Capsule Storage Area Conceptual Design Report (Project W-135)

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Contractor for the U.S. Department of Energy
under Contract DE-AC06-08RL14788

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<th>Description</th>
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<tbody>
<tr>
<td>ACI</td>
<td>American Concrete Institute</td>
</tr>
<tr>
<td>ALARA</td>
<td>as low as reasonably achievable</td>
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<tr>
<td>AoA</td>
<td>analysis of alternative</td>
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<tr>
<td>APT</td>
<td>Air Pallet Transporter</td>
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<td>ASME</td>
<td>American Society of Mechanical Engineers</td>
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<tr>
<td>BOE</td>
<td>basis of estimate</td>
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<tr>
<td>CAP</td>
<td>capital asset project</td>
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<tr>
<td>CD</td>
<td>critical decision</td>
</tr>
<tr>
<td>CDR</td>
<td>conceptual design report</td>
</tr>
<tr>
<td>CE&amp;I</td>
<td>control, electrical, and instrumentation</td>
</tr>
<tr>
<td>CFR</td>
<td>code of federal regulations</td>
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<tr>
<td>CHBWV</td>
<td>CH2M HILL BWXT West Valley, LLC</td>
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<tr>
<td>CHPRC</td>
<td>CH2M Plateau Remediation Company</td>
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<tr>
<td>CSA</td>
<td>Capsule Storage Area</td>
</tr>
<tr>
<td>CSB</td>
<td>Canister Storage Building</td>
</tr>
<tr>
<td>CSP</td>
<td>Capsule Storage Pad</td>
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<tr>
<td>CSS</td>
<td>cask storage system</td>
</tr>
<tr>
<td>DBI</td>
<td>design basis input</td>
</tr>
<tr>
<td>DCM</td>
<td>design compliance matrix</td>
</tr>
<tr>
<td>DOE-HQ</td>
<td>U.S. Department of Energy, Headquarters</td>
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<tr>
<td>DOE-RL</td>
<td>U.S. Department of Energy, Richland Operations Office</td>
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<tr>
<td>DSA</td>
<td>documented safety analysis</td>
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<tr>
<td>FDC</td>
<td>functional design criteria</td>
</tr>
<tr>
<td>FRD</td>
<td>functions and requirements document</td>
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<tr>
<td>GPP</td>
<td>general plant project</td>
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<tr>
<td>GPR</td>
<td>ground penetrating radar</td>
</tr>
<tr>
<td>HLW</td>
<td>high-level waste</td>
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<tr>
<td>HLWCRP</td>
<td>High-Level Waste Canister Relocation Project</td>
</tr>
<tr>
<td>HWVP</td>
<td>Hanford Waste Vitrification Plant</td>
</tr>
<tr>
<td>ISA</td>
<td>Interim Storage Area</td>
</tr>
<tr>
<td>KPP</td>
<td>key performance parameter</td>
</tr>
<tr>
<td>LS</td>
<td>limit state</td>
</tr>
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Lucas Engineering and Management Services, Inc.
Management of Cesium and Strontium Capsules
operations and maintenance
project execution plan
Mission Support Alliance
NAC International, Inc.
performance category
quality assurance
seismic design category
structure, system, and component
Storage, Laydown, and Fabrication
Temporary Controlled Storage Area
Temperature Monitoring System
Transportable Storage Canister
Transportable Storage Canister Basket
Universal Capsule Sleeves
unplanned release radioactive
Vertical Concrete Casks
Vertical Cask Transporter
Waste Encapsulation and Storage Facility
Waste Information Database System
West Valley Demonstration Project
Key Definitions

The following general definitions pertain to the Management of the Cesium and Strontium Capsules (MCSC) Project.

**Capsule Storage Area:** The Capsule Storage Area (CSA) includes the capsule storage pad (CSP) required for storage of the capsules within the Vertical Concrete Cask (VCC), as well as associated fencing, lighting, and road access. The CSA will include a prepared area around the pad sufficient for CSS operations, and surveillance and maintenance operations. This area may be graded, compacted gravel, or concrete, depending upon usage and load requirements. The fencing will be used to limit radiological exposure to non-radiological workers from storage system structures, systems, and components (SSCs) and will provide required physical security. The CSA shall include features to address storm water in a manner that does not interfere with the operation of the CSS (e.g. passive cooling).

**Capsule Storage Pad:** The CSP is the concrete foundation upon which the VCC will be placed for interim storage of the capsules. The storage pad is a component of the CSA and CSS. The CSP shall include features to address storm water in a manner that does not interfere with the operation of the CSS (e.g. passive cooling).

**Cask Storage System:** The Cask Storage System (CSS) is the complete system that provides storage of the capsules for the required interim storage period. The CSS includes capsule loading equipment, transfer equipment, storage system components, and ancillary equipment.

**Safety class structures, systems, and components:** Safety class SSCs are defined by 10 CFR 830, “Nuclear Safety Management,” as “the structures, systems, or components, including portions of process systems, whose preventive or mitigative function is necessary to limit radioactive hazardous material exposure to the public, as determined from safety analyses.”

**Safety significant structures, systems, and components:** Safety significant SSCs are defined by 10 CFR 830 as “the structures, systems, and components which are not designated as safety class structures, systems, and components, but whose preventive or mitigative function is a major contributor to defense in depth and/or worker safety as determined from safety analyses.”

**Safety structures, systems, and components:** Safety SSCs are defined by 10 CFR 830 to mean both safety class and safety significant SSCs.

**Storage, Laydown and Fabrication Area:** The Storage, Laydown and Fabrication (SLF) Area is the project designated storage and laydown site located adjacent to Waste Encapsulation and Storage Facility (WESF) to support CSS equipment receipt, fabrication and/or storage, and consists of several SSCs including the Fabrication and Storage Pad and other sub-systems.

**SLF Fabrication and Storage Pad:** The SLF Fabrication and Storage Pad is a concrete monolith located within the SLF. The Fabrication and Storage Pad provides a stable operating area for fabrication of the VCCs and subsequent storage of the empty VCCs loaded with select internals (e.g., Transportable Storage Canister Basket [TSCB], Transportable Storage Canister [TSC], TSCB and TSC closure lids, etc.), pending the pickup of the VCCs utilizing the Vertical Cask Transporter (VCT) and tug for delivery to WESF for loading operations.

**Transfer cask:** A component that provides heat removal, shielding, and physical protection during transfer of a loaded TSC into a VCC or from a VCC into a transportation cask. The transfer cask is typically lifted via lifting trunnions and yoke. A transfer cask is not expected to be used for the MCSC Project but it is a component that could be used for future transportation of the TSC offsite for final disposition or as a recovery action.
Transfer equipment: Used to move the loaded VCC from WESF to the CSA. It may also be used to move unloaded VCCs. It includes equipment such as trailers, crawlers, or tow vehicles (including any restraint or tie-downs required to move the VCC) and may include tugs, pushers or tractors used to move any trailer or dolly. SSCs used to protect the VCC from environmental conditions once it leaves WESF shall be included. Transfer equipment does not include temporary lifting yokes, slings, and rigging that are considered ancillary equipment (see also VCT).

Transportable Storage Canister: The TSC is designed to fit inside the VCC for storage and the transportation cask for transportation. The TSC houses the empty or Universal Capsule Sleeve (UCS) loaded TSCB.

Transportable Storage Canister Basket: The TSCB, is commonly referred to as a basket. It is designed to house multiple UCS and is placed inside the TSC.

Transportation cask: A component that provides heat removal, shielding, and physical protection during offsite transfer of a loaded TSC to an alternate offsite location. The transportation cask is typically licensed in accordance with 10 CFR 71, “Packaging and Transportation of Radioactive Material,” for all Nuclear Regulatory Commission-defined transportation accidents for a list of approved contents. A transportation cask is typically lifted with lifting trunnions and yoke. A transportation cask is not expected to be used for the MCSC Project but it is a component that could be used for future transportation of the TSC offsite for final disposition or as a recovery action.

Universal Capsule Sleeve: The UCS is designed to hold standard Cesium/Strontium capsules or Type W capsules. It is a metal cylinder used to confine the capsules in a storage system using a canister/overpack design. It is protected from normal, off-normal, and accident conditions by the TSCB/TSC/VCC integrated overpack load.

Vertical Concrete Cask: The VCC is the storage overpack that houses the TSC. Once loaded, the VCC will be transferred to the CSA with the VCT. The VCC provides radiological shielding and physical protection for the loaded TSC.

Vertical Cask Transporter: The VCT is part of the Transfer Equipment set of SSCs. It is a wheeled, towed hydraulic lift unit designed to lift and carry a VCC over the grade and road conditions existing at the site along the designated haul path. An aircraft gate tractor is typically provided as the prime mover of the VCT for all onsite cask movements. The VCT interfaces with the VCC via two lifting lug sets bolted to the VCC top plate connected by engagement pins to two lift links on the VCT.
1 Introduction

The Management of Cesium and Strontium Capsules (MCSC) Project will fill the capability gap for interim storage of cesium and strontium capsules currently stored underwater at the Waste Encapsulation and Storage Facility (WESF). The scope of the MCSC Project is consistent with DOE/RL-2012-47, Mission Need Statement for the Management of the Cesium and Strontium Capsules (hereinafter called the Mission Need Statement). The MCSC Project is managed by the CH2M Plateau Remediation Company (CHPRC) in compliance with requirements established by the U.S. Department of Energy, Richland Operations Office (DOE-RL) in the Plateau Remediation Contract (DE-AC06-08RL14788, CH2M HILL Plateau Remediation Company Plateau Remediation Contract).

The approach for managing and controlling all activities necessary to successfully execute all responsibilities inherent to the Plateau Remediation Contract are described in the project execution plan (PEP) PRC-MP-MS-19361, CH2M HILL Plateau Remediation Company Project Execution Plan, which has been approved by DOE-RL. The CHPRC PEP describes the CHPRC project management approach, procedures and methods that comply with DOE O 413.3B, Program and Project Management for the Acquisition of Capital Assets. The MCSC Project is a CHPRC subproject and will be managed in accordance with the CHPRC PEP.

Lucas Engineering and Management Services, Inc. (Lucas) under CHPRC Subcontract 57805 has prepared the conceptual designs for the WESF modifications, and the Capsule Storage Area (CSA) portion of the MCSC Project Capital Asset Project (CAP). This document is the Conceptual Design Report (CDR) for the CSA portion of the MCSC Project CAP. The CSA portion of the MCSC CAP includes, at a summary level, the following key elements:

1. Design and construction of the CSA, including the Capsule Storage Pad (CSP) and other sub-systems to support interim storage of the capsules
2. Design and construction of the Storage, Laydown and Fabrication (SLF) Area and other sub-systems adjacent to WESF to support Cask Storage System (CSS) equipment receipt, fabrication, and/or storage
3. Design and construction of transfer roadway and haul path facility access improvements from the SLF to WESF and from WESF to the CSA, as necessary to support transfer of the capsules utilizing the CSS supplied VCT and tug.

Section 1.3 of this CDR provides additional details on the execution structure for the MCSC Project and the relationship of the scope of this conceptual design to the other pieces of the MCSC Project CAP. This CDR has been prepared in accordance with the requirements and guidance provided in PRC-STD-EN-40261, Conceptual Design Report.

1.1 Background

From 1974 to 1985, cesium and strontium were removed from the nuclear waste at B Plant and then encapsulated and stored at the WESF (Figure 1-1). Removal of the cesium and strontium from the underground tanks allowed for improved management of the underground tanks, enhanced isolation of the tank waste, and provided an opportunity for beneficial use of the encapsulated cesium and strontium.

WESF is located adjacent to B Plant in the 200-East Area on the Central Plateau of the Hanford Site. The mission of WESF is the safe and compliant storage of 1,936 cesium and strontium capsules. As of June 2017, the capsules contain approximately 90 million curies. This activity includes the short half-life daughter products barium-137m and yttrium-90.
The capsules are stored underwater in pool cells. The WESF is an aging facility that is being operated beyond its design life. The facility relies on active systems for ventilation, maintaining pool cell water levels, and monitoring the capsules. These systems are becoming more expensive and difficult to operate and maintain.

Figure 1-1. Photograph of Waste Encapsulation and Storage Facility

The planning for the final disposal of the capsules has assumed that they would be shipped to a High-Level Waste (HLW) repository. The Yucca Mountain Nuclear Waste Repository, as designated by the Nuclear Waste Policy Act of 1982 1987 amendment, was to be the deep geological repository for spent nuclear fuel and other high-level radioactive wastes.

Federal funding for the Yucca Mountain Nuclear Waste Repository ended in 2011 via an amendment to a U.S. Department of Defense appropriations action, passed on April 14, 2011. This left the United States without any disposal option for spent nuclear fuel and high-level wastes. It also left Hanford in a position of not having a disposal pathway for the capsules, and with the need to store the capsules for the foreseeable future.

Recognizing the need for continued storage of the capsules, DOE-RL prepared the Mission Need Statement (DOE/RL-2012-47). The U.S. Department of Energy, Headquarters (DOE-HQ) approved this Mission Need Statement and Critical Decision 0 (CD-0) on November 5, 2015.

The MCSC Project was created to close the capability gaps identified in the Mission Need Statement (DOE/RL-2012-47). The project will close the capability gaps in a manner that:

- Does not eliminate any capsule disposal alternative.
- Considers the future transfer of the capsules from storage to disposal.
- Incorporates the universal canister system concept developed by DOE for disposal of small waste forms.
- Utilizes the experience and technologies used by the commercial nuclear industry for the storage of Spent Nuclear Fuel.

The CHPRC has the overall responsibility for the successful completion of the MCSC Project and will manage the project in accordance with DOE O 413.3B. The CHPRC will maintain the technical baseline,
cost baseline and schedule baseline. The CHPRC is responsible for obtaining the necessary environmental permits and nuclear safety approvals.

1.2 Project Need

A Mission Need Statement (DOE/RL-2012-47) and CD-0 has been approved by DOE-HQ in accordance with DOE O 413.3B. The MCSC Project will address the capability gaps identified in the Mission Need Statement. The statement of mission need is as follows:

- **The Hanford Site needs to provide safe, compliant, and cost-effective storage of the cesium-137 and strontium-90 capsules. This storage capability will be necessary until a disposal path for the capsules is established and implemented.**

- **Fulfillment of this mission need will align management of the capsules with site goals for cleanup of the Central Plateau, including safe management of legacy material and long-term stewardship of the site.**

DOE-RL is responsible for the safe, compliant, and cost-effective management of the cesium-137 and strontium-90 capsules. The capsules represent a significant portion of the radioactive materials on the Hanford Site. Storage of the capsules is required until final disposal of the capsules is possible.

It has been assumed that the capsules would eventually be disposed in a national HLW repository. With the elimination of funding for the HLW repository in Yucca Mountain, a disposal pathway for the capsules no longer exists.

The need to store the capsules until a disposal pathway is identified and available represents a capability gap. Other factors that contribute to this capability cap include:

- Continued operation of the WESF systems for an extended period of time will result in increased costs as the equipment ages and becomes more difficult to maintain.

- Cleanup of the B Plant Complex cannot proceed until the capsules are removed from the WESF.

- A Beyond Design Basis Accident would result in a significant risk to the Hanford Site workers and the public.

1.3 Project Description

The MCSC Project will provide the necessary capabilities to close the gaps identified in the Mission Need Statement (DOE/RL-2012-47). The project will provide the capabilities necessary to transfer the capsules from the WESF pool cell to a CSS which will be located in a new CSA. The CSS will safely and compliantly store the 1,936 capsules, until a capsule disposal option is available.

