INTERIM STORAGE PARTNERS

July 21, 2020
E-57108

Director, Division of Fuel Management
Office of Nuclear Material Safety and Safeguards
U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
One White Flint North
11555 Rockville Pike
Rockville, MD 20852

Subject: Submittal of Supplemental Information in Support of ISP's Response to RAIs NP-2.6-3 and NP-4-4, Docket 72-1050 CAC/EPID 001028/L-2017-NEW-0002

Reference:

1. Letter from John-Chau Nguyen (NRC) to Jeffery D. Isakson, "Interim Storage Partners LLC's License Application to Construct and Operate the Waste Control Specialists Consolidated Interim Storage Facility, Andrews County, Texas, Docket No. 72-1050 – First Request for Additional Information, Part 2," dated March 6, 2019

2. Letter from Jeffery D. Isakson to Director, Division of Fuel Management (NRC), "Submission of ISP Responses for RAIs and Associated Document Markups from First Request for Additional Information, Parts 2, 3, and 4, Docket 72-1050 CAC/EPID 001028/L-2017-NEW-0002," E-56483, dated May 18, 2020

Interim Storage Partners LLC (ISP) hereby submits supplemental information in support of our partial response to the First Request for Additional Information (RAI), Part 2, issued March 6, 2019 (Reference [1]) provided in Reference [2] for RAIs NP-2.6-3 and NP-4-4, to support the continued review of the WCS CISF License Application. Contained in this submittal are Safety Analysis Report (SAR) change pages to 1) clarify the operations associated with use of the Cask Handling Building (CHB) to remove the NAC Transportation Casks from the rail cars, 2) update the SAR with the design basis floor loads in the CHB to support the uprighted transportation cask and operations of the vertical cask transporter (VCT) inside the CHB, 3) update of the SAR to include an evaluation of the uprighted transportation casks demonstrating that these do not tip over during the design basis seismic events, 4) updated the SAR to provide additional descriptions related to the CHB overhead crane design and quality classifications for the crane subcomponents, 5) updated SAR Table 4-3 to include the VCT and Cask Transfer System (CTS), 6) provide clarification on CTS and associated pad Quality Categories, and 7) update Chapter 2 of the SAR to clarify which bearing capacity values are used for the CHB, storage pads and other foundations related to the CISF.

The following enclosures are being submitted:

- Enclosure 1 includes affidavits pursuant to 10 CFR 2.390 for NAC International
- Enclosure 2 provides the SAR change pages (Proprietary Version)
- Enclosure 3 provides the public version of the SAR change pages

Should you have any questions regarding this submission, please contact Mr. Jack Boshoven by telephone at (410) 910-6955, or by email at jack.boshoven@orano.group.

Sincerely,

Digitally signed by ISAKSON Jeffery

Jeffery D. Isakson
Chief Executive Officer/President
Interim Storage Partners LLC

cc: John-Chau Nguyen, Senior Project Manager, U.S. NRC
Jack Boshoven, ISP LLC
Elicia Sanchez, ISP LLC

Enclosures:

1. Affidavits Pursuant to 10 CFR 2.390 for NAC International
2. SAR Change Pages (Proprietary)
3. SAR Change Pages (Public)

# Enclosure 1 to E-57108

# Affidavit Pursuant to 10 CFR 2.390

NAC INTERNATIONAL

# NAC INTERNATIONAL
# AFFIDAVIT PURSUANT TO 10 CFR 2.390

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George Carver (Affiant), Vice President, Engineering and Support Services, hereinafter referred to as NAC, at 3930 East Jones Bridge Road, Peachtree Corners, Georgia 30092, being duly sworn, deposes and says that:

1. Affiant has reviewed the information described in Item 2 and is personally familiar with the trade secrets and privileged information contained therein, and is authorized to request its withholding.

2. The information to be withheld includes the following NAC Proprietary Information that is being provided in support of the NRC review of Interim Storage Partners (ISP) Centralized Interim Storage Facility (CISF) site-specific license application (NRC Docket No. 72-1050).

   - Submittal E-57108, NAC Proprietary Changed Page 7-15.

   NAC is the owner of this information that is considered to be NAC Proprietary Information.

3. NAC makes this application for withholding of proprietary information based upon the exemption from disclosure set forth in: the Freedom of Information Act ("FOIA"); 5 USC Sec. 552(b)(4) and the Trade Secrets Act; 18 USC Sec. 1905; and NRC Regulations 10 CFR Part 9.17(a)(4), 2.390(a)(4), and 2.390(b)(1) for "trade secrets and commercial financial information obtained from a person, and privileged or confidential" (Exemption 4). The information for which exemption from disclosure is herein sought is all "confidential commercial information," and some portions may also qualify under the narrower definition of "trade secret," within the meanings assigned to those terms for purposes of FOIA Exemption 4.

4. Examples of categories of information that fit into the definition of proprietary information are:

   a. Information that discloses a process, method, or apparatus, including supporting data and analyses, where prevention of its use by competitors of NAC, without license from NAC, constitutes a competitive economic advantage over other companies.

   b. Information that, if used by a competitor, would reduce their expenditure of resources or improve their competitive position in the design, manufacture, shipment, installation, assurance of quality or licensing of a similar product.

   c. Information that reveals cost or price information, production capacities, budget levels or commercial strategies of NAC, its customers, or its suppliers.

   d. Information that reveals aspects of past, present or future NAC customer-funded development plans and programs of potential commercial value to NAC.

**NAC INTERNATIONAL**
**AFFIDAVIT PURSUANT TO 10 CFR 2.390 (continued)**

e. Information that discloses patentable subject matter for which it may be desirable to obtain patent protection.

The information that is sought to be withheld is considered to be proprietary for the reasons set forth in Items 4.a, 4.b, and 4.d.

5. The information to be withheld is being transmitted to the NRC in confidence.

6. The information sought to be withheld, including that compiled from many sources, is of a sort customarily held in confidence by NAC, and is, in fact, so held. This information has, to the best of my knowledge and belief, consistently been held in confidence by NAC. No public disclosure has been made, and it is not available in public sources. All disclosures to third parties, including any required transmittals to the NRC, have been made, or must be made, pursuant to regulatory provisions or proprietary agreements, which provide for maintenance of the information in confidence. Its initial designation as proprietary information and the subsequent steps taken to prevent its unauthorized disclosure are as set forth in Items 7 and 8 following.

7. Initial approval of proprietary treatment of a document/information is made by the Vice President, Engineering, the Project Manager, the Licensing Specialist, or the Director, Licensing – the persons most likely to know the value and sensitivity of the information in relation to industry knowledge. Access to proprietary documents within NAC is limited via "controlled distribution" to individuals on a "need to know" basis. The procedure for external release of NAC proprietary documents typically requires the approval of the Project Manager based on a review of the documents for technical content, competitive effect and accuracy of the proprietary designation. Disclosures of proprietary documents outside of NAC are limited to regulatory agencies, customers and potential customers and their agents, suppliers, licensees and contractors with a legitimate need for the information, and then only in accordance with appropriate regulatory provisions or proprietary agreements.

8. NAC has invested a significant amount of time and money in the research, development, engineering and analytical costs to develop the information that is sought to be withheld as proprietary. This information is considered to be proprietary because it contains detailed descriptions of analytical approaches, methodologies, technical data and/or evaluation results not available elsewhere. The precise value of the expertise required to develop the proprietary information is difficult to quantify, but it is clearly substantial.

   Public disclosure of the information to be withheld is likely to cause substantial harm to the competitive position of NAC, as the owner of the information, and reduce or eliminate the availability of profit-making opportunities. The proprietary information is part of NAC's comprehensive spent fuel storage and transport technology base, and its commercial value extends beyond the original development cost to include the development of the expertise to determine and apply the appropriate evaluation process. The value of this proprietary information and the competitive advantage that it provides to NAC would be lost if the information were disclosed to the public. Making such information available to other parties, including competitors, without their having to make similar investments of time, labor and money would provide competitors with an unfair advantage and deprive NAC of the opportunity to seek an adequate return on its large investment.

NAC INTERNATIONAL

**NAC INTERNATIONAL**
**AFFIDAVIT PURSUANT TO 10 CFR 2.390 (continued)**

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**STATE OF GEORGIA, COUNTY OF GWINNETT**

Mr. George Carver, being duly sworn, deposes and says:

That he has read the foregoing affidavit and the matters stated herein are true and correct to the best of his knowledge, information and belief.

Executed at Peachtree Corners, Georgia, this 16 day of July, 2020.

George Carver
Vice President, Engineering and Support Services
NAC International

Subscribed and sworn before me this 16 day of July, 2020.

Rachel K. Little
Notary Public

RACHEL K LITTLE
MY COMMISSION EXPIRES
NOTARY
PUBLIC
DECEMBER 28, 2021
CHEROKEE COUNTY, GEORGIA

**Enclosure 2 to E-57108**

**SAR Change Pages**

**Withheld Pursuant to 10 CFR 2.390**

# Enclosure 3 to E-57108

# SAR Change Pages

# (Public)

## 1.3 General Description of Systems and Operations

A general description of the WCS CISF systems and operations is provided in this section. The systems described relate to the receipt, handling, transfer, and storage of canisterized spent nuclear fuel and GTCC waste. In general, the same systems provide the corresponding function for canister retrieval and off site shipment operations.

