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High-Burnup Demo Cask Receipt at INL

October 2020

Considerations for the Transport, Receipt, and Opening of the TN-32B High-Burnup Demo Cask

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EXECUTIVE SUMMARY

The Idaho Settlement Agreement[a] and related supplements between the Department of Energy and the State of Idaho are clear that the spent fuel under consideration is prohibited from being received at the Idaho National Laboratory (INL) under present restrictions. This report is a planning document under the presumption that this prohibition is modified (eased or lifted) at some future date such that the receipt and opening of the high-burnup demo cask (HBDC) at INL is deemed allowable.

In support of the High-Burnup Spent Fuel Data Project[b], the HBDC and spent nuclear fuel (SNF) contents were placed in dry storage in November 2017, with periodic thermal data collection to continue throughout the intended 10-year storage period. The High-Burnup Spent Fuel Data Project anticipates the HBDC will be transported and opened to allow spent fuel examinations that can support the licensing safety bases for extended storage of high-burnup spent fuels. To avoid disturbing the properties of the cask, cladding, fuel, and other hardware, the desire is to transport the HBDC to a facility with capabilities for cask and dry fuel handling, with the intent to avoid rewetting the cask and contents.

The designated research project cask is a single TN-32B cask at the North Anna Power Station (NAPS) Independent Spent Fuel Storage Installation (ISFSI). This report assumes the HBDC can be transported to, received at, and opened at the INL Site, with the spent fuel removed and prepared for examination at facilities located at INL. It is assumed that some SNF rods and pins are removed from the HBDC using capabilities at the CPP-603 facility as adapted for such task, and delivered to the Hot Fuel Examination Facility (HFEF) for examination and testing in a manner analogous to that done earlier for the "sibling pins."[c]

This report examines the considerations necessary and prudent for an anticipated transport, receipt, and opening of the HBDC with SNF retrieval and examination at INL in support of the High-Burnup Spent Fuel Data Project.

This report fulfills the M4 milestone, M4SF-20IN010201042, "Steps Needed and Timeline for Acceptance of Demo Cask to INL."

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[a] https://www.deq.idaho.gov/inl-oversight/oversight-agreements/1995-settlement-agreement/

[b] The U.S. Department of Energy Office of Nuclear Energy, Office of Fuel Cycle Technology under the Used Fuel Disposition Campaign instituted the "High Burnup Spent Fuel Data Project," which is how it is referred to herein. It has also been referred to in earlier documents as the "High Burnup Dry Storage Cask Research and Development Project" or the "High Burnup Dry Storage Research Project."

[c] See EPRI 2014, High Burnup Dry Storage Cask Research and Development Project Final Test Plan https://www.energy.gov/sites/prod/files/2014/03/f8/HBUDry%20StrgeCaskRDfinalDemoTestPlanRev9.pdf

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FIGURES

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ACRONYMS

CFA	Central Facilities Area
CoC	certificate of compliance
DOE	Department of Energy
EPRI	Electric Power Research Institute
HBDC	high-burnup demonstration cask
HBU	high burnup
HFEF	Hot Fuels Examination Facility
INL	Idaho National Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
IPT	Integrated Project Team
ISFSI	Independent Spent Fuel Storage Installation
MFC	Materials and Fuels Complex
NAPS	North Anna Power Station
NRC	Nuclear Regulatory Commission
ORNL	Oak Ridge National Laboratory
PCS	permanent containment structure
PNNL	Pacific Northwest National Laboratory
SNF	spent nuclear fuel

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HBU Demo Cask Receipt at INL

1. Background and Introduction

The High-Burnup Spent Fuel Data Project is being performed by the U.S. Department of Energy's Spent Fuel and Waste Science and Technology research and development program. This project is obtaining data to support the enhancement of the technical bases for the extended storage and transportation of high burnup (HBU) (>45 GWd/MTU) spent nuclear fuel (SNF).

Under this project, a U.S. Nuclear Regulatory Commission-licensed storage cask was loaded with 32 HBU SNF assemblies from the North Anna Nuclear Power Stations (NAPS) spent fuel pool. The storage module selected for this demonstration is a modified Orano TN-32B high-burnup cask, referred to hereafter as the high-burnup demo cask (HBDC). The HBDC was modified to allow radial and axial temperature profiles to be measured using thermocouple lances inserted through the lid (see Figure 1).