The MCSC Project will be managed in accordance with DOE O 413.3B. The tailoring strategy for DOE O 413.3B is described in CHPRC-02264, *MCSC Project Execution Plan for the Management of the Cesium and Strontium Capsules (MCSC) Project (W-135)*. The MCSC Project includes a CAP portion and an expense-funded portion. Figure 1-2 is an illustration of what is included in each of these portions of the project.

The CAP portion of the project includes a Line Item and a General Plant Project (GPP). The Line Item will fund the design and construction of the WESF modifications necessary to transfer the capsules to the CSS and the GPP will fund the design and construction of the CSA.

The expense-funded portion of the MCSC Project will provide: design and fabrication of the CSS, as well as start-up and readiness activities. The scope of the MCSC Project does not include the actual transfer of the capsules to the CSA.
1.4 MCSC Project Scope

The scope of the MCSC Project is described in the functions and requirements documents (FRD), CHPRC-02252, *Management of the Cesium and Strontium Capsules Project (W-135) Functions and Requirements Document*. The project includes the following major activities to successfully transfer the capsules to a new storage capability:

- Design and fabricate a storage capability that can safely, compliantly, and cost-effectively store the capsules until a disposal pathway for the capsules is available.
- Design and construct the equipment necessary to retrieve, load, and transfer the capsules from the WESF pool cells to the storage capability.
- Design and construct a CSA (including storage pad, fencing, lighting, and road access).
- Design and construct the WESF modifications needed to support capsule retrieval, load, and transfer to the storage capability.
- Prepare operational procedures, maintenance procedures, and training.
- Perform operational startup readiness activities.
- Prepare required environmental permits and approvals.
- Prepare safety basis documents and obtain DOE-HQ approval.

1.5 Capsule Storage Area Scope

The CSA portion of the MCSC CAP consists of the following key elements.
1.5.1 Capsule Storage Area

The designated CSA is the storage site location selected for interim storage of the capsules and consists of several structures, systems, and components (SSCs) including the CSP and other sub-systems to support interim storage of the capsules until a disposal pathway becomes available. The CSA consists of:

- The CSP – A concrete monolith designed and sized to support the fully loaded Vertical Concrete Casks (VCCs) for the duration of interim storage.

- The Operating Pad and CSA yard – The Operating Pad is a concrete monolith adjacent and connected to the CSP. The Operating Pad provides a stable operating area for the maneuvering of the VCCs into designated positions utilizing the Vertical Cask Transporter (VCT) and tug system previously utilized at the West Valley Demonstration Project’s (WVDP) High-Level Waste Canister Relocation Project (HLWCRP) for similar purpose. The CSA Yard is the balance of the designated CSA open space that will be cleared, grubbed, and graveled with the gravel being compacted and leveled grade to match with the CSP and Operating Pad.

- The Security/Property Protection sub-systems – These CSA sub-systems consist of fencing, vehicular and personnel access gates, pole-mounted flood lighting, and any other associated equipment as may be required and necessary based upon security assessment, hazard analysis, safety analysis, and housed SSC quality level designations.

- The Temperature Monitoring System (TMS) and Control, Electrical, and Instrumentation (CE&I) interfaces and support equipment – these CSA sub-systems consist of the CE&I interface to the TMS, as well as the weather tight enclosure sufficient for the TMS and any Operations and Maintenance, and/or upgrade/system replacement needs during the interim storage period.

1.5.2 Storage, Laydown and Fabrication Area

The SLF area is the project-designated storage, laydown, and fabrication site located adjacent to WESF to support CSS equipment receipt, fabrication, and/or storage and consists of several SSCs including the Fabrication and Storage Pad and other sub-systems:

- The SLF Fabrication and Storage Pad – the Fabrication and Storage Pad is a concrete monolith located within the SLF. The Fabrication and Storage Pad provides a stable operating area for fabrication of the VCCs and subsequent storage of the empty VCCs loaded with select internals, pending the pickup of the VCCs utilizing the VCT and tug for delivery to WESF for loading operations. The SLF Yard is the balance of the designated SLF open space that will be cleared, grubbed, and graveled with the gravel being compacted and leveled grade to match with the Fabrication and Storage Pad. The yard is anticipated to be utilized for general construction, equipment, receipt, assembly, testing, acceptance and staging activities, or as otherwise designated.

- The Security/Property Protection sub-systems – These SLF sub-systems consist of fencing, vehicular and personnel access gates, pole mounted flood lighting, and any other associated equipment as may be required and necessary based upon security assessment, hazard analysis, safety analysis, and housed SSC quality level designations.

1.5.3 Transfer Roadway and Facility Access Haul Path Improvements

Transfer roadway and facility access haul path improvements consist of improvements and modifications of Polaris Drive and Atlanta Avenue from the SLF to WESF in support of unloaded VCC transfer from the SLF to WESF; and Atlanta Avenue and 7th Street from WESF to the CSA necessary to support transfer of the capsules in the loaded VCCs utilizing the VCT and tug.

1.6 Analysis of Alternatives

An Alternative Analysis report was prepared for the MCSC Project in accordance with the requirements of
DOE O 413.3B and the guidance provided in DOE G 413.3-1, Managing Design and Construction Using Systems Engineering for Use with DOE O 413.3A. The Alternative Analysis was developed using a phased and systematic approach that integrated the Analysis of Alternatives (AoA) Best Practices recommended by the U.S. Government Accountability Office (GAO-15-37, DOE and NNSA Project Management Analysis of Alternatives Could Be Improved by Incorporating Best Practices). This Alternative Analysis was based on the mission need to optimize the design solution, taking into account safety, cost, schedule, and the use of proven technology.

A Value Engineering approach was used during development of the Alternative Analysis. The results of the analysis, documented in CHPRC-02828, Alternative Analysis for the Management of the Cesium and Strontium Capsules (MCSC) Project (W-135), was selection of the alternative for a new commercial dry cask storage system as the best and preferred alternative to meet the capability gap identified in the Mission Need Statement (DOE/RL-2012-47).

1.7 Independent Analysis of Alternatives

Recent changes to DOE O 413.3B require DOE to conduct an AoA that is independent of the contractor organization responsible for managing the construction or constructing the capital asset project. DOE O 413.3B tailoring strategy addresses this requirement in the following manner:

- The MCSC Project has a project history that acknowledges a number of independent alternatives analyses. These analyses were completed prior to the award of the Plateau Remediation Contract. The transfer of the capsules to dry storage was included as scope in the Plateau Remediation Contract on a funding available basis (contract established in 2008). In addition, dry interim storage of the capsules for an extended period was an evaluated case in the DOE/EIS-0391, Final Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington (TC & WM EIS).

- In consideration of the work having been performed, the existing analyses will be used to satisfy the requirement for a project independent AoA, as comprising an equivalent document, in accordance with DOE O 413.3B and DOE O 251.1D, Departmental Directives Program. An AoA equivalent report will be prepared and included in the CD-1 package for approval.

1.8 Design Reviews and Approvals

A formal design review was performed of the CSA conceptual design on May 15, 2017, in accordance with the requirements of PRC-PRO-EN-40264, Formal Design Review. The function of this review team was to perform systematic overall review and evaluation of the design by personnel representing affected disciplines. This process involved a detailed review of design media to verify the following:

- Design inputs are adequately defined (including functions, requirements, and design criteria.)
- Design meets all defined requirements and parameters.
- Proof in the functional design verification matrix clearly indicates that the design is adequate to confirm that the requirements meet the performance specification.
- Design is sufficient to proceed to construction and startup.

Design acceptance will be documented through an approved report as a controlled, released engineering document according to PRC-PRO-EN-440, Engineering Documentation Preparation and Control. A design review report will be developed, approved, and issued by the MCSC Project’s Engineering Lead.

At each design stage (conceptual, preliminary, final), a single design review will be performed to review the design for the capital asset portion of the project (the CSA and WESF Modifications). A separate
design review will be performed for the CSS design. The reviews will be staffed and chaired by CHPRC personnel with DOE-RL participation.

Additional design verification will be performed in the future as components and systems are received and tested prior to placing SSCs into operation. Receipt inspections will be performed by qualified inspectors on select SSCs in accordance with PRC-PRO-QA-268, Control of Purchased/Acquired Items and Services. Testing of SSCs will be planned, performed, and documented in accordance with PRC-PRO-EN-286, Testing of Equipment and Systems.

Lucas, in conjunction with the development of the CSA conceptual design, prepared a Design Compliance Matrix (DCM). The DCM summarily lists the requirements from the functional design criteria (FDC) document, CHPRC-02623, Capsule Storage Area (CSA) Functional Design Criteria (W-135), and describes by reference where and how this requirement is met by the conceptual design. As this is a conceptual design, there are many of the detailed requirements in the FDC that are either not addressed or only partially addressed during this design phase. The DCM identifies those requirements that are not addressed or only partially addressed in this design phase.

2 Design Selection

The conceptual design for the CSA presented in this CDR has been developed to meet the requirements as defined in the MCSC project key requirement documents (CHPRC-02252 and CHPRC-02623). In addition to development of a conceptual design that meets the project requirement documents, the CSA design needed to meet the technical interface requirements of the CSS, as well as that of multiple CHPRC and other onsite Hanford services organizations.

Finally, the conceptual design integrated several key lessons learned and design features of the recently completed WVDP HLWCRP. This is a project that employed the same dry cask storage technology as is being used for the MCSC Project to package and provide extended onsite storage of 275 canisters of vitrified HLW. The following sections provide additional details on the key requirements of the FRD and FDC for the CSA; how the design activities of the CSA and WESF modifications conceptual designs have been integrated with that of the CSS; how the integration with interfacing Hanford organizations were met; and how the project design, construction, and operational experience from the WVDP HLWCRP were integrated into the CSA design.

2.1 Summary of Functions and Requirements Document/ Functional Design Criteria

The following sections provide at a summary level the key requirements for the CSA design as defined in the FRD and FDC.

2.1.1 Functions and Requirements Document

The FRD defines the top-level functional requirements for the MCSC Project, summarized in the following:

- The MCSC Project shall have the capability to transfer all 1,936 capsules from WESF to the CSA within a 52-week period, following successful completion of system startup and readiness review. This includes all activities necessary to retrieve and inspect the capsules, load the capsules into the canisters, close the canisters, transfer the canisters to the CSA, and place the canisters in the storage overpacks at the CSA.
- The process to move canisters out of WESF shall be designed as a clean operation with no contamination external to the package the canisters are in when they leave WESF.
The MCSC Project shall interface with existing Hanford Site utilities and infrastructure, as needed, to support construction, capsule transfer operations, and long-term storage operations. Existing systems at WESF shall be used to the maximum extent possible to distribute required utilities (e.g., water, electricity, and sanitation).

WESF Modifications and equipment used within WESF shall have a minimum design life of 5 years or be designed for ease of replacement. All systems and equipment provided shall be designed, to the maximum extent practicable, to provide a minimum 5-year maintenance-free service life.

The MCSC Project shall be designed to limit occupational radiation exposures in accordance with the requirements of 10 CFR 835, “Occupational Radiation Protection Program,” and CHPRC-00073, CH2M HILL Plateau Remediation Company Radiological Control Manual.

The MCSC Project shall comply with the requirements of 10 CFR 830, “Nuclear Safety Management,” and DOE-STD-1189-2008, Integration of Safety Into the Design Process, as implemented by PRC-PRO-NS-700, Safety Basis Development. The specific strategy that will be used to ensure compliance is described in CHPRC-02236, Waste Encapsulation and Storage Facility Management of Cesium and Strontium Capsules (Project W-135) Safety Design Strategy.

2.1.2 Functional Design Criteria
The FDC, CHPRC-02623, is a subset document to the FRD and provides those lower-level design requirements as they pertain to the scope of the CSA project.

CHPRC’s Key Performance Parameter (KPP) for the CSA is: “Provide a location for interim storage of Hanford’s cesium and strontium capsules. This KPP is complete when readiness activities are complete and authorization to begin transfer of the capsules from WESF to the storage area is received.”

The key requirements to meet the requirements of this KPP were established in the CSA FDC and can be summarized as follows:

- The CSA is sufficiently sized to accommodate CSS operations and maintenance (O&M) during interim storage.
- CSA SSCs design lifetime:
  - Components shall be designed such that continued integrity of the component can be verified over the design life to ensure continued functionality of the component within original requirements.
  - Unless otherwise stated, all systems and equipment provided shall be designed, to the maximum extent practical, to provide a minimum 5-years maintenance-free service life unless stipulated otherwise.
  - Components within CSA shall have a minimum design life of 100 years, or be designed to be easily replaced without relocation of the capsules from the storage configuration
- CSP is sufficiently sized to accommodate all VCCs with room for an additional 50% as contingency.
- Roadway/haul path improved where necessary for SSC movements.
- Under and over crossing of utilities and services protected.
- SLF sufficiently sized to support receipt, inspection, fabrication (if required), assembly, testing, storage, and quality assurance (QA)/quality control/Foreign Material Exclusion compliance of SSCs.
- TMS weather protection and accessibility during interim storage period.
A key overarching functional requirement for all MCSC Project SSCs is that the integrated design shall preclude drops of CSS components that may result in loss of confinement at any time during the process.

2.2 Design Integration

The three primary elements of the MCSC Project (the CSS, the WESF modifications, and the CSA) must be integrated technically. An additional complexity to this integration was that the CSS was being designed by NAC International (NAC), while the conceptual designs for the CSA and WESF modifications were being designed by Lucas. Integration and management of the design interfaces began with the development of the project FRD and the three FDCs. Lucas served as the lead author on these four project requirements documents. Lucas has taken the lead for providing the lower-level design integration management of the three design efforts. The CSS design largely drives the conceptual designs for the CSA and the WESF modifications. Lucas has participated in regular interfaces with NAC as they have proceeded with development of the CSS conceptual design. Lucas has additionally been a participant on design reviews of the NAC design products.

Design Basis Input (DBI) matrices were developed for both the CSA and WESF modifications designs to capture and manage the design interfaces. The DBI for the CSA design is included in this report as Appendix A. The DBI documents the technical inputs utilized to develop the conceptual design to meet a functional requirement. The following are a few key examples of inputs from the CSS contractor to the CSA:

- Size and design requirements for the CSP in the CSA.
- Requirements for the CSS VCT that will transfer the loaded CSS canisters from WESF to the CSA to the storage casks to be placed on the CSP. The CSS contractor will provide the transfer system. The existing roadway from WESF to the CSA will likely require modifications to accommodate the size and weight of the transfer system. This includes any approach aprons to the CSP within the CSA and requirements for crane pads within the CSA.
- Requirements for fabrication, assembly, and storage of the CSS components onsite prior to installation in WESF or utilized for capsule loading operations.

These inputs and many others have evolved throughout the conceptual design process. The DBI matrix identifies the design inputs required, those that were ultimately utilized in the design, the source of that input. The design basis additionally identifies any areas of uncertainty softness or risk with the inputs that will require further confirmation or refinement at later design stages.

In addition to technical inputs from the CSS design contractor, the design of the CSA required technical integration and inputs from multiple onsite organizations. The key onsite technical interfaces were as follows:

- WESF Operations.
- CHPRC Projects and Engineering.
- Mission Support Alliance (MSA) utilities (water, electrical, sanitary water).
- Fire Protection.
- MSA Roads.
- MSA Rail.
- Site Security.
The required inputs from these organizations that were utilized in the conceptual design of the CSA are likewise captured and documented in the DBI.