### 1.3.1 WCS Consolidated Interim Storage Facility Systems

The major systems for the WCS CISF include the following: Cask Off-Loading and Loading System in the Cask Handling Building, Canister Transfer System (for vertical systems) and Transfer Cask or Storage Overpack Carrier System. These systems are used to transfer canisterized spent nuclear fuel and GTCC waste from transportation systems to storage overpacks and are used to retrieve canisters for off-site shipment.

#### 1.3.1.1 Cask Off-Loading and Loading System

The purpose of the Cask Off-Loading and Loading System is to remove transportation casks from the cask railcars and to move transportation casks onto the railcars for shipment from the WCS CISF. Major components include two 130-ton capacity overhead bridge cranes. The overhead bridge cranes and associated lifting fixtures are used to perform a horizontal transfer of the NUHOMS® transportation/transfer cask from the railcar (skid) onto the transfer skid for transfer operations. This transfer is performed without lifting the loaded NUHOMS® transportation/transfer cask above a height of 80” and *is* classified as NITS. The ITS overhead bridge cranes are also used to upright the NAC transportation casks. An ITS VCT is then used to place the casks under the Canister Transfer System for the vertical storage systems. The VCT is also used to place the transportation cask under the overhead crane, which is used to down end the transportation cask onto the railcar for offsite transport.

#### 1.3.1.2 Canister Transfer System

For vertical systems, the ITS Canister Transfer System is used to transfer spent nuclear fuel and GTCC waste canisters from the uprighted transportation casks to vertical storage overpacks. Major components include a shielded transfer cask, mobile gantry crane and ancillary equipment used to move the canisters from the upright transportation cask to the vertical storage overpack. This system is not used with the NUHOMS® Systems.



All Indicated Changes are in response to RAI NP-4-4

The natural moisture content of the subsurface materials ranged from 2.5 to 9 percent. Atterberg limits testing on three selected residual samples revealed liquid limits (LL) ranging from 26 to 20 percent and each sample was non-plastic. Wash 200 tests performed on eight soil samples revealed 24 to 45 percent finer than the 200 sieve.

Shear wave velocities for the upper 100 feet below ground surface (bgs) range from 820.3 ft/sec to 23,383 ft/sec. The upper 10 feet of the site is a loose fill material and shear wave velocities for 0-10 feet bgs ranged from 820.3 ft/sec to 1,107 ft/sec. For 15 to 35 feet bgs, the shear wave velocities were 1302 to 1940 feet per second for a stratigraphic unit of silty sands, gravels, and caliche referred to as the Ogallala/Antlers/Gatuna formation (OAG). The Dockum Formation (dense clay) starts at 35 to 40 feet bgs beneath the OAG and shear wave velocities ranged from 2,058 feet/s to 3,383 ft/s. The results of the shear wave studies are located in Table 4 of the Geotechnical Exploration Report (Attachment E). The plot plan of the linear array is shown in Figure 12 of Appendix E of the Geotechnical Report (Attachment E). The engineering properties of site materials by strata, based on the geophysical survey investigation, are contained in Table 8 located in Appendix C of Attachment E.

During the geotechnical investigation, no water was encountered in any of the borings. There are no water table conditions anticipated beneath the site during facility construction and operations. Several monitor wells in the area are installed in the uppermost transmissive zone, and have been dry since installation in 2005 or 2008. The site is underlain by a northerly dipping lower confining unit. Since groundwater was not encountered in any of the 18 soil test borings and given that some of the borings penetrated as deep as 45 feet below the ground surface, it can be concluded that a liquefaction hazard does not exist for the proposed CISF.

*Specific calculated allowable bearing capacity values for the CHB and storage pads are presented in Section 4.3 of Attachment E and range between 4,000 psf and 6,000 psf. For other foundations constructed at the proposed CISF, the* recommended allowable bearing capacity for design of the foundations is 3,000 pounds per square foot (psf) or less. A one-third increase in the allowable bearing capacity for all load conditions that include transient loads (wind, seismic, other short term loads) is permitted. The 33% increase in allowable bearing capacity (stress) can be applied to load combinations that consider transient loads in conjunction with dead loads. Calculations can be found in Appendix G of Attachment E. A summary table for the site characteristics geotechnical-related parameters can be found in Table 9 in Appendix D of Attachment E. Plans and profiles showing the extent of excavations and backfill are shown in Figure 2-26, Figure 2-31, Figure 2-32, and Figure 2-33. Structural backfill shall comply with the criteria for material, compaction, and quality control specified in Section 4.2.2 of Attachment E.

### 3.4.1 Cask Handling Building Quality Classification

The purpose of the CHB and associated lifting equipment is to receive, inspect and prepare for storage, shipments of canisterized SNF and GTCC waste canisters and to provide for cask and rail car light maintenance. The CTS and associated lifting hardware used for stack up and transfer operations for the NAC canisters is located inside the building. The NUHOMS® MP197HB and MP187 Casks Lift Beam Assembly is NITS because the NUHOMS® cask and canister are not lifted above the Technical Specifications [3-1] height limits. The building structure (structural steel and column foundations) is classified as ITS, Category B to meet the requirements of 10 CFR 72.122(b)(2)(ii) [3-23] and to prevent massive building collapse onto cask systems and related ITS SSCs. The overhead crane bridge overhead cranes, runway beams, integral crane structure consisting of the bridge rails, bridge girders, and trucks, as well as the trolley structure and the various drive components are ITS. *The CHB overhead cranes shall meet the single-failure-proof criteria of NUREG-0612, and are designed as Type I, per ASME NOG-1 [3-36] for compliance with NUREG-0554, are capable of handling critical loads of the rated capacity (130 tons), are classified as Important to Safety (ITS) Quality Category B, as defined in the WCS CISF Quality Assurance Program. Quality categories for the individual subcomponents for the CHB overhead cranes will be determined based on the description of Quality Categories in Section 3.4. The quality assurance program of the Manufacturer of the two 130 ton overhead cranes in the CHB shall meet the Basic and Supplemental Requirements of ASME NQA-1. All components that are located in the load path between the load and the source of energy holding the load are classified as ITS Category B. The cranes shall be manufactured in accordance with Section 7200 Manufacturing of NOG-1[3-36] for Type 1 cranes.* The Special Lifting Devices used to offload the NAC transportation casks from the railcar are ITS. The balance of the facility is also NITS as the fuel remains sealed from the environment inside the confinement boundary provided by the canister for all operations and the overpacks provide protection from natural phenomena and postulated off-normal and accident events.

### 3.4.2 Design Criteria for Other SSCs Not Important-to-Safety

The classification of SSCs allows the application of design criteria in a graded manner. The system classifies SSCs by function in order to apply the appropriate design criteria. Design criteria for NITS buildings and structures are discussed in this section.

The design criteria for SSCs classified as NITS, but that have importance to operations, such as transport vehicles, fire detection and suppression systems, security systems, radiation monitoring systems, and temperature monitoring systems, are addressed in subsequent chapters of this SAR. These SSCs are designed in accordance with their applicable codes and standards.



All Indicated Changes are in response to RAI NP-4-4

**Table 3-5**
**Quality Assurance Classification of Structures, Systems, and Components as Utilized at the WCS CISF(1)*(4)***

| Important-To-Safety | Not Important-To-Safety |
|---|---|
| **Classification Category A** | Facility Infrastructure |
| SNF Canister | Security and Administration Building |
| | Storage Pads (NUHOMS® Storage Overpacks) |
| **Classification Category B** | |
| Storage Overpacks | Overhead Building Crane Lifting Devices for NUHOMS® Transportation Casks |
| Canister Transfer System (See Note 3) | Electrical Power |
| Vertical Cask Transporter | |
| Cask Handling Building | |
| Overhead Building Cranes | |
| Special Lifting Devices for NAC Transportation Casks | |
| **Classification Category C** | Facility Lighting |
| Storage Pads (Vertical Concrete Storage overpacks) | NUHOMS® Cask Transfer Trailer |
| *Canister Transfer System Pad in Cask Handling Building* | Radiation Monitors |
| | Temperature Monitoring System |
| **Treated as Category C** | Communication System |
| Derailer (See Note 2) | Fire Protection System |
| CAS (See Note 2) | Potable Water System |
| Security Lighting (See Note 2) | Sanitary Waste/Septic Systems |
| Security Cameras (See Note 2) | Facility Roads |
| Security Alarm Systems (See Note 2) | Railroad Line Components |
| Backup Electric Power (Generators) (See Note 2) | Associated Support Equipment |

Notes:

(1) Quality Assurance Classifications for each of the Storage Systems SSCs are addressed in Table 3-4.

(2) Treated as ITS Category C with the exception 10 CFR Part 21 does not apply.

(3) The Canister Transfer System includes transfer casks for the NAC MAGNASTOR, UMS, and MPC systems.

