DEPARTMENT OF THE NAVY
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19 NOV 2019

CERTIFIED NO: 7016 0910 0001 0898 4569
Mr. Omer Shalev
U.S. Environmental Protection Agency, Region 9
75 Hawthorne Street
San Francisco, CA 94105

CERTIFIED NO: 7016 0910 0001 0898 4576
Ms. Roxanne Kwan
State of Hawaii Department of Health
Solid and Hazardous Branch
2827 Waimano Home Road
Pearl City, HI 96782

Dear Mr. Shalev and Ms. Kwan,

SUBJECT: RISK AND VULNERABILITY ASSESSMENT ("RVA") PHASE 2 FOR THE RED HILL ADMINISTRATIVE ORDER ON CONSENT ("AOC") STATEMENT OF WORK ("SOW") SECTION 8

Thank you for your letter dated September 23, 2019 approving the Navy/DLA Quantitative Risk and Vulnerability Assessment Phase 1.

As discussed previously between Navy/DLA and EPA/DOH, Navy/DLA are submitting a proposed scope of work to complete Phases 2, 3 and 4 (hereinafter referred to as "Phase 2 of the Risk and Vulnerability Assessment" (RVA)) in accordance with the AOC SOW Section 8 and Reference (1) within the 120-day timeframe as required.

In accordance with reference (1), as requested in the "Additional Work Requirements" Section, Work Requirement number 1, Navy/DLA's proposed scope of work for the RVA Phase 2 is attached. The RVA Phase 2 will provide the risk and vulnerability assessment for what was previously defined as:

Phase 2: Internal and External Fire and Flooding Initiating Events,
Phase 3: Seismic Initiating Events, and
Phase 4: Other External Initiating Events.

Navy/DLA have considered the recommendation that the revised approach be discussed with external stakeholders beyond the Regulatory Agencies. At this time, Navy/DLA do not intend to seek input from external stakeholders. The qualitative screening methodology is not intended to be complex. The targeted quantitative analysis will utilize standardized engineering calculations. Comments will be reviewed and considered when the assessment is publicly released.

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As requested in the "Additional Work Requirements" Section, Work Requirement number 2 from reference (1) the Navy/DLA will conduct vadose zone modeling (based on past light non-aqueous phase liquid (LNAPL) modeling discussions) which will help bound our understanding of LNAPL behavior and associated footprints for a range of releases from a reasonably conservative standpoint. This effort will provide a basis for developing the source terms that will be used in the required fate and transport model used for evaluation of chemicals of potential concern (COPCs) in groundwater. In addition, both the LNAPL vadose zone and groundwater model will also be used to help develop a human health/ecological risk assessment as requested by the Agencies under the Quantitative Risk and Vulnerability Assessment Phase 1 ("Risk Assessment") Section of the approval letter.

The Navy/DLA believe we have adequately addressed tank fuel inventory instrumentation improvements, tank ullage and other emergency response procedures in the Tank Upgrades Alternative and Release Detection Decision document submitted in September.

Navy/DLA understand the Honolulu Board of Water Supply's request to review the un-redacted version of the Quantitative Risk and Vulnerability Assessment Phase 1. We will provided an un-redacted copy of the report to BWS upon receipt of a signed non-disclosure agreement.

If you have any questions, please contact CDR Darrel Frame, the acting Red Hill Program Director/Project Coordinator at (808) 312-2652 or darrel.e.frame@navy.mil.

Sincerely,

M. R. DELAO
Captain, CEC, U.S. Navy
Regional Engineer
By direction of the
Commander

Reference: 1. Letter to CAPT Delao from Mr. Shalev and Ms. Kwan dated September 23, 2019, Re: Section 8 of the Red Hill Administrative Order on Consent ("AOC") Statement of Work ("SOW") Approval of Section 8.3 and Requirement to Complete Additional Work.

Enclosures: 1. Navy/DLA proposed RVA Phase 2 Scope of Work

Contract N62742-17-D-1802, Delivery Order N6274218F0180

8.2 Risk/Vulnerability Assessment Phase 2 Scope of Work

6 September 2019

Red Hill Bulk Fuel Storage Facility NAVSUP FLC Pearl Harbor, HI (PRL)

Joint Base Pearl Harbor-Hickam

Administrative Order on Consent
In the matter of Red Hill Bulk Fuel Storage Facility
EPA Docket No. RCRA 7003-R9-2015-01
DOH Docket No. 15-UST-EA-01

Contract Agency:

NAVFAC Hawaii
400 Marshall Road
JBPHH Hawaii 96860-3139

Prime Contract:

element environmental llc
environmental · engineering · water resources

First-Tier Subcontract:

Engineering, Inc.
1132 Bishop Street, Suite 1200
Honolulu, Hawaii 96813-2822

Prepared By:

ABS Consulting

300 Commerce Drive, Suite 150, Irvine, California 92602-1302

ABS Consulting Project No. 4134723

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1. Introduction

This work plan has been developed as guidance for implementing Phase 2 of the Red Hill Bulk Fuel Storage Facility (RHBFSF) Risk and Vulnerability Assessment (RVA) in compliance with the RHBFSF Administrative Order on Consent (AOC) (Reference 1). This work plan is the primary deliverable of project work authorized to ABSG Consulting Inc. (ABS Consulting) via HDR Engineering, Inc. (HDR Engineering) and Element Environmental, LLC (Element Environmental) under Navy Contract N62742-17-D-1802, Delivery Order N6274218F0180 (Reference 2).

Phase 1 of the project was executed as Contract Task Order (CTO) No. N6274217F0119, Amendment 64, under Contract N62742-14-D-1884. Phase 1 was completed in the form of a rigorous, comprehensive Quantitative Risk and Vulnerability Assessment (QRVA) of internal events only (without fire or flooding) as documented in ABS Consulting report number R-3751812-2043 dated 12 November 2018. Originally, Phases 2 (Fire and Flooding Hazards) and 3 (Seismic Hazards) of the QRVA were authorized to begin and were initiated in late 2018, but these phases of the QRVA work were suspended by the Navy in late March 2019 to consider a more expedient, primarily qualitative approach for Phase 2 of the RVA, the focus of this work plan.

The intent of the current CTO is to execute Phase 2 of the RVA to assess the risk of potential fuel releases from the RHBFSF, Joint Base Pearl Harbor-Hickam. Phase 2 of the RVA will address the initiating events covered in Phases 2 through 4 of the original QRVA:

Phase 1 – Internal Events
Phase 2 – Internal and External Flooding and Fire
Phase 3 – Seismic Events
Phase 4 – Other External Events

In March 2019, the Regulatory Agencies and the Navy agreed to utilize a qualitative approach to the Risk and Vulnerability Assessment over a quantitative one to satisfy the intent of the AOC-Scope of Work (SOW) (Reference 1). The current CTO has been modified to de-scope the quantitative risk and vulnerability assessment and change the approach to a qualitative screening level assessment with targeted quantitative analyses.

2. Methods, Process, and Criteria for Data Quality

2.1 Purpose

The purpose of this work plan is to clearly communicate the approach and methodology for effective and efficient development of the RHBFSF RVA. The RHBFSF RVA will be designed to serve as a support tool to help facilitate prudent decisions for future RHBFSF risk and safety management.

2.2 Background

The Red Hill Bulk Fuel Storage Facility site is located approximately 2.5 miles northeast of Pearl Harbor on the island of Oahu in Hawaii. The facility lies along the western edge of the Koolau Range and is situated on a topographic ridge that divides the Halawa Valley and the Moanalua Valley. The site is bordered to the south by the Salt Lake volcanic crater and occupies approximately 144 acres of land. The surface topography varies from approximately 200 feet to 500 feet above mean sea level.

The facility consists of twenty 12.5-million-gallon underground storage tanks (UST) constructed in the early 1940s. Currently, three USTs are out of service (T-1, T-5, and T-19). The facility currently stores Jet Propulsion Fuel No. 5 (JP-5), Jet Propulsion Fuel No. 8 (JP-8), and marine diesel (F-76). Historic fuel storage has included diesel oil, Navy Special Fuel Oil, Navy distillate, F-76, aviation gas, motor gas, JP-5, and JP-8.

There have been several prior petroleum, oil, and lubrication releases at the site and numerous environmental activities/studies performed for various reasons, including pipe and tank testing, release response, tank monitoring, long-term monitoring, and removal actions.

In January 2014, up to 27,000 gallons of JP-8 was released from T-5, which was being re-filled after having undergone inspections and repair. Tank T-5 is currently out of service undergoing inspection, repair, maintenance, and testing. The Navy plans to eventually bring T-5 back into service. As a result of the fuel release from Tank 5 at the RHBFSF in January 2014, the U.S. Environmental Protection Agency (EPA) and the Hawaii Department of Health (DOH) brought an enforcement action against the Navy and the Defense Logistics Agency to address past fuel releases and minimize the likelihood and impact of future releases. Regulatory experience has shown that a negotiated agreement, such as an Administrative Order on Consent, is the appropriate enforcement tool to solve complex environmental problems since it allows for flexible and innovative solutions. The Administrative Order on Consent goes beyond the scope of merely complying with the current regulations.

2.3 Objectives

The objectives of this work plan are:

- Clearly communicate a comprehensive technical approach and methodology to effectively and efficiently support development of the RHBFSF Phase 2 RVA in this project.

- Provide a foundation for the Naval Facilities Engineering Command (NAVFAC) to implement effective project management for the Phase 2 of the RHBFSF RVA.

- Provide guidance, references, and a bibliography of information sources supporting implementation of the Phase 2 RHBFSF RVA, and supporting a basis for a clear understanding of the Phase 2 RHBFSF RVA results to NAVFAC and others outside the RVA team who will be required to review and apply RVA results to facilitate prudent decision-making for RHBFSF management, operation, maintenance, inspection, testing, and associated facility activities.

2.4 RVA Scope Determination

The scope of hazards to be addressed within the RVA must be specified. Industry experience, supplemented by industry standards for risk assessment, has established that a comprehensive RVA should generally consider risks from the following hazard sources, which are recommended to characterize the scope of hazards to be addressed in the Phase 2 RHBFSF RVA:

- Internal Flooding
- Internal Fires
- Internal Sabotage (not included within the scope of this analysis for security reasons)
- External Flooding (including tsunami and heavy precipitation)
- External Fires
- Seismic Events (earthquakes)
- Other External Events:
    - High Winds
    - Storms (tornados, hurricanes, etc.)
    - Landslides (or mud slides)
    - Proximity Transportation Accidents
    - Proximity Aircraft Crashes
    - External Hazardous Material or Chemical Spills or Releases
    - Extreme Weather (e.g., high temperature, etc.)

