP) Study. This step collects first-hand knowledge from operators through workshops aimed at capturing the decision-making process of individuals to determine the sensitivity of the system to different decisions in "what-if" scenarios. We will evaluate the potential outcomes and provide as-needed recommendations.	
2.2	Review EPA Spill Prevention, Control and Countermeasure (SPCC) Checklist	3/21/2022	3/25/2022	This will be completed to evaluate the facility's spill response preparedness	
2.3	Conduct Interviews	2/14/2022	2/18/2022	Conduct interviews to evaluate the overall training of operations staff. These on-site interviews will indicate the level of understanding of the systems they have in place and their approach to risk assessment for any workarounds. If there is a degree of misunderstanding of how systems operate, this will need to be evaluated for defueling of the facility. Depending on our assessment, we may recommend additional detailed training for all systems related to defueling.	
2.4	Review Defueling Procedure	TBD	TBD	Based on a review of the defueling procedures we may recommend re-writing the procedures in a format that is single step-by-step and which allows for sign-off for all steps with accompanying risk assessment and dry runs as needed. There may also be a need to require specific training for the Operations staff including a walkthrough of the procedures.	
2.5	Perform a Risk Assessment	TBD	TBD	Perform a Risk Assessment from an emergency response perspective including a review of the facility's emergency response manual. This may require response training by all staff involved, specific to the defueling and addressing identified scenarios.	
2.6	Stop Work Evaluation	TBD	TBD	Evaluate the need for stopping all non-essential work and clearing the tunnels of all material not associated with defueling.	
2.7	Evaluate Emergency Systems	TBD	TBD	Evaluate emergency systems prior to defueling and determine whether an emergency response team should be on standby. This may include spill response with specific scenarios tested and personnel/equipment on standby.	
2.8	Evaluate the Need for Sealing	TBD	TBD	Evaluate the need for sealing of penetrations, holes, cracks, etc. which have the potential for allowing fuel spillage to leak out of the tunnels.	
2.9	Determine the Need to Engage Third Party for Monitoring Defueling Activities	TBD	TBD	Determine the need for engagement of third parties to monitor defueling activities.	
2.10	Determine the Need for Installation of Additional Instrumentation and Mitigation of Observed Defects	TBD	TBD	Determine the need for installation of additional instrumentation as well as mitigation of observed deficiencies prior to defueling. In order to mitigate escalation risks, the facility Operators should provide us with a list of their observations regardless of their perceived criticality.	



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3	Structural Integrity Assessment	1/31/2022	4/11/2022	Evaluation of critical structures	
3.1	Perform Tank Finite Element Analysis (FEA)	2/7/2022	4/11/2022	While this analysis is more geared towards existing operations, it may also be instructive to perform our tank structural analysis (since tank fill levels change during defueling operations) in order to evaluate the integrity of the existing tanks for various loading conditions, i.e., considering different fill levels, loading demands, and degradation of the tank materials, to quantify the risk of leakage to the surrounding rock and underlying aquifer.	
3.2	Perform Non-Destructive Testing	1/19/2022	TBD	SGH on-site personnel will spot check the thickness of the fuel pipelines and the steel tank liners using an ultrasonic thickness (UT) gauge and the tank interior and pipeline exterior protective paint coating, if accessible, using a dry film thickness (DFT) gauge to verify reported material conditions from historic data based on UFC 3-460-003.	
4	Mechanical Integrity Assessment	1/31/2022	4/18/2022	Fitness for service (FFS) evaluation of piping and equipment	
4.1	Perform Pipeline FEA	2/7/2022	4/11/2022	This structural analysis will evaluate the integrity of the piping systems specifically used between the underground fuel tanks and Hotel Pier, through which the fuel would be transported during defueling.	
4.2	Perform Non-Destructive Testing	1/19/2022	TBD	SGH on-site personnel will spot check the thickness of the fuel pipelines and the steel tank liners using an ultrasonic thickness (UT) gauge and the tank interior and pipeline exterior protective paint coating, if accessible, using a dry film thickness (DFT) gauge to verify reported material conditions from historic data based on UFC 3-460-003.	
4.3	Develop Repair, Retrofit, and Maintenance Requirements	2/14/2022	4/18/2022	Our FE analyses, document reviews, and site walkdown observations may highlight structural integrity vulnerabilities in the tanks and piping systems. Repair and retrofit strategies may include but are not limited to the items listed here.	