*(4) Quality categories for the individual subcomponents are further evaluated based on the description of Quality Categories in Section 3.4, and on the guidance provided in NUREG/CR- 6407 [3-31].*



All Indicated Changes are in response to RAI NP-4-4

#### 4.7.1.3 Confinement Features

The CHB is not counted on to provide confinement for SNF or GTCC waste.

#### 4.7.1.4 Function

The CHB facilitates cask handling operations at the WCS CISF. Those operations are described in more detail in Chapter 5. The functions of the CHB include: loading and unloading transportation casks from rail cars; general weather protection for the handling operations; a location for the CTS; support structure for overhead cranes; staging area for storage overpacks; and storage and staging for other transfer and shipping equipment. The CHB is not counted on to provide shielding or confinement.

#### 4.7.1.5 Components

The major components that comprise the CHB are two 130 ton overhead bridge cranes. Minor components include a compressed air supply system for tools as discussed in Section 4.3.3 and the CHB will have a standard commercial HVAC system in the Utility and Storage room area of the building. The larger building will not be heated or cooled. Ventilation will be commercial grade equipment and materials.

In addition to components that are part of the CHB, all or parts of the transfer systems will operate within the building. Six storage systems were evaluated for storage in the WCS CISF Storage Area. These storage systems use various cask transfer systems. These transfer systems are described in Sections 4.7.3 and 4.7.4. Table 4-1 provides a cross-reference to the applicable appendix and section for each canister/storage overpack where the individual cask transfer systems are discussed.

#### 4.7.1.6 Design Bases and Safety Assurance

The CHB is classified as being ITS Category B. The design bases for the CHB are described in Section 7.5.3.

### 4.7.2 Overhead Bridge Cranes

The CHB houses two 130 ton overhead bridge cranes. These cranes are classified as ITS along with the seismic clips, runway beams, and support structures, and are designed as Type 1, Single Failure Proof cranes in accordance with NOG-1-2015 to provide defense in depth. The cranes are provided for the purpose of loading and unloading NUHOMS® transportation casks off or on the rail car and to or from the Transfer Trailer. The cranes shall include limit switches that shall be procedurally verified to be pre-set, limiting the travel (lifting height) so that they do not lift the NUHOMS® casks above their analyzed drop height. Section 7.5.3.1 *and the CHB Specification for Cask Handling Overhead Bridge Crane [4-14] provide* additional information on the overhead bridge cranes. The NUHOMS® casks will be lifted by the crane utilizing the WCS Lift Beam Assembly, which is referenced in Section 4.10. The NAC casks will be removed from the railcars using the applicable Special Lifting Device, which are also referenced in Section 4.10.



All Indicated Changes are in response to RAI NP-4-4

## 4.9 References


4-1 NUREG-1567, "Standard Review Plan for Spent Fuel Dry Storage Facilities," Revision 0, U.S. Nuclear Regulatory Commission, Office of Nuclear Material Safety and Safeguards, March 2000.

4-2 NRC Regulatory Guide 3.48, "Standard Format And Content For The Safety Analysis Report For An Independent Spent Fuel Storage Installation Or Monitored Retrievable Storage Installation (Dry Storage)," Rev 1.

4-3 Proposed SNM-1050, WCS Consolidated Interim Storage Facility Technical Specifications, Amendment 0.

4-4 "TN Americas LLC Quality Assurance Program Description Manual for 10 CFR Part 71, Subpart H and 10 CFR Part 72, Subpart G," current revision.

4-5 Title 10, Code of Federal Regulations, Part 72, "Licensing Requirements for the Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste, and Reactor-Related Greater Than Class C Waste."

4-6 IEEE 692, 2013, Institute of Electrical and Electronics Engineers, "Criteria for Security Systems for Nuclear Power Generating Stations".)

4-7 NFPA 70, 2016, National Fire Protection Association, "National Electric Code"

4-8 IBC, 2009, International Building Code.

4-9 NFPA 101, 2015, National Fire Protection Association, "Life Safety Code."

4-10 Not Used.

4-11 Drawing NAC004-C-002, Rev. 0, "ISFSI Pad Licensing Design Structural Concrete Plan, Sections, and Details."

4-12 NFPA 25. 2014, National Fire Protection Association, "Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems

4-13 NRC Information Notice No. 85-46, "Clarification of Several Aspects of Removable Surface Contamination Limits for Transport Packages," dated June 10, 1985.

*4-14 AECOM Specification SPEC-15-1001, "Cask Handling Building (CHB) Specification for Cask Handling Overhead Bridge Crane," Revision A.*




All Indicated Changes are in response to RAI NP-4-4

**Table 4-3**
**Heavy Load Handling Equipment Certification *and Inspection***

| HANDLING EQUIPMENT TYPE | ANSI/ASME STANDARD |
|---|---|
| Overhead Cranes | B30.2 |
| Mobile Cranes | B30.5 |
| Slings and Rigging | B30.9 |
| Hooks | B30.10 |
| Overhead Hoists | B30.16 |
| Below-the-Hook Lifting Devices | B30.20 |
| Special Lifting Devices | N14.6 |
| *Vertical Cask Transporter (VCT)* | *B30.1*<br>*NOG-1*<br>*N14.6* |
| *Canister Transfer System (CTS)* | *B30.1*<br>*B30.10*<br>*NOG-1*<br>*N14.6*<br>*NUM-1* |



All Indicated Changes are in response to RAI NP-4-4

*CHB Specification for Cask Handling Overhead Bridge Crane [7-77] provides additional detail to address how the CHB overhead cranes are evaluated and provides supplementary information that demonstrate compliance with NUREG-0612 and applicable NUREG-0554 requirements.*

As both the CTS and VCT are essentially longitudinally moving jacking towers, and not electric overhead traveling cranes, as described in NUREG-0612 and NUREG-0554, their component parts must be addressed individually, with regards to applicable criteria located within U.S. NRC regulatory guides and nuclear & non-nuclear industry standards, for the purpose of confirming their single-failure-proof handling capability. The following sections, 7.5.1 and 7.5.2, will outline the integration of the standards and substantiate the safety of the described systems.

### 7.5.1 Canister Transfer System

#### 7.5.1.1 Introduction

Three (3) types of storage systems, provided by NAC International, are implemented at the WCS CISF – the NAC MAGNASTOR, NAC-UMS and NAC-MPC. Each storage system has an associated transportation configuration in which the canister arrives at the WCS CISF. The CTS is used to transfer the contents of the transportation casks into the storage casks. The CTS is essentially a hydraulic gantry crane with a dedicated transfer cask (which is unique for each of the three system types being loaded). Figure 7-1 is a rendering of the CTS.

For NAC's vertical concrete cask storage systems, the transfer of the canister (TSC) occurs in a configuration referred to as a "stack-up". Stack-up occurs when the transfer cask, which is a shielded handling device for the TSC, is placed on top of a vertical concrete cask storage system (VCC). The objective is to ensure the shielded transfer of the TSC from the transportation cask into the transfer cask and then into the VCC.

Sections 7.5.1.4 through 7.5.1.15 follow NUREG-0554's table of contents as a means to present how the CTS is evaluated and provide the necessary information to demonstrate compliance with NUREG-0612 and applicable NUREG-0554 requirements.

The canister being handled by the CTS is classified as a critical load, per NUREG-0554 and NUREG-0612. Safe handling of this critical load is accomplished by ensuring, through the use of redundancy in active components or load paths and through the use of increased factors of safety, that failure of the heavy load system is highly unlikely and therefore provides adequate defense-in-depth for the CTS heavy loads.

Incorporation of the CTS into the Cask Handling Building *utilizes an independent pad design, thicker than that of the CHB floor*. In the typical installation detail (Figure 7-32), the rail system is *shown integrated with* an ISFSI pad *design with a thickness of 3' and have ISFSI pad reinforcement. The pad will span an area of approximately 42' wide and up to 60' long, essentially the size of an ISFSI pad for a 2 x 4 cask array. This allows adequate spacing for the placement of 2 transportation systems and 2 storage systems for content transfer in the CTS*. As can be seen in *Figure 7-32*, the rail embedment is integrated into the ISFSI pad rebar design and is located at the edges of the pad. The figure only shows a single rail system whereas two systems, mirror image, are required for the CTS gantry crane.

*As the CTS pad is essentially a small ISFSI pad, the CTS pad will be ITS to the same degree as an ISFSI pad. Tip-over has been evaluated for both the transport casks (Section 7.6.6) and storage casks (Section 7.6.1.6) and would be applicable for those components during their period of placement on the CTS pad.*

The following Codes and Standards are used in the analysis, fabrication and installation of the CTS rail installation and supporting pad design.

transfer and storage casks are also considered, along with sufficient allowance for any impact resulting from placing the moving loads *with the loaded VCT* on the floor or other areas of the structure. Within the building, the floor under the Canister Transfer System will be designed to handle the specific loads produced by the hydraulic gantry system.

- **Floor Live Loads** – A floor live load of *6,000 lbs/ft$^2$ is applied to the concrete floor in the CHB.* Live load for stairs, walkways, and platforms is 100 lb/ft$^2$.