2.3 WVDP HLW Relocation Project Lessons Learned Integration

A valuable source of input to the conceptual design for the MCSC Project has been the WVDP HLWCRP. The HLWCRP removed 275 canisters of vitrified HLW, 2 evacuated canisters, and 1 debris canister that were being stored in the site’s Main Plant Process Building and relocated to a new onsite HLW Canister Interim Storage Facility. The relevancy of this project to the MCSC Project is that West Valley utilized a very similar commercial dry cask storage system supplied by NAC as NAC is utilizing for the MCSC Project.

The HLW Canister Project was completed in November 2016 with the placement of the last HLW canister on the storage pad. CH2M HILL BWXT West Valley (CHBWV) is the site prime contractor at the WVDP site. During the conceptual design for the MCSC Project, there have been multiple exchanges of information between the CHPRC MCSC project team and CHBWV HLWCRP team. This information has included design and construction information, cost information, and operational inputs. Design information, as well as cost information, have been integrated in the design input basis for multiple aspects of the CSA conceptual design.

The MCSC Project is currently planning on re-utilizing the WVDP HLWCRP VCT and its associated tug (Figure 2-1) for use on the MCSC Project for transfer of the loaded VCCs to the CSA. CHBWV has provided design and specification information on the VCT and tug to the MCSC Project team for use in the development of this conceptual design. Information (such as the VCT weight, minimum turn radius, and road grade limitations) was utilized in the identification of areas of the MCSC Project transfer roadway path that would require modifications. Additionally, their Interim HLW CSP concrete thickness and steel reinforcement quantities were utilized as the basis for the CSP. Where and how inputs from the HLWCRP project were utilized in the conceptual design of the CSA are cited in this report and in the MCSC Project CSA DBI matrix.
2.4  Design Options

As discussed in Section 1.6 of this report, the primary analysis of alternatives for the MCSC Project was completed in 2015 with the selection of a commercial dry cask storage system as the option for extended storage of the cesium and strontium capsules. The selection of a CSS provided by NAC was completed in 2016 through a competitive procurement process. The design of the CSS largely drives the design of the CSA. During the conceptual design of the CSA, the design options examined were lower level solutions to meet the functional requirements of the FDC. The various options examined to meet these requirements are discussed in Sections 3 and 4 of this report in the context of each of the CSA SSCs.

3  Design Overview

The CSA design consists of primarily of passive infrastructure facilities and SSCs, being principally comprised of the CSA proper; the SLF area; and the transport roadway/ facility access haul paths and improvements to and between the SLF, WESF, and CSA. Their principle respective functions are to support interim storage of the capsules; support CSS equipment/SSC receipt, fabrication, and storage until needed; and support and enable transportation of the CSS equipment from the SLF to WESF and the capsules from WESF to the CSA/CSP.

3.1  Interfaces with Existing Facilities/Systems

Key interfaces are driven by the operational elements and principal activities associated with the MCSC Project construction; select CSS SSC receipt, fabrication, and assembly operations; and the project operations associated with the cesium and strontium capsule removal, packaging, and transfer from
To the extent that they are known at this stage of the design, the following subsections provide a
simplified overview and summary of the anticipated operations and principle activities of the MCSC
Project as they relate to each operable unit of the CSA SSCs, as well as their interface with existing
infrastructure. At this stage of the design there are several elements that will require further development
as the design progresses. These elements will be called out, as will any correlating subsections of this
report where additional detail can be found.

3.1.1 Staging/Laydown/Fabrication Area

The SLF is the project designated storage and laydown site currently identified as being located adjacent
to WESF to support CSS equipment receipt, fabrication and/or storage, and consists of several SSCs
including the Fabrication and Storage Pad and other sub-systems.

The size of the SLF area and of the Fabrication and Storage Pad were provided by NAC to CHPRC. The
full range of operations at the SLF has not yet been fully defined. However, based upon initial input
from, and review of the following:

- NAC discussion during and after their initial design review.
- NAC draft input to CHPRC for the SLF Operating Area size and Fabrication and Storage Pad size.
- NAC original proposal.
- Discussion with CHPRC project engineering staff.
- A review of publicly available materials describing the WVDP (WM2014 #14521; WM2015
  #15269).
- A review of WVDP provided documentation (GPP Closeout Package for Construct Road Upgrades
  PBS OH-WV-004.O1.1 dated 03/03/2016; GPP Closeout Package for Constructing the HLW Cask
The following operations are assumed to be typical of those that will be executed within the SLF and are those that are likely to have impact on key interfaces to the SLF. The associated key interface elements are identified with each operation listed.

3.1.1.1 **Receipt of Materials.**

Receipt of all the raw construction materials for the Fabrication and Storage Pad, the SLF yard, the VCCs, and some partially completed sub-assemblies for the VCCs; receipt and staging of the Transportable Storage Canister (TSCs) and Transportable Storage Canister Baskets (TSCB) – internals that will be stored within the empty VCCs as each VCC is fabricated onsite; receipt of the disassembled VCT; receipt of the GT50 tug; receipt of other items not yet identified.

**Key Interfaces:** The SLF is situated on the north end of an existing WESF staging and laydown area (Appendix C, W135-CSA-SK-C-001 - SK-C-004). There is also a Temporary Controlled Storage Area (TCSA) just south of the SLF boundary. Polaris Drive is currently the common access road to the SLF and to the WESF operating areas and TCSA. Polaris Drive is not wide enough for the VCT and it is located within the designated SLF boundary.

3.1.1.2 **Fabrication, Assembly, Inspection, and Testing.**

Aside from the actual construction of the SLF and SLF Fabrication and Storage Pad, the single most significant activity that impacts the co-located and adjacent facilities and operations is that of fabricating the VCCs and of staging of the TSC/TSCBs. These activities will require a substantial number of concrete pump trucks, iron work/hot work, and small crane operations to complete as shown in Figure 3-1, courtesy of WVDP. The fabrication campaign is anticipated to be approximately 10 to 12 weeks long.

**Key Interfaces:** The co-located/adjacent nature of the SLF to the existing WESF storage and operating areas, as well as to the TCSA, pose a challenge. The substantial amount of truck traffic associated with SLF operations will interrupt operations at the WESF storage and TCSA. Also, receipt or shipment of radioactive materials associated with the TCSA operations may interrupt SLF operations. The movement of non-SLF related truck traffic through the SLF operations area will pose a challenge as many of the materials that will be staged and/or stored within the SLF area are quality level-2 or better and thus controlled ingress/egress requirements will be in place.

In addition, there are one or more radioactive transfer lines in the area, and likely a Waste Information Database System (WIDS) area as well. These are not yet fully evaluated and will need further evaluation during Preliminary Design/the next phase of the design effort.

**Design Solution/Strategy:** It is likely that Polaris Drive may need to be widened (moved or relocated via widening) in order to mitigate the potential traffic logistics issues noted above. In conjunction to, or in lieu of, this strategy, building an alternate entrance to the SLF on the north side of the designated SLF boundary may be an augmentation or alternative to relocating Polaris Drive. This effort may likely
impact one or more buried radioactive transfer lines that are adjacent to the designated SLF boundaries on both the east and west boundaries. The alternate entrance into the SLF is identified as Area 3 in the drawing set (see Appendix C, drawings W135-CSA-SK-C-003 and CSA-SK-C-004). Area 3 is on the northern side of the SLF.

It is recommended that once further operations detail for the SLF is better known, that the size of the site be further evaluated to assess whether there are potential alternative solutions to those posed above. It is recommended that these further evaluations be completed during Preliminary Design/the next phase of the design effort.

### 3.1.2 Transport VCC from the SLF to WESF

Once the first few VCCs have been fabricated and assembled, the WESF modifications and CSA construction is complete, the loading operations can begin. This will be done using the same VCT and GT50 Tug combination used successfully at the /WVDP/HLWCRP, the empty VCCs will be moved from the SLF to WESF. At the designated transfer location on the expanded WESF Truck Port Apron an Air Pallet Transporter (APT) will be in place; the empty VCC will be positioned over the APT utilizing the VCT and tug. The empty VCC will be lowered on to the APT and secured to it; the VCT lifting mechanisms will be disengaged and removed from the empty VCC and the empty VCC will then be placed into position within the WESF Truck Bay and made ready to receive the capsules contained within Universal Capsule Sleeves (UCS).

The VCT and tug will be moved from the WESF location to its designated storage location; yet to be determined but assumed to be at either the SLF or the CSA yard areas.

**Key Interfaces:** The co-located/adjacent nature of the SLF to the existing WESF storage and operating areas, as well as to the TCSA pose a traffic logistics challenge that will require a temporary road closure from the SLF along Polaris Drive and west on Atlanta Avenue through to the haul path WESF access and the WESF Truck Port Apron. This limited duration and task specific road closure falls within normal process and standard operating procedures.

The empty VCC/VCT and tug combination will exit the SLF via Polaris Drive on the west side of the SLF, or via the alternative Area 3 SLF ingress/egress area located on the northerly side of the SLF. In either event, the empty VCC/VCT and tug will turn left (westerly) on Atlanta Avenue. The next interface area of transfer roadway/haul path road improvements is designated Area 2 in the drawing set (see Appendix C, drawings W135-CSA-SK-C-001 - CSA-SK-C-004). The key feature and interface associated with Area 2 is that of an abandoned rail crossing located immediately on the westerly side of the Polaris Drive and Atlanta Avenue intersection. In addition, the road in this area will likely need road widening and/or shoulder improvements to accommodate the left turn of the empty VCC/VCT and tug.

Moving further along Atlanta Avenue in a westerly direction, the next key interface and transfer roadway/haul path improvement area is designated as Area 1 in the drawing set (see Appendix C, drawings W135-CSA-SK-C-001 - CSA-SK-C-004). The need for road improvements in this Area is driven by the current elevation change and resulting run (axial slope) that is greater than the 5% limit for the VCC/VCT and tug combination.

Moving further along Atlanta Avenue to a point approximately 100 yds. north of the Atlanta Avenue and 7th Street intersection and exiting easterly will be the WESF access haul path. This key interface and transfer roadway/haul path improvement area is designated as Area 4 in the drawing set (see Appendix C, drawings W135-CSA-SK-C-001 - CSA-SK-C-006). The needs for road improvements in this area are driven by the current elevation change and resulting run (axial slope) from the road to the interface with the WESF Truck Port that is greater than the 5% limit for the VCC/VCT and tug combination, the number of buried utilities and services under the designated WESF access haul path route and Truck Port Apron,
and a set of overhead lines on the southerly side of the WESF access haul path where it intersects with Atlanta Avenue. An additional concern will be overhead lines that may be in the load movement zone. For conceptual design, it is assumed that the more explicit crane or equipment designation, as appropriate, has been assigned to the VCT in support of the applicable limited approach boundaries requirements of DOE-0359, Hanford Site Electrical Safety Program (HSESP).

In addition to the key interfaces noted above, an initial review of WIDS indicates that there are also one or more radioactive transfer lines and WIDS areas in a number of these key interface areas; some of which are indicated in Figure 3-8. The WIDS and buried utilities and services are not yet fully evaluated and will need further evaluation during Preliminary Design/the next phase of the design effort.

Design Solution/Strategy: It is likely that Polaris Drive may need to be widened (moved or relocated via widening) to mitigate the potential traffic logistics issues noted above. In conjunction to, or in lieu of, this strategy, building an alternate entrance to the SLF on the north side of the designated SLF boundary may be an augmentation or alternative to relocating Polaris Drive. This effort may likely impact one or more buried radioactive transfer lines that are adjacent to the designated SLF boundaries on both the east and west boundaries.

It is recommended that the abandoned rail spur section(s) that cross Atlanta Avenue be cut, removed, and the section be milled and filled to achieve a stable and slope complaint travel path for the VCC/VCT and tug.

The Area 1 improvements are required; however, it is not yet clear as to why there is currently such a large ‘dip’ in that area. It is recommended that further evaluation of the feature be completed to assure that any road improvements in the area do not adversely impact impervious surface rainwater and runoff collection and control. It may be necessary to install a culvert in this area during the road improvement project for Area 1 to ensure that any required/impacted function(s) can still be met.

Area 4 has a high density of underground utilities and services (see Appendix B), as well as the level of uncertainty associated with current drawings and their depiction of underground lines and utilities. Historically, the drawing sets have been shown to not be accurate as built and, therefore, further examination and ground penetrating radar (GPR) surveys are likely in order. It is recommended that these efforts be undertaken during preliminary design and that they are coordinate with the necessary geotechnical evaluations and radiological surveys for the affected area. It is recommended that the transition from the expanded WESF Truck Port Apron, which will be an 18-in. pour with compacted engineered fill below the pour and around the buried lines in the area, be continued and matched from that transition point to the edge of Atlanta Avenue. This should provide the necessary protection to the underground lines and services that may need it. This approach will need to be further evaluated during preliminary design.

There are also fire main lines in areas of the project adjacent to the WESF Truck Bay and in between MO225B and MO400 (see Appendix B). There may be a need to extend this system to install a fire hydrant in closer proximity to the SLF. Should this be required, this work should be coordinated with the other improvement evaluation and execution recommendations noted herein.

Also, as noted above, the temporary storage location for the VCT and tug will need to be defined during later design phases.
3.1.3 Transport Loaded VCC from WESF to the CSA/CSP

Within the WESF facility, once the capsule loading campaign for a VCC is completed it is moved to the Truck Port doorway and the door is opened to permit movement of the VCC out of the Truck Port (Figure 3-2).

The VCC moved out of the Truck Port and on to the Truck Port Apron to a designated load transfer location (Figure 3-3) by the APT.

At the designated load transfer location on the WESF Truck Port Apron and Haul Path Access, the VCC Lift Lugs are installed and the GT50 is used to position the VCT to the Transfer Station above the VCC. VCT is lowered and the VCT lifting beam is engaged with the VCC Lift Lugs (Figure 3-4).

The VCT raises the VCC to the travel height (typically 6 in.), the manual Lift Tower Locking Pins and/or self-contained automatic wedgelocks are installed/engaged to provide redundant drop protection, and the VCC is readied for transport (Figure 3-5).

Once the VCC is secured and ready for transport, the VCT with the VCC is towed and/or pushed, as necessary, by the GT50 to the CSA (Figure 3-6) and the fully loaded VCC is indexed to the designated location on the CSP. There is a left turn out of the WESF access haul path on to Atlanta Avenue; a right turn from Atlanta Avenue on to 7th Street; and then a left turn onto the CSA access haul path. The fully loaded VCC will either be towed or pushed into position on the CSP by the VCT and tug. Maneuvering will be executed on the Operating Pads and the CSA access haul path.

Once indexed, the VCC restraints and VCT Lift Tower redundant drop protection restraints are removed, the VCC lowered to the CSP, and the VCT disengaged from the VCC. The VCT and tug will be moved from the WESF location to its designated storage location; yet to be determined but assumed to be at either the SLF or the CSA yard areas.

Key Interfaces: The transition from the WESF access haul path has been addressed in part in section 3.2.2. As previously noted, a key safety issue will be the presence of overhead lines along this haul path that may be in the load movement zone. For conceptual design, it is assumed that the more explicit crane or equipment designation, as appropriate, has been assigned to the VCT in support of the applicable limited approach boundaries requirements of DOE-0359. The fully loaded VCC/VCT and tug system will then make a right turn onto 7th Street from Atlanta Avenue. This turn is tight but should be able to be accommodated without the need for transfer roadway improvements (see Appendix C, W135-CSA-SK-C-001, CSA-SK-C-002, CSA-SK-C-005 - CSA-SK-C-007, and CSA-SK-C-008 Detail D).
In addition, there are one or more radioactive transfer lines in the area, as well as a known WIDS area (UPR-600-20).