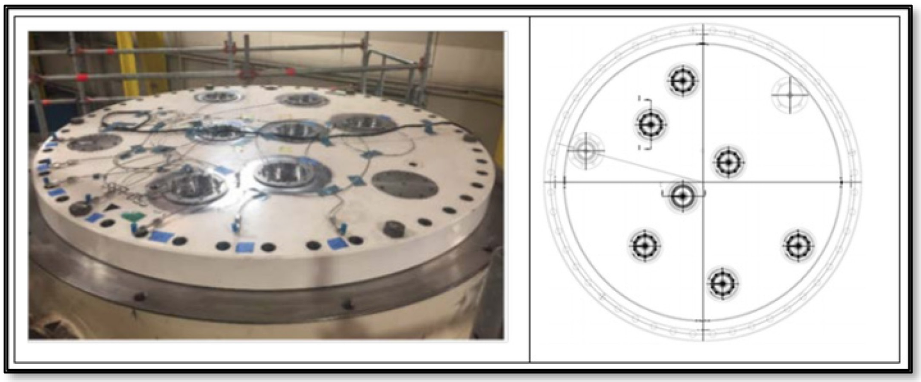

Figure 1. Thermocouple lance locations in TN-32B lid—the drain and vent ports are also visible.

Loading of the HBDC was completed in November 2017, and the HBDC was moved to Pad No. 1 on the NAPS Independent Spent Fuel Storage Installation (ISFSI) (see Figure 2 and 3), a reinforced concrete pad under a site-specific license (License Number SNM-2507). Thermal data monitoring is expected to continue for at least ten years. Cask gas sampling is desired but infrequent.

Figure 2. TN-32B HBU demonstration cask on North Anna ISFSI and temperature data equipment (Photo courtesy of Dominion Energy).

Figure 3. North Anna Power Station ISFSI with Pad 1 on the left (Google Maps screen shot).

An overall goal of the High-Burnup Spent Fuel Data Project for the HBDC is to collect and develop data for model validation, provide input to future SNF dry-storage cask design, support license renewals and new licenses for ISFSIs, and support transportation licensing for high-burnup SNF. After a period of at least 10 years, the High-Burnup Spent Fuel Data Project calls for the HBDC to be transported from NAPS to an appropriate facility capable of opening the cask so the HBU SNF can be examined and tested as representing a dry-storage configuration.

The fuel assemblies in the HBDC now in storage at the NAPS ISFSI contain fuel rods that correspond to an earlier set of twenty-five HBU fuel rods (i.e., the "sibling rods") taken directly from assemblies in the NAPS spent fuel pool. Using a smaller canister, the sibling rods were then shipped in 2016 for detailed nondestructive examination and destructive examination at Oak Ridge National Laboratory (ORNL) and Pacific Northwest National Laboratory (PNNL). As noted above, additional HBU SNF assemblies were loaded into the HBDC and placed in dry storage at the NAPS ISFSI. To remove only some HBDC rods for shipment elsewhere (as opposed to the whole of the HBDC) would require rewetting the fuel and cask, disturbing the properties of interest to the High-Burnup Spent Fuel Data Project. Thus, the desire is to transport the HBDC to a facility such as INL with the capabilities for handling large casks and dry fuel handling and thereby avoid rewetting the cask, cladding, fuel, and other hardware after extended dry storage.

The ability to handle the HBDC and examine the fuel assemblies is a motivating factor for the selection of the INL as the desired fuel examining facility for this project. This report examines the steps necessary and prudent for transporting the HBDC to INL. Once at INL, the cask is expected to be moved to and opened at the CPP-603 facility, with some contents transferred to the Hot Fuel Examination Facility (HFEF). Fuel examinations and testing at the HFEF are expected to be conducted according to an appropriate test and examination plan analogous to the tests and examinations performed on the "sibling pins" at ORNL and PNNL.[d]

The Idaho Settlement Agreement[e] and related supplements between DOE and the State of Idaho is explicitly clear that, under present conditions, the HBDC is prohibited from being received at INL. This document is a planning document under the presumption that this prohibition is modified (eased or lifted) at some future date such that receipt and opening the HBDC at INL is deemed allowable.