- **Crane and Hoist Loads (C)** – Design loads for the CHB permanently installed cranes and hoists envelop the full rated capacity of the cranes, including allowances for impact loads and test load requirements. The rated capacity of each of the two overhead bridge cranes in the CHB is 130 tons. Crane test loads are considered in the design at 125% of the rated capacity of the cranes, increased by an additional 5% in accordance with ASME NOG-1-2015 Section 7423. Forces induced by crane movement are calculated in accordance with ASCE 7-16, as follows:
  - Vertical impact: 25% of maximum wheel loads (including lifted load and crane self-weight).
  - Lateral side thrust: 20% of the sum of the rated hoist capacity, plus the weight of the crane trolley and hoist.
  - Longitudinal traction: 10% of maximum wheel loads (including lifted load and crane self-weight).
- **Snow Load (S)** – As described in Chapter 3, the design live load due to rain, snow, and ice is 10 lb/ft$^2$, which is the ground snow load. Determination of roof snow and ice loads is in accordance with the requirements of ASCE 7-16.
- **Hydrostatic Fluid Pressure Loads** – Are due to fluids held in internal building compartments, such as tanks. There are no reinforced concrete tanks in the CHB. All tanks located in the CHB are designed in accordance with mechanical equipment design criteria.
- **Soil Load (H)** – Based on the density of the soil and includes the effects of groundwater, see attachment E of the WCS CISF SAR Chapter 2. Since the WCS CISF site is a dry, relatively flat site and the CHB is a slab-on-grade structure, no groundwater or soil pressure loads are exerted on building structures. Therefore, determination of lateral soil pressure loads is not necessary for structural analysis or design.

### *7.6.6 Transport Cask Stability*

*During cask receipt operations, the Cask Handling Building (CHB) crane will remove the transport casks from the conveyances (railcar, heavy haul, etc.) and stage the transport casks, vertically, on the CHB floor. A vertical cask transporter (VCT) will drive up to the transport cask, engage for lifting, and raise the cask for movement to the Canister Transfer System (CTS). The transport cask is then staged in the CTS for transferring the contents into the storage overpack.*

*During the operations process described above, the transport casks will be standing vertically, unrestrained, for some time. An evaluation has been performed to determine if during a seismic event there is any potential for tip-over of the transport casks. As noted in Section 7.5.3.2.1, administrative controls will be used to mitigate certain impacts of design-basis tornado loading. The transportation cask will not be moved into the building to begin the railcar unloading process unless current and forecasted weather for the approaching eight (8) hours indicate safe weather conditions. Safe weather conditions are defined in Section 7.5.3.2.1.*

#### *7.6.6.1 Design Basis*

*The objective of the evaluation is to follow the guidelines in 10CFR72 and calculate the factors of safety (FS) for three different NAC transport casks (STC, UMS, and MAGNATRAN) to withstand a design basis seismic event at the WCS CISF site located at Andrews County, Texas. The maximum design basis seismic event is 0.261g [7-33].*

#### *7.6.6.2 Design Input*

*WCS-12-05-100-001, Rev. 0 "Site-Specific Seismic Hazard Evaluation and Development of Seismic Design Ground Motions" [7-33].*

#### *7.6.6.3 Assumptions*

- *For casks that are identical in exterior dimensions but configured with different types of fuels, evaluation of the configuration with the highest location of Center of Gravity (CG) is the most conservative to withstand the seismic tip-over event.*

  *Basis: The primary overturning moment is the product of (height of CG measured from the base corner) × (horizontal seismic force measured in fraction of gravity). Therefore, the higher the CG position, the greater the overturning moment.*

- *The pivot point of the tip-over event is the extreme outer corner of the cask bottom support plate.*

  *Basis: By kinematics, the pivot point and the Center of gravity form a vertical line at the threshold of instability of the cask during a tip-over event.*

- *The natural frequencies of the STC, UMS, MAGNASTOR transport casks are greater than 33Hz. Therefore, there is no amplification of the seismic force in any direction.*

  *Basis: By engineering judgement and past analysis records.*

### *7.6.6.4 Methodology*

*The maximum horizontal acceleration at the surface of the concrete pad due to an earthquake is evaluated. As required by 10 CFR 72.102 [7-74], the design minimum earthquake ground acceleration is 0.261g (Reference [7-33], page 60). This stability evaluation will show that the NAC STC, NAC-UMS, and MAGNASTOR transport cask systems at the WCS CISF are stable during the 0.261g design earthquake horizontal acceleration. The vertical acceleration is defined as 2/3 of the horizontal acceleration in accordance with ASCE 4-86 [7-75].*

*This evaluation determines the effects of ground accelerations (horizontal components $a_x$, $a_z$ and vertical component $a_y$) on the Transport cask for tip-over. The peak ground acceleration is associated with a safe shutdown earthquake. For this evaluation, the maximum overturning moment is compared to the restoring moment required to keep the cask in a stable upright position (i.e., cask will not tip over due to the earthquake). The maximum ground accelerations and overturning/restoring forces and moment are calculated for both empty and fully loaded cask configurations.*

*In the event of earthquake, there exists a base shear force or overturning force due to the horizontal ground acceleration and a restoring force due to the net force of vertical ground acceleration and gravity. This ground motion tends to rotate the cask about the bottom corner at the point of rotation (at the chamfer). The horizontal moment arm is from the CG toward the outer radius of the cask. The vertical moment arm is from the CG to the bottom of the cask. If the overturning moment is greater than the restoring moment, the cask may tip over. Using the geometry of the cask design, the maximum horizontal and vertical ground accelerations that the cask can safely withstand without becoming unstable are identified.*

*The two orthogonal horizontal acceleration components ($a_x$ and $a_z$) are combined for maximum horizontal acceleration magnitude. The result is applied simultaneously with the vertical component to statically evaluate the overturning force and moment. Upward ground acceleration reduces the vertical force that restores the cask to its undisturbed vertical position. Based upon the requirements presented in NUREG-0800 [7-43], the static analysis method is considered applicable if the natural frequency of the structure is greater than 33 cps (Hz). The natural frequency of the STC, UMS, MAGNASTOR transport cask are greater than 33Hz. During the design basis earthquake event, a factor of safety of greater than 1 against tip over of the cask must be maintained.*

### 7.6.6.5 Evaluation

*To maintain the metal transport cask in equilibrium, the restoring moment, $M_R$ must be greater than, or equal to, the overturning moment, $M_O$. The combination of horizontal and vertical acceleration components is based on the 100-40-40 approach of ASCE 4-86 [7-75], which considers that when the maximum response from one component occurs, the response from the other two components statistically are at 40% of their respective maximum value. Normally, the maximum vertical component of acceleration can be obtained by scaling the maximum ground acceleration by two-thirds. However, the maximum vertical acceleration is very conservatively considered to be the same as the design basis ground acceleration.*

*Let:*

*a = maximum design basis earthquake ground acceleration in the horizontal direction*

*$a_x$ = horizontal acceleration component in X-direction*

*$a_z$ = horizontal acceleration component in Z-direction*

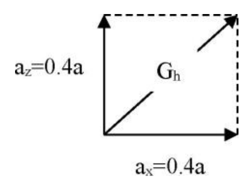
*$a_y$ = vertical acceleration component in Y-direction*

*$G_H$ = Vector sum of two horizontal acceleration components*

*$G_V$ = Vertical acceleration component*

*Two cases are analyzed:*

*Case 1) The vertical acceleration, $a_y$, is at its peak:*

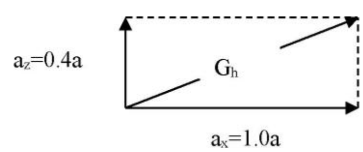



$$\left(a_y = 1.0a,\ a_x = 0.4a,\ \text{and}\ a_z = 0.4a\right)$$

$$G_H = \sqrt{a_x^2 + a_z^2} = \sqrt{(0.4a)^2 + (0.4a)^2} = 0.566a$$

$$G_v = 1.0a_y = 1.0a$$

*Case 2) One horizontal acceleration, $a_x$, is at its peak:*




$$\left(a_x = a,\ a_y = 0.4a,\ \text{and}\ a_z, = 0.4a\right)$$

$$G_H = \sqrt{a_x^2 + a_z^2} = \sqrt{(1.0a)^2 + (0.4a)^2} = 1.077a$$

$$G_v = a_y = 0.4a$$



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*For the cask to resist overturning, the restoring moment ($M_R$) about the point of rotation must be greater than the overturning moment ($M_o$).*

$$M_R \geq M_O \text{ or } F_r b \geq F_o d; \text{ therefore, } (W \times 1 - W \times G_V) \times b \geq (W \times G_H) \times d \qquad \text{(Eq 7.6.6.5-1)}$$

*$d$ = vertical distance measured from the base of the cask to the center of gravity*

*$b$ = horizontal distance measured from the point of rotation to the C.G.*

*$W$ = the weight of the metal cask*

*$F_o$ = overturning force*

*$F_r$ = restoring force*

*Substituting for $G_V$ and $G_H$ into Equation 7.6.6.5-1 gives:*

| *Case 1 (primary vertical)* | *Case 2 (primary horizontal)* |
|---|---|
| $(1-a)\dfrac{b}{d} \geq 0.566a$ | $(1-0.4a)\dfrac{b}{d} \geq 1.077a$ |
| $a \leq \dfrac{\frac{b}{d}}{0.566+\frac{b}{d}}$ | $a \leq \dfrac{\frac{b}{d}}{1.077+0.4\times\frac{b}{d}}$ |

*These equations are solved for each of the transport cask designs, in both loaded and empty configurations, and summarized in Table 7-44.*

*For the loaded transport casks, the minimum factor of safety to withstand a tip-over accident under Case 1 seismic load scenario is 1.55 for UMS loaded transport cask. The minimum factor of safety to withstand a tip-over accident under Case 2 seismic load scenario is 1.19 for UMS loaded transport cask. Each of the NAC transport casks, loaded or empty, meet the acceptance criteria of a FS greater than 1.*

7-57 SC-SASSI Manual, Version 2.1.7, SC Solutions, Inc., November 6, 2015.