- Terrorist Acts (not included within the scope of this analysis for security reasons)

- Other Facility-Specific Hazards (often location-dependent hazards that can be special cases of other general hazard sources)

It is very important that the desired RVA scope (including analysis boundaries) issues are resolved early during the project to best facilitate an effective and efficient RHBFSF RVA.

2.5 Boundaries of Assessment

The scope of an RVA is defined via clear and comprehensive characterization of assessment boundaries. First, the functional and physical boundaries of the facility to be assessed must be clearly defined. The functional boundaries are facility-specific, depending upon the processes performed by or at the facility. The physical boundaries are generally defined by specifying the target property lines, structures, systems, and components (SSC) considered to be within the facility functional boundaries. Functional and physical boundaries are generally those supported by existing as-built, as-operated design basis documentation (DBD). DBD includes currently effective documentation and schematic drawing information associated with the as-built, as-operated facility. DBD includes all effective documentation associated with facility design, operation, maintenance, and testing; e.g., documentation associated with the initial information item request presented in Section 2.7 of this work plan.

Closely related to analysis boundaries is the issue of the physical and functional basis or starting point for the RVA. An effective design freeze date must be established to ensure a stable design basis for the RVA. Regarding determination of the RHBFSF design basis for the RVA, the following design basis has been selected by the Navy:

> Freeze the facility design as of the date of notification to proceed (NTP) for Phase 2 of the RVA project. The design basis will be the as-built, as-operated facility as of the NTP date, to include design, operation, maintenance, and testing changes that have been approved and funded as of the NTP date, but with no additional modification options.

2.6 Procedural Approach

The overall process flow for the RHBFSF Phase 2 RVA is summarized in Figure 2-1.

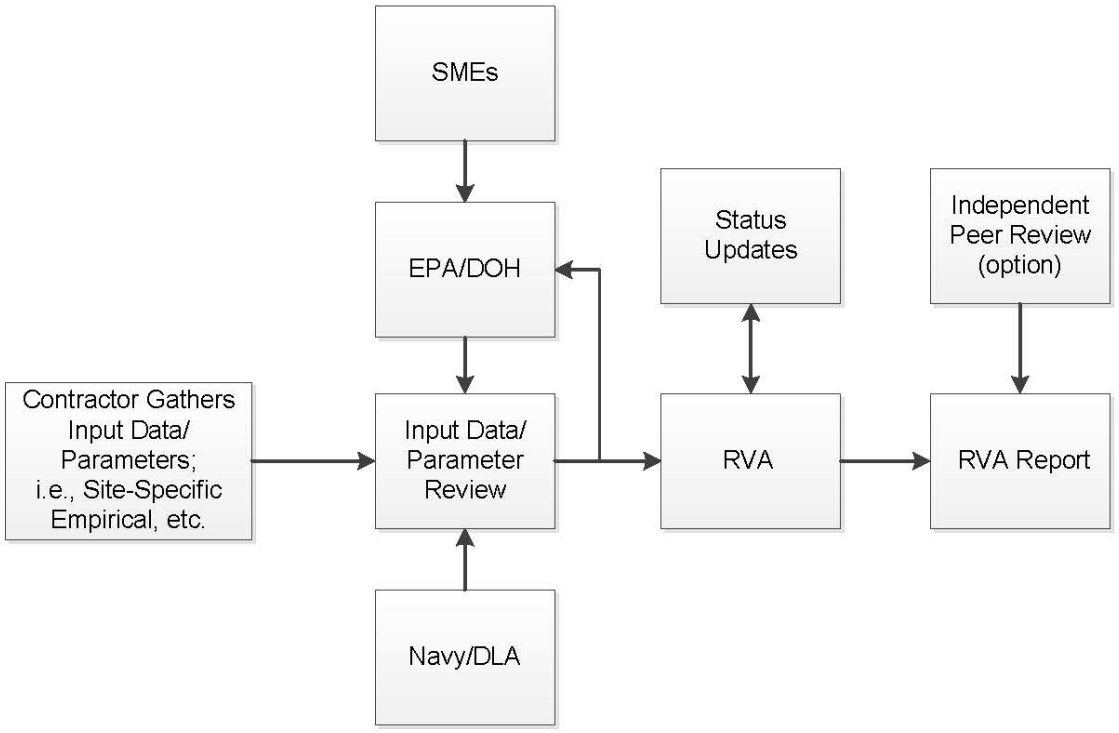

Figure 2-1. RVA Process Overview

Communication

From a project management overview perspective, all communication on the project will be made by the RVA team (the ABS Consulting team) to the Navy via the contractor chain of command identified in Figure 2-2. It is important to note that the personnel listed in Figure 2-2 are current as of the publication of this work plan but may change over time throughout the project.

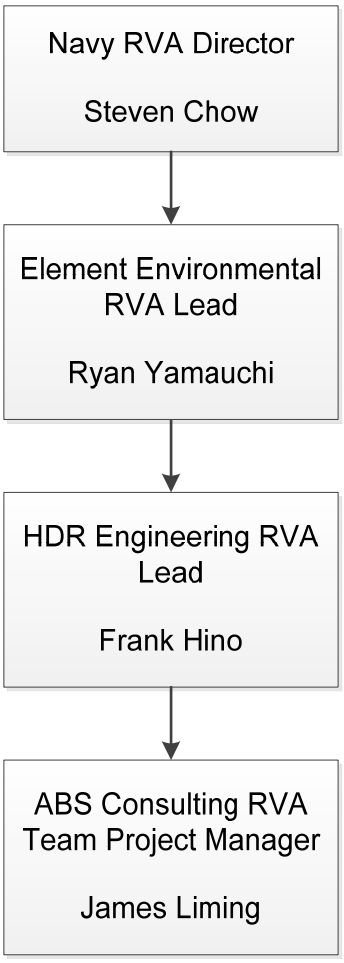

Figure 2-2. Project Communication Channels

All communication will be controlled as directed by the Navy. Information requests and product delivery will be submitted by the RVA Team Project Manager to the Navy RVA Director through the HDR Engineering and Element Environmental RVA Leads as shown in Figure 2-2. Communication will be made in written form, primarily via e-mail, but may, in some cases, involve formal letter communication via express mail or U.S. Post Office mail services.

Technical Work

Technical work on the RHBFSF Phase 2 RVA will be conducted applying the methodology, guidelines, and procedures determined by the RVA Team. The primary guidance information sources are the qualitative risk guidance presented in American Institute of Chemical Engineers Center for Chemical Process Safety qualitative risk assessment guideline documents. Additional guidance for special RVA topics and tasks is provided via the references cited in the bibliography of this work plan.

2.7 Information Collection, Review, and Data Management

Information collection, review, and data management will be performed and controlled via the RVA communication channels presented in Figure 2-2. The RVA Team Project Manager will hold the primary responsibility for implementing and controlling all RVA tasks, including information collection, review, and data management for this project. RVA information collection will be supported by the Navy, primarily the Joint Base Pearl Harbor-Hickam Fuels Department, via information requests originated by the RVA Team Project Manager submitted via the communication channels presented in Figure 2-2. All such requests will be submitted to the Navy RVA Director for dissemination to the proper Navy organization. The Navy RVA Director will manage and control information requests within the Navy organizations to facilitate accurate, complete, and timely responses to RVA Project Team information requests.

An initial information request for the Phase 2 RVA has been submitted to the Navy during this work planning phase of the project. That information request includes the following items:

Any updated information associated with the Phase 1 QRVA, as follows:

1. RHBFSF general site and facility layout and arrangement drawings.

2. A comprehensive set of RHBFSF Piping and Instrument Diagrams (P&ID) or equivalent flow and/or logic diagrams.

3. Tank and piping isometric drawings or similar layout diagrams.

4. System description documentation.

5. A comprehensive electronic list of all SSCs included within the scope of the QRVA, including alpha-numeric component ID numbers, system designators, specific component service descriptions, component types, component locations, and reference(s) to SSC design documentation. This list should include all tanks, piping, pumps, valves, electric power, and associated instrumentation and controls equipment required to operate the facility.

6. SSC design documentation, preferably in electronic format, including design or building code information; e.g., American Petroleum Institute (API) and/or American Society of Mechanical Engineers (ASME) code information for tanks.

7. Structure and component seismic design criteria.

8. RHBFSF site location scheme; e.g., areas, zones, rooms, or compartments with associated location (e.g., 3D coordinate system) information. If fire zones have been designated for this facility based on fire area and barrier criteria, this information is preferred.

9. All facility operating and maintenance procedures, including normal and emergency (incident response) operating procedures and policies.

10. Facility operating logs, preferably for the entire history of the facility, but for at least the last 5 years (e.g., 2012 to present) of facility operation.

11. A list of all historical incidents involving hydrocarbon or other fuel or material release from facility tanks and systems, to include not only tank or piping rupture events, but also releases associated with human errors; e.g., during fuel or other fluid tank fill, tank emptying, or other transfer, maintenance, or testing operations. This includes all unplanned fuel movement reports and associated corrective action taken.

12. Loss of fuel inventory incident reports over the entire history of the facility.

13. Either the record of all fuel movements over the past 5 years or an expected realistic facility operating profile to be used in the RVA; i.e., average demand loading for all RHBFSF equipment over the long term. This includes estimates for run time and demand cycle numbers for all RHBFSF equipment per year over the long term; e.g., pump on/off cycles and run time, valve open/closure cycles, tank fill/offload cycles and timing, piping segment active flow time and standby/rest time, equipment sensor cycles and monitoring time, instrumentation and control equipment actuation cycles and monitoring time, and power source energize/de-energize cycles and power provision time over the long term.

14. The full text of any previous facility risk and vulnerability assessments and other risk assessment reports performed for the RHBFSF, along with all associated appendices, models, and databases.