2. Scope

This report assumes key decisions for any necessary actions to bring the HBDC to the INL are resolved and refers to the capabilities of the existing sites at INL that would most likely be invoked. Previous reports[f] showing the level of readiness and the extent of the required effort needed to accept different casks are available and are generally applicable to the HBDC receipt and unloading.

This report is intended to briefly describe logistical considerations for the anticipated transport of the HBDC from its location at the NAPS ISFSI to the INL facilities for subsequent cask opening and handoff to the fuel/cask examination effort. In describing the pre-transport, transport, and receipt activities, the intent is to better assure that the test integrity (data quality objectives) are preserved by identifying those actions that may affect the data quality, and to identify key administrative boundaries and responsibilities (person or organization) for maintaining the integrity of the test and data objectives on either side of the 'chain of custody' before, during, and after transport to INL.

Conceptually the 'chain of custody' is broken into three phases: the pre-transport, the transport, and the cask receipt and unloading phase. Each is elaborated below.

2.1 Pre-Transport Issues

2.1.1 Stakeholders

To reiterate, at the present time, the Idaho Settlement Agreement effectively prohibits the import of the HBDC to the INL Site. Assuming relief has been negotiated between DOE and the State of Idaho prior to the scheduled shipment date, prudence would suggest that this be confirmed by representatives from the offices of DOE-NE, DOE-ID, and INL before final preparations are made for transport.

Most actions prior to and arranging for transport are the responsibility of the High Burnup Spent Fuel Data Project Team (DOE-NE81 with EPRI, et al.) and the NAPS personnel, including, but not limited to, arranging for transport services, securing transport certificates and licenses, performance of final data collections, etc.

2.1.2 Certification of the TN-32B

At the present time, the TN-32B does not hold a transportation Certificate of Compliance, though a review of the HBU Demonstration Cask Design/Licensing Basis documentation[g] filed with the Nuclear Regulatory Commission (NRC) would suggest this is anticipated and that the HBDC could be transported

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[d] See EPRI 2014, High Burnup Dry Storage Cask Research and Development Project Final Test Plan https://www.energy.gov/sites/prod/files/2014/03/f8/HBUDry%20StrgeCaskRDfinalDemoTestPlanRev9.pdf

[e] https://www.deq.idaho.gov/inl-oversight/oversight-agreements/1995-settlement-agreement/

[f] Viability of Existing INL Facilities for Dry Storage Cask Handling. Revision 1, April 2013, FCRD-UFD-2013-000027

[g] https://www.nrc.gov/docs/ML1523/ML15239B252.pdf, https://www.nrc.gov/docs/ML1633/ML16330A647.pdf

with a modified lid, where "four-paired bolting bars are attached to each end of the outer shell for attaching impact limiters to the HBU demonstration cask for future transportation."

The project team expects to leverage the TN-40 transportation certification to complete the eventual TN-32 certification, with a principal concern being the modified lid and thermocouple penetrations that serve as the cask containment boundary. The project team is exploring options for thermocouple treatment for transport and TN-32B transportation certification. Having begun pre-application meetings with NRC in 2019, the project team anticipates receiving a transportation CoC (presumably with the lid/thermocouple option decided) in 2022.

2.1.3 Facility Infrastructure

Because there is no active rail at the NAPS, the TN-32B will need to be readied for heavy-haul road vehicle transport from the NAPS ISFSI to a suitable railhead location for further transport to INL (assuming a railhead is not later established at NAPS). Transfer to and from the heavy-haul trailer will require the use of a crane system capable of moving the TN-32B at the ISFSI and railhead. The availability and capacity of heavy haul systems at NAPS for transferring the TN-32B needs to be confirmed.

As a part of the HBDC data collection process, it is assumed that a final thermal data scan will be completed before disconnecting the existing external data logger and thermocouple terminations. Whether the thermocouples can continue to be read during transport or terminated at NAPS such that they can be reconnected at INL is not yet known. The inclusion of the sampling of the cavity gas prior to transport and/or the addition of other sensors for transport (e.g. accelerometers) is not yet determined.