4.3.1	Evaluate the Need for Piping Lateral Restraints	2/14/2022	4/18/2022	Evaluate the need for lateral restraints to the fuel lines at each of the offtakes at the tanks (i.e., at 19/20, 18/17, 16/15, etc.) so that in the event of a transient pressure surge during defueling, the fuel lines are laterally restrained to prevent significant movements from occurring.	
4.3.2	Evaluate the Need of Adding a Bypass Line	2/14/2022	4/18/2022	Evaluate the need for adding a bypass line around the outboard main fuel block valves with a double block and bleed valve arrangement before defueling. This may allow the fuel team to remove the vacuum without operating a main block valve and be able to control the rate that fuel is entering the product line to clear the vacuum/void and mitigate a "surge" event.	
4.3.3	Evaluate Adding a Differential Pressure Measurement	2/14/2022	4/18/2022	Evaluate adding a differential pressure measurement at each of the main block valves at the storage tanks and the valves that are located along the product lines before defueling so that the fuel team can monitor valve differential pressure before opening a valve.	
4.3.4	Evaluate the Option of Adding Pressure Measurement	2/14/2022	4/18/2022	Evaluate the option of adding pressure measurement at key points along the product lines before defueling.	
4.3.5	Evaluate the Need to Replace the Valves on the Product Lines	2/14/2022	4/18/2022	Evaluate the need to replace the valves on the product lines that are allowing the vacuum to occur with valves that have block and bleed capability. Also, evaluate the need to replace the valves at the "end" of the product lines just as they enter the underground valve/pump station with properly designed control and shut-off valves that can be safely opened with full differential pressure.	
4.3.6	Recommend Instrumentation Plan, as Needed, to Monitor Pipeline Movement	2/14/2022	4/18/2022	Recommend a plan, as needed, to monitor pipeline movement during defueling.	
5	Cost Estimate	3/7/2022	4/18/2022		
5.1	Quantity Takeoff	3/7/2022	4/18/2022	Develop quantity takeoffs using the structural and mechanical retrofit concepts	
5.2	Class 4 Cost Estimate	3/7/2022	4/18/2022	Develop cost estimates for required repairs using the quantity takeoffs for developed retrofit concepts or replacement	
6	Special Studies	2/17/2022	3/28/2022		
6.1	Response to Stakeholders	2/17/2022	3/28/2022	Respond to stakeholder questions and comments, as determined, requested and coordinated by the US Government. Stakeholder questions and comments to be provided no later than 3/11/2022.	
7	Reports	1/24/2022	4/30/2022		
7.1	Interim Assessment Report with Identified Deficiencies (50%)	2/21/2022	3/7/2022	Identified deficiencies, key assumptions, summary of inputs, methodology, analysis cases, and preliminary evaluation findings, and initial mitigation recommendations.	



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7.2	Pre-Final Assessment Report (75%)	3/21/2022	3/28/2022	- More refined recommendations to address identified design and operational deficiencies in addition to interim report contents - Structural upgrade and mechanical repair recommendations as drawing markups and sketches - Preliminary cost estimates - Implementation plan and recommended schedule	
7.3	Assessment Report (100%)	4/18/2022	4/25/2022	Update 75% report incorporating stakeholder comments and to include final results	
7.4	Weekly Reports	1/25/2022	4/26/2022	Document progress, areas concerns and weekly plans	
8	Meetings	1/19/2022	4/30/2022		
8.1	Kickoff Meeting (On-Site)	1/19/2022	1/19/2022	Introduction and presentation of assessment approach, list of deliverables and schedule to stakeholders	Complete
8.2	Post HAZOP Stakeholder Meeting (On-Site)	2/17/2022	2/17/2022	In person project progress presentation to stakeholders (after the HAZOP), updating them on project status and HAZOP	
8.3	Interim Deficiencies Stakeholder Meeting (On-Site)	3/10/2022	3/10/2022	At the 50% project completion point present interim deficiencies	
8.4	Pre-Final Recommendations Stakeholder Meeting	3/29/2022	3/29/2022	At the 75% project completion point, present the list of Pre-Final Recommendations and progress to date	
8.5	Out-Briefing Stakeholder Meeting – Draft Assessment Report	4/19/2022	4/19/2022	Presentation for stakeholders that provides a draft summary of all completed work and communicates all recommendations and estimated costs.	
8.6	Final Assessment Presentation (On-Site)	4/26/2022	4/26/2022	Present findings of our studies and recommendations in person after the completion of the final report	
8.7	Weekly Meetings (Tuesday)	1/25/2022	4/26/2022	Present progress, areas concerns and weekly plans	