Red Hill Bulk Fuel Storage Facility Scoping Meeting

AOC Section 3 Tank Upgrade Alternatives

November 30 – December 4, 2015

Presented By:

Enterprise Engineering, Inc.
Freeport, Maine

Under Contract To:

HDR Engineering, Inc.
Honolulu, Hawaii

Prepared For:
NAVFAC Pacific
Joint Base Pearl Harbor-Hickam, Hawaii

Contract Number: N62742-13-D-0001
Delivery Order 0009

AOC Section 3
Tank Upgrade Alternatives

- AOC 3.0 Tank Upgrade Alternatives Deliverables

The purpose of deliverables to be developed and work to be performed must result in:

- Identify and evaluate tank upgrade alternatives (TUA)
- Select and implement the BAPT and TIRM procedures that can be applied
- Integrate discussion on TUA Alternative, and appropriate BAPT Release Detection/Tank Tightness Testing

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AOC Section 3
Scoping Meeting

- AOC 3.1 Scoping Meeting(s) for TUA Report
  - Within 30 days from effective date of the AOC conduct an initial scoping meeting
  - Purpose of the Meeting:
    - Detail the contents of the Scope of Work for the TUA Report
    - Discuss criteria for decision making
    - Decide whether additional Scoping Meetings are needed
  - An initial Scoping Meeting was conducted 27 Oct 2015

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AOC Section 3
Scoping Meeting 27 OCT 2015

- Highlights of Items Discussed
  - Previous EEI studies
  - Current Tank Upgrade Study (HDR/EEI)
    - A-E Scope based on AOC SOW version as of 30 April 2015
    - In Progress Review Report submitted 24 July 2015
    - In Progress Review Meeting conducted 4 – 5 August 2015
  - Elements of Scope of Work for TUA Report
  - Evaluation/Decisions Criteria
  - Role of Subject Matter Experts (SME)
  - Quality Assurance / Quality Control
  - Items to be further discussed at 30 November Face-to-Face Meeting

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AOC Section 3
Scoping Meeting 27 OCT 2015

- Action Items
  - NAVFAC Pacific to provide EPA and DOH review comments on In Progress Report
  - EPA and DOH to provide comments on In Progress Report
  - EEI to give presentation on In Progress Report

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AOC Section 3
Face to Face Meeting

- AOC 3.1 Continuation of AOC Scoping Meeting…….

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AOC Section 3
TUA Scope of Work

- AOC 3.2 TUA Scope of Work
  - Due within 90 days of final Scoping Meeting
  - Navy/DLA submit TUA scope to Regulatory Agencies for Approval

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AOC Section 3
TUA Report

- AOC 3.3 TUA Report
  - Due within 12 months from Regulatory Agencies approval of the Scope of Work
  - The purpose of the report is to identify and evaluate various tank upgrade alternatives that can be applied to the tank at the Red Hill Bulk Fuel Storage Facility
  - The report shall evaluate the following:
    - Current tank upgrade procedures
    - Secondary containment alternatives
    - Coatings
    - Liners / Bladders
    - Associated release detection systems
    - Any other alternative deemed promising

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AOC Section 3
TUA Deliverables and Timeline

Deliverable/Milestone	Date/Duration
AOC Effective Date	28 SEPT 2015
Initial Scoping Meeting for TUA Report (within 30 days of Effective Date of AOC)	27 OCT 2015
Face-to-Face Scoping Meeting for TUA Report	30 NOV to 4 DEC 2015
TUA Scope of Work	Within 90 days of final Scoping Meeting
TUA Report	Within 12 months from Regulatory Agencies' approval of the Scope of Work
Regulatory Review and Approval of TUA Report	TBD
TUA Decision Meeting	Within 60 days of Regulator Agencies' approval of TUA Report
TUA Decision Document and Implementation	Within 60 days from Decision Meeting

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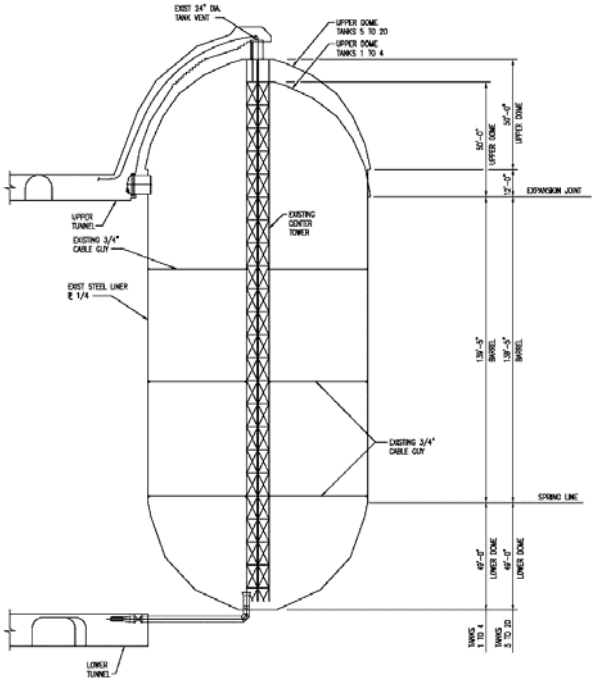
AOC Section 3
Tank Upgrade Alternatives