2.2 Transport of the HBU Demo Cask

It is expected that DOE, with the High Burnup Spent Fuel Data Project Team, will arrange transport, with the DOE taking the title at the NAPS boundary. As DOE takes the title to the SNF, it effectively will become part of the DOE-managed SNF inventory at INL upon its receipt. After some SNF is removed from the HBDC, any remaining contents will need to be placed in dry storage awaiting removal per the Idaho Settlement Agreement, as with all DOE-managed SNF at INL. Because this cask will have a valid transportation CoC from the NRC, it is assumed to be 'road-ready' at such time when there is a suitable receipt location outside the State.

For transport, all prior management approvals must be confirmed for the HBDC to be transported onto the INL Site with regards to the Idaho State Agreement, and all other necessary transport licensing/certifications or other arrangements (e.g. state notifications) secured. The contracted transport company has custody of the HBDC from North Anna to INL, and the High Burnup Spent Fuel Data Project Team should confirm that the integrity of the HBDC test conditions will be preserved during transport.

The High Burnup Spent Fuel Data Project Team and the transport company should maintain communications with INL regarding the departure and estimated time of arrival and monitor progress, in addition to the required NRC notifications, security requirements, etc. The INL receiving site will need to be prepared for receipt actions, such as an initial inspection of the HBDC and potential initial data collection.

The timeline for the transportation of the cask will be dependent on the mode of transportation (generally assumed to be by rail). A specific target date for transportation is still to be decided but cannot reliably be set until (1) Idaho State Agreement relief is obtained and (2) actions and conditions for receipt at INL (see next section) are complete.

2.3 Receipt, Storage, and Opening of the HBU Demo Cask

The current expectation is for the HBDC to remain at NAPS until the end of the 10-year extended storage period (~3rd quarter 2028). However, if the HBDC is arranged for an early removal from NAPS and to INL, it may be possible to hold the HBDC in an INL cask storage facility for the remaining duration before it undergoes the opening and assembly retrieval process.

The receipt and handling of the HBDC involves several remote facilities across the INL complex, principally the Central Facilities Area (CFA), the Idaho Nuclear Technology and Engineering Center (INTEC), and the Materials and Fuels Complex (see items in red in Figure 4, adapted from Price 2015).