### 3.1.4 Capsule Storage Cask Monitoring and Maintenance

The last step in placing the fully loaded VCC into the Interim Storage Configuration is to connect and check the TMS. Once the VCT and tug have been disengaged and move from the immediate work area on the CSP, the temperature monitoring system is connected to the VCC exit air instruments, lift lugs are removed, and the post movement radiation surveys are completed. The fully loaded VCC is now in its Storage Configuration and Condition (Figure 3-7).

**Key Interfaces:** There are four key interfaces associated with the VCCs being placed in Interim Storage Configuration:

- Connection of the TMS to the exit air instrumentation.
- The weather tight enclosure for the TMS local alarm and monitoring station.
- The remote (Canister Storage Building [CSB] and/or WESF) alarm annunciator station.
- The control, electrical, and instrumentation interface for the TMS and the area security lighting.

**Design Solution/Strategy:** The power requirements for the Temperature Monitoring System (whether the system will be of wired or wireless design, any special housing requirements, and interface points for alarm and system monitoring at the CSB and/or any other local or remote location) have not yet been provided nor identified. Therefore, the following enabling assumptions have been established:

- There is sufficient 13.8 kV power available to support a local transformer to the TMS, security lights, and that the transformer capacity, conduit, etc. shall include spare capacity to accommodate future changes in security requirements.
- A 10-ft by 16-ft by 8-ft weather tight enclosure located outside of the north-east corner of the CSA perimeter fence will be sufficient for the TMS and any O&M and/or upgrade/system replacement needs during the interim storage period.
- The 10-ft by 16-ft by 8-ft weather tight enclosure is also suitable to provide weather protection for any other switchgear and/or CE&I SSCs that may be required and need to be locally housed.

It is recommended that these aspects be further developed as the design matures and the CSA specific elements become better defined by the CSS contractor during preliminary design.

### 3.2 Nuclear Safety

The MCSC Project shall comply with the requirements of 10 CFR 830 and DOE-STD-1189, as implemented by PRC-PRO-NS-700. The specific strategy that will be used to ensure compliance is described in CHPRC-02236. Required safety documentation that will be developed by CHPRC for CSA includes a preliminary hazard analysis, a conceptual safety design report, a preliminary documented safety analysis (DSA), and a final DSA document.
A key overarching functional requirement for all MCSC Project SSCs is that the integrated design shall preclude drops of CSS components that may result in loss of confinement at any time during the process. The CSS design and SSC design features have principal responsibility for providing this function. All of the CSA SSCs that relate to the CSS and nuclear safety issues are of a passive design nature (largely concrete, asphalt, and gravel), which are designed and constructed to support safe transport and placement operations associated with the movement of empty and loaded VCCs utilizing the VCT. Therefore, the operational requirements of the VCT drive the CSA SSC nuclear safety support requirements.

The operational requirements of concern are those for operating surface runout (longitudinal axis slope) and crown (transverse axis slope or pitch), as well as the VCT/Tug system package turning radius when carrying a fully loaded VCC. The operational limits set by the manufacturer require travel pathways and operational areas that have less than 5% runout (longitudinal slope relative to the fore and aft axis of the VCT) and no more than 2% transverse (side to side) slope. The specified VCT turning radii are 56 ft 4-3/4 in. on the outside and 33 ft-5/8 in. on the inside. In addition, the length, width, and VCT height are also important factors. The VCT length – including the tow tongue - is specified at 34 ft 9-13/16 in.; width is specified at 17 ft 9 in.; and the height is 17 ft 5-3/4 in. with the lift tower unit in the retracted position and an estimated overall extended height of 22 ft. The GT50 tug outside turning radius with standard front-wheel steer is specified at 21 ft; optional 4-wheel steer is 14 ft. The GT50 tug length is 16 ft 2 in. and width is 8 ft 5 in.

For purpose of conceptual design development, a conservative approach (not as sharp a turn radius, and length and width rounded off to an increment beyond the specified dimension) was taken. Conservative values for the VCT of 57-ft outside radius, 34-ft inside radius, and 35-ft length by 18-ft width was used for the Turn Radius Study. The turn radius of the GT50 tug was not considered at this stage of the design as it falls within the travel track of the VCT during a turn, and it is not yet known whether the GT50 tug for this project will be of the standard or optional steering configuration. In addition, ground clearance was considered. The VCT has a variable ground clearance dependent upon the load lift height imposed. The established lift height for a VCC in the empty and in the fully loaded configurations is currently under development by the CSS contractor. An enabling assumption of a maximum load lift height and, thus, ground clearance of 6 in. was used in evaluation of the pad, yard, and haul path. The GT50 tug has a 7-in. ground clearance, thus, the VCC/VCT load ground clearance is the limiting factor.

The loaded VCC/VCT system (VCT, VCC/TSC/TSCB, and capsules inside UCSs) was assigned an assumed operating weight of ~ 285,000 lbs (conservative estimate), assuming a VCT empty weight of 95,000 lbs. per specification, and a fully loaded VCC estimated weight of 190,000 to 200,000 lbs., per most conservative range value to date provided by NAC. The fully fueled GT50 tug has a specified weight of 60,000 lbs. These are the weights for the haul path from WESF to the CSA/CSP. Note: The current VCC weight fully loaded is estimated at 155,000 lbs. or ~ 78 tons. The partially loaded VCC/VCT system (VCT, VCC/TSC/TSCB but no UCS nor capsules) is ~ 225,000 lbs. (conservative estimate) and, along with the GT50 tug weight of 60,000 lbs., would be the weight for the haul path from the SLF to WESF.

These requirements/assumed limitations are in turn supported by CSA SSCs by way of their design features in surface runout or slope, as well as their design load capacities. Pads will be controlled to no more than 2% runout in any direction to minimize the opportunity of stalling of the VCT and to ensure adequate ground clearance. Runout, slope, and conceptual design load capacity were developed with the consideration of minimizing the conditions that might lead to a tipping and/or dropped load event, as well as normal and potential off-normal operating scenarios and loads and ground clearance considerations. Similarly, the transport roadway/haul path has been evaluated and five sections identified for road improvements. This is inclusive of widening so that the wheels of the VCC/VCT/Tug package combination stay on suitable engineered surfaces and improvements in grade adjustment to meet the 5%
longitudinal and 2% transverse slope requirements with a target of 2% slope in any direction, as well as the ground clearance considerations. All balance of yard areas will be graded, leveled, filled with 5 in. of engineered gravel cover (typically 2.5-in. minus rock), and leveled to match grade of the pads. These measures will allow for the operations of the VCC/VCT/Tug package in a manner that supports active measures associated with CSS SSC operations that are specific to meeting the nuclear safety requirements.

The above conceptual design elements have been established to progress the design effort. They will be further optimized during preliminary design, evaluated during the hazard and documented safety analysis, and confirmed during final design. For further information regarding the VCT and the GT50 Tug, Appendix D of this report contains vendor drawings and cut sheets. See Section 4.3 for further information regarding the Turn Radius Study.

There are no fissile materials associated with the cesium and strontium capsules and, therefore, no criticality concerns to be addressed.

3.3 Operations Integration

For conceptual design associated with the CSA SSCs, two critical aspects of operations integration have been considered and evaluated at some level of detail. They are Human Factors and Siting.

Human Factors are largely self-explanatory. This element has significant impact on the constructability and operability of operable units, even though many would consider the CSA SSCs to be passive systems.

Siting is evaluated under this category as the locations selected and developed for the CSA, the SLF, and the transfer roadway/haul path are critical to the traffic, logistics, and material handling and control elements of the entire MCSC Project. The geospatial relationships are particularly crucial.

3.3.1 Human Factors

At this stage of the design consideration is most often given to the factors of operating environment, constructability, operability, inspectability, and maintainability. Reliability, availability, and end-of-life disposition pathways and requirements are often companion considerations; however, these are typically addressed in later phases of design and field operations/operating procedure development. Human Factors will be re-evaluated at each design phase.

Basic tenants of operating environment, constructability, operability, inspectability, and maintainability were evaluated where there was sufficient design concept to do so. The primary focus was on active systems, those often associated with CE&I interfaces, as well as some mechanical systems.

The majority of the CSA SSCs are of a passive design nature (largely concrete, asphalt, gravel, and security/property protection fencing), which are designed and constructed to support safe transport and placement operations associated with the movement of empty and loaded VCCs utilizing the VCT, as well as the proper level of property protection and controlled access to the MCSC Project SSCs and operable units. Therefore, the primary focus was on the following systems and design features associated with the CSA CAP SSCs and operable units.

3.3.1.1 VCT and Tug

The VCT and tug are not part of the CSA CAP. However, they are one of two principle systems/components that drive the design features and requirements for the CSA scope of work.

During this conceptual design phase, human factor aspects considered included the design of CSA SSCs/operable units that interface with the VCT and tug including transport roadway/access haul path improvements to assure that the systems can operate as designed, have less wear and tear placed upon
them as a result of not having suitable travel surfaces, and have improvements that accommodate the width of operations during transit that will accommodate personnel accompaniment of the systems within the normal range of a control pendant without having to unnecessarily having to walk off pavement.

Relative to utilities interface with the VCT and tug, and in particular overhead lines for conceptual design, it is assumed that the more explicit crane or equipment designation, as appropriate, has been assigned to the VCT in support of the applicable limited approach boundaries requirements of DOE-0359. This in turn supports Human Factor aspects associated with work in the vicinity of overhead power lines in a manner that is standard operating procedure.

### 3.3.1.2 Vertical Concrete Casks

The VCCs themselves are also not part of the CSA CAP. However, they are the other of the two principle systems/components that drive the design features and requirements for the CSA scope of work. Human factor aspects considered in the design of CSA SSCs/operable units that interface with the VCC include:

- Transfer roadway/facility access haul path improvements, which take into consideration that steering control for the VCT is often accomplished with a pendant control and an operator walking alongside the VCT.
- Placement position consideration of minimizing pinch points between the VCT and adjacent VCCs.

### 3.3.1.3 CSA/CSP Security and Property Protection Lighting

Human factor aspects considered in the design of CSA operable units that interface with the lighting and fencing include:

- Locating the floodlamp/security lighting poles in between the two fencelines, adjacent to the outer fence at the CSA, so that maintenance can be performed without the need of entering the controlled area of the CSP. This is also an as low as reasonably achievable (ALARA) measure as the dose rates within the controlled area of the CSP are expected to be higher than those near the outer fenceline based upon pre-conceptual design information provided by the CSS contractor.
- Emergency crash bars on the personnel gates installed in each fenceline at the CSP and within the fenceline at the SLF.

### 3.3.1.4 TMS and CE&I Interfaces

Human factor aspects considered in the design of the TMS and CE&I Interfaces include:

- The design allowance of a 10-ft by 16-ft by 8-ft weather tight enclosure located outside of the north-east corner of the CSA perimeter fence, which should be sufficient for the TMS and any O&M and/or upgrade/system replacement needs during the interim storage period.
- Based upon pre-conceptual design information from the CSS contractor with regard to VCC shielding analysis, an enabling assumption has been established that the design dose rate at the fenceline is less than or equal to 0.5 mRem/hr; however, the dose rates within the controlled area of the CSP are expected to be higher than those near the outer fenceline. The CSS contractor is responsible for the VCC shielding design and it is expected that a combination of both engineering and administrative controls will be required to minimize exposure. The CSA CAP will provide some elements of those measures via the fencing for controlled area access limitation. Operations may also need to provide local and/or temporary shielding (e.g., ecoblocks) as may be needed.
- The 10-ft by 16-ft by 8-ft weather tight enclosure is also suitable to provide weather protection for any other switchgear and/or CE&I SSCs that may be required and need to be locally housed.
3.3.2 Siting

Facility siting is a key factor in considering Operations Integration of the SSCs. The siting of the CSA and of the SLF were oriented around the WESF location. The CSA siting has been evaluated multiple times, was the subject of a formal Site Evaluation Study (2E-11-09, *Cesium and Strontium Capsules Dry Storage Project*), considered multiple possible locations, and was finalized when the corner coordinates were established earlier this year. The SLF siting was evaluated during the first quarter of this year, considered multiple locations, and has been established for this conceptual design effort, pending further evaluation of potential impacts from buried utilities and services, as well as evaluation of co-located and/or adjacent WIDS areas.

3.3.2.1 Capsule Storage Area

Based on Site Evaluation 2E-11-09, the CSA will be located in the 200-East Area approximately 0.12 miles (200m) from WESF. It is designated as Site 1 in the Site Evaluation’s Attachment 1 depicted in Figure 3-8. In accordance with the Site Evaluation, Site 1 is reserved for the MCSC Project with no outstanding land-use commitments. Should an expansion area of Site 1 still be required, it will be developed south of 7th Street as a simple expansion area of the current designated Site 1 location. The previously designated Site 1 expansion area is no longer considered viable due to conditions that were identified during subsequent assessment between the time of the original site evaluation and the time of the AoAs, at which time Site 1 was designated as the CSA location site. This was further reinforced when CHPRC Project staff had the site surveyed and staked the CSA on March 6, 2017. Corner stakes were established at WCS83S/91 coordinates of N136410.0, E573006.0; N136410.0, E573086.0; N136330.0, E573086.0; and N136330.0, E573066.0 (see Appendix B for a copy of the Survey Data Report, *W-135 MCSC Interim Storage Site Boundary Staking*).

The currently designated CSA site location is approximately 200 yards / 0.12 miles westerly on 7th Street and on the south side of 7th Street (see drawings W135-CSA-SK-C-001, CSA-SK-002, CSA-SK-007, CSA-SK-010 and CSA-SK-12). It is in the vicinity of a catch tank (241-ER-311), diversion box (241-ER-351), and underground pipeline (V-224) used to transfer radioactive wastes within the Hanford tank waste system. Historic releases from these underground utilities have led to an area of contaminated soil (Unplanned Release Radioactive [UPR]-600-20 area) in the vicinity of the CSA site. Depending on needs of the CSA, excavation work for the CSA and related roadways may require some soil remediation work. Site surveys will be required to delineate the extent of UPR-600-20 in this area and ensure that it is not impacted by the new construction. In addition, contaminated tumbleweeds grow with some regularity on some of those UPR areas, so ongoing monitoring should be regularly performed. CHPRC will conduct these surveys. See Sections 4.1 and 4.4.4 for further detail.

Other potential interferences noted in the Site Evaluation include a buried 13.8 kV power line and pad-mounted transformer adjacent to the northern-most boundary of Site 1, across 7th Street from Site 1, and buried pipelines (200-E-217-PL and 200-E-161-PL) crossing and parallel to 7th Street. A site walkdown identified and confirmed the location of the WIDS area and pipelines; however, it could not confirm the buried power line nor locate the pad mounted transformer. Therefore, these features will need to be confirmed as part of the further development work during preliminary design. In addition to the known and earlier noted WIDS associated with UPR-600-20 are one or more radioactive transfer lines in the area, as well as the likelihood of other WIDS areas too. These are not yet fully evaluated and will need further evaluation during Preliminary Design/the next phase of the design effort. The site walkdown and corner staking effort also identified the presence of eco-blocks on the north and east sides of the current site. Select numbers of these eco-blocks will need to be removed and/or relocated in order to support fenceline installation and CSA access haul path construction. It is recommended that the current ecology
block configuration and installation requirements be evaluated prior to their removal to assure that their function is otherwise met.

**Figure 3-8. Site Evaluation 2E-11-09, Attachment 1 CSA Siting Locations.**

As part of the preliminary design effort, work shall continue to identify any potential utility interferences based on the selected design solution including, but not limited to, the potential interferences described above and proposing the best means for resolving them. All items that can be removed/relocated without undue impact on other site operations, and will be identified and plans developed to facilitate that removal/relocation effort during preliminary design.