7-58 Nuclear Energy Institute (NEI), "Consistent Site-Response/Soil-Structure Interaction Analysis and Evaluation," June 2009.

7-59 Deleted.

7-60 Deleted.

7-61 ANSI/AISC N690-06, "Specification for the Design, Fabrication, and Erection of Steel Safety-Related Structures in Nuclear Facilities."

7-62 ANSI/AISC 360-05, "Specification for Structural Steel Buildings."

7-63 APA Consulting Computer Code SASSI, Version 1.0.

7-64 ASCE 7-10, "Minimum Design Loads for Buildings and Other Structures."

7-65 ANSYS Computer Code and User's Manual, Version 16.0.

7-66 Calculation AREVATN00l-CALC-002, Rev. 0 "Soil Structure Interaction Analysis of TN Independent Spent Fuel Storage Installation (ISFSI) Concrete Pad at Andrews, TX."

7-67 Calculation AREVATN00l-CALC-001, Rev. 2 "ISFSI Pad Design for WCS at Andrews, Texas."

7-68 ACI 349-13, "Code Requirements for Nuclear Safety-Related Concrete Structures and 731Commentary."

7-69 ASCE 7-16, "Minimum Design Loads for Buildings and Other Structures."

7-70 ASME NOG-1-2015, "Rules for Construction of Overhead Gantry Cranes (Top Running Bridge, Multiple Girder)," The American Society of Mechanical Engineers, 2015.

7-71 ASCE/SEI 4-16, "Seismic Analysis of Safety-Related Nuclear Structures," American Society of Civil Engineers, 2016.

7-72 NIST GCR 12-917-21, "Soil-Structure Interaction for Building Structures," September 2012.

7-73 Calculation NAC004-CALC-01, Rev. 2, "Licensing Design of Independent Spent Fuel Storage Installation (ISFSI) Concrete Pad at Andrews, TX."

*7-74 10CFR72, "Licensing Requirements for the Independent Storage of Spent Nuclear Fuel and High-Level Radioactive Materials," January 1, 1994.*

*7-75 ASCE 4-86, "Seismic Analysis of Safety-related Nuclear Structures and Commentary on Standard for Seismic Analysis of Safety-related Nuclear Structures," ASCE 4-86, American Society of Civil Engineers, September 1986.*

*7-76 NAC Calculation 30039-2025, Rev. 0, "Seismic Stability of the NAC-UMS, NAC-STC and NAC-MAGNATRAN Transport Casks at WCS CISF"*

*7-77 AECOM Specification SPEC-15-1001, "Cask Handling Building (CHB) Specification for Cask Handling Overhead Bridge Crane," Revision A.*



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***Table 7-44***
***Evaluation Results with Factors of Safety for Transportation Cask Stability***

| ***Transport Cask Type*** | ***Minimum Earthquake Level to cause a Tipover (g)*** | | ***Factor of Safety*** | |
|---|---|---|---|---|
| | ***Case 1*** | ***Case 2*** | ***Case 1*** | ***Case 2*** |
| *STC, empty* | *0.442* | *0.357* | *1.69* | *1.37* |
| *UMS, empty* | *0.412* | *0.321* | *1.58* | *1.23* |
| *MAGNATRAN, empty* | *0.428* | *0.340* | *1.64* | *1.30* |
| *STC, loaded* | *0.436* | *0.350* | *1.67* | *1.34* |
| *UMS, loaded* | *0.403* | *0.311* | *1.55* | *1.19* |
| *MAGNATRAN, loaded* | *0.420* | *0.330* | *1.61* | *1.26* |

7. Attach slings to the upper impact limiter lifting lugs and the crane hook and remove the tamper indicating seal.

8. Remove the top impact limiter lock wires, jam nuts, attachment nuts, and retaining rods and remove the upper impact limiter from the transport cask.

9. Repeat the operations in Steps 7 and 8 for the bottom impact limiter.

10. Complete radiation and contamination surveys for exposed transport cask surfaces.

11. Release the tiedown assembly from the front support by removing the front tiedown pins and retaining pins.

12. Attach a sling to the tiedown assembly lifting lugs and remove the tiedown assembly from the transport vehicle.

13. *Using one of the CHB overhead cranes, attach* the transport cask lifting yoke *(Item 2, Section 4.10)* to a crane hook with the appropriate load rating and engage the two yoke arms with the primary lifting trunnions at the top of the transport cask.

14. Rotate/lift the transport cask to the vertical position and raise the cask off the rear support structure *of the railcar*.

15. *Move and place* the cask *at the predetermined location on the CHB deck* in the vertical position. *Disengage the yoke from the cask lifting trunnions and remove it from the immediate area. Note, no physical restraints are required to maintain the transport cask in vertical position as evaluated in SAR Section 7.6.6.*

16. Wash any dust and dirt off the cask and decontaminate cask exterior, as required.

17. *Using the VCT, engage the transportation cask primary lifting trunnions. Then lift the transport cask off the CHB deck between 3 and 6 inches and move the transport cask to the CTS in preparation for canister transfer to its designated storage overpack.*

#### E.5.1.4.2 Preparing to Unload the Transportable Storage Canister from the NAC-STC Transport Cask

The assumptions underlying this procedure are:

- The NAC-STC Transport Cask is in a vertical position in the designated unloading area.
- The top of the NAC-STC Transport Cask is accessible.
- The NAC-STC contains a sealed transportable storage canister.