- Preliminary TUA Report

  Under contract to NAVFAC HI, HDR and EEI have completed a Jump start to the TUA, based on the preliminary AOC SOW.

  Although the final AOC SOW has differences, the material developed to date does have relevancy and will be presented as a snapshot of ideas

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Tank Upgrade Technologies

Step 1: Identify Available Tank Upgrade Technologies

First Pass List of TUA technologies

- Brainstorm of initial TUA concepts to test against initial screening criteria to determine if worthy of additional evaluation
- Separated into groups by primary characteristic

Step 1: Identify Available Technologies

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Tank Interior Upgrade Technologies

- Repair steel liner
  - Patch Plates and Welding
- Coatings
  - Epoxy (thin film)
  - Polysulfide Modified Epoxy Novolac (thin film)
  - Urethane (thin film)
  - Polyurea (thick film)
  - Thermal Spay Aluminum (Metalizing)
  - Thermal Spray Ceramic
  - Glass

Step 1: Identify Available Technologies

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Tank Interior Upgrade Technologies

- Liners
  - Single Wall Fiberglass
  - Double Wall Fiberglass with Release Detection (TankBau system)
  - Rubber Lining (bonded to existing steel liner)
  - Flexible Membrane
  - Carbon Fiber Sheet
  - Carbon Fiber Sandwich Panel
  - Carbon Steel
  - Stainless Steel

Step 1: Identify Available Technologies

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Tank Interior Upgrade Technologies

- Liners
  - Stainless Steel Membrane (similar to LNG membrane tank concept)
  - Dimple Jacket
  - Weld Overlay
  - Concrete
  - Gunite
  - Ceramic Tile

Step 1: Identify Available Technologies

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Tank Exterior Upgrade Technologies

- Encapsulation
  - Cementitious Grout
  - Chemical Grout (Types of chemical grout include urethane, polyurethane, sodium silicate, and acrylic)
- Cut-off Pan below Tank
- Sheet Pile Wall
- Cryogenic (Ice layer outside Tank)

Step 1: Identify Available Technologies

Tank Upgrade Technologies

Step 2: Initial Screening Considerations

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Tank Upgrade Alternatives
Initial Screening Considerations

Any viable upgrade alternative should as a minimum be:

- Constructible and Testable (after construction)
- Inspectable and Repairable (future integrity assessment)

Step 2: Initial Screening Considerations

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Tank Upgrade Alternatives
Initial Screening Consideration Definitions

- **Constructible**: Can be constructed in field at Red Hill using traditional construction means and methods
- **Testable**: Can be tested and shown acceptable during construction and startup/commissioning
- **Inspectable**: Able to determine integrity on a periodic basis either in service and/or out of service
- **Repairable**: Able to be repaired in field at Red Hill using traditional construction/repair means and methods

Step 2: Initial Screening Considerations

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Tank Upgrade Alternatives

Step 3: Identify Tank Upgrade Alternatives

Tank Upgrade Alternatives

- Single Wall Tank No Secondary Containment
- Double Wall Tank / Secondary Containment

Step 3: Identify Tank Upgrade Alternatives

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Single Wall Tank
No Secondary Containment

- Single Wall Tank Upgrade Concepts for further evaluation
  - **1A** Restoration of Existing Tank with improved TIRM procedures
  - **1B** Restoration of Existing Tank Plus Interior Coating
  - **1C** Restoration of Existing Tank plus Metalizing on Existing Steel Liner
  - **1D** Rubber Lining bonded to Existing Steel Liner
  - **1E** Replace Existing Steel Liner (remove existing)
  - These concepts include replacing the existing single wall concrete encased piping from the tank to the first valve outside tank with double wall construction

Step 3: Identify Tank Upgrade Alternatives

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Single Wall Tank
No Secondary Containment

- Each of the Single Wall Tank – No Secondary Containment Alternatives is described in the In Progress Review Report

Step 3: Identify Tank Upgrade Alternatives

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Single Wall Tank
No Secondary Containment