### 3.3.2.2 Storage, Laydown, and Fabrication

The currently designated SLF siting location is approximately 0.17 miles (~275m) from the WESF access haul path easterly along Atlanta Avenue. An enabling assumption has been established that the geotechnical data identified and reviewed in support of the CSA is valid for the SLF.

Multiple site walkdown and field measurements, meetings with MSA and CHPRC, marked up and annotated drawings from MSA, and feedback from NAC by way of CHPRC were key factors in determining the best potential location sites for the SLF. Siting locations considered were colocation within the designated CSA, making use of some of the CSA yard expansion area, the current designated siting location, and an alternative location that is south of 7th Street and east of Atlanta Avenue. The current designated location is identified in drawings W135-CSA-SK-C-001 – CSA-SK-004. The current designated alternative area location is identified in drawings W135-CSA-SK-001, CSA-SK-013, and
CSA-SK-014 (Appendix C). The transit times from WESF to/from either area are estimated at 15 minutes, plus or minus 5 minutes. The transit time is based upon a walking speed of 88 ft/min, and consideration of yet to be defined traffic and logistics elements for these movements. The geospatial relationships of the CSA, SLF, and WESF are shown in Figure 3-9.

Figure 3-9. CSA, WESF, and SLF Geospatial Relationships.

4 Conceptual Design

This section of the CDR presents details of the conceptual designs for the CSA, SLF area, and Transportation Roadway/Facility Access Haul Path improvements commensurate with the current design phase. The general arrangement and geospatial relationship for each of these facilities is shown in Figure 4-1.
Key design features and notation of design elements that require further definition in subsequent design phases are presented in the following sections.

4.1 **Capsule Storage Area**

The CSA consists of the following key SSCs:

- CSP.
- Any required CSA access/operations pads or structures to support loading of the storage casks onto the CSP, including any required rainwater drainage and control features.
- Security/property protection fencing; access controls; and any required security-related surveillance, monitoring, and/or alarm features.
- A local weather-protected structure to house local readout and annunciation instrumentation for the CSS temperature monitoring system.
- Interfacing communications to the CSB and/or other designated location for remote annunciation of the temperature monitoring system.
- Any utility interfaces for the CSA that may be required during construction and/or for routine operations.
- Improvements required for any facility access haul path for ingress/egress to the CSA.
The CSA has been established as a 262.5-ft by 262.5-ft site area, for a total of ~ 69,000 ft$^2$ of allocated space. Within this area are the CSA Yard, Operations Pad, and CSP. Based upon initial input from the CSS contractor, the CSA includes prepared areas around the CSP sufficient for CSS operations and surveillance and maintenance operations, designated the Operations Pad and the CSA Yard.

The CSA Yard/Expansion Area is an area that is ~ 46,632 ft$^2$. The area will be grubbed, cleared, leveled, compacted, and have 6-in. depth/865 yd$^3$ of 2-in. minus rock compacted and graded to match the grade of the CSP and Operations Pads.

A rainwater drainage control feature surrounds the CSP and Operating Apron impervious surfaces. It is 2 ft wide, 5 ft deep, and will contain ~ 250 yd$^3$ of permeable gravel fill. The conceptual design of this feature considers natural phenomena impacts, other than seismic and specifically impervious surface storm drainage runoff and control in accordance with DOE-STD-1020-12, *Natural Phenomenon Hazards Analysis and Design Criteria for Department of Energy Facilities*, HNF-SD-GN-ER-501, *Natural Phenomena Hazards, Hanford Site, Washington*, and PRC-PRO-EN-097, *Engineering Design and Evaluation (Natural Phenomena Hazard)*. This feature is believed to be adequate to meet regulatory requirements for rainwater/runoff control from the CSP and Operating Apron; however, the design of the rainwater/runoff control feature will need to be further refined once the permitting requirements have been determined.

There are a number of WIDS areas near the designated CSA location. Care will be required so as not to disturb nor unduly interfere with remediation of those sites. It is recommended that additional evaluation of the WIDS and the WIDS and Wells MapOptix database tools be completed in conjunction with the Environmental Field Services Group to further identify potential WIDS sites and radiological systems (e.g., transfer lines such as 200-E-160-PL) that may impact or be impacted by the MCSC Project. See Section 4.4.4 for additional information.

A key overarching functional requirement for all MCSC Project SSCs is that the integrated design shall preclude drops of CSS components that may result in loss of confinement at any time during the process. This aspect is discussed in Section 3.1 of this report.

### 4.1.1 Geotechnical Evaluation

A Dames and Moore 1989 geotechnical investigation report in support of the Hanford Waste Vitrification Plant (HWVP) Project has been historically used for conceptual design activities in the 200-East Area of Hanford. The formerly designated HWVP site is in close proximity of the currently designated CSA, SLF, and haul path roadway for the W135 Project. NAC has identified the following subsoil requirements for the CSP:

- Subsoil modulus of elasticity shall be less than or equal to 30,000 psi.
- Subsoil in-place density shall be greater than or equal to 100 lb/ft$^3$ and less than or equal to 160 lb/ft$^3$.
- Subsoil must extend a least 5 ft beyond the edge of the concrete pad and shall have a depth at least 10 ft as measured from the bottom surface of the concrete pad.

Based upon a review and assessment of this report it is expected an excavation to a depth of approximately 5 to 7 ft from current grade level would be required to encounter subsoil meeting the requirements provided by NAC for the CSP. A 2- to 3-ft deep backfill of compacted engineered fill and a 36-in. slab for the CSP and CSA operating pads would be required. This also bounds the 3- to 5-ft deep excavation depth for the CSA Access Haul path, followed by engineered backfill and a wear surface of either 18 in. of concrete or 6 to 12 in. of asphalt overlay (two courses each at 6 in.).

It is recommended that the following work be completed during preliminary design:
A suitably designed geotechnical field investigation, inclusive of GPR scans and select borings and analysis, to confirm and improve upon the data and conclusions contained in the 1989 Dames and Moore report, in particular as to whether or not the soils in the designated areas are disturbed or not.

Completion of radiological and vegetation surveys to determine extent of any contamination at the site, since the areas designated for construction and operation areas are outside the normal sampling areas of the adjacent WIDS areas.

Identify locations of available fill for engineered fill requirements.

Identify locations for spoils disposal/retention.

4.1.2 Capsule Storage Pad

Within the ~ 69,000 ft² of allocated space for the CSA are the CSA yard, Operations Pad, and CSP. The CSP is a 75-ft by 75-ft by 36-in. thick 5000-psi compressive strength pad with ~ 640 yd³ of concrete and ~ 50 tons of steel, and 5 ft./1,042 yd³ of excavation and 2 ft/417 yd³ of engineered fill. Based upon input from NAC, the CSS contractor, and existing soil conditions the excavation and backfill with engineered materials may need to extend to a zone that is 5 ft beyond the edges of the CSP and 10 ft below the CSP base. This will be determined via a confirming geotechnical analysis. These dimensions are based upon the initial input data received from the CSS contractor. The CSP will be controlled to no more than 2% runout in any direction to preclude stall of the VCT during VCC placement operations.

The 36-in. slab thickness is based upon input from the CSS contractor (NAC). It is also the same design that is used at the WVDP HLWCRP, sized for our area and number of VCCs.

Additionally, 36 in. is the maximum thickness of the CSP per the NAC-provided CSS design based upon an extension of their U.S. Nuclear Regulatory Agency-certified (Certificates of Compliance Nos. 1025 and 71-9235) NAC-MPC TSC-based system described in NAC Design Specifications 455-S-01 and 414-S-01, and documented in the NAC-MPC Updated Final Safety Analysis Report. The NAC Certificate of Compliance and Updated Final Safety Analysis Report are compliant with 10 CFR 72, “Licensing Requirements for the Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste, and Reactor-Related Greater than Class C Waste”.

This approach provides a reasonable and conservative design basis as the (exact) same transport systems, and very similar VCCs, are being used; therefore, it is likely that the CSA safety basis document will dictate pads of similar thickness and rebar density. A formal calculation will be done during the next design phase. In contrast, but also considered, the Interim Storage Area (ISA) in the 200 Area has pads that are 18 in. and 12 in. thick. However, the loads are much lighter than those anticipated with the fully loaded MCSC VCCs. During preliminary design, the design basis CSP and Operating Pad thicknesses and reinforcement steel design will be further developed.

Safety class components are not anticipated for the CSA CAP SSCs. Therefore, the CSP will be designed to Seismic Design Category (SDC)-2/ Limit State (LS) C per PRC-PRO-EN-097, pending final hazards analysis and safety class determination. The final SSC classification is not yet complete, and although not anticipated to be needed, potential requirements for SS and SC SSCs are a possible risk item and may wish to be accounted for in the development of the basis of estimate (BOE) by establishing an enabling assumption that the CSP will be designed to ACI 349, Code Requirements for Nuclear Safety Related Concrete Structures, and built to ACI 318, Building Code Requirements for Structural Concrete. It is recognized that these standards only apply to SSCs classified at PC-3/SDC-3 and above; however, this approach would be consistent with that taken for the ISA pads wherein the concrete pads were identified as general service but used design values assigned to Performance Category (PC)-3 structures.
Fencelines for property protection and additional construction and GA detail are shown in drawings W135-CSA-SK-C-001, 002, 007, 010, 012 (Appendix C).

A simplified scoping study/comparative assessment of likely VCC storage configurations on the CSP was performed to determine the comparative effect of VCC storage configurations on dose rates at the CSA boundary. This study was performed to evaluate if CSA boundary dose rates would drive the VCC configuration to a denser array or whether a more open array would be viable, the latter being more conducive to operations. The two configurations evaluated were the 4 by 4 configuration being proposed by the CSS contractor, and a 2 by 8 configuration, which would better support VCC placement and retrieval/movement operations. The comparative assessment confirmed that the self-shielding of the denser 4 by 4 array better meets project needs for CSA boundary dose rate control. It should be noted that this comparative assessment was not a formal shielding calculation. That calculation is the responsibility of the CSS contractor. Based upon early reported shielding calculation results, it is anticipated that the CSA boundary fenceline dose rate will be less than 0.5 mRem/hr. Further reduction will likely require a combination of engineered and administrative controls.

4.1.3 Operational Pad/Aprons

The Operations Pad is contiguous to the CSP and provides the operating area necessary to facilitate placement of the VCCs into the 4 by 4 array. The Operations Pad is ~ 15,410 ft² in area, ~ 1,750 to 3,500 yd³ of 5000-psi compressive strength pad with ~ 130 to 260 tons of reinforcing steel, up to 5 ft/2,854 yd³ of excavation with a minimum of 2 ft/1,142 yd³ of engineered fill. Based upon input from NAC, the CSS contractor, and existing soil conditions the excavation and backfill with engineered materials may need to extend to a zone that is 5 ft beyond the edges of the CSP and 10 ft below the CSP base. This will be determined via a confirming geotechnical analysis. Fencelines for property protection and additional construction and General Arrangement detail are shown in drawings W135-CSA-SK-C-001, 002, 007, 010, 012 (Appendix C).

For conceptual design, the Operations Pad is currently 36-in. thick and is designed and constructed to the same specification of the CSP. This was done at the request of CHPRC as a means to potentially accommodate up to 50% additional storage expansion needs without the need for further significant civil construction work. It should be noted that there may be an opportunity for potential cost savings if this pad is reduced to 18-in. thick concrete. The 18-in. slab is sufficient for VCC/VCT and tug operations but is not considered adequate to support the design life interim storage requirement. This should be further evaluated during subsequent design phases.

Safety class components are not anticipated for the CSA CAP SSCs. Therefore, the Operating Pad will be designed to SDC-2/ LS C per PRC-PRO-EN-097, pending final hazards analysis and safety class determination. The final SSC classification is not yet complete and, although not anticipated to be needed, potential requirements for SS and SC SSCs are a possible risk item and may wish to be accounted for in the development of the BOE by establishing an enabling assumption that the Operating Pad will be designed to ACI 349 and built to ACI 318. It is recognized that these standards only apply to SSCs classified at PC-3/SDC-3 and above; however, this approach would be consistent with that taken for the ISA pads wherein the concrete pads were identified as general service but used design values assigned to PC-3 structures.

4.1.4 Security

4.1.4.1 Fencing and Gates

Fencelines will be for property protection per the security assessment. There will be two fencelines, one around the CSA and one around the CSP.
In all cases, the fence is designed as 8-ft high chain link fence with outriggers and 3-strand barb wire, 10 ft on center anchor poles with top rail. There will be a single vehicular gate in each fence. There will be two personnel gates in each fence and these gates will have emergency crash bars. All gates shall have security lock capability.

An enabling assumption design basis has been established for conceptual design that the design dose rate at the fenceline is less than or equal to 0.5 mRem / hr. NAC is responsible for the design of the VCC’s shielding to meet these exposure limits at the fenceline and within the CSA. The design of the CSS VCC’s has not yet been completed by NAC at the time of completion of this conceptual design. It is recognized that additional local and/or temporary engineered and/or administrative controls may need to be put in place to achieve required outer fenceline dose rates. The CSA fencing will also be used in support of limiting radiological exposure to non-radiological workers from the loaded VCCs by providing controlled access into the CSA and the CSP. The fencelines and gates will provide the required physical security and quality control-limited access.

4.1.4.2 Lighting
In consideration of DOE O 436.1, Departmental Sustainability, and of the High Performance Sustainability Building requirements (Executive Order 13693, Planning for Federal Sustainability in the Next Decade), a high output LED lighting solution has been identified. A conceptual lighting assessment has been performed with a lighting value of not less than 0.2 ft-candles light at any area within the CSA (see Appendix D, High Efficiency LED Flood Light cut sheets and assessment data). There will be a total of 4 to 9 flood light poles.

Within the double fence area there will be lighting poles in between fencelines for ease of Operations and Maintenance access. The location of the light poles is shown in drawings W135-CSA-SK-C-001, 002, 007, 010, 012.

4.1.4.3 Cameras
Cameras have not been identified as a requirement in the security assessment.

4.1.4.4 Intrusion Detection
The need for intrusion detection systems have not been identified as a requirement in the draft security assessment. Upon finalization of the security analysis and/or as may be required to meet controlled materials stored in the field requirements, should cameras be determined to be required that the same cameras used in WESF be used at the CSA and/or SLF as a human factors and design consistency/spares minimization element.

4.1.5 Utility Requirements/Interfaces for the CSA
As noted in Section 4.1.6, utility requirements for the CSA are not yet well defined. Currently, the only power requirements identified are those for the CSA lighting and power to the VCC temperature monitoring system; these are low power users. The utility requirements will need further development during preliminary design. For conceptual design, any installed transformer capacity, conduit, etc. shall include spare capacity to accommodate future changes in security requirements and/or other not yet known potential operational needs.

4.1.6 Temperature Monitoring System Interface
Power requirements for the TMS while the fully loaded VCCs are at the CSA Storage Pad; Operating frequency and signal transmission requirements, including identification as to whether the system will be of wired or wireless design; any special housing requirements for the local and/or remote annunciation system enclosures; and interface points for alarm and system monitoring at the CSB and/or any other
local or remote location have not yet been provided nor identified. Therefore, the following enabling assumptions have been established:

- There is sufficient 13.8 kV power available to support a local transformer to the TMS and security lights.
- A 10-ft by 16-ft by 8-ft weather tight enclosure located outside of the north-east corner of the CSA perimeter fence will be sufficient for the TMS and any O&M and/or upgrade/system replacement needs during the interim storage period.
- The 10-ft by 16-ft by 8-ft weather tight enclosure is also suitable to provide weather protection for any other switchgear and/or CE&I SSCs that may be required and need to be locally housed.