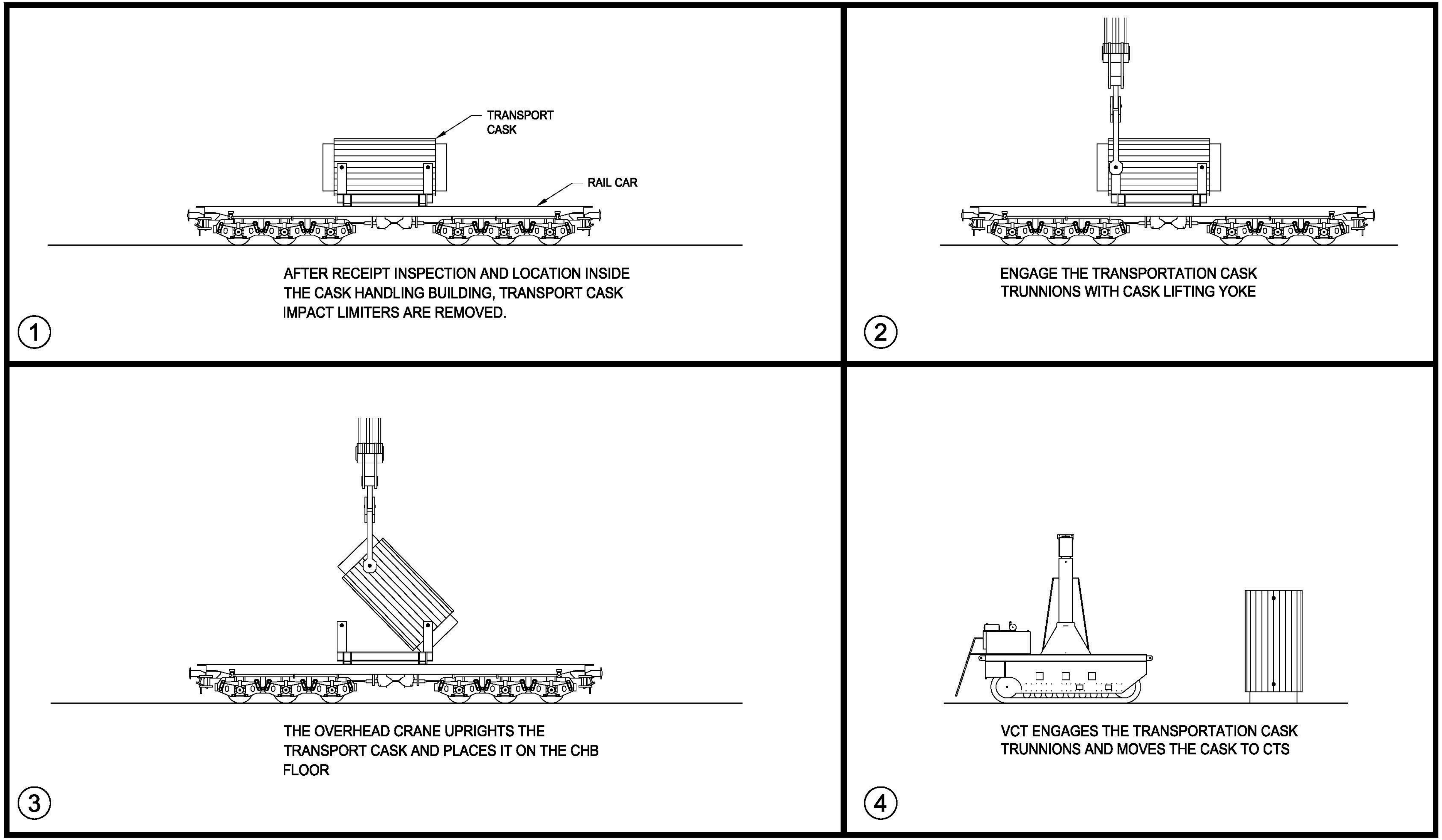


**Figure E.5-1**
**Canister Transfer Operations**
2 Pages



All Indicated Changes are in response to RAI NP-4-4

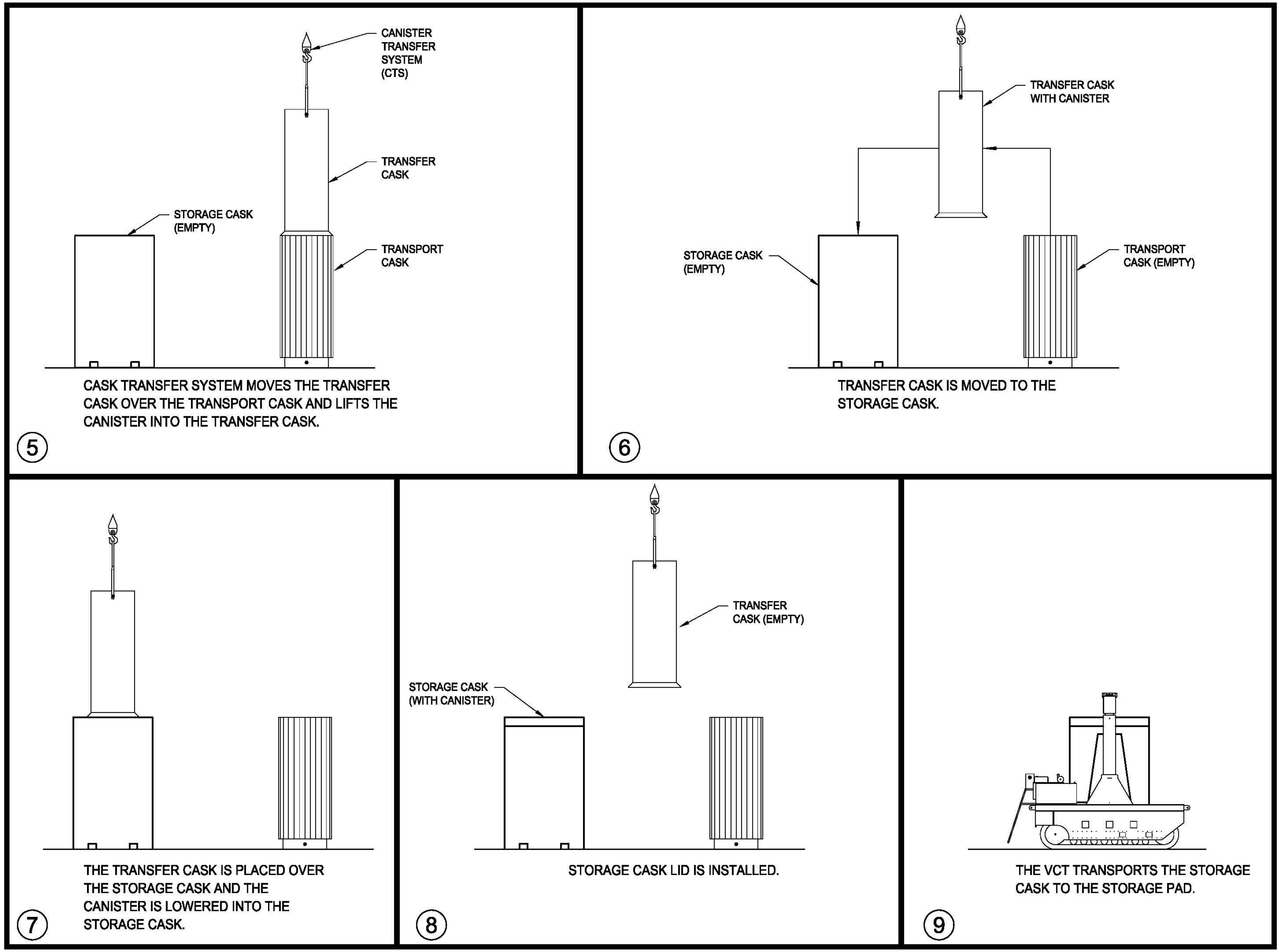


**Figure E.5-1**
**Canister Transfer Operations**
2 Pages



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4. While the cask is in the horizontal position on the transport vehicle, visually inspect the cask for any physical damage that may have been incurred during transport.
5. Verify that the tamper indicating seals are in place, and verify their numbers.
6. Move the transport vehicle to the cask receiving area and secure the vehicle.
7. Attach slings to the upper impact limiter lifting lugs and the crane hook and remove the tamper indicating seal.
8. Remove the upper impact limiter lock wires, jam nuts, attachment nuts, and retaining rods and remove the upper impact limiter from the transport cask.
9. Repeat the operations in Steps 7 and 8 for the lower impact limiter.
10. Remove the lower impact limiter positioner screws and store the positioner and screws.
11. Complete radiation and contamination surveys for exposed transport cask surfaces.
12. Release the tiedown assembly from the front support by removing the front tiedown pins and retaining pins.
13. Attach a sling to the tiedown assembly lifting lugs and remove the tiedown assembly from the transport vehicle.
14. *Using one of the CHB overhead cranes, attach* the transport cask lifting yoke *(Item 3, Section 4.10)* to a crane hook with the appropriate load rating and engage the two yoke arms with the primary lifting trunnions at the top of the transport cask.
15. Rotate/lift the transport cask to the vertical position and raise the cask off the rear support structure *of the railcar*.
16. *Move and place* the cask *at the predetermined location on the CHB deck* in the vertical position. *Disengage the yoke from the cask lifting trunnions and remove it from the immediate area. Note, no physical restraints are required to maintain the transport cask in vertical position as evaluated in SAR Section 7.6.6.*
17. Wash any dust and dirt off the cask and decontaminate cask exterior, as required.
18. *Using the VCT, engage the transportation cask primary lifting trunnions. Then lift the transport cask off the CHB deck between 3 and 6 inches and move the transport cask to the CTS in preparation for canister transfer to its designated storage overpack.*