- Associated Release Detection
  - A technology based method of determining a release via appropriate sensors and computer based algorithm software considered mandatory for any single wall TUA concept
  - Additional discussion under AOC Section 4, Release Detection / Tank Tightness Testing

Step 3: Identify Tank Upgrade Alternatives

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Double Wall Tank with Secondary Containment for Evaluation

- Double Wall / Secondary Containment Concepts for further evaluation
  - **2A** Composite Double Wall Tank (Carbon Steel)
  - **2B** Composite Double Wall Tank (Duplex Stainless Steel)
  - **3A** Tank within a Tank (Carbon Steel)
  - **3B** Tank within a Tank (Duplex Stainless Steel)
  - **4** Double Wall Fiberglass System
  - **5A** Steel Liner Plates Welded to Existing Steel Liner
  - **5B** Steel Liner Plates with Expanded Metal Plate between Existing Steel Liner and Steel Liner
  - **6** Stainless Steel Membrane with insulation over existing steel liner (similar to LNG Concept)
  - **7** Flexible Membrane Liner, not bonded to steel liner
  - These concepts include replacing the existing single wall concrete encased piping from the tank to the first valve outside tank with double wall construction

Step 3: Identify Tank Upgrade Alternatives

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Double Wall Tank with Secondary Containment for Evaluation

- Each of the Double Wall Tank with Secondary Containment Alternatives is described in the In Progress Review Report

Step 3: Identify Tank Upgrade Alternatives

Double Wall Tank / Secondary Containment

- Associated Release Detection
  - Only simple technology needed to identify liquid outside of tank containment primary barrier

Step 3: Identify Tank Upgrade Alternatives

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TUA Alternative Evaluation

Step 4: Evaluate Tank Upgrade Alternatives

TUA Alternative Evaluation

- Current TUA evaluation required development of Evaluation Attributes, to identify common elements and differences between each alternative
- The Attributes were to be presented without weighting for use by others in determining the BAPT
- A change in this direction is required to meet the final AOC requirements
- Current Evaluation Attributes presented for info only

Step 4: Evaluate Tank Upgrade Alternatives

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Tank Fuel Volume Considerations

- Each overall TUA results in its own resultant net usable volume for fuel storage
- The resultant useable volume is important as it drives the number of tanks needed to meet total Red Hill storage requirements
- [redacted] tanks currently needed to meet current requirements.

Step 4: Evaluate Tank Upgrade Alternatives

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Tank Upgrade BAPT Evaluation Attributes

NAVFAC BAPT Evaluation Attributes

- Impact on current fuel storage
  - Does alternative result in reduction container capacity compared to existing tank?

Step 4: Evaluate Tank Upgrade Alternatives

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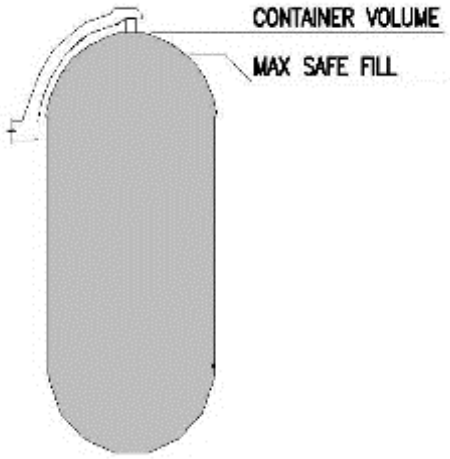
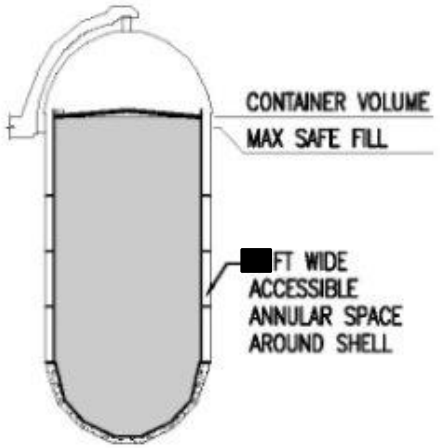
Tank Fuel Volume Considerations



Existing and Single Wall Tank

Double Wall Tank



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Tank in Tank (AST)

Step 4: Evaluate Tank Upgrade Alternatives

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Tank Upgrade BAPT Evaluation Attributes

NAVFAC BAPT Evaluation Attributes

- Secondary Containment
  - Does the alternative provide secondary containment?
  - What does the secondary containment consist of?
- Associated Release Detection System
  - What type of release detection system is required?
- Commercially available products – Existing Tank Preparation and Repairs/Construction
  - What materials are needed?
  - Are the materials readily available?