These aspects shall be further developed as the design matures and the CSA specific elements defined during preliminary design.

4.2 Site Laydown/Staging/Fabrication Area

The SLF is the project designated storage and laydown site located adjacent to WESF to support CSS operations and is anticipated to be utilized for general construction, equipment receipt, assembly, testing, acceptance and staging activities, VCC fabrication and storage with select internals housed within the VCCs, or as otherwise designated and consists of several SSCs including the Fabrication and Storage Pad and other sub-systems.

An available SLF yard area of 41,000 ft² was identified during a site walkdown with CHPRC project personnel. Based upon input from the CSS contractor, a designated property security area with dimensions of 230 ft by 90 ft has been reserved within that site, along with a fabrication and storage pad with dimensions of 180 ft by 40 ft by 12 to 18 in. thick. As with the CSA, designed and built to the same standards, there will be a 24-in. drainage apron as well as 6 in. of compacted fill to grade match with the pad for the full SLF site area.

The final SSC classification is not yet complete; however, Safety Class components are not anticipated for the CSA CAP SSCs. Therefore, the SLF Fabrication and Storage Pad will be designed to SDC-2/ LS C per PRC-PRO-EN-097, pending final hazards analysis and safety class determination.

The full range of operations at the SLF has not yet been defined. However, based upon initial input from, CHPRC and the CSS contractor, the operations assumed to be typical of those that will be executed within the SLF include material receipt, inspection, assembly, testing; VCC fabrication; VCC; and select internals storage until needed on a demand basis. Two significant aspects to this area are that Polaris Drive may need to be re-aligned and the intersection of Atlanta Avenue and Polaris Drive will need road improvement work in an area of approximately 3,900 ft², inclusive of the removal of a section of rail spur. In addition, the VCC fabrication campaign is anticipated to last ~ 10 to 12 weeks in duration.

It is recommended that the requirements for the SLF be further defined during preliminary design.

4.2.1 Geotechnical Evaluation

It has been assumed for the purposes of conceptual design that the geotechnical data identified and reviewed in support of CSA is valid for the SLF.

4.2.2 Fabrication and Assembly Pad

Other than as noted above, there are no further details developed for this feature.

4.2.3 Aprons and Balance of SLF Yard

Other than as noted above, there are no further details developed for this feature.
4.2.4 SLF Area Security

As with the CSA, the SLF security requirements have been identified as a property protection only per the draft security assessment. The SLF will have a single fenceline around the designated SLF boundary line. The fence is designed as 8-ft high chain link fence with outriggers and 3-strand barbwire, 10 ft on center anchor poles with top-rail. There will be a single vehicular gate in the fence. There will be two personnel gates in the fence and these gates will have emergency crash bars. All gates shall have security lock capability, which shall also meet the requirements for a quality controlled storage area to meet the requirements of PRC-PRO-AC-52750, Control of Materials Stored in the Field. The fencelines and gates will provide the required physical security and quality control limited access.

The SLF lighting will be the same as that for the CSA/CSP. Cameras have not been identified as a requirement in the draft security assessment, nor the need for an intrusion detection system.

4.2.5 Utility Requirements and Interfaces for the SLF

The operational requirements of the SLF have not yet been fully defined. For conceptual design and per discussion with CHPRC project staff, an enabling assumption is that the utility and service requirements shall be met with temporary power, water, etc. It is recommended that this be re-evaluated during preliminary design.

4.3 Transfer Roadway/Facility Access Haul Paths

This aspect of the CSA CAP consists of the design and construction of transfer roadway and facility access haul path improvements, from the SLF to WESF and from WESF to the CSA, necessary to support transfer of the capsules utilizing the CSS supplied VCT and tug.

Five areas have been identified for improvement based upon multiple site walkdown and field measurements, meetings with MSA and CHPRC, and marked up and annotated drawings from MSA (See Appendix C for W135-CSA-SK-C-001; See Appendix B for H-2-828885; H-2-830460; H-2-830461; H-2-836143).

No significant issues have been identified to date. All buried lines are at or near the depth of likely excavation and will required care and protection per existing normal operating and construction procedures in place.

Multiple buried water (e.g., raw, sanitary), electrical, and radioactive lines were identified throughout the project area. Particular note of the density of these lines in the WESF Access path to Atlanta Avenue, the SLF access to Atlanta, a rail line east of the Atlanta Avenue/Polaris Drive intersection, and electrical and radioactive liquid lines on the north side of the CSA/CSP location along 7th. Overhead lines noted in the vicinity of the WESF access path and on the north side of the CSA/CSP location along 7th.

The Design Authority for the rail system was not available during the timeframe prior to the completion of this conceptual design development effort. An enabling assumption has been made that we can abandon and remove certain sections of the rail lines on Atlanta Avenue as required. There may be a need to restore these lines; therefore, it is recommended that further discussion and confirmation be made during the next design evolution. In addition, all items that can be removed/relocated without undue impact on other site operations will be identified and plans developed to facilitate that removal/relocation effort.

For conceptual design, it is assumed that the more explicit crane or equipment designation, as appropriate, has been assigned to the VCT in support of the applicable limited approach boundaries requirements of DOE-0359.
Also during preliminary design, it is recommended that additional GPR scans be completed in identified affected project areas that do not already have recent scan data.

Significant detail and design recommendations are associated with key interfaces. See Sections 3.2.1 through 3.2.3 for additional information.

4.4 Functional Elements

4.4.1 Fire Protection

The draft preliminary Fire Hazards Analysis for the MCSC Project (CHPRC-03299, Preliminary Fire Hazards Analysis for the Management of the Cesium and Strontium Capsules Project [W-135]), lists the need for crash bars as a recommendation. Both CSA personnel entry gates and SLF personnel entry gates should have crash bars for egress. Crash bars would ensure that occupants would not be locked inside the CSA. For conceptual design, personnel entry gates with crash bars for all protection fences at the CSA and the SLF have been identified as a requirement and captured in the drawing design notes updates, as well as the BOE.

It is unlikely that either the CSA or SLF will need a fire hydrant water supply since the amount of combustible material stored at either location will be minimal and wildland exposure fire separation distances appear to be adequate. Further, both areas will be grubbed, cleared, leveled, and have compacted gravel over all areas not otherwise covered by concrete, thus further reducing the potential for wildland fire exposure. However, it should be noted that there will be additional combustible material present during construction, as well as local hot-work at the SLF during the fabrication of the VCC structural elements prior to their being formed up with concrete and steel per their design. These activities may require fire protection beyond the normal fire watch with local fire suppression equipment. For conceptual design, extension of the fire main has been captured as an allowance in the BOE.

The FPE shall reevaluate the need for fire hydrant water supply in preliminary and final design and capture any additional requirements in the FHA. Further, the FPE shall confirm that the use of crash bars on all personnel entry gates for the CSA and SLF have been incorporated into the preliminary and final designs.

4.4.2 Worker Health and Safety

As noted in Section 4.4.1, both CSA personnel entry gates and SLF personnel entry gates should have crash bars for egress. Crash bars would ensure that occupants would not be locked inside the CSA. For conceptual design, personnel entry gates with crash bars for all protection fences at the CSA and the SLF have been identified as a requirement and captured in the drawing design notes updates, as well as the BOE.

During preliminary design, all items that can be removed/relocated without undue impact on other site operations will be identified and plans developed to facilitate that removal/relocation effort.

For conceptual design, it is assumed that the more explicit crane or equipment designation, as appropriate, has been assigned to the VCT in support of the applicable limited approach boundaries requirements of DOE-0359.

4.4.3 Radiological Control

The security/property protection fencing is the primary feature of the CSA in providing exposure control via access control to the CSA and CSP and sufficient distance to the CSA outer fenceline to meet exposure limitation requirements. During conceptual design, the following design concepts have been developed as initial elements satisfying this requirement: Based upon pre-conceptual design information from the CSS contractor (NAC) with regard to VCC shielding analysis, an enabling assumption has been
established that the design dose rate at the fenceline is less than or equal to 0.5 mRem/hr., however, the
dose rates within the controlled area of the CSP are expected to be higher than those near the outer
fenceline. NAC is responsible for the design of the VCC’s shielding to meet these exposure limits at the
fenceline and within the CSA. The design of the CSS VCC’s had not yet been completed by NAC at the
time of completion of this conceptual design. It is expected that a combination of both engineering and
administrative controls will be required to minimize exposure. The CSA CAP will provide some
elements of those measures via the fencing for controlled area access limitation. Operations may also
need to provide local and/or temporary shielding (e.g. ecoblocks, etc.) as may be needed. See Appendix
C, drawings W135-CSA-SK-C-001, 002, 007, 010, 012; as well as Sections 3.3.1 and 4.1.6 of this report
for additional information.

4.4.4 Environmental
An initial assumed design basis during conceptual design is that the CSA Operating Pads, the CSP, and
the SLF Pad shall be designed per ACI 349 and built per ACI 318. General Arrangement detail and
design notes can be found in Appendix C, drawings W135-CSA-SK-C-001, 002, 007, 010, 012.

The CSP has an initial design basis classification of PC-2, safety significant, until completion of the new
safety basis determination and DSA. The CSP will be designed to SDC-2, LS C pending final hazards
analysis and safety class determination. There will be a 24-in. drainage apron as well as 6 in. of
compacted fill to grade match with the Operating Pad and the CSP for the full CSA site area. Pads will
be controlled to no more than 2% runout in any direction to preclude stall of the VCT and still allow for
drainage and runoff control.

Initial assessment has identified that the CSA siting location, at least two of the five designated transport
road/haul path road improvement/widening areas, and potentially the SLF siting location are adjacent to
or co-located with known and documented WIDS sites as noted below:

- The CSA siting location is adjacent to UPR-600-20.
- The Transport Roadway/Haul Path Area 5 Improvement/Road Widening area, as well as the CSA
  Access Roadway are adjacent to UPR-600-20 and possibly UPR-200-E-64.
- The Transport Roadway/Haul Path Area 4 Improvement/Road Widening area, as well as the WESF
  access roadway are adjacent to UPR-200-E-64 and possibly UPR-200-E-54, as well as 216-B-64.

Based upon limited initial analysis commensurate with the conceptual design phase, site walkdowns, and
discussion with interfacing organizations planned construction and operation details defined to date for
the CSA and its related sub-elements is perceived to be able to be implemented consistent with the
requirements of DOE 436.1, WAC 173-303, “Dangerous Waste Regulations,” and EO 13693 as stated in
the FDC and as applicable.

In support of the preliminary and final design activities, it is recommended that:

- A more detailed review of WIDS and the WIDS and Wells MapOptix database tools be completed in
  conjunction with the Environmental Field Services Group to further identify potential WIDS sites and
  radiological systems (e.g., transfer lines such as 200-E-160-PL) that may impact or be impacted by
  the MCSC Project.
- The selected CSA siting location, each of the transfer roadway/haul path road improvement/widening
  areas, and the designated SLF siting location have site characterization performed and documented to
  verify the presence or absence of levels of contamination in the surface, subsurface soil, and
  vegetation at the site.
4.4.5 Criticality

There are no fissile materials associated with the cesium and strontium capsules. Therefore, criticality is not a concern and criticality control measures are not a requirement of the MCSC Project.

4.4.6 Quality Assurance

Project activities in support of CSA CAP design, procurement, construction, and acceptance will be governed by the requirements of ASME NQA-1-2008, *Quality Assurance Requirements for Nuclear Facility Applications*, and 10 CFR 830 as implemented by PRC-MP-QA-599, *Quality Assurance Program Description*.

The specific technical and quality requirements, material certifications, qualification and certification of personnel, inspections, examinations/testing, and applicable QA records will be established during the detailed design and included in the detailed design documents. The CSA CAP will have an effective program preventing the introduction of suspect/counterfeit items through the design, procurement, fabrication, and modification process. This includes critical load paths of lifting equipment, where the introduction of suspect/counterfeit items would have the greatest potential for creating unsafe conditions.

In support of PRC-MP-QA-599 control measures, it is anticipated that the SLF access control will require gated access that meets the requirements for a quality controlled storage area per PRC-PRO-AC-52750.

5 Design Completion Strategy

This CDR reflects the conceptual nature of the MCSC Project at its present stage, specific to the required CSA CAP SSC design development. As with all conceptual design efforts, a conservative approach has been taken regarding many design aspects such as standard earthwork, grubbing, clearing, CSA yard and SLF yard gravel fill requirements, etc. Another example would be the CSS vendor utility needs. Current assumptions are that for the SLF and the limited duration campaign associated with activities there, that temporary power, water, sanitary services, etc. will be sufficient to meet project needs. The one possible exception associated with VCC fabrication may be the need for extending the fire main and installing a local fire hydrant in support of anticipated hot work that may not be able to be safely managed via normal fire watch and local portable suppression equipment being staged on location. These conservative
elements, and others like them in nature, can and should be addressed during the normal course of design iteration and maturation.

However, the conceptual design has been developed making use of what is to be a significant extent preconceptual design information from the CSS contractor. Therefore, the CSA CAP conceptual design effort has been, to a large extent, in advance of the CSS design effort. This has resulted in the need for establishing enabling assumptions to advance the CSA CAP design. The largest uncertainties in the conceptual design for the CSA CAP drive key risk elements of the design. These are presented in Section 5.1. Recommended actions during subsequent design efforts follow in Section 5.2.

5.1 Identified Risk Elements

5.1.1 Design Status of the CSS

CSS design aspects critical to the CSA design effort include, but are not limited to:

- VCC footprints.
- Weights and final dimensions.
- Contact dose rates and shielding values.
- Number of VCCs.

When this conceptual design for CSA was developed, most of the CSS vendor-supplied equipment was in a pre-conceptual state of design. As a result, this CDR incorporates multiple assumptions that will require verification as the CSS vendor design progresses.

5.1.2 SLF Functional Requirements

The current SLF design is based solely upon the dimensions provided by the CSS contractor and CHPRC for the required secure property control area and for the Fabrication and Storage Pad. There are no descriptions of the anticipated truck traffic, delivery schedule, number of VCCs in fabrication at any point in time, number of TSC/TSCBs being delivered to the SLF on what schedule and subsequent placement in storage/staged at the SLF pending insertion in the VCCs, etc.

5.1.3 Possible Polaris Drive Relocation

CSS contractor-defined use of the SLF has a critical impact on the potential need to alter the access in to the SLF, as well as impacting the current and planned operations associated with WESF until such time as current in use WESF support facilities that are located just south of the SLF are no longer needed.

5.1.4 VCC Quantity and Capsule Loading Sequence

The design details associated with the final number of VCCs and the loading sequence for the capsules. The current CSP design is based upon a 4 by 4 array. While the project can accommodate additional VCCs, in accordance with the stated FDC requirement, it is known that a number of VCCs will be higher dose than the rest – currently estimated at 5 – and that these will need to be staged in the center of the 4 by 4 matrix. With 5, this has an impact on where in the array the odd cask will be placed. Given that there may be more than 16 VCCs, this affords an opportunity to further reduce the CSA boundary dose rate via additional self-shielding.

5.1.5 CSA Geotechnical Analysis

The CSA CAP conceptual design has been based upon the Dames and Moore 1989 geotechnical investigation report, which was completed in support of the HWVP Project. While this report has been historically used for conceptual design activities in the 200-East Area of Hanford, it is also recognized as being dated.
5.1.6 Buried/Underground Utilities and Services
The absence of as-built design details associated with buried/underground utilities and services. The improvements in the WESF facility access haul path pose the single highest risk to the CSA project due to the high density of underground utilities and services, as well as the level of uncertainty associated with current drawings and their depiction of underground lines and utilities. Historically, the drawing sets have been shown to not be accurate as-builts and, therefore, further examination and GPR surveys are likely in order. It should be noted that experience with GPR scans in the area do not always result in 100% correct data.