All Indicated Changes are in response to RAI NP-4-4

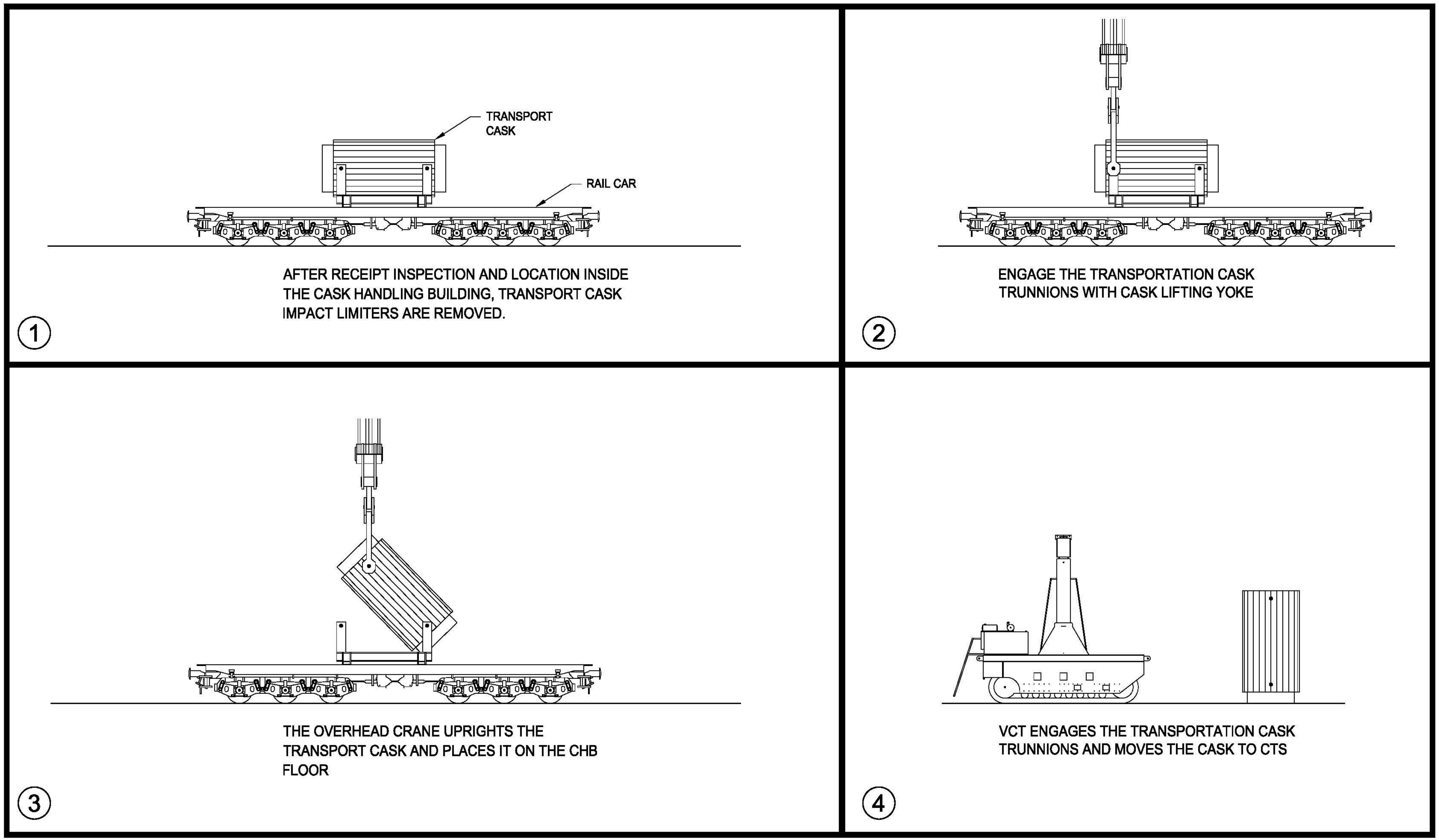


**Figure F.5-1**
**Canister Transfer Operations**
2 Pages


All Indicated Changes are in response to RAI NP-4-4

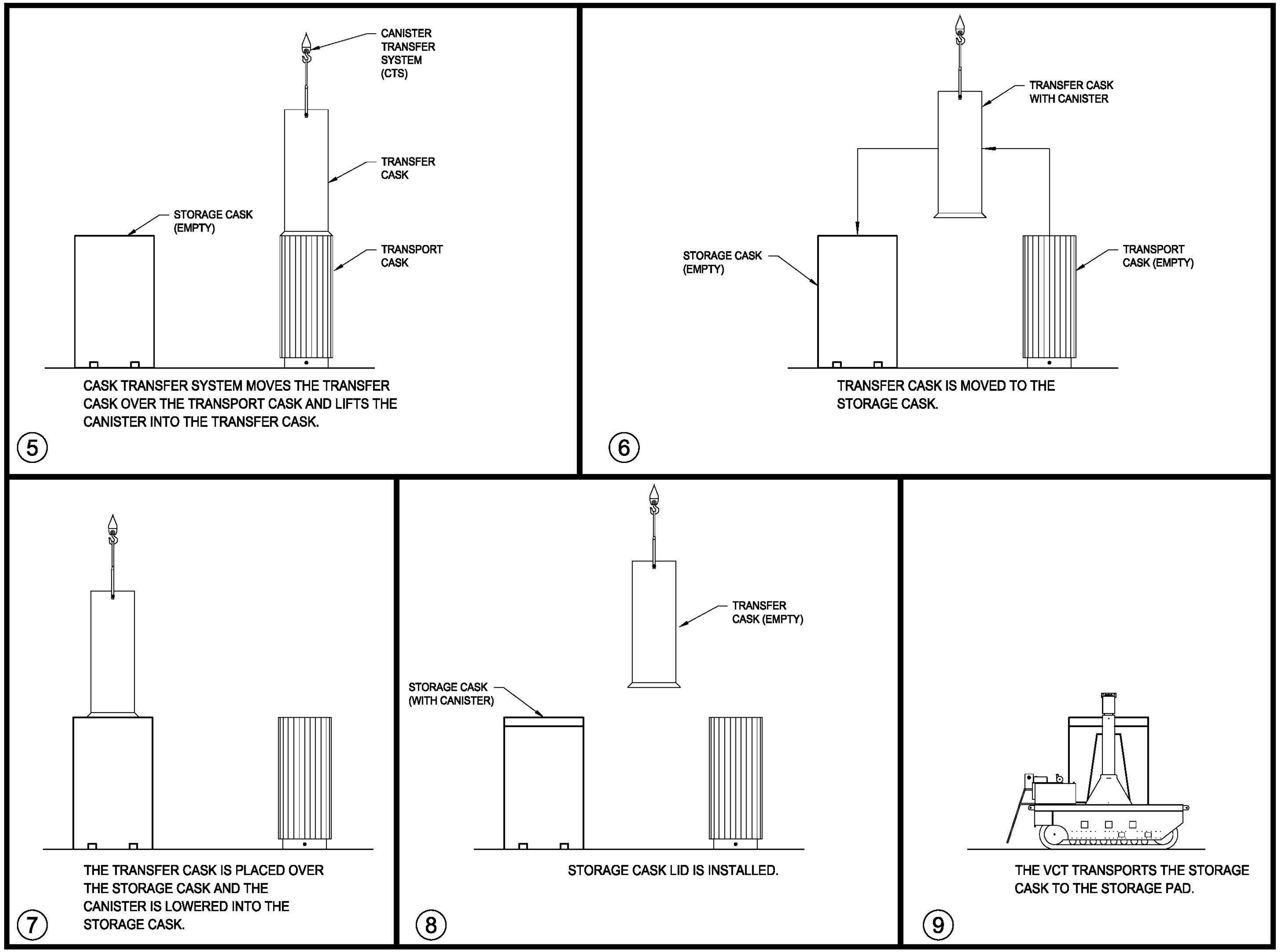


**Figure F.5-1**
**Canister Transfer Operations**
2 Pages


All Indicated Changes are in response to RAI NP-4-4

#### G.5.1.4.1 Performing Receiving Inspection of the Loaded MAGNATRAN Transport Cask

1. Upon receipt of the loaded MAGNATRAN transport cask, perform and record radiation and removable contamination surveys on the transport vehicle, personnel barrier and package surfaces to verify that radiation dose rates and contamination levels comply with the requirements of 10 CFR 20.1906, the limits of 10 CFR 71.87(i), and the limits of 10 CFR 71.47.

2. Remove the personnel barrier and complete radiation and contamination surveys of the now-accessible package surfaces to verify that radiation dose rates and contamination levels comply with the requirements of 10 CFR 20.1906, the limits of 10 CFR 71.87(i), and the limits of 10 CFR 71.47.

3. Perform a visual receipt inspection of the vehicle and package to identify any transport damage. Clean the vehicle and cask of road dirt and debris. Cleaning of the package exterior shall ensure that surfaces are cleaned of chloride-containing salts and other corrosive agents. Confirm the acceptable removal of chloride-containing salts and other corrosive agents.

4. Verify the tamper indicating device (TID) installed on the upper impact limiter is intact and the identification number matches the number documented on the shipping papers. Make appropriate notifications if tampering is suspected. Remove the TID.

5. Move the transport vehicle to the cask unloading area. Secure the vehicle by applying the brakes or chocking the wheels. Attach impact limiter slings to the upper impact limiter and a suitable crane hook and take up the slack in the slings.

6. Remove the impact limiter lock wires and the jam and attachment nuts. Remove the impact limiter retaining rods. Remove the upper impact limiter and store it in the upright position in a clean area.

7. Repeat Steps 5-6 for the lower impact limiter.

8. Complete radiation and contamination surveys for exposed transport cask surfaces.

9. Release the front tie-down assembly from the top forging of the cask and remove the rotation trunnion tie-downs. Remove the two trunnion plugs and store the plugs and bolts to prevent damage. Visually inspect the trunnion recesses for any damage.

10. Using *one of the CHB overhead cranes* and slings, lift and position a lifting trunnion, install the attachment bolts, and torque the bolts as specified. Repeat for the second lifting trunnion.



All Indicated Changes are in response to RAI NP-4-4

11. *Using one of the CHB overhead cranes, attach* the cask lifting yoke *(Item 4, Section 4.10)* to the cask handling crane hook. Verify the proper operation of the lift arm pneumatic actuation system. Position the cask lifting yoke arms adjacent to the cask lifting trunnions and close the arms using the actuation system. Visually verify proper yoke arm engagement.

12. Lift and rotate the cask to the vertical orientation on the rotation trunnions. Lift the cask from the transport frame/vehicle rear support structure *of the railcar* and position the cask vertically *at the predetermined location on the CHB deck. Note, no physical restraints are required to maintain the transport cask in vertical position as evaluated in SAR Section 7.6.6.*

13. Disengage the yoke from the cask lifting trunnions and remove it from the immediate area. Wash any dust and dirt off the cask and decontaminate cask exterior, as required

14. *Using the VCT, engage the transportation cask primary lifting trunnions. Then lift the transport cask off the CHB deck between 3 and 6 inches and move the transport cask to the CTS in preparation for canister transfer to its designated storage overpack.*

15. Install appropriate work platforms, scaffolding or lifts to facilitate access to the top of the cask.

G.5.1.4.2 Preparing to unload the transportable storage canister (TSC) from the MAGNATRAN Transport Cask

The assumptions underlying this procedure are:

- The MAGNATRAN Transport Cask is in a vertical position in the designated unloading area.
- The top of the MAGNATRAN Transport Cask is accessible.