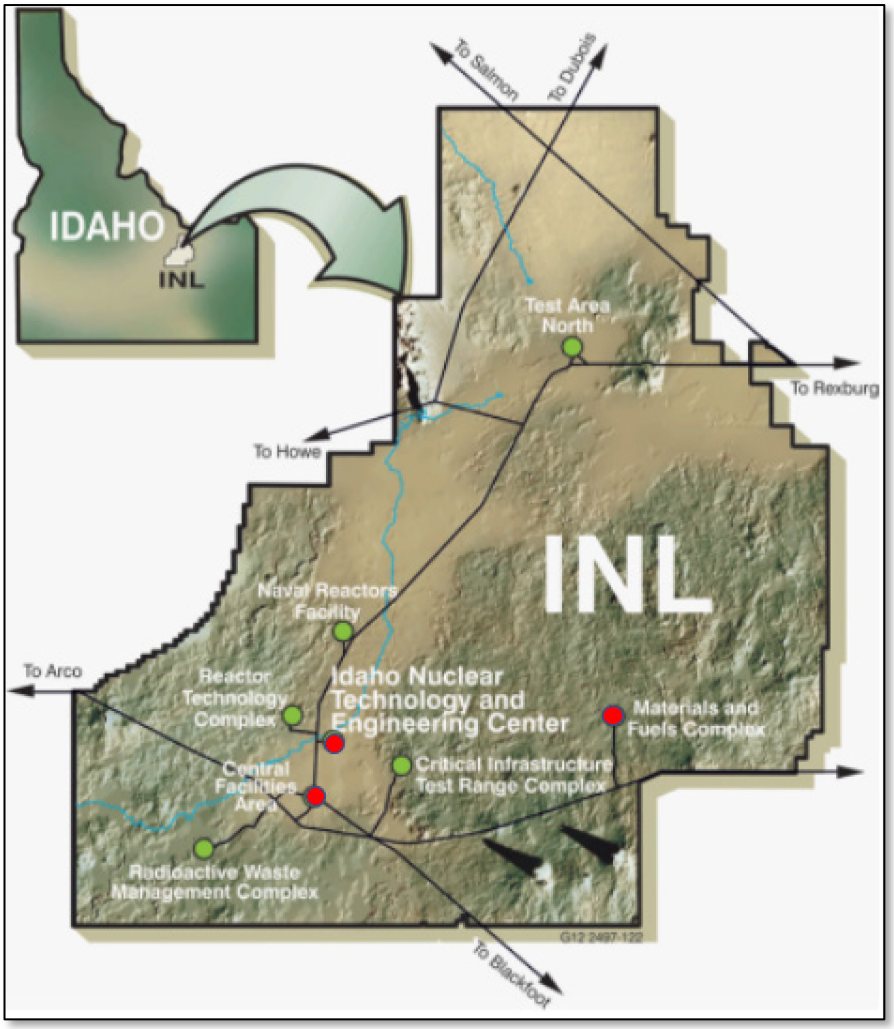

Figure 4. INL remote facilities.

The planning basis of this report draws on previous reports (Bohachek 2013, Price 2015) to consider the logistical path for the movement of the HBDC to and through INL property. Notionally that path includes:

- The HBDC rail car is received at the INL CFA railyard.

- The HBDC is moved to the INTEC, either the CPP-603 facility or to intermediate storage on CPP-2707 cask pad if received earlier than the 10-year storage end date.
- The HBDC is opened inside the fuel-handling cave of CPP-603 facility and selected contents removed for delivery to the Materials and Fuels Complex (MFC) to make use of its post-irradiation examination capabilities.
- The HBDC and remaining/returned contents will be placed at the INTEC CPP-2707 storage facility in a 'road-ready' configuration, awaiting removal per the Idaho Settlement Agreement, as with all DOE-managed SNF at INL.

Each operation is further summarized below.

2.3.1 HBDC Receipt at INL

Once enroute, the HBDC will eventually arrive at the State of Idaho and INL Site boundaries. The HBDC will be received at the existing CFA railyard shown in Figure 5. A previous report (Bohachek 2013) notes that a TN-32 cask can be transferred directly to the INTEC CPP-603 facility using an existing rail line. However, maintenance will need to be performed on the rail line that extends from the CFA switch (connecting to the main north-south line running through the INL Site) to the INTEC CPP-603 facility.

Alternatively, the TN-32 cask could also be transferred from the CFA railyard to INTEC by truck/trailer, either for placement on the CPP-2707 cask pad if received early or for transfer to the CPP-603 facility directly. A mobile boom crane would lift the cask off the rail car at CFA and place it on a truck/trailer to haul it to INTEC, ~5 miles north.

To enter CPP-603, the cask impact limiters will be removed and the cask placed on a low-boy trailer in a vertical position. INTEC has a mobile boom crane, 160-ton capacity that could be utilized for this transfer. The low-boy truck/trailer can then drive into CPP-603 through a modified bay door.

Confirmation that rail line maintenance has been completed and cleared for use, or that a heavy-haul truck/trailer and/or low-boy trailer is available, is a prerequisite to shipping the cask from NAPS, and should be coordinated with the DOE and the High Burnup Spent Fuel Data Project Team well in advance.