5.1.7 WIDS Areas
Extent of WIDS areas adjacent to the SLF, and to a limited extent to the CSA and at least two of the Transfer Roadway improvement areas (Areas 1 and 4), poses a challenge to planned improvements and operations in those areas.

Initial assessment has identified that the CSA siting location, at least two of the five designated transport road/haul path road improvement/widening areas, and potentially the SLF siting location are adjacent to or co-located with known and documented WIDS sites.

5.2 Recommendations for Preliminary and Final Design

5.2.1 Update Design Based Upon Updated CSS Design Inputs
Based upon completed conceptual design of the CSS, review and update the CSA conceptual design as appropriate to coincide with updated CSS inputs/interfaces.

5.2.2 Fully Define the Operational Requirements for the SLF
Develop an optimization study regarding planned use of the SLF, especially in support of the VCC fabrication activity. Of importance will be the quantity, type, and delivery schedule of materials necessary to fabricate the VCCs. This assessment should also capture the quantity, type, and delivery schedule of all offsite assembled/pre-assembled sub-assemblies anticipated to be delivered to the SLF for (controlled) storage/staging until they are needed for VCC fabrication and/or assembly. This study should also assess the pros and cons of potential utilization of the designated alternative SLF location.

This effort should be coordinated with the recommendation regarding the Polaris Drive Traffic Management Analysis identified in Section 5.2.3. Conceivably, these two efforts could be combined.

5.2.3 Polaris Drive Analysis and SLF Access Study
Perform a detailed traffic management analysis/study of the current WESF staging area use, the radioactive materials shipment schedules and activities associated with the WESF TSCA, and other Polaris Drive use. The analysis should be designed to account for current and planned use during and after the VCC fabrication period. The impacts of SLF access and traffic identified from the study in support of the above recommendation (Section 5.2.2) should then be overlaid upon the Polaris Drive study to look for ways to optimize the required access for both sets of operations. The establishment and use of the Alternative SLF access path on the north side of the designated SLF location should be considered and documented in the study.

5.2.4 VCC Quantity Establishment and Capsule Loading Plan
A draft capsule loading plan, on a capsule set per specific VCC basis, should be developed so that the draft loading sequence and storage location plan can be developed and evaluated for CSA/CSP optimization. This will also have an impact on CSA site boundary management and control for ALARA considerations, designations, and controls.
5.2.5 Targeted Geotechnical Field Survey

It is recommended that a suitably designed geotechnical field investigation be implemented, inclusive of GPR scans (see Section 5.2.6) and select borings and analysis, to confirm and improve upon the data and conclusions contained in the 1989 Dames and Moore report. Emphasis should be placed upon whether or not the soils in the designated areas are disturbed or not, as well as the locations of suitable borrow pits and spoils disposal sites.

5.2.6 Underground Utility Survey

It is recommended that a suitably designed GPR scan program be initiated as soon as possible to confirm and improve upon the data and conclusions contained in currently documented scan results, as well as expand the GPR scan data to previously un-scanned areas associated with the CSA CAP. Emphasis should be placed upon the five designated Transport Roadway Improvement areas, the Access Haul-Path to WESF, the area of and surrounding the designated SLF site, and the area adjacent to and within the designated CSA site. GPR scan program efforts should be coordinated with any geotechnical field survey programs (see Section 5.2.4).

5.2.7 Review of the WIDS Database

The selected CSA siting location, each of the transfer roadway/haul path road improvement/widening areas, and the designated SLF siting location should have site characterization performed and documented to verify the presence or absence of levels of contamination in the surface, subsurface soil, and vegetation at the site. In the event of any contamination, that it is not at a level requiring future remedial action and, if it is, identify early on those actions necessary to address the concerns while supporting the progress of the MCSC Project. Where possible, these site characterization activities shall be coordinated with any required geotechnical field investigations. It is further recommended that all CSA-related construction activities be coordinated and completed in such manner to minimize any adverse impact to, nor further exacerbate, future remediation efforts associated with the adjacent WIDS site(s).

6 References


ACI 318-14, 2014, Building Code Requirements for Structural Concrete, American Concrete Institute, Farmington Hill, Michigan.

ACI 349-13, 2013, Code Requirements for Nuclear Safety Related Concrete Structures, American Concrete Institute, Farmington Hills, Michigan.


Appendix A
Design Basis Inputs Matrix
<table>
<thead>
<tr>
<th>Number</th>
<th>System/Area</th>
<th>Input Needed</th>
<th>Value/Data Used</th>
<th>Source</th>
<th>Where Used or Needed</th>
<th>Comments</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>CSA Site Security Requirements</td>
<td>Obtain current safeguards and security related fencing, lighting, camera, motion detection, and setback requirements.</td>
<td>Obtain current safeguards and security related fencing, lighting, camera, motion detection, and setback requirements.</td>
<td>CHPRC provided data from review of the safeguards and security report analysis.</td>
<td>For CSA/CSP: Drawings W135-CSA-SK-C-001, 002, 007, 010, 012. For SLF: Drawings W135-CSA-SK-C-003, 004. CHPRC-03328, Sections 3.3.1, 4.1.4, 4.2.4.</td>
<td>It is recommended that the requirements for the SLF be further defined during preliminary design. Note: For conceptual design, single fence line around the SLF is assumed adequate. Multiple vehicular gates and personnel gates. Fence and gate for property protection where quality level items will be stored.</td>
</tr>
<tr>
<td>2</td>
<td>CSA Site Soils and Geotechnical Information</td>
<td>Identify historical data and evaluate applicability for the following: Soils makeup and status (disturbed or not, etc.). Identify locations of available fill for engineered fill requirements. Identify locations for spoils disposal / retention. Identify any known radiological contamination on or near site.</td>
<td>The Dames &amp; Moore 1989 geotechnical investigation report in support of HWVP has been historically used for conceptual design activities in the 2000s. Area of Hanford. The formerly designated HWVP site is in close proximity to the currently designated CSA, SLF, and haul path roadway for the W-135 Project. A review and assessment of the report confirms that the data and recommendations in the report support excavation to a depth of approximately 5 ft with a 2-ft backfill of compacted engineered fill and a 36 in. slab for the CSP. For the CSA Operations Pad the excavation would be the same. However, a potential cost savings could be realized with an excavation of 3 - 4 ft, compacted engineered backfill of 2 - 2.5 ft, and an 18 in. slab. For the CSA Yard / Expansion Area, the site would be grubbed, cleared, leveled, compacted, and topped with 6 in. of 2-in. minus rock graded to match the CSP and Operations Pad. The SLF will be addressed the same as the CSA Operations Pad and the CSA Yard.</td>
<td>Dames &amp; Moore 009164, &quot;Report of Geotechnical Investigation Proposed Hanford Waste Vitrification Plant.&quot; Hanford, Washington, 11-15-1989 Site Evaluation 2E-11-09, &quot;Cesium and Strontium Capsules Dry Storage Project.&quot;</td>
<td>For CSA/CSP, SLF, and roadway / haul path: Drawings W135-CSA-SK-C-001 through 014. CHPRC-03328, Sections 4.1.1, 4.3.1, 5.1.</td>
<td>The following work will need to be completed during preliminary design: A suitably designed geotechnical field investigation to confirm and improve upon the data and conclusions contained in the 1989 Dames &amp; Moore report, in particular as to whether or not the soils in the designated area are disturbed or not. Identify locations of available fill for engineered fill requirement. Identify locations for spoils disposal / retention. Identify if the Operations Pad will be 36 in. or 18 in. Further assess and determine if the CSA access entry can be shortened or narrowed in a cost savings measure.</td>
</tr>
<tr>
<td>3</td>
<td>CSA Current Radiological Survey Status</td>
<td>Current radiological status of the designated CSA area and any constraint to construction and operations.</td>
<td>No known issues in CSA site designated and staked area. A known and marked area adjacent to the marked and staked CSA site, as well as a temporary Radiological Storage Area adjacent to the SLF location.</td>
<td>Site Evaluation 2E-11-09, &quot;Cesium and Strontium Capsules Dry Storage Project.&quot;</td>
<td>For CSA/CSP: Drawings W135-CSA-SK-C-001, 002, 007, 010, 012. For SLF: Drawings W135-CSA-SK-C-003, 004. CHPRC-03328, Sections 3.2, 3.3.2, 4.1, 4.2, 4.3, 5.</td>
<td>No known issues in CSA site designated and staked area. Limited based upon Site Evaluation 2E-11-09. WIDS and Wells database should be further evaluated in preliminary design phase in conjunction with the geotechnical field investigation.</td>
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### CSA - Design Basis Inputs Matrix

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<th>Number</th>
<th>System/Area</th>
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<th>Source</th>
<th>Where Used or Needed</th>
<th>Comments</th>
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<tr>
<td>4</td>
<td>CSA (inclusive of SLF and roadway / haul path) Utilities and Services Interferences</td>
<td>Any known and suspected underground and/or overhead utilities under or near the CSA site that need protection and/or to be moved (temporary or permanent), as well as rail lines or other services.</td>
<td>No unsolvable issues identified to date. All buried lines are at or near the depth of likely excavation and will require care and protection per normal operating and construction procedures in place. Multiple buried water (raw, sanitary, etc.), electrical, and radioactive lines identified throughout the project area. Particular note of the density of these lines in the WESF access path to Atlanta, the SLF access to Atlanta, a rail line east of the Atlanta / Polaris intersection, and electrical and radioactive liquid lines on the north side of the CSA/CSP location along 7th. Overhead lines noted in the vicinity of the WESF access path and on the north side of the CSA/CSP location along 7th.</td>
<td>Site Evaluation 2E-11-09, &quot;Cesium and Strontium Capsules Dry Storage Project.&quot; Multiple site walkdowns and field measurements. Meetings with MSA and CHPRC. Marked up and annotated drawings from MSA. Drawings W135-CSA-SK-C-001, H-2-828885, H-2-830460, H-2-830461, H-2-836143.</td>
<td>For CSA/CSP, SLF, and roadway / haul path: Drawings W135-CSA-SK-C-001 through 014, marked up and annotated drawings from MSA, H-2-828885, H-2-830460, H-2-830461, H-2-836143. CHPRC-03328, Sections 3.2.4, 3.3.1, 4.1.4-4.1.6, 4.2.4, 4.2.5.</td>
<td>The Design Authority for the rail system was not available during the timeframe prior to the design review date. An enabling assumption has been made that sections of the rail lines on Atlantic can be abandoned and removed. Recommended that further discussion and confirmation be made during preliminary design. Also during preliminary design, recommend additional GPR scans in identified affected project areas that do not already have recent scan data. WIDS and Wells database should be further evaluated in preliminary design phase in conjunction with the geotechnical field investigation.</td>
</tr>
<tr>
<td>5</td>
<td>CSA Utility Sources</td>
<td>Identify current power and water utilities near CSA site available for MCSC Project needs.</td>
<td>The design is not mature enough to fully determine how the requirement is met. This is to be completed during preliminary design and confirmed during final design. An enabling assumption has been established that sufficient and adequate power and water are available for construction support activities through co-located and/or temporary services. An enabling assumption for equipment in the CSA has been established that there is sufficient 13.8 kilovolt power available to support a local transformer to the TMS, security lights, and any other systems as may be required. An enabling assumption for the SLF is that the utility and service requirements shall be met with temporary services via skid, trailer, and/or truck mounted systems, etc.</td>
<td>Site walk downs and discussion with CHPRC project staff and MSA staff.</td>
<td>CHPRC-03328, Sections 3.2.4, 3.3.1, 4.1.4-4.1.6, 4.2.4, 4.2.5.</td>
<td>During preliminary design, it is recommended that the enabling assumption be confirmed by identifying current water and power availability, type, and interconnect requirements in support of possible MCSC Project need.</td>
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<td>Number</td>
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<td>Input Needed</td>
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<td>6</td>
<td>CSP, Operations Pads and Aprons, SLF Pads and Aprons</td>
<td>VCT weights, dimensions, and operating area / maneuvering requirements.</td>
<td>VCT weight: 95,000 lb VCT length: 34 ft 9-13/16 in. VCT width: 17 ft 9 in. VCT height: 17 ft 5-3/4 in. VCT turning radius - Max/inside: 56 ft 4-3/8 in. Min/inside: 33 ft 5/8 in. Conservative values of 57 ft outside radius and 34 ft inside radius, 35 ft length, 18 ft width, and 18 ft height have been used for Turn Radius Study. The fully loaded (VCT, casks and internals, and capsules inside UCSs) operating weight is ~285,000 lb (conservative estimate), assuming a 95-ton fully loaded VCC weight. This is the weight for the haul path from WESF to the CSA/CSP. The partially loaded (VCT, cask and internals) operating weight is ~225,000 lb (conservative estimate) and would be the weight for the haul path from the SLF to WESF.</td>
<td>Lift Systems, Inc. drawing dated 11-17-2010 as provided by NAC in their proposal. NAC document 30559-S-01, &quot;Design Specification for the Cask Storage System (CSS) for the Management of the Cesium and Strontium Capsules Project (MCSC) at the Hanford Site.&quot; CHPRC provided responses to Lucas identified information needs and clarifications of the NAC 30059-S-01 document.</td>
<td>For CSA/CSP, SLF, and roadway / haul path: Drawings W135-CSA-SK-C-001 through 014, marked up and annotated drawings from MSA, H-2-828885, H-2-830460, H-2-830461, H-2-836143. CHPRC-03328, Sections 3.3, 4.1, 4.2, 4.3, 4.4.4, 5.1.</td>
<td>It is recommended for preliminary design that final dimensions and weights need to be confirmed upon completion of NAC CSS conceptual design and upon receipt of equipment from West Valley.</td>
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<td>7</td>
<td>Temperature Monitoring System Requirements</td>
<td>Power requirements for the TMS while the fully loaded VCCs are at the CSA Storage Pad, operating frequency and signal transmission requirements including identification as to whether the system will be of wired or wireless design, any special housing requirements for the local and/or remote operation and maintenance and/or upgrade/system replacement needs during the interim storage period.</td>
<td>The design is not mature enough to fully determine how the requirement is met. This is to be completed during preliminary design and confirmed during final design. An enabling assumption has been established that there is sufficient 13.8 kilovolt power available to support a local transformer to the TMS, security lights, and any other systems as may be required. An enabling assumption has been established that a 10 ft by 16 ft by 8 ft weather-tight enclosure located at the outside northeast corner of the CSA perimeter fence will be sufficient for the TMS and any operation and maintenance and/or upgrade/system replacement needs during the interim storage period.</td>
<td>Site walk downs and discussion with CHPRC project staff and MSA staff.</td>
<td>CHPRC-03328, Sections 3.2.4, 3.3.1, 4.1.6. Recommend update and confirmation during preliminary design.</td>
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<td>8</td>
<td>Site Laydown and Storage Area Requirements</td>
<td>An enabling assumption that the geotechnical data identified and reviewed in support of the CSA is valid for the SLF. An available SLF yard area of 41,000 square feet was identified during a site walk down with CHPRC project personnel. A designated property security area with dimensions of 250 ft by 90 ft has been reserved within that site, along with a fabrication and storage pad with dimensions of 180 ft by 40 ft by 12-18 in. thick located in the center of the property security site. There will be a 24 in. drainage apron as well as 6 in. of compacted fill to grade match with the pad for the full SLF site area. Polaris Drive will need to be realigned and the intersection of Atlanta and Polaris will need road improvement work in an area of approximately 3900 square feet, inclusive of the removal of a section of rail spur.</td>
<td>Multiple site walkdowns and field measurements. Meetings with MSA and CHPRC. Marked up and annotated drawings from MSA.</td>
<td>Drawing W135-CSA-SK-C-001. Feedback from NAC.</td>
<td>For SLF: Drawings W135-CSA-SK-C-003, 004. CHPRC-03328, Section 4.2. It is recommended that the requirements for the SLF be further defined during preliminary design. Note: For conceptual design, single fenceline around the SLF is assumed adequate. Multiple vehicular gates and personnel gates. Fence and gate for property protection where quality level items will be stored. WIDS and Wells database should be further evaluated in preliminary design phase in conjunction with the geotechnical field investigation.</td>
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<td>9</td>
<td>Transfer Roadway Current Roadway Conditions</td>
<td>Road condition assessment, inclusive of shoulders, width, grade assessment, etc., between WESF and the designated CSA location, inclusive of the WESF Truck Port apron. Identify all utilities that cross over or under the designated transfer path and determine any possible impacts and/or upgrades needed to support the MCSC Project. No unsolvable issues identified to date. All buried lines are at or near the depth of likely excavation and will require care and protection per normal operating and construction procedures in place. Multiple buried water (raw, sanitary, etc.), electrical, and radioactive lines identified throughout the project area. Particular note of the density of these lines in the WESF access path to Atlanta, the SLF access to Atlanta, a rail line east of the Atlanta / Polaris intersection, and electrical and radioactive liquid lines on the north side of the CSA/CSP location along 7th. Overhead lines noted in the vicinity of the WESF access path and on the north side of the CSA/CSP location along 7th.</td>
<td>Site Evaluation 2E-11-09, &quot;Cesium and Strontium Capsules Dry Storage Project.&quot; HNF-59690. Multiple site walkdowns and field measurements. Meetings with MSA and CHPRC. Marked up and annotated drawings from MSA.</td>
<td>Drawings W135-CSA-SK-C-001, H-2-828885, H-2-830460, H-2-830461, H-2-836143.</td>
<td>For CSA/CSP, SLF, and roadway / haul path. Drawings W135-CSA-SK-C-001 through 014, marked up and annotated drawings from MSA, H-2-828885, H-2-830460, H-2-830461, H-2-836143. CHPRC-03328, Sections 3.3, 4.3, 4.4.4, 5.1.</td>
<td>The Design Authority for the rail system was not available during the timeframe prior to the design review date. An enabling assumption has been made that sections of the rail lines on Atlantic can be abandoned and removed. Recommended that further discussion and confirmation be made during preliminary design. Also during preliminary design, recommend additional GPR scans in identified affected project areas that do not already have recent scan data. WIDS and Wells database should be further evaluated in preliminary design phase in conjunction with the geotechnical field investigation.</td>
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<td>Number</td>
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<td>10</td>
<td>CSP</td>
<td>Performance / design requirements basis.</td>
<td>An enabling assumption that the geotechnical data identified and reviewed in support of the CSA is valid for the CSP. The CSP is 75 ft by 75 ft by 36 in. thick with a surface area of 5625 sq ft and is located in the center of the CSA property security site. There are ~ 640 cubic yards of 3000 psi concrete with ~ 59 tons of reinforcing steel. There will be a 5 ft deep / 1042 cubic yard excavation followed by a 2 ft deep / 417 cubic yard engineered fill under the pad. There will be a 24 in.-drainage apron as well as 6 in. of compacted fill to grade match with the Operating Pad and the CSP for the full CSA site area.</td>
<td>Conceptual design basis is derived from the requirements and as built data from WVDP. Design verification data associated with the ISA (HNF-2074, HNF-2448). NAC April design review briefing materials. PRC-PRO-EN-097. FCRD-NFST-2013-000330, Rev. 2 (2016).</td>
<td>For CSA/CSP: Drawings W135-CSA-SK-C-001, 002, 007, 010, 012. CHPRC-03328, Section 4.1.</td>
<td>Recommend that the final dimensions of the CSP be confirmed during preliminary design, based upon final VCC weight and number.</td>
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Appendix B