The procedures for preparing to unload the TSC from the MAGNATRAN Transport Cask are:

1. Detorque and remove the lid port coverplate bolts. Visually inspect the bolt threads for damage and store them. Remove the coverplate and store it.

2. Attach a pressure fixture, including a pressure gauge, evacuated gas sample bottle and a valve to the lid port quick-disconnect valve. Measure the cask internal pressure. Withdraw a sample of the cavity gas using the evacuated sample bottle and determine the cask cavity's gaseous activity. If activity and pressure levels are acceptable per facility criteria, vent the cavity gas to an appropriate filter/system. Disconnect the pressure fixture from the lid port.

3. Detorque and remove the cask lid bolts using the reverse of the torquing sequence shown on the lid. Clean and inspect the bolt threads for damage and store them.



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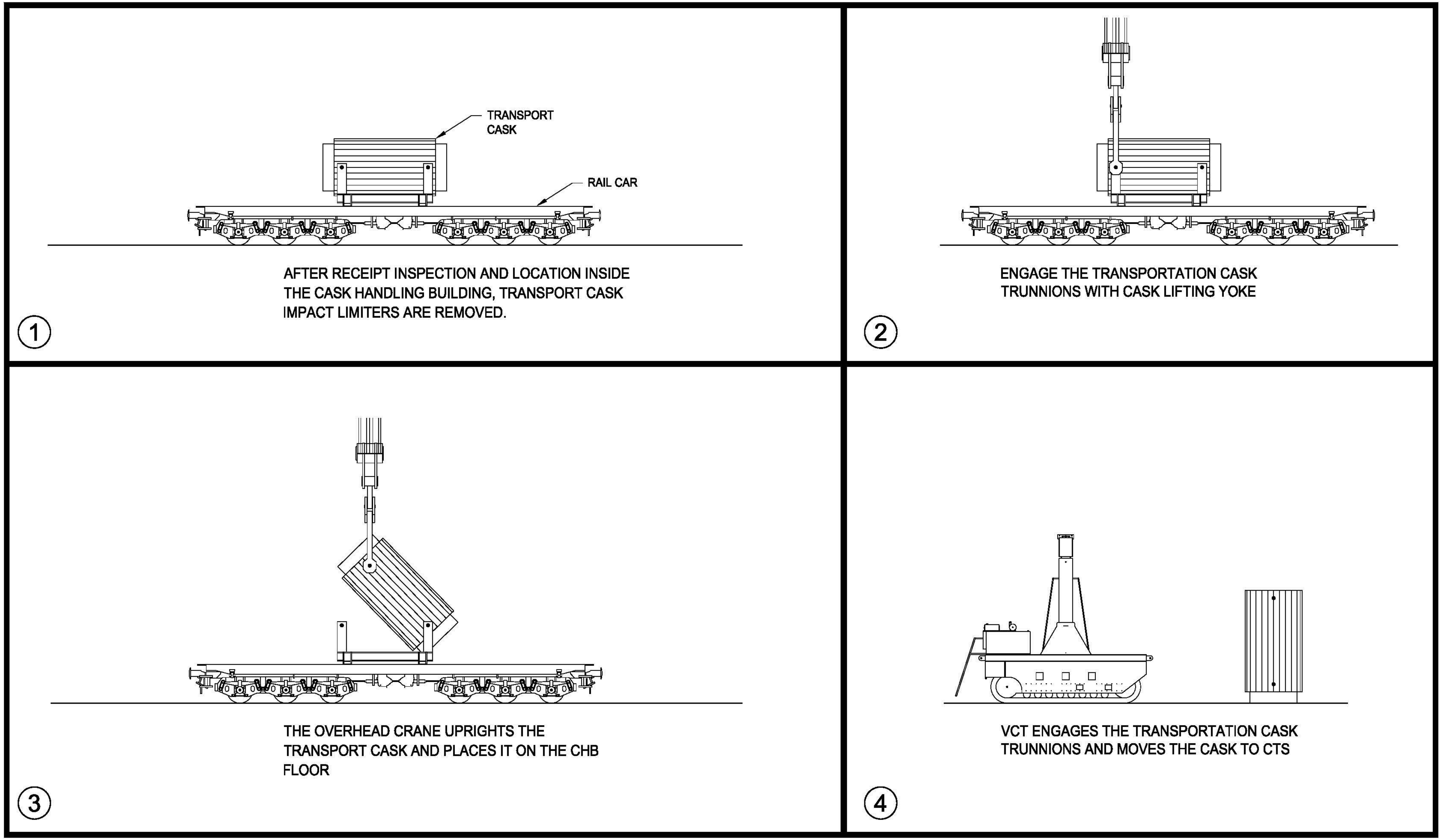


**Figure G.5-1**
**Canister Transfer Operations**
2 Pages



All Indicated Changes are in response to RAI NP-4-4

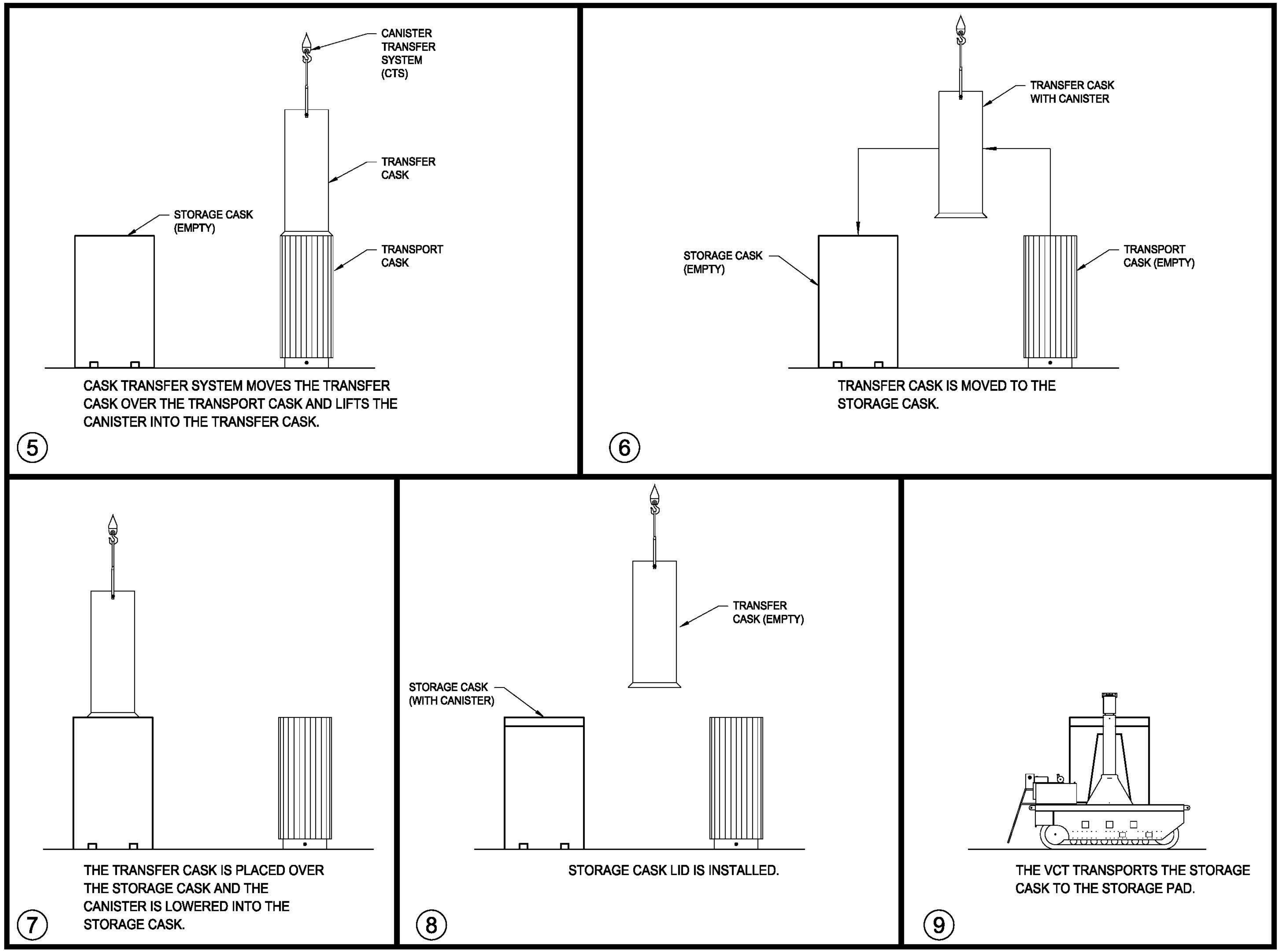


**Figure G.5-1**
**Canister Transfer Operations**
2 Pages



All Indicated Changes are in response to RAI NP-4-4