Step 4: Evaluate Tank Upgrade Alternatives

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Tank Upgrade BAPT Evaluation Attributes

NAVFAC BAPT Evaluation Attributes

- Commercially available products – Release Detection
  - Is the release detection system an "off the shelf" item, readily available?
  - Or is an enhanced system with sensors and computer based algorithm software required?
- Facilities/sites the technology has been utilized and its performance
- Design or anticipated service life
- Operating requirements
- Maintenance requirements

Step 4: Evaluate Tank Upgrade Alternatives

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Tank Upgrade BAPT Evaluation Attributes

NAVFAC BAPT Evaluation Attributes

- Testing and commissioning procedures
- Rational for the testing and commissioning procedures

Step 4: Evaluate Tank Upgrade Alternatives

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Tank Upgrade BAPT Evaluation Attributes

NAVFAC BAPT Evaluation Attributes

- Risks
  - Environmental (ability to contain and locate leaks)
- Benefits
  - Environmental (ability to contain and locate leaks)
- Reliability
- Ability to repair failures
- Manufacturer's technical information
- Applicability to tanks at Red Hill

Step 4: Evaluate Tank Upgrade Alternatives

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Tank Upgrade BAPT Evaluation Attributes

NAVFAC BAPT Evaluation Attributes

- Compatibility with current release detection system
- Compatibility with current tank tightness tests
- Compatibility with existing ancillary equipment and if required, upgrades to implement the technology
- Cost
- Maintenance Cost
- Construction Schedule

Step 4: Evaluate Tank Upgrade Alternatives

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Tank Upgrade BAPT Evaluation Attributes

EEI added Evaluation Attributes

- Primary Positive Attributes
- Primary Negative Attributes
- Constructible and Testable
- Future Inspectability and Reparability
- Dependency on Existing Tank Integrity

Step 4: Evaluate Tank Upgrade Alternatives

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Tank Upgrade BAPT Evaluation Attributes

EEI added Evaluation Attributes

- Capabilities (Release Detection)
  - Ability to contain and locate leaks
- Lower Dome Treatment Considerations and Alternatives
- Upper Dome Treatment Considerations and Alternatives
- Quality Control and Quality Assurance (during inspection and construction

Step 4: Evaluate Tank Upgrade Alternatives

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BAPT SUMMARY MATRIX

A BAPT Summary Matrix is provided in the In Progress Review Report (Table 2-4)

Step 4: Evaluate Tank Upgrade Alternatives

TABLE 2-4
TANK UPGRADE ALTERNATIVES - BAPT DECISION MATRIX

Item	Alternative												
	1A	1B	1C	2A	2B	3A	3B	4	5A	5B	6	7	8
Description	Restoration of Tank	Restoration of Tank plus Interior Coating	Restoration of Tank plus Metalizing and Interior Coating on Existing Steel Liner	Composite Tank (Double Wall) Carbon Steel	Composite Tank (Double Wall) Duplex Stainless Steel	Tank within a Tank (Carbon Steel)	Tank within a Tank (Duplex Stainless Steel)	Double Wall Fiberglass System with Release Detection	Steel Liner Plates Welded to Existing Steel Liner	Steel Liner Plates with Expanded Metal between Existing Steel Liner and Steel Liner	Stainless Steel Membrane over Existing Steel Liner	Rubber Lining Bonded to Existing Steel Liner	Flexible Membrane Liner
Primary Positive Attributes	Low cost Least volume lost	Low cost Least volume lost	Low cost Least volume lost	Double wall barrel and lower dome with release detection	Same as 2A. Use of stainless steel, eliminates coatings.	Exterior of tank fully visible and inspectable. Existing tank serves as secondary containment	Same as 3A. Use of stainless steel eliminates coating of tank	Double wall with release detection	Double wall with release detection	Same as Alt 5A	Double wall, stainless steel liner, no coatings	None identified	None identified
Primary Negative Attributes	Single wall, must rely on BAPT release detection system	Single wall, must rely on BAPT release detection system	Single wall, must rely on BAPT release detection system Difficult surface prep for metalizing	Modest loss of fuel storage in lower dome and barrel, no fuel stored in upper dome	Modest loss of fuel storage in lower dome and barrel, no fuel stored in upper dome	Considerable reduction in fuel storage capacity	Same as Alt 3A	Release detection piping must be inside of primary tank. Fiberglass historically does not last as long as steel, easily damaged.	Release detection piping must be inside of primary tank	Same as 5A	Not yet determined ability to provide release detection channeling. Stainless steel membrane may suffer damage during future inspection and cleaning.	Single wall, must rely on BAPT release detection system	Inability to obtain certified strapping tables as liner not attached to steel liner at all points. May not be suitable for pressure at bottom of tank

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Thank You