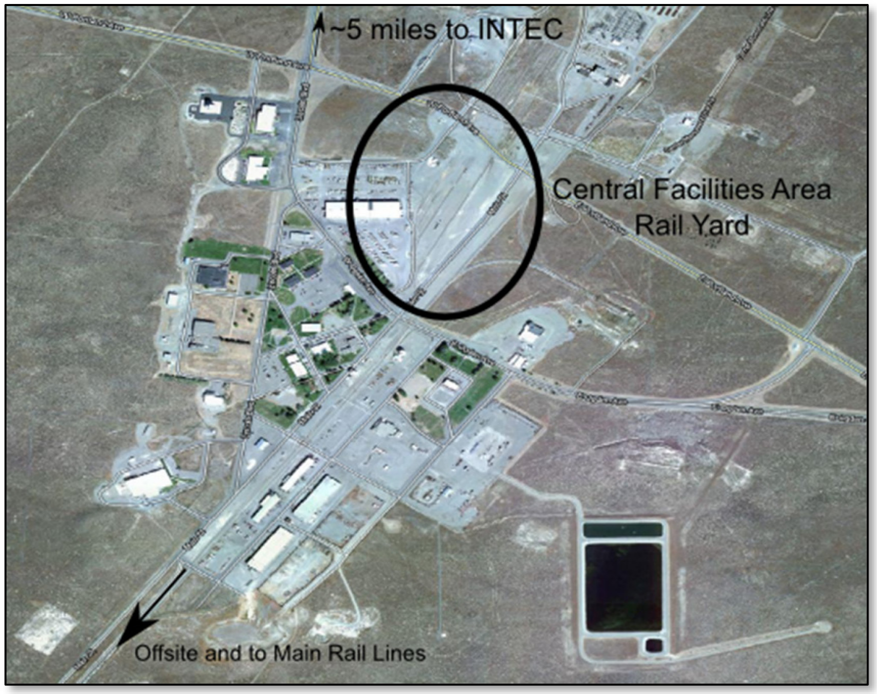

Figure 5. Aerial view of the Central Facilities Area and rail yard.

2.3.2 INTEC and CPP-603 Facility Operations

After passing through CFA, the HBDC will be directed, whether by truck or rail, to the INTEC and CPP-603 facility (see Figure 6). The essential elements of the CPP-603 facility (see Figure 8. Plan View CPP-603 (from Wahnschaffe, 2011, Figure 2). and Figure 9. Section View CPP-603, the PCS over the transfer pit not shown, (from Wahnschaffe, 2011, Figure 3).) include:

- the east-west truck bay and
- cask receiving area
- the permanent containment structure (PCS)
- the transfer pit and cask transfer car
- the fuel-handling cave.

The function of each element is briefly summarized below.

The cask receiving area currently contains a truck ramp accessible to fuel-cask-bearing trucks from a lower elevation for unloading and loading casks. The cask receiving area formerly included rail access, but this could possibly be remediated before the shipment of the HBDC (Bohachek 2013). The truck/trailer (or rail car) with the HBDC would enter the cask receiving area; upending of the HBDC may be necessary outside of the facility, depending on the overheard crane clearance and filling of the truck ramp. Once secured in the cask receiving area, the HBDC would be lifted by overhead crane and moved into the cask transfer car (fitted with appropriate insert and adaptor plates specific to the TN-32B) positioned inside the PCS.

The PCS, sitting above the south end of the transfer pit, has top and side panels that can be opened to provide crane access and allow the transfer of the cask to and from the cask transfer car. The PCS is the radiological boundary (Bohachek 2013) between the fuel-handling cave and the cask receiving area and confines any possible contamination that could be transferred out of the fuel-handling cave during operational use. Once inside the PCS, a cask going to or from the fuel-handling cave can be surveyed, vented, and decontaminated, if necessary. Cask lids are normally unbolted or unsealed, but not removed, in the PCS prior to movement of the cask into the fuel-handling cave.