15. Other documentation deemed pertinent to RHBFSF RVA, as determined by the Department of Defense.

New information for the Flooding and Fire RVA, as follows:

1. Facility Layout, the Characteristics of Compartment Boundary Elements, and the General Location of Facility Systems and Equipment

2. Plan and Elevation Views of Different Buildings in the Facility

3. Facility P&IDs and Electrical Diagrams

4. Facility Procedures (e.g., emergency operating procedures, fire procedures, annunciator response procedures)

5. Other Facility Drawings and Documents, as Necessary

6. Facility Cable and Raceway System

7. Component Elementary Circuit Diagrams

8. Component Cable Block Diagrams

9. Component Wiring/Connection Diagrams

10. Electrical Distribution System Single-Line Diagrams

11. System P&IDs
12. Instrument Loop Diagrams and Block Diagrams
13. Cable Raceway Schedules and Routing Drawings
14. Equipment Location and Layout Drawings
15. Electrical Distribution System Protective Device Coordination Studies/Calculations
16. Electrical Distribution System Short Circuit and Equipment Rating Studies
17. Fire Event Records (these fire event records may be categorized based on location, ignition source, and facility operating mode)
18. List of Equipment in compartments
19. Equipment Layout Drawings
20. Elevation Drawings of Rooms and Equipment
21. Quantity of the Oil Maintained inside Rotating Machinery
22. Power and Voltage of Motors
23. Power of Electrical Cabinets
24. Quantity and Nature of Combustible and Flammable Materials Maintained in an Enclosure
25. Cable and Circuit Attribute Data:
    - Cable Insulating Material
    - Cable Size and Number of Conductors
    - Number of Normally Energized Conductors (source conductors) and Number of Conductors Susceptible to Failure Modes of Concern (target conductors)
    - Number of Normally Grounded Conductors
    - Power Source Characteristics
26. Configuration Attributes:
    - Type of Raceway (i.e., ladder tray or conduit)
    - Quantity and Type of Other Cables Contained in the Raceway
27. Applicable Software Security and Backup Procedures and Policies
28. Facility Software Development Procedures

29. Past Fire and Flood Experience for the Facility

30. Fire Protection System and Features Inspection, Testing, and Maintenance Records

New information for Seismic Events RVA, as follows:

1. Seismic Design Calculations for the Facility
2. Design Structural Drawings and Specifications for the Original Facility and Modification Projects
3. Geotechnical Reports for the Facility Site
4. Facility Seismic Assessment Reports
5. Facility Safety Analysis Reports
6. Facility Specific Seismic Qualification Test Data
7. Past Earthquake Experience for the Facility (Oahu, Hawaii)

New information for Other External Events RVA, as follows:

1. Any previously collected or analyzed information regarding the characteristics, frequency, and/or severity of the following hazard type events on Oahu that could reasonably affect RHBFSF safety:
    - High Winds
    - Storms (tornados, hurricanes, etc.)
    - Landslides (or mud slides)
    - Proximity Ground Transportation Accidents (e.g., chlorine or other hazardous chemical truck or rail car accidents)
    - Proximity Aircraft Crashes
    - External Hazardous Material or Chemical Spills or Releases
    - Extreme Weather (e.g., high temperature, etc.)
    - Internal train (rail car) accidents in the lower access tunnel
    - Golf cart accidents in the lower access tunnel
2. Internal Train Design, Operation, Maintenance, Test, and Inspection Information (e.g., train size [height, width, weight], load limitations/constraints, track gauge, track layout with dimensions, etc.)

It is important to note that this is an initial information request list, only, and that subsequent information requests will be made by the RVA Team during the RVA Phase 2 project.

3. Risk and Vulnerability Assessment Approach

3.1 Description of RVA Methodology

A conceptual overview of general RVA tasks is presented as follows:

- Facility Familiarization and RVA Scope Determination
- Initiating Event Characterization
- Event Sequence or Scenario Characterization
- Risk and Vulnerability Assessment
- RVA Documentation and Communication (presentation)

The RVA Team must first review and evaluate facility information, such as that identified in the initial information request items presented in Section 2.7, to become thoroughly familiar with facility SSCs and the operational profile of the facility. This includes review of facility operating, maintenance, inspection, and testing procedures for both normal and emergency operating conditions.

The team then conducts an analysis of potential event sequence initiating events, which may be precipitated via the hazards considered within the scope of the RVA. For this RVA, these hazards are those identified in Section 2.4 of this work plan.

The team then, using experience gained during the Phase 1 QRVA, information provided in response to project information requests, and information obtained as a result of subject matter expert (SME) walkdowns of the facility, characterizes risk-dominating qualitative event sequences that could lead to undesired consequences contributing to risk. For this RVA, the primary undesired consequence is the loss of fuel inventory control within the RHBFSF. The team then identifies and evaluates RHBFSF vulnerabilities associated with the risk-dominating scenario(s) for each hazard within the scope of the RVA. Then, the team develops suggested risk mitigation alternatives risk management actions for safety management associated with identified risk-dominating scenarios. Finally, the RVA results are documented in a report in terms that can support prudent decision-making for the facility.

3.2 Definitions of Key Terms

The definitions of some key terms applied in RVA are presented in this section. Some definitions of fundamental RVA terms are presented as follows:

Risk: The combined answer to three questions that consider (1) what can go wrong?, (2) how likely is it?, and (3) what are the potential consequences?

Hazard: Anything that has the potential to initiate or cause an undesired sequence of events and/or conditions to occur that leads to an undesired consequence. Examples of RVA hazards are facility equipment failures, human errors, fires, floods, earthquakes, adverse weather, etc.

Vulnerability: Weakness in the design or operation of a system, component, or structure that could increase the probability of disabling its function and, thus, contribute, in a potentially significant way, to overall facility risk.

Initiating Event: An event that perturbs the steady state operation of the facility and could lead to an undesired facility condition. This is an event that can start or precipitate a sequence of additional events or conditions that ultimately result in an undesired consequence.

Scenario: An initiating event and associated facility conditions and response events (including both hardware failures and human errors) that could lead to an undesired consequence of interest for the RVA.

Probability: The likelihood that an event will occur as expressed by the ratio of the number of actual occurrences to the total number of possible occurrences.

Frequency: The actual (historical) or expected (future) number of occurrences of an event or accident condition expressed per unit of time.

3.3 Assumptions

The bases and assumptions associated with the RVA will be clearly documented in the RVA report. In RVA, every effort is made to develop and apply realistic "best estimate" event scenarios. In some cases, simplifying assumptions may be applied to simplify overall risk characterization. In cases, where simplifying assumptions are made in the RVA, these assumptions will be documented in the RVA report.

3.4 Evaluating and Prioritizing Events

In this RVA, event sequences and individual events will be evaluated and prioritized based on their evaluated contribution to overall facility risk. In some areas of the RVA, simplifying assumptions may be applied, which may be slightly conservative "locally" at the individual event or event sequence level of indenture, but which "globally" have no significant effect on the overall facility baseline risk. In cases where simplifying assumptions are applied, they will be documented in the RVA report.

Screening analyses may also be applied in this RVA to effectively simplify the risk assessment. Any such screening analyses or evaluations applied in this RVA will be based on criteria for acceptable threshold of risk provided by the regulator; e.g., the EPA in this case. If the regulator does not or cannot provide quantitative acceptable risk thresholds for this RVA, these risk thresholds will be developed by the RHBFSF RVA Team, and the bases behind these risk thresholds will be documented in the RVA report for Navy and other stakeholder review.

3.5 Content and Format of Deliverables

The primary deliverable of the RVA for this project will be the RVA report (or multiple reports), which clearly documents the bases, assumptions, methodology, databases, calculations, and results of the RHBFSF Phase 2 RVA. Report content will be developed generally corresponding to the tasks identified in the project work breakdown

structure (WBS) presented in Section 4 of this work plan. The report(s) will be generated applying standard software tools, such as Microsoft Word, and will be communicated via Adobe Acrobat PDF file format. Supporting databases and computer calculation files will also be transmitted to the Navy to archive as part of the overall RVA deliverable.

3.6 Coordination with Other AOC/SOW Sections

The RVA Team welcomes open communication and cooperation with work being performed under other sections of the RHBFSF AOC. Coordination of this communication will be implemented by the Navy RVA Director using the lines of communication presented in Figure 2-2. It is anticipated that meetings and conference calls will be arranged and facilitated by the Navy to support work coordination, communication, and cooperation among AOC technical teams. For the RVA, these types of meetings and lines of communication will be established, controlled, and facilitated by the Navy RVA Director, again via the lines of communication shown in Figure 2-2.

3.7 Quality Control/Assurance Process

This section describes the recommended quality assurance (QA) and quality controls practices to be applied to the RVA Phase 2 project. Work on this project will be conducted following the standard ISO 9001 Quality Management System. Experience has shown that this approach provides sufficient quality controls and assurance of product quality for high-quality analyses and evaluations, while also providing a significant basis for cost savings.

The Phase 2 RVA project will commit to operate consistent with applicable environmental legislation and regulations and to provide services consistent with international standards developed to avoid, reduce, or control pollution to the environment.

The Phase 2 RVA project will monitor performance as an ongoing activity, to strive for continual improvement, and to provide a framework for establishing and reviewing quality and environmental objectives and targets.

3.8 Phase 2 Activities

This section describes the activities to be accomplished during the Phase 2 RVA project.

Activity 1 – Project Management and Coordination

1. The Contractor shall provide project oversight and coordination, provide budget control/tracking/reports, attend meetings to discuss special concerns, provide monthly progress reports, and perform project completion/close-out efforts.

2. The Contractor shall prepare and maintain a detailed project schedule. Project milestones will be coordinated between NAVFAC HI, Command, Navy Region Hawaii (CNRH), U.S. EPA, and Hawaii DOH as part of the AOC.

3. All Contractor personnel (including subcontractors) anticipated to work on this project will be required to sign a Navy non-disclosure agreement provided by the Contracting Officer, prior to handling any project information.

Activity 2 – Meetings

The Contractor shall participate in progress meetings via conference call, as needed, for the duration of this project. The progress meeting discussions can include the status of the work including scheduling, channels of communication, coordination, issue resolution, and points of contact. Primary communications shall be via email and progress meetings are only needed as issues arise.

Activity 3 – Subject Matter Expert Support

1. The Contractor shall provide at least one subject matter expert in the field of fire sciences. The intent of this SME is to provide a qualitative discussion with facility operators on potential vulnerabilities related to an internal or external fire event that could cause facility infrastructure failure or loss of operator control.

2. The Contractor shall provide at least one SME with expertise in flooding. The intent of this SME is to provide a qualitative discussion with facility operators on potential vulnerabilities related to an internal or external flood event that could cause release of fuel due to infrastructure failure or loss of operator control. This SME shall also perform design-related calculations to quantify performance and potential performance improvements.

3. The Contractor shall provide at least one SME with expertise in structural performance during a seismic event. The intent of this SME is to provide a qualitative discussion with facility operators on potential vulnerabilities related to a seismic event that could cause infrastructure failure or loss of operator control. This SME shall also perform design-related calculations to quantify performance and potential performance improvements. Sample calculations include effects of wave action on the tank's center tower and seismic performance of pipe supports.