Hanford Site Drawings

Survey Data Reports
W-135 MCSC Interim Storage Site Boundary Staking ........................................... B-2

Utility Drawings
H-2-828885 Sheet 1, Civil Alignment A Sta. 0+00 – 0+800 ........................................ B-4
H-2-830460 Sheet 9, Site Map Potable Water System 200 East Enlarged Plan ............ B-5
H-2-830460 Sheet 9, MSA Sanitary Water Markup Site Map Potable Water System 200 East Enlarged Plan ................................................................. B-6
H-2-830461 Sheet 9, Site Map Raw Water System 200 East Enlarged Plan .................. B-7
H-2-830461 Sheet 9, MSA Raw Water Markup Site Map Raw Water System 200 East Enlarged Plan ................................................................. B-8
H-2-836143 Sheet 1, Underground Utilities Composite Plan North and East Yards ........ B-9

Fire Main Drawings
H-2-825969 Sheet 1 Rev. 9, Fire Protection Sanitary & Raw Water Distribution Key Site Plan ...... B-10
H-2-825969 Sheet 1 Rev. 11, Fire Protection Sanitary & Raw Water Distribution Key Site Plan ..... B-11
H-2-825969 Sheet 2, Fire Protection Sanitary & Raw Water Details ............................... B-12
H-2-825969 Sheet 6, Fire Protection Sanitary & Raw Water Details ............................... B-13
DESCRIPTION OF WORK

Staked 4 corners of proposed MCSC Interim Storage Site Boundary, located east of the Canister Storage Building in 200E Area, as directed and obtained coordinates of miscellaneous features.

Horizontal Coordinate System: WCS83S/91 (Meters)
Vertical Datum: NAVD88 (Meters)

SURVEY RESULTS AND COMMENTS

See Attached Sketch and Point (.csv) File

FOR OFFICE USE ONLY

OR Doc Type:

WMU Code(S):
Appendix C

MCSC Project Sketches

W-135-CSA-SK-G-001, W-135 Project General Arrangement Cover Sheet ........................................ C-2
W-135-CSA-SK-G-002, W-135 Project General Arrangement Drawing Index ................................. C-3
W-135-CSA-SK-G-003, W-135 Project General Arrangement Abbreviations, Symbols & Legend ......................................................... C-4
W-135-CSA-SK-C-001, W-135 Project General Arrangement Overall Plan (1 of 2) ....................... C-5
W-135-CSA-SK-C-002, W-135 Project General Arrangement Overall Plan (2 of 2) ....................... C-6
W-135-CSA-SK-C-003, W-135 Project General Arrangement CSA Storage/Laydown/Fab. Area Overall Plan .......................................................... C-7
W-135-CSA-SK-C-004, W-135 Project General Arrangement CSA Storage/Laydown/Fab. Area Enlarged Plan ................................................................. C-8
W-135-CSA-SK-C-005, W-135 Project General Arrangement Truck Port & Haul Path (1 of 2) .................................................. C-9
W-135-CSA-SK-C-006, W-135 Project General Arrangement Truck Port & Haul Path (2 of 2) ....................................................................................... C-10
W-135-CSA-SK-C-007, W-135 Project General Arrangement CSA/CSP Overall Plan ............... C-11
W-135-CSA-SK-C-008, W-135 Project General Arrangement VCT / Tug Turn Radius ................ C-12
W-135-CSA-SK-C-010, W-135 Project General Arrangement CSA/CSP - Enlarged Plan ........ C-14
W-135-CSA-SK-C-011, W-135 Project General Arrangement VCC Alternate Storage Layout ........................................................................................................ C-15
W-135-CSA-SK-C-012, W-135 Project General Arrangement CSA/CSP Optional VCC – Enlarged Plan ..................................................................................... C-16
W-135-CSA-SK-C-013, W-135 Project General Arrangement CSA Alternate Storage/Laydown/Fab. Area – Overall Plan (1 of 2) ............................................. C-17
W-135-CSA-SK-C-014, W-135 Project General Arrangement CSA Alternate Storage/Laydown/Fab. Area – Overall Plan (2 of 2) .................................................. C-18
CH2M HILL PLATEAU REMEDIATION COMPANY
FOR
U.S. DEPARTMENT OF ENERGY

MANAGEMENT OF CESIUM AND STRONTIUM CAPSULES (MCSC) W-135 PROJECT

3160 George Washington Way
Sigma III Building
Richland, WA 99352
Phone: 509.942.1080
Fax: 509.942.1081
www.lucasinc.com

CHPRC-03328, Rev. 0

C-2
BASELINE CSP VCC LAYOUT

ALTERNATE CSP VCC

CONCRETE VOLUME: 16,875 Cu.ft.

CONCRETE VOLUME: 19,829 Cu.ft.

NOTE: OPTIONAL CONSIDERATION
(NOT YET EVALUATED FOR ALARA IMPACT)

CURRENTLY EVALUATED FOR ALARA IMPACT

NOT FOR CONSTRUCTION
Appendix D

Vendor Literature

WVDP/HLWCRP VCT Vendor Drawing ................................................................. D-2
WVDP/HLWCRP GT50 Tug Vendor Data Sheet ........................................... D-3
High Efficiency LED Flood Lights Cut Sheet ........................................ D-5
TUG TECHNOLOGIES

Providing Ground Support Solutions Worldwide

Equipment Sales
Tel: (770) 422-7230
Fax: (770) 428-7315

Parts Sales
Tel: (800) 989-8499
Fax: (770) 422-8730

Online
www.tugtech.com

Standard features include:
- Glow plugs for cold-weather starting
- Sealed-beam headlights
- Backup lights
- Front, rear & side reflectors
- Dual-rearview mirrors
- Electric horn
- Single-color polyurethane paint
- Anti-skid matting on top of tractor surface

TUG GT50
Aircraft Gate Tractor

The TUG's Tractor Model GT-50/GT-50H provides our customers with dependable pushback service for all mid-sized aircraft. This popular model has helped make our tractor product line synonymous with quality and performance. The GT-50 features optional gross vehicle weight packages for the various applications and airport conditions. Customers can choose the 60,000-lb (GT-50H) tractor for difficult towing requirements such as heavier aircraft, inclement weather conditions and tight maneuvering, or they may choose the 50,000-lb tractor for less stringent applications.

If it doesn't say TUG, it's not TUG TUFF
Specifications

**Model GT50**

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<th>General</th>
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<tr>
<td>Gross Vehicle Weight (g.v.w.)</td>
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<tr>
<td>At g.v.w 66,000 lb (29,950 kg)</td>
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<tr>
<td>At g.v.w 66,000 lb (29,950 kg)</td>
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**Speed**

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<td>3rd</td>
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**Overall Dimensions**

| Height (with Cab) | 86" (2.18 m) |
| Ground Clearance | 7" (178 mm) |
| Wheel Base | 107" (2.71 m) |
| Ground Clearance | 7" (178 mm) |

**Steering Hydraulic System**

- Type: Two (2) wheel hydraulic
- Optional: Four (4) wheel hydraulic
- Steering Cylinders: Four (4) wheel hydraulic
- Steering Valve: Tilt, dual-acting
- Pump: Two (2) wheel hydraulic
- Electric pre-selection with push-pull

**Hydraulic Oil Tank**

- Type: Removable
- Capacity: 17 U.S. gallons (64.4 L)

**Electrical System**

- Starting System: 12V
- Charging System: 65A (high output @ idle speed)

**Fuel System**

- Capacity: 45 U.S. gallons (171 L)
- Fuel: No. 2 Diesel (Jet-A approved)

**Transmission**

- Manufacturer: Volkswagen AG (VW)
- Type: 4-speed manual
- Speeds: 1st, 2nd, 3rd, 4th

**Axles - Front**

- Manufacturer: Rockwell (V) Series 5 (Axle-77)
- Type: planetary differential
- Steering System: Cylinders hydraulically-actuated
- Tires: 7.50x16.90R20 radial, tubeless
- Subdivision: 2-speed

**Axles - Rear**

- Manufacturer: Rockwell (V) Series 5 (Axle-77)
- Type: planetary differential

**Brakes**

- Service, Front and Rear: Four-wheel drum brakes
- 400 lb/120-mm hydraulically actuated
- Spindles are forged of ductile iron
- Power-assist provided by an engine-driven hydraulic pump
- Automatic back-up power assist, in event of engine shutdown provided by a battery-powered motor pump
- Parking Mechanism actuated on caliper en

**Standard Operator Compartments**

- Operator instrument panel: engine tachometer, engine oil pressure gauge, voltmeter, coolant temperature gauge, engine oil temperature gauge, oil level indicator, gasoline gauge, battery charge indicator, clock
- Emergency stop switch, rearview mirror, side view mirrors, front and rear seat belts, seat belt indicators
- Symbols and labels for all instruments & controls
- Glow plugs, immersion heater, engine coolant high temperature warning light, low oil pressure warning light, alternator failure, brake booster and parking brake

**Optional Equipment**

- Two-man cab: windshield wipers, dome light, ventilating fan, sound insulation, electrical switches for air conditioning, electric seat adjustment, windshield wipers, and heater
- Auxiliary power outlet, CD player, radio, cassette player, CD player, CD player, CD player
- Rearview mirror, side view mirrors, front and rear seat belts, seat belt indicators
- Emergency stop switch, rearview mirror, side view mirrors, front and rear seat belts, seat belt indicators
- Symbols and labels for all instruments & controls
- Glow plugs, immersion heater, engine coolant high temperature warning light, low oil pressure warning light, alternator failure, brake booster and parking brake

---

Specifications are subject to change without notice. Models shown may include optional features.

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D-4
The Owl Pack offers remarkable energy and maintenance savings compared to traditional High Intensity Discharge (HID) Floods and provide an economically-sensitive solution to reduce your operating costs.

The Owl Pack is a exclusive series of cut-off, a high intensity discharge (HID) Floodlights made in the USA, ideal for replacing the yellow, atomized, high-pressure sodium (HPS) and metal halide (MH) Floodlights.

The Owl Pack is available in a variety of inductive, each with a specialized ballast, mount, and wiring, making it a flexible and versatile solution for a wide range of applications such as walkway, entrance, and architectural fixtures.

**Advantages**
- Energy and maintenance savings
- Eliminates the aging cycle
- Rated for outdoor use, protected against dust, sleet, and precipitation
- Kicked by wind, daylight or weather
- Features
  - Die-cast aluminum housing and flange with high-impact polycarbonate lens
  - High light efficiency with a minimum of 0.8 light output for a 200-watt HPS or MH Floodlight
- **Applications**
  - Industrial Warehouse
  - Retail & Commercial
  - Parking Lot
  - Gas Station
  - Infill
  - Building Exterior
  - AEP AEP
  - Government & Municipal
  - Highlighting and Highlighting

**Specifications**
- **10 Watt SOC Pack**
  - Wattage: 10 watts
  - Operating Hours: 50,000 hours
  - Light Output: 8,000 lumens

- **12 Watt SOC Pack**
  - Wattage: 12 watts
  - Operating Hours: 50,000 hours
  - Light Output: 10,000 lumens

**Features**
- Die-cast aluminum housing and flange with high-impact polycarbonate lens
- High light efficiency with a minimum of 0.8 light output for a 200-watt HPS or MH Floodlight
- **Applications**
  - Industrial Warehouse
  - Retail & Commercial
  - Parking Lot
  - Gas Station
  - Infill
  - Building Exterior
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  - Parking Lot
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**Features**
- Die-cast aluminum housing and flange with high-impact polycarbonate lens
- High light efficiency with a minimum of 0.8 light output for a 200-watt HPS or MH Floodlight
- **Applications**
  - Industrial Warehouse
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