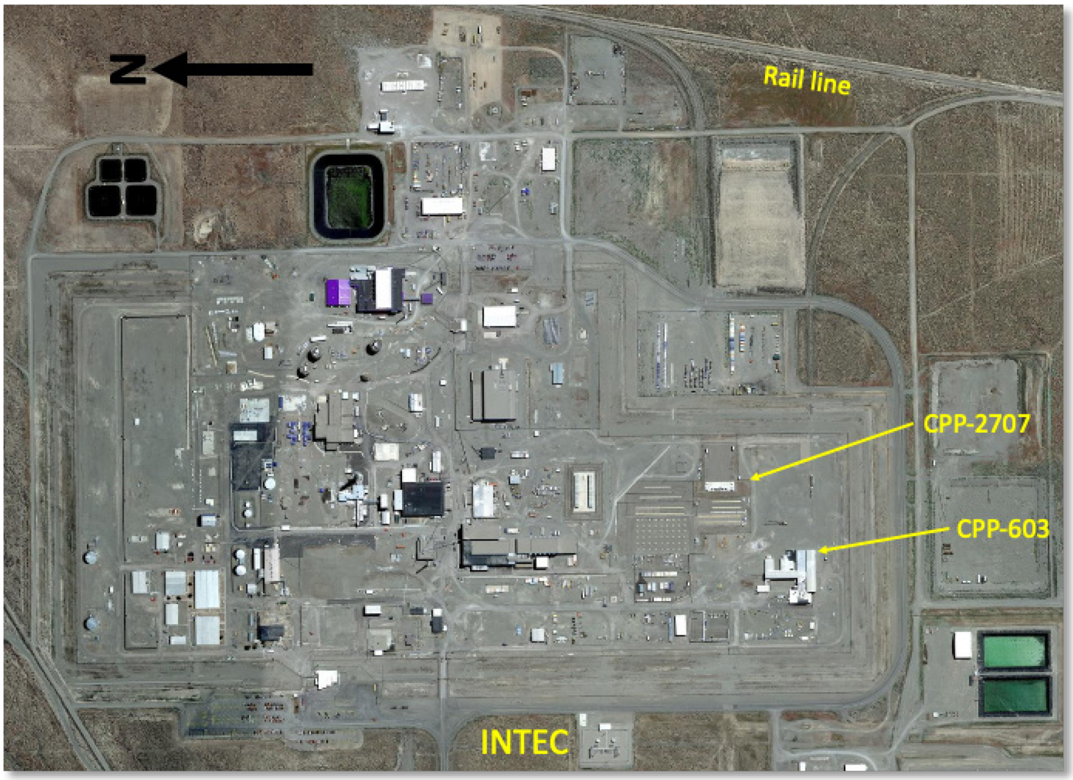

Figure 6. Aerial view of INTEC showing CPP-603 and CPP-2707.

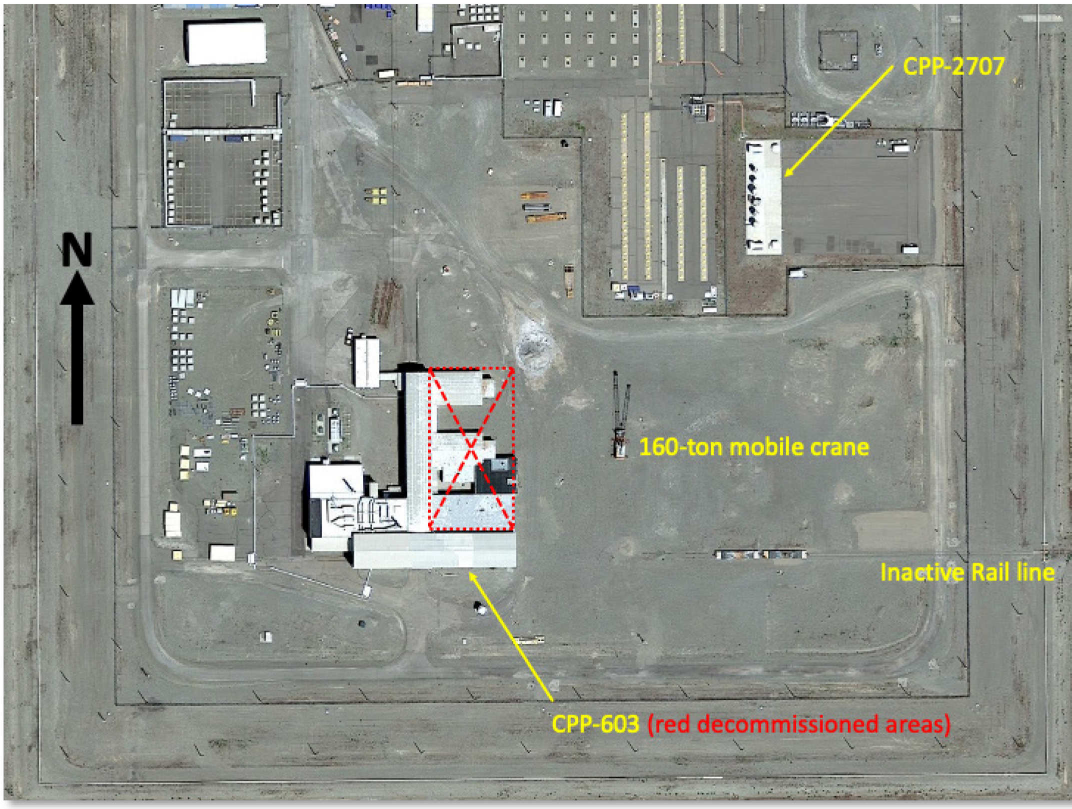

Figure 7.CPP-603 and CPP-2707 (more detail).

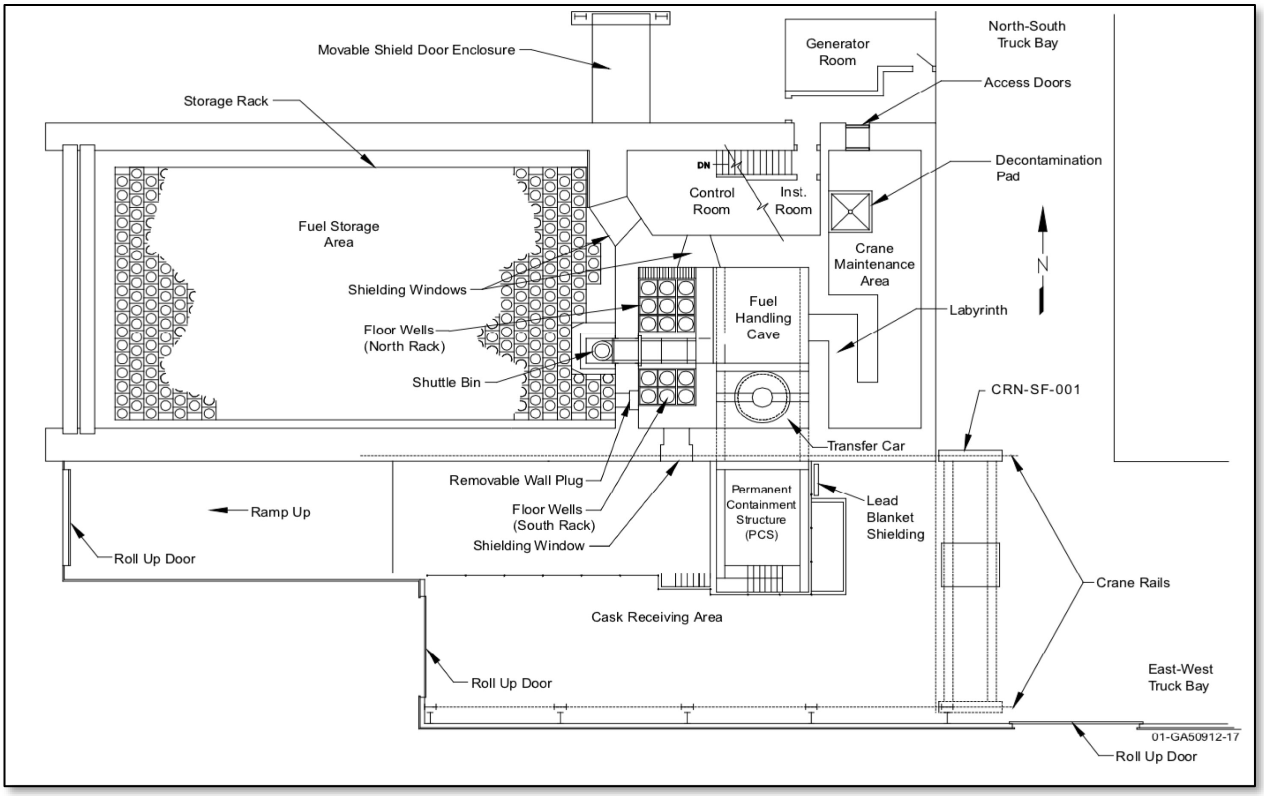

Figure 8. Plan View CPP-603 (from Wahnschaffe, 2011, Figure 2).