4. SMEs are expected to participate in the Phase 2 project work.

Activity 4 – Risk and Vulnerability Assessment Scope of Work for Phase 2

The following work scope outline is applied to the Phase 2 RVA Scope of Work:

Basis

- Simplified bounding assessment in lieu of a comprehensive quantitative assessment, which is complex and time consuming.

- Targeted analyses to identify potential facility improvements.

- White paper approach for initiating events with lower probabilities.

- Will not quantify or characterize the impact to the water table; assessment will be limited to consideration of likelihood of a loss of inventory control. The Phase 1

assessment will be the baseline for loss of inventory control (e.g., hole in liner, hole in nozzle, hole in the pipeline, etc.) that can be caused by the initiating events considered in Phase 2.

Internal and External Fire and Flood Events

These events will likely require additional ("secondary") conditions to result in a loss in inventory control, so a white paper approach will be used for the assessment.

- Internal Flooding (including an assessment of the potential impact of internal flooding on erosion of fuel handling pipeline support and brackets)
- Internal Fires
- External Flooding, Tsunami, and Heavy Precipitation
- External Fires

Seismic Events

A general review/discussion/summary of Oahu's seismic risks. Assessment of effects on other infrastructure at certain magnitude events for comparison with RHBFSF components. Establish seismic hazard criteria to be used for the facility assessment. Focus will be on the main fuel storage tanks and lower tunnel, as these were identified in Phase 1 and has the most potential risk of an inventory release. One tank structure will be selected for seismic evaluation as a representative example to establish similar risk for all of the other tanks. It is understood that the nozzle configuration may vary from tank to tank. Nozzle configurations will be documented during the walkdown and the seismic analysis is expected to include several distinct variations.

- Seismic Hazard
- Seismic Hazard Caused by Ground Shaking Determined on a Probabilistic and Deterministic Basis in Accordance with established U.S. Geological Survey (USGS) Data but not less than seismic parameters of UFC 3-3-1-1 Structural Engineering.
- Seismic Risk Category in accordance with UFC 3-3-1-1 Structural Engineering and ASCE 7. Targeted Structural and Nonstructural Component Performance Level in accordance with ASCE 41.

The following assessments have been selected for simplified bounding assessment and targeted quantitative analysis:

- Effects of Wave Action within the Tank
  - Finite Element Analysis of Overall Concrete Tank Structure and Center Steel Tower for Seismic and Hydrodynamic (Impulsive and Convective) Loading in Accordance with ACI 350.3 Seismic Design of Liquid-Containing Concrete Structures and Commentary

- Seismic Effects on Tank Shell/Liner
  - Structural Analysis of Liner Elements for Seismic Loading
- Seismic Effects on Tank Nozzle that Could Lead to Large Releases of Fuel
  - Finite Element Analysis of Tank Nozzle and Buried Piping for Differential Movement
- Seismic Performance of Pipeline and Supports in the Lower Access Tunnel
  - ASCE 7 Minimum Design Loads for Buildings and Other Structures
  - ASCE 41 Seismic Evaluation and Retrofit of Existing Buildings

Additional External Events

These events will likely require additional ("secondary") conditions to result in a significant loss of inventory control, so a white paper approach will be used for the assessment:

- High Winds
- Storms (tornados, hurricanes, etc.)
- Landslides (or mud slides)
- Proximity Ground Transportation Accidents (e.g., chlorine or other hazardous chemical truck or rail car accidents)
- Proximity Aircraft Crashes
- External Hazardous Material or Chemical Spills or Releases
- Extreme Weather (e.g., high temperature, etc.)

The following events have been selected for simplified bounding assessment and targeted quantitative analysis:

- Rail Car or Golf Cart Accidents in the Lower Tunnel
- Vulnerabilities of the Pipelines in the Lower Tunnel
- Discussion of Potential Administrative Controls to Avoid Accidents
- Identify Potential Facility Improvement to Protect Pipeline
- Simplified Calculations of Potential Utility Train Derailment Events that Could Threaten Piping Integrity in the Lower Access Tunnel

Malicious acts (e.g., terrorism or insider threats) are not included in the assessment for physical security reasons.

Detailed Scope of Work

The detailed scope of work for Phase 2 of the RHBFSF RVA is presented as follows:

1. For the **Internal Flooding RVA**, the Contractor shall memorialize the results of scoping discussions and workshop with a revised scope of work document that will be submitted by the Navy to the Regulatory Agencies for approval will develop a white paper style report characterizing the expected risk-dominating scenario of events (or top few, five or fewer, risk-dominating scenarios) based on the contractor team risk assessment experience, in general, and risk insights and knowledge about the RHBFSF obtained through performance of the Phase 1 Quantitative Risk and Vulnerability Assessment work, as documented in the Phase 1 QRVA Report (ABS Consulting Report Number R-3751812-2043) dated 12 November 2018. This white paper will include the following major topical sections:

   - Executive Summary
   - List of Acronyms
   - Introduction
   - Assessment Approach
   - Summary of Assessment Bases and Assumptions
   - Evaluation Results and Conclusions
   - Recommendations for Risk Management Option Consideration
   - References
   - Appendices (as required)

   This RVA white paper report will be primarily qualitative in nature. Specifically, it will not include analyses previously included in the full scope QRVA, such as Initiating Event Data Analysis, Event Sequence Analysis, Systems Response Logic Modeling and Data Analysis, Human Action Response Logic Modeling and Data Analysis, Risk Quantification, or Uncertainty Analysis. However, it will include qualitative characterization of risk-dominating scenarios, identification of associated risk vulnerabilities, and recommendations for risk mitigation or risk management options or alternatives to be considered by the Navy for implementation over the remainder of facility life. The primary activities to be performed for development of this white paper report are:

   - Facility and Hazard Information Collection and Review
   - Phase 1 QRVA Review
   - SME Walkdown (likely combined with other hazard assessment walkdown[s])
   - Formulation of Evaluation Boundaries, Bases, and Assumptions
   - Identification, Characterization, and Evaluation of Hazard-Specific Risk-Dominating Scenarios

- Identification of Hazard-Specific Risk Vulnerabilities
- Identification of Hazard-Specific Risk Mitigation and Risk Management Options
- White Paper Draft Report Documentation
- White Paper Response to Review Comments and Final Report Documentation

The Internal Flooding RVA will include an assessment of the potential impact of internal flooding on erosion of fuel handling pipeline support and brackets. A general process flow chart for the Internal Flooding RVA work is presented in Figure 3-1.

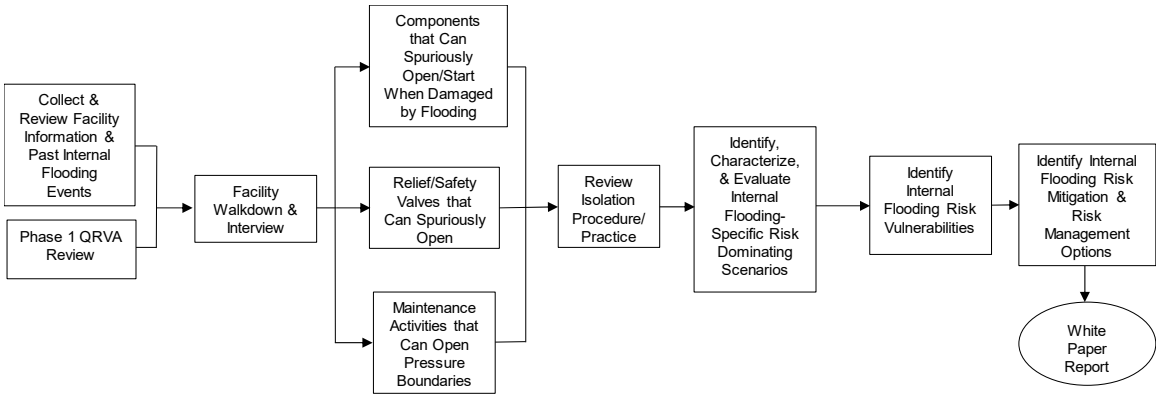

Figure 3-1. Internal Flooding RVA White Paper Approach Process Flow

Final report documentation will be delivered in both Adobe PDF and Microsoft Word formats, as specified by the Navy.

2. For the **External Flooding, Tsunami, and Heavy Precipitation RVA**, the Contractor will develop a white paper style report characterizing the expected risk-dominating scenario of events (or top few, five or fewer, risk-dominating scenarios) based on the contractor team risk assessment experience, in general, and risk insights and knowledge about the RHBFSF obtained through performance of the Phase 1 Quantitative Risk and Vulnerability Assessment work, as documented in the Phase 1 QRVA Report (ABS Consulting Report Number R-3751812-2043) dated 12 November 2018. This white paper will include the following major topical sections:

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This RVA white paper report will be primarily qualitative in nature. Specifically, it will not include analyses previously included in the full scope QRVA, such as Initiating Event Data Analysis, Event Sequence Analysis, Systems Response Logic Modeling and Data Analysis, Human Action Response Logic Modeling and Data Analysis, Risk Quantification, or Uncertainty Analysis. However, it will include qualitative characterization of risk-dominating scenarios, identification of associated risk vulnerabilities, and recommendations for risk mitigation or risk management options or alternatives to be considered by the Navy for implementation over the remainder of facility life. The primary activities to be performed for development of this white paper report are:

- Facility and Hazard Information Collection and Review
- Phase 1 QRVA Review
- SME Walkdown (likely combined with other hazard assessment walkdown[s])
- Formulation of Evaluation Boundaries, Bases, and Assumptions
- Identification, Characterization, and Evaluation of Hazard-Specific Risk-Dominating Scenarios
- Identification of Hazard-Specific Risk Vulnerabilities
- Identification of Hazard-Specific Risk Mitigation and Risk Management Options
- White Paper Draft Report Documentation
- White Paper Response to Review Comments and Final Report Documentation

A general process flow chart for the External Flooding, Tsunami, and Heavy Precipitation RVA work is presented in Figure 3-2.

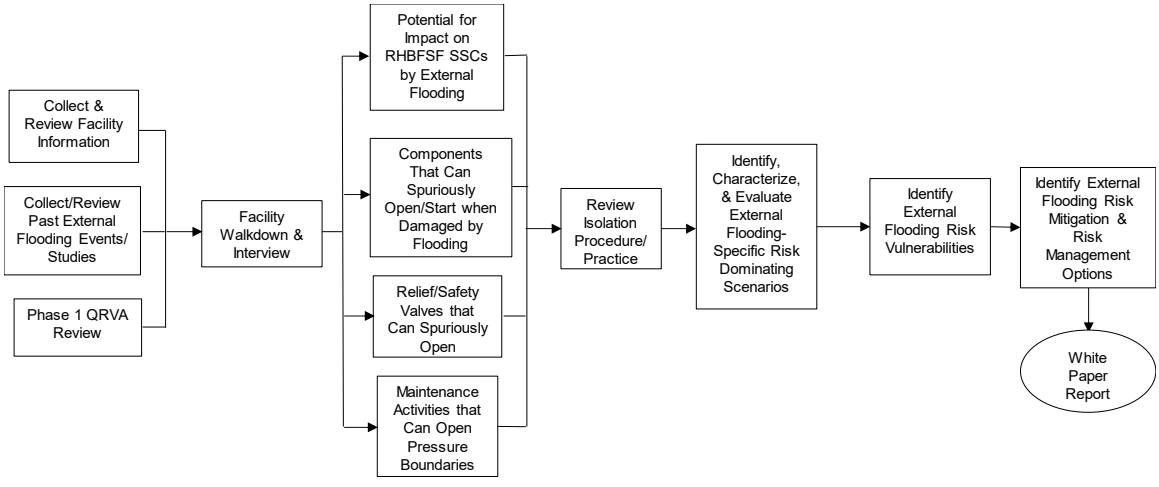

Figure 3-2. External Flooding RVA White Paper Approach Process Flow

Final report documentation will be delivered in both Adobe PDF and Microsoft Word formats, as specified by the Navy.

It is expected that the SOW will be approximately 90% determined by the close of scoping discussions and prior to the scheduled workshop.

3. For the **Internal Fire RVA**, the Contractor will develop a white paper style report characterizing the expected risk-dominating scenario of events (or top few, five or fewer, risk-dominating scenarios) based on the contractor team risk assessment experience, in general, and risk insights and knowledge about the RHBFSF obtained through performance of the Phase 1 Quantitative Risk and Vulnerability Assessment work, as documented in the Phase 1 QRVA Report (ABS Consulting Report Number R-3751812-2043) dated 12 November 2018. This white paper will include the following major topical sections:

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   - Evaluation Results and Conclusions
   - Recommendations for Risk Management Option Consideration
   - References
   - Appendices (as required)

   This RVA white paper report will be primarily qualitative in nature. Specifically, it will not include analyses previously included in the full scope QRVA, such as Initiating Event Data Analysis, Event Sequence Analysis, Systems Response Logic Modeling and Data Analysis, Human Action Response Logic Modeling and Data Analysis, Risk Quantification, or Uncertainty Analysis. However, it will include qualitative characterization of risk-dominating scenarios, identification of associated risk vulnerabilities, and recommendations for risk mitigation or risk management options or alternatives to be considered by the Navy for implementation over the remainder of facility life. The primary activities to be performed for development of this white paper report are:

   - Facility and Hazard Information Collection and Review
   - Phase 1 QRVA Review
   - SME Walkdown (likely combined with other hazard assessment walkdown[s])
   - Formulation of Evaluation Boundaries, Bases, and Assumptions
   - Identification, Characterization, and Evaluation of Hazard-Specific Risk-Dominating Scenarios
   - Identification of Hazard-Specific Risk Vulnerabilities
   - Identification of Hazard-Specific Risk Mitigation and Risk Management Options

- White Paper Draft Report Documentation
- White Paper Response to Review Comments and Final Report Documentation

A general process flow chart for the Internal Fire RVA work is presented in Figure 3-3.

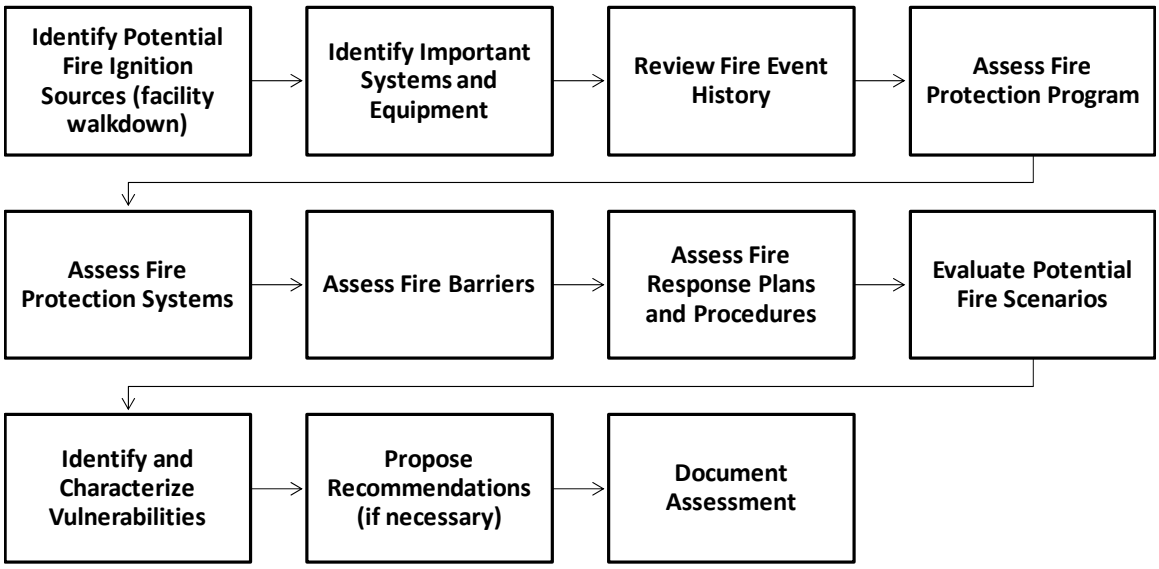

Figure 3-3. Internal Fires RVA Approach

Final report documentation will be delivered in both Adobe PDF and Microsoft Word formats, as specified by the Navy. The results of the workshop will be documented and included as part of the SOW.

4. For the **External Fire RVA**, the Contractor will develop a white paper style report characterizing the expected risk-dominating scenario of events (or top few, five or fewer, risk-dominating scenarios) based on the contractor team risk assessment experience, in general, and risk insights and knowledge about the RHBFSF obtained through performance of the Phase 1 Quantitative Risk and Vulnerability Assessment work, as documented in the Phase 1 QRVA Report (ABS Consulting Report Number R-3751812-2043) dated 12 November 2018. This white paper will include the following major topical sections:

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   - Evaluation Results and Conclusions
   - Recommendations for Risk Management Option Consideration

- References
- Appendices (as required)

This RVA white paper report will be primarily qualitative in nature. Specifically, it will not include analyses previously included in the full scope QRVA, such as Initiating Event Data Analysis, Event Sequence Analysis, Systems Response Logic Modeling and Data Analysis, Human Action Response Logic Modeling and Data Analysis, Risk Quantification, or Uncertainty Analysis. However, it will include qualitative characterization of risk-dominating scenarios, identification of associated risk vulnerabilities, and recommendations for risk mitigation or risk management options or alternatives to be considered by the Navy for implementation over the remainder of facility life. The primary activities to be performed for development of this white paper report are:

- Facility and Hazard Information Collection and Review
- Phase 1 QRVA Review
- SME Walkdown (likely combined with other hazard assessment walkdown[s])
- Formulation of Evaluation Boundaries, Bases, and Assumptions.
- Identification, Characterization, and Evaluation of Hazard-Specific Risk-Dominating Scenarios.
- Identification of Hazard-Specific Risk Vulnerabilities
- Identification of Hazard-Specific Risk Mitigation and Risk Management Options
- White Paper Draft Report Documentation
- White Paper Response to Review Comments and Final Report Documentation

A general process flow chart for the External Fire RVA work is presented in Figure 3-4.

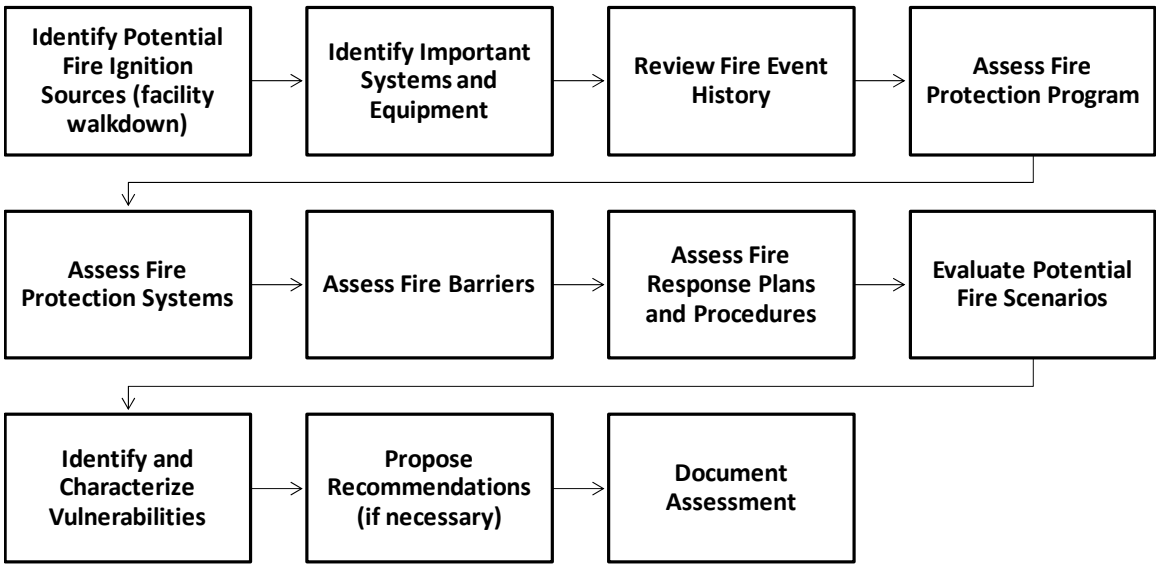

Figure 3-4. External Fires RVA Approach

Final report documentation will be delivered in both Adobe PDF and Microsoft Word formats, as specified by the Navy.

5. For the **Seismic Events RVA**, the Contractor will develop a bounding analysis style report characterizing the expected risk-dominating scenario of events (or top few, five or fewer, risk-dominating scenarios) based on the contractor team risk assessment experience, in general, and risk insights and knowledge about the RHBFSF obtained through performance of the Phase 1 Quantitative Risk and Vulnerability Assessment work, as documented in the Phase 1 QRVA Report (ABS Consulting Report Number R-3751812-2043) dated 12 November 2018. This report paper will include the following major topical sections:

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   - Evaluation Results and Conclusions
   - Recommendations for Risk Management Option Consideration
   - References
   - Appendices (as required)

   This RVA bounding analysis report will be primarily qualitative in nature. Specifically, it will not include comprehensive analyses previously included in the full scope QRVA, such as Initiating Event Data Analysis, Event Sequence Analysis, Systems Response Logic Modeling and Data Analysis, Human Action Response Logic Modeling and Data Analysis, Risk Quantification, or Uncertainty Analysis. However, it will include probabilistic bounding analysis of seismic hazards under the assumption of an agreed analysis design basis earthquake (currently established as

facility impacts consistent with an Oahu area earthquake resulting in peak ground acceleration and seismic motion frequency effects on the RHBFSF expected from a probabilistic and deterministic design basis earthquake hazard), qualitative characterization of risk-dominating scenarios, seismic analysis of the relevant structures and nonstructural components, identification of associated risk vulnerabilities, and recommendations for risk mitigation or risk management options or alternatives to be considered by the Navy for implementation over the remainder of facility life. No detailed soil-structure interaction analysis (e.g., for potential effects of earthquake-caused soil liquefaction) will be performed. Also, no detailed analysis of facility specific component fragility to earthquake ground motion intensity and/or frequency will be performed. The primary activities to be performed for development of this bounding analysis report are:

- Facility and Hazard Information Collection and Review
- Phase 1 QRVA Review
- SME Walkdown (likely combined with other hazard assessment walkdown[s]). This could also include follow-up walkdowns by the seismic hazard SME team.
- Formulation of Evaluation Boundaries, Bases, and Assumptions
- Identification, Characterization, and Evaluation of Hazard-Specific Risk-Dominating Scenarios
- Determination of Seismic Hazard Criteria and Risk Categories/Performance Objectives to Be Used for the Analysis
- Identification of Seismic Risk Vulnerabilities
- Identification of Seismic Risk Mitigation and Risk Management Options
- Bounding Analysis Draft Report Documentation
- Bounding Analysis Response to Review Comments and Final Report Documentation

This bounding analysis will include a general review/discussion/summary of Oahu's seismic risks. Assessment of effects on other infrastructure at certain magnitude events for comparison with RHBFSF components. Establish seismic hazard criteria to be used for the facility assessment. Focus will be on the main fuel storage tanks and lower tunnel, as these were identified in Phase 1 and has the most potential risk of an inventory release.

- Seismic Hazard
- Seismic Hazard Caused by Ground Shaking Determined on a Probabilistic and Deterministic Basis in Accordance with Established USGS Data but Not Less than Seismic Parameters of UFC 3-3-1-1 Structural Engineering

Seismic Risk Category in accordance with UFC 3-3-1-1 Structural Engineering and ASCE 7. Targeted Structural and Nonstructural Component Performance Level in accordance with ASCE 41. We understand that the Navy will request inter-agency consultation with the USGS to provide additional input on seismic activity in the area of the RHBFSF.

The following assessments have been selected for simplified bounding assessment and targeted quantitative analysis:

- Effects of Wave Action within the Tank
    - Finite Element Analysis of One Representative Overall Concrete Tank Structure and Center Steel Tower for Seismic and Hydrodynamic (Impulsive and Convective) Loading in Accordance with ACI 350.3 Seismic Design of Liquid-Containing Concrete Structures and Commentary
- Seismic Effects on Tank Shell/Liner
    - Structural Analysis of Liner Elements for Seismic Loading
- Seismic Effects on Tank Nozzle Including Distinct Variations that Could Lead to Large Releases of:
    - Finite Element Analysis of Tank Nozzle and Buried Piping for Differential Movement
- Seismic Performance of Pipeline and Supports in the Lower Access Tunnel
    - ASCE 7 Minimum Design Loads for Buildings and Other Structures
    - ASCE 41 Seismic Evaluation and Retrofit of Existing Buildings

The seismic RVA bounding analysis will apply a demand-to-capacity ratio approach for decision support. A general process flow chart for the Seismic RVA work is presented in Figure 3-5.

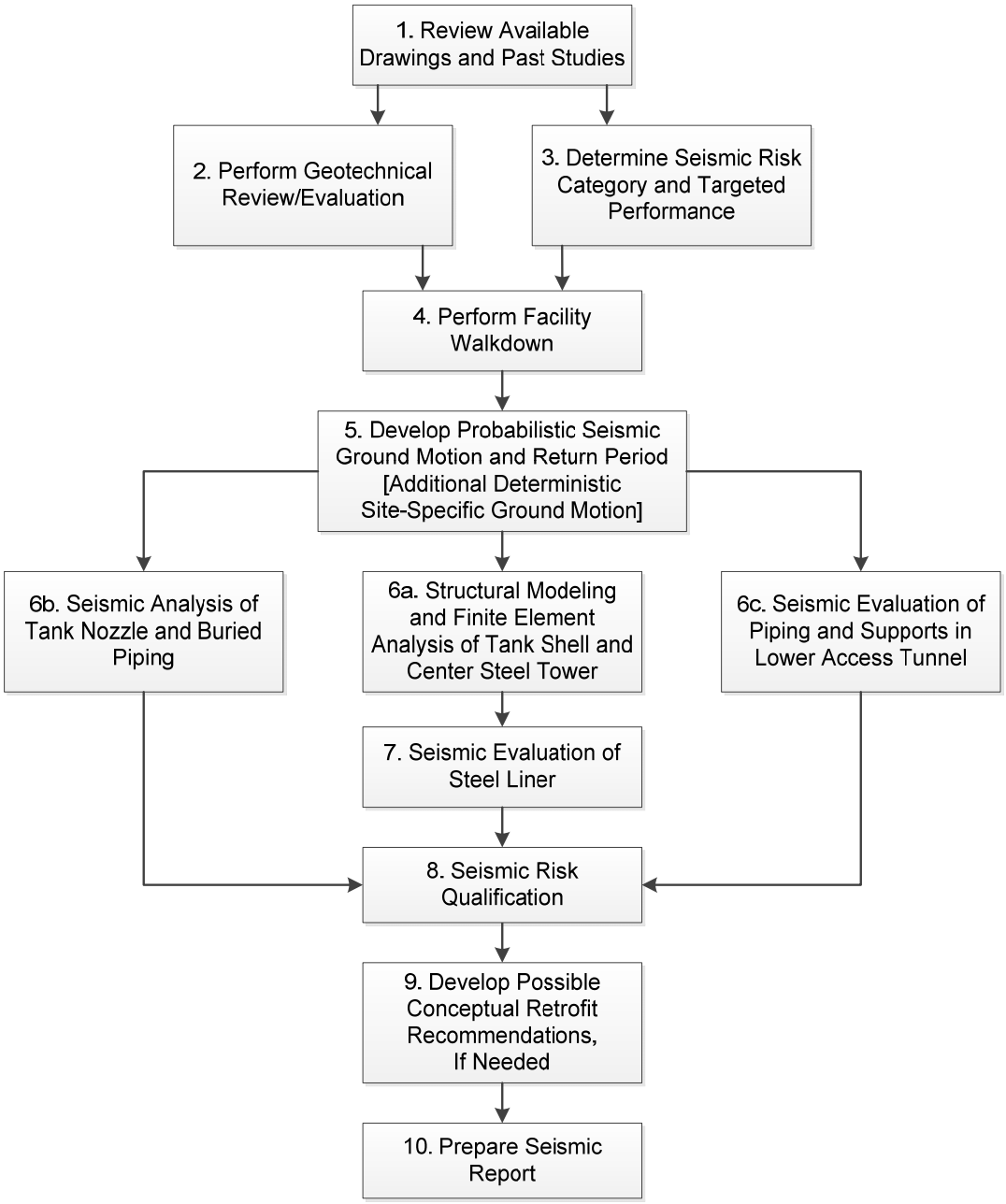

Figure 3-5. Seismic Approach

Final report documentation will be delivered in both Adobe PDF and Microsoft Word formats, as specified by the Navy.

6. For the **<u>High Winds and Storms (Hurricanes, Typhoons, Tornados) RVA</u>**, the Contractor will develop a white paper style report characterizing the expected risk-dominating scenario of events (or top few, five or fewer, risk-dominating scenarios) based on the contractor team risk assessment experience, in general, and risk insights and knowledge about the RHBFSF obtained through performance of the Phase 1 Quantitative Risk and Vulnerability Assessment work, as documented in the

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This RVA white paper report will be primarily qualitative in nature. Specifically, it will not include analyses previously included in the full scope QRVA, such as Initiating Event Data Analysis, Event Sequence Analysis, Systems Response Logic Modeling and Data Analysis, Human Action Response Logic Modeling and Data Analysis, Risk Quantification, or Uncertainty Analysis. However, it will include qualitative characterization of risk-dominating scenarios, identification of associated risk vulnerabilities, and recommendations for risk mitigation or risk management options or alternatives to be considered by the Navy for implementation over the remainder of facility life. The primary activities to be performed for development of this white paper report are:

- Facility and Hazard Information Collection and Review
- Phase 1 QRVA Review
- SME Walkdown (likely combined with other hazard assessment walkdown[s])
- Formulation of Evaluation Boundaries, Bases, and Assumptions
- Identification, Characterization, and Evaluation of Hazard-Specific Risk-Dominating Scenarios
- Identification of Hazard-Specific Risk Vulnerabilities
- Identification of Hazard-Specific Risk Mitigation and Risk Management Options
- White Paper Draft Report Documentation
- White Paper Response to Review Comments and Final Report Documentation

A general process flow chart for the Other External Events RVA work is presented in Figure 3-6. This figure applies to the RVA process for all other external event hazards.

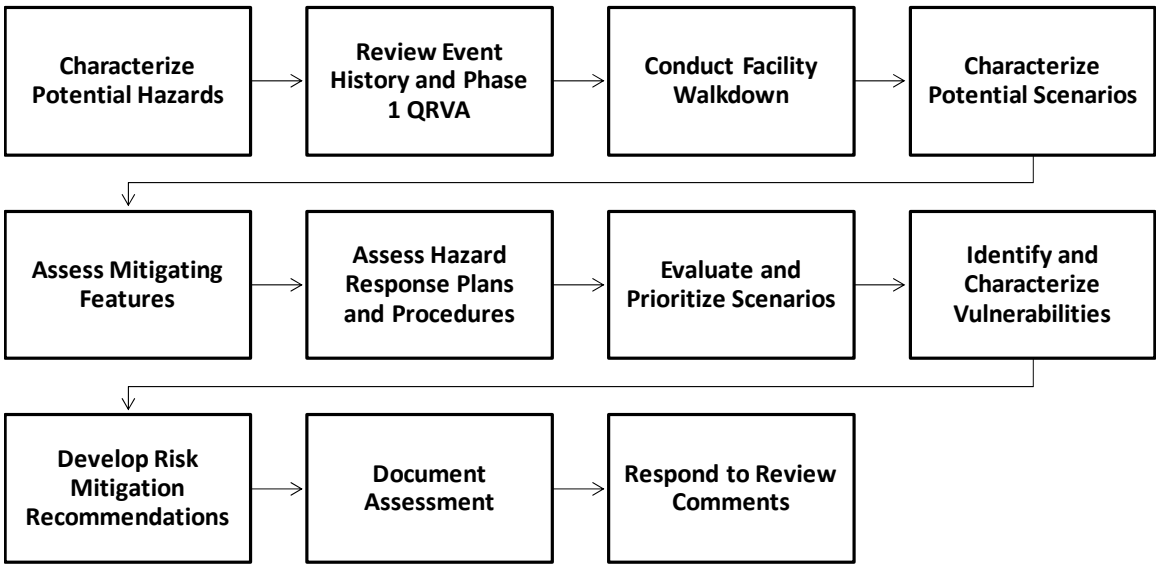

Figure 3-6. Other External Events RVA Approach

Final report documentation will be delivered in both Adobe PDF and Microsoft Word formats, as specified by the Navy.

7. For the **Landslides (including Mud Slides) RVA**, the Contractor will develop a white paper style report characterizing the expected risk-dominating scenario of events (or top few, five or fewer, risk-dominating scenarios) based on the contractor team risk assessment experience, in general, and risk insights and knowledge about the RHBFSF obtained through performance of the Phase 1 Quantitative Risk and Vulnerability Assessment work, as documented in the Phase 1 QRVA Report (ABS Consulting Report Number R-3751812-2043) dated 12 November 2018. This white paper will include the following major topical sections:

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   - References
   - Appendices (as required)

   This RVA white paper report will be primarily qualitative in nature. Specifically, it will not include analyses previously included in the full scope QRVA, such as Initiating Event Data Analysis, Event Sequence Analysis, Systems Response Logic Modeling and Data Analysis, Human Action Response Logic Modeling and Data Analysis, Risk Quantification, or Uncertainty Analysis. However, it will include qualitative characterization of risk-dominating scenarios, identification of associated risk

vulnerabilities, and recommendations for risk mitigation or risk management options or alternatives to be considered by the Navy for implementation over the remainder of facility life. The primary activities to be performed for development of this white paper report are:

- Facility and Hazard Information Collection and Review
- Phase 1 QRVA Review
- SME Walkdown (likely combined with other hazard assessment walkdown[s])
- Formulation of Evaluation Boundaries, Bases, and Assumptions
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- Identification of Hazard-Specific Risk Mitigation and Risk Management Options
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Final report documentation will be delivered in both Adobe PDF and Microsoft Word formats, as specified by the Navy.

8. For the **Proximity Ground Transportation Accidents (e.g., chlorine or other hazardous chemical truck or rail car accidents) RVA**, the Contractor will develop a white paper style report characterizing the expected risk-dominating scenario of events (or top few, five or fewer, risk-dominating scenarios) based on the contractor team risk assessment experience, in general, and risk insights and knowledge about the RHBFSF obtained through performance of the Phase 1 Quantitative Risk and Vulnerability Assessment work, as documented in the Phase 1 QRVA Report (ABS Consulting Report Number R-3751812-2043) dated 12 November 2018. This white paper will include the following major topical sections:

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   This RVA white paper report will be primarily qualitative in nature. Specifically, it will not include analyses previously included in the full scope QRVA, such as Initiating Event Data Analysis, Event Sequence Analysis, Systems Response Logic Modeling

and Data Analysis, Human Action Response Logic Modeling and Data Analysis, Risk Quantification, or Uncertainty Analysis. However, it will include qualitative characterization of risk-dominating scenarios, identification of associated risk vulnerabilities, and recommendations for risk mitigation or risk management options or alternatives to be considered by the Navy for implementation over the remainder of facility life. The primary activities to be performed for development of this white paper report are:

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- Identification of Hazard-Specific Risk Vulnerabilities
- Identification of Hazard-Specific Risk Mitigation and Risk Management Options
- White Paper Draft Report Documentation
- White Paper Response to Review Comments and Final Report Documentation

Final report documentation will be delivered in both Adobe PDF and Microsoft Word formats, as specified by the Navy.

9. For the **Proximity Aircraft Accidents (e.g., accidental commercial or military aircraft crashes) RVA**, the Contractor will develop a white paper style report characterizing the expected risk-dominating scenario of events (or top few, five or fewer, risk-dominating scenarios) based on the contractor team risk assessment experience, in general, and risk insights and knowledge about the RHBFSF obtained through performance of the Phase 1 Quantitative Risk and Vulnerability Assessment work, as documented in the Phase 1 QRVA Report (ABS Consulting Report Number R-3751812-2043) dated 12 November 2018. This white paper will include the following major topical sections:

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- Facility and Hazard Information Collection and Review
- Phase 1 QRVA Review
- SME Walkdown (likely combined with other hazard assessment walkdown[s])
- Formulation of Evaluation Boundaries, Bases, and Assumptions
- Identification, Characterization, and Evaluation of Hazard-Specific Risk-Dominating Scenarios
- Identification of Hazard-Specific Risk Vulnerabilities
- Identification of Hazard-Specific Risk Mitigation and Risk Management Options
- White Paper Draft Report Documentation
- White Paper Response to Review Comments and Final Report Documentation

Final report documentation will be delivered in both Adobe PDF and Microsoft Word formats, as specified by the Navy.

10. For the **External Hazardous Material or Chemical Spills or Releases RVA**, the Contractor will develop a white paper style report characterizing the expected risk-dominating scenario of events (or top few, five or fewer, risk-dominating scenarios) based on the contractor team risk assessment experience, in general, and risk insights and knowledge about the RHBFSF obtained through performance of the Phase 1 Quantitative Risk and Vulnerability Assessment work, as documented in the Phase 1 QRVA Report (ABS Consulting Report Number R-3751812-2043) dated 12 November 2018. This white paper will include the following major topical sections:

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    - Evaluation Results and Conclusions
    - Recommendations for Risk Management Option Consideration

- References
- Appendices (as required)

This RVA white paper report will be primarily qualitative in nature. Specifically, it will not include analyses previously included in the full scope QRVA, such as Initiating Event Data Analysis, Event Sequence Analysis, Systems Response Logic Modeling and Data Analysis, Human Action Response Logic Modeling and Data Analysis, Risk Quantification, or Uncertainty Analysis. However, it will include qualitative characterization of risk-dominating scenarios, identification of associated risk vulnerabilities, and recommendations for risk mitigation or risk management options or alternatives to be considered by the Navy for implementation over the remainder of facility life. The primary activities to be performed for development of this white paper report are:

- Facility and Hazard Information Collection and Review
- Phase 1 QRVA Review
- SME Walkdown (likely combined with other hazard assessment walkdown[s])
- Formulation of Evaluation Boundaries, Bases, and Assumptions
- Identification, Characterization, and Evaluation of Hazard-Specific Risk-Dominating Scenarios
- Identification of Hazard-Specific Risk Vulnerabilities
- Identification of Hazard-Specific Risk Mitigation and Risk Management Options
- White Paper Draft Report Documentation
- White Paper Response to Review Comments and Final Report Documentation

Final report documentation will be delivered in both Adobe PDF and Microsoft Word formats, as specified by the Navy.

11. For the **Extreme Weather (e.g., high temperature, etc.) RVA**, the Contractor will develop a white paper style report characterizing the expected risk-dominating scenario of events (or top few, five or fewer, risk-dominating scenarios) based on the contractor team risk assessment experience, in general, and risk insights and knowledge about the RHBFSF obtained through performance of the Phase 1 Quantitative Risk and Vulnerability Assessment work, as documented in the Phase 1 QRVA Report (ABS Consulting Report Number R-3751812-2043) dated 12 November 2018. This white paper will include the following major topical sections:

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    - Introduction
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    - Summary of Assessment Bases and Assumptions

- Evaluation Results and Conclusions
- Recommendations for Risk Management Option Consideration
- References
- Appendices (as required)

This RVA white paper report will be primarily qualitative in nature. Specifically, it will not include analyses previously included in the full scope QRVA, such as Initiating Event Data Analysis, Event Sequence Analysis, Systems Response Logic Modeling and Data Analysis, Human Action Response Logic Modeling and Data Analysis, Risk Quantification, or Uncertainty Analysis. However, it will include qualitative characterization of risk-dominating scenarios, identification of associated risk vulnerabilities, and recommendations for risk mitigation or risk management options or alternatives to be considered by the Navy for implementation over the remainder of facility life. The primary activities to be performed for development of this white paper report are:

- Facility and Hazard Information Collection and Review
- Phase 1 QRVA Review
- SME Walkdown (likely combined with other hazard assessment walkdown[s])
- Formulation of Evaluation Boundaries, Bases, and Assumptions
- Identification, Characterization, and Evaluation of Hazard-Specific Risk-Dominating Scenarios
- Identification of Hazard-Specific Risk Vulnerabilities
- Identification of Hazard-Specific Risk Mitigation and Risk Management Options
- White Paper Draft Report Documentation
- White Paper Response to Review Comments and Final Report Documentation

Final report documentation will be delivered in both Adobe PDF and Microsoft Word formats, as specified by the Navy.

12. For the **Other Facility-Specific Hazards (e.g., internal utility train accidents) RVA**, the Contractor will develop a white paper style report characterizing the expected risk-dominating scenario of events (or top few, five or fewer, risk-dominating scenarios) based on the contractor team risk assessment experience, in general, and risk insights and knowledge about the RHBFSF obtained through performance of the Phase 1 Quantitative Risk and Vulnerability Assessment work, as documented in the Phase 1 QRVA Report (ABS Consulting Report Number R-3751812-2043) dated 12 November 2018. This white paper will include the following major topical sections:

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This RVA white paper report will be primarily qualitative in nature. Specifically, it will not include analyses previously included in the full scope QRVA, such as Initiating Event Data Analysis, Event Sequence Analysis, Systems Response Logic Modeling and Data Analysis, Human Action Response Logic Modeling and Data Analysis, Risk Quantification, or Uncertainty Analysis. However, it will include qualitative characterization of risk-dominating scenarios, identification of associated risk vulnerabilities, and recommendations for risk mitigation or risk management options or alternatives to be considered by the Navy for implementation over the remainder of facility life. The primary activities to be performed for development of this white paper report are:

- Facility and Hazard Information Collection and Review
- Phase 1 QRVA Review
- SME Walkdown (likely combined with other hazard assessment walkdown[s])
- Formulation of Evaluation Boundaries, Bases, and Assumptions
- Identification, Characterization, and Evaluation of Hazard-Specific Risk-Dominating Scenarios
- Identification of Hazard-Specific Risk Vulnerabilities
- Identification of Hazard-Specific Risk Mitigation and Risk Management Options
- White Paper Draft Report Documentation
- White Paper Response to Review Comments and Final Report Documentation

This hazard RVA will include simplified calculations of potential utility train derailment events that could threaten piping integrity in the Lower Access Tunnel. Such calculations consider utility train weight, size (height and width, including carried loads), speed, and center of gravity.

Final report documentation will be delivered in both Adobe PDF and Microsoft Word formats, as specified by the Navy.

4. Project Milestones and Schedule

The general list of proposed project milestones is presented in Table 4-1.

Table 4-1. Project Deliverable/Milestone Table

Deliverable/Milestone	Tentative Due Date
Work Start Authorization Issued	December 2, 2019
Field Investigation by SMEs	December 31, 2019
Phases 2–4 Interim Review #1 Conference Call (Includes Selected Stakeholders)	February 10, 2020
Phase 2 (Fire and Flooding) RVA Draft White Paper Reports Delivered for Review	March 16, 2020
Phases 2–4 Interim Review #2 Conference Call (Includes Selected Stakeholders)	May 11, 2020
Phase 3 (Seismic) RVA Bounding Assessment Draft Report Delivered for Review	June 15, 2020
Phase 4 (Other External Event) RVA Draft White Paper Reports Delivered for Review	August 14, 2020
Contractor Receive All Final Phases 2–4 Draft Report Review Comments from the Navy	October 30, 2020
Phases 2–4 Final Reports Delivered to the Navy	December 31, 2020

5. Communication among AOC Parties and Stakeholders during RVA Development

The RVA Team welcomes open communication and cooperation with work being performed under other sections of the RHBFSF AOC. Coordination of this communication will be implemented by the Navy RVA Director using the lines of communication presented in Figure 2-2. It is anticipated that meetings and conference calls will be arranged and facilitated by the Navy to support work coordination, communication, and cooperation among AOC technical teams. For the RVA, these types of meetings and lines of communication will be established, controlled, and facilitated by the Navy RVA Director, again via the lines of communication shown in Figure 2-2.

During this project, any communication from AOC parties and stakeholders other than those identified in Figure 2-2 will be pre-approved, facilitated, coordinated, and monitored by the Navy RVA Director. As shown in Table 4-1, there are currently two stakeholder interim project review conference calls planned for the Phase 2 RVA work, which are designed to promote communication among AOC parties.

6. References

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Appendix A. RVA Project Management

Considerations and recommendations for project management in Phase 2 are presented in this section. For Phase 2, it is recommended that a project manager (PM) be assigned as the single point of contact for all project activities. Included in this function activity will be development of the project plan, project task plans, and milestone scheduling.

The project plan will identify the overall Phase 2 project scope, project quality requirements, roles and responsibilities, internal/external project interfaces, design input requirements, interfacing RHBFSF procedures, project deliverables, performance measures for the project, requirements for project review(s), project software and associated software requirements, project schedule, and any associated project instructions and training requirements.

It is recommended that the draft project plan be reviewed during the Phase 2 project kickoff meeting. Also, during the project kickoff meeting the PM will coordinate personnel mobilization for the project. As part of the project schedule and activities, the PM will schedule and coordinate all interim and final reviews for project deliverables, to include review comment resolution and incorporation. The PM will coordinate status reports, project conference calls, and project status meetings.

The project plan will define the quality assurance requirements for this project. Project work results will be documented in a format that facilitates effective and efficient review by an independent reviewer. The scope and content of the quality assurance will be sufficient to satisfy Capability Category II requirements of the Probabilistic Risk Assessment (PRA) Standard.

Bases and Assumptions (applicable to all sub-tasks of project management)

- The project plan and individual task plans will be submitted to NAVFAC for review and approval.
- One cycle of review and comment incorporation is assumed for all project deliverables.

Recommended Deliverables of Project Management

- Project Plan
- Project Schedule
- Task Plans, as Applicable
- Kickoff Meeting and Project Status Meeting Support

- Monthly Status Reports

- Weekly E-Mail Reports and Project Leadership Conference Calls, or More Frequently as Necessary, with a Status and Action Item Tracking Report

These deliverables include a project work breakdown structure and a project schedule. The WBS will be defined in the project plan. The task structure will be sufficiently detailed to establish accurate project cost plans and schedule. The RVA work breakdown structure will incorporate all Navy, contractor, subcontractor, and other applicable organization tasks.

The Phase 2 project manager will develop and maintain a project schedule. The project schedule will be based on the WBS, incorporating all Navy, contractors, subcontractors, and other organizations. The project schedule will be sufficiently detailed to demonstrate project critical path and evaluate changes to critical path in the event of schedule advances or delays.

It is recommended that project administration and controls be established prior to or during the Phase 2 project kickoff meeting as part of the project ground rules. These will support delivery of high-quality products on time and within budget.

The scope and schedule for this project are sufficient to warrant a project controls officer. The project controls officer is a senior manager who can monitor progress and provide senior mentoring advice such that project delays are minimized. The project controls officer will provide input to the weekly status meetings. Additionally, it is recommended that a senior oversight director be assigned for the project. The senior oversight director will review project management and project controls activities throughout the project to ensure compliance with the project work plan and to ensure that high-quality deliverables are being prepared and issued as part of this project.

Appendix B. Bibliography

A list of useful RVA information sources that were not called out as specific references in the body of this work plan is presented in the following bibliography:

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Appendix C. List of Acronyms

Table C-1 presents the acronyms used in RVA.

Table C-1. List of Acronyms

Acronym	Term
ANS	American Nuclear Society
AOC	administrative order on consent
AOO	anticipated operational occurrences
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
CTO	contract task order
DBD	design basis documentation
DOH	Department of Health
EPA	U.S. Environmental Protection Agency
EPRI	Electric Power Research Institute
F-76	marine diesel
JP-5	jet propulsion fuel no. 5
JP-8	jet propulsion fuel no.8
NAVFAC	naval facilities engineering command
NTP	notification to proceed
OBE	operating-basis earthquake
P&ID	piping and instrument diagrams
PM	project manager
PRA	probabilistic risk assessment
QRVA	quantitative risk and vulnerability assessment
RHBFSF	Red Hill Bulk Fuel Storage Facility
RVA	risk and vulnerability assessment
SSC	structure, system, or component
SME	subject matter expert
SOW	scope of work

Acronym	Term
USGS	U.S. Geological Survey
UST	underground storage tanks
WBS	work breakdown structure

Table C-2 presents additional useful RVA abbreviations and acronyms.

Table C-2. Additional Useful Abbreviations and Acronyms

Acronym	Term
AFRF	acute fuel release frequency
AOO	anticipated operational occurrences
APET	accident progression event tree
ASTM	American Society of Testing and Materials
BAPT	best available practicable technology
BDBA	beyond-design-basis accidents
BDBE	beyond-design-basis events
BE	basic event
BFR	binomial failure rate
CAFRP	conditional acute fuel release probability
CCDF	complementary cumulative distribution function
CCF	common cause failure
CCW	component cooling water
CD	complete dependence
CET	containment event tree
CLB	current licensing basis
CLOFICP	conditional loss of fuel inventory control probability
CMF	common-mode failure
CRM	configuration risk management
CRS	cable and raceway database system
CY	calendar year
DBA	design-basis accident
DBE	design-basis event
DI	dependence importance
DLA	Defense Logistics Agency
EAB	exclusion area boundary
EDG	emergency diesel generator
EOP	emergency operating procedure

Table C-2. Additional Useful Abbreviations and Acronyms (Continued)

Acronym	Term
EP	emergency preparedness
ESD	event sequence diagram
ET	event tree
FEDB	Fire Events Database
FEP	fire emergency procedure
FM	failure mode
FMEA	failure modes and effects analysis
FOS	facility operating states
FRVA	fire RVA
FT	fault tree
FTR	fails to run
FTS	fails to start
GL	generic letter
HADA	human action dependency analysis
HD	high dependence
HCLPF	high confidence in low probability of failure
HEP	human error probability
HFE	human failure event
HLR	high-level requirement
HRA	human reliability analysis
HRR	heat release rate
HVAC	heating, ventilation, and air conditioning
IAEA	International Atomic Energy Agency
IAFRP	incremental acute fuel release probability
IM	importance measure
IPEEE	individual plant examinations for external events
LD	low dependence
LOFICF	loss of fuel inventory control frequency
LOFICP	incremental loss of fuel inventory control probability
LOIA	loss of inventory accidents

Table C-2. Additional Useful Abbreviations and Acronyms (Continued)

Acronym	Term
LOOP	loss of offsite power
MCR	main control room
MD	medium dependence
MFF	master frequency file
MGL	multiple Greek letter
MLD	master logic diagram
MLE	maximum-likelihood estimate
ND	navy distillate
NEI	Nuclear Energy Institute
NRC	U.S. Nuclear Regulatory Commission
OG	owners' group
PORV	power-operated relief valve
PSD	partial system description
PSF	performance shaping factor
QA	quality assurance
QHO	quantitative health objectives
QRA	quantitative risk assessment
RA	risk achievement
RAW	risk achievement worth
RG	Regulatory Guide
RIDM	risk-informed decision making
SA	systems analysis
SB, SBO	station blackout
SDM	system dependency matrix
s.e.	standard error
SM	seismic margin
SOKC	state-of-knowledge correlation
SR	supporting requirement
SRVA	seismic RVA
ST	source term

Table C-2. Additional Useful Abbreviations and Acronyms (Continued)

Acronym	Term
THERP	Technique for Human Error Rate Prediction
UFM	unplanned fuel movement
VA	vulnerability assessment
ZD	zero dependence
ZOI	zone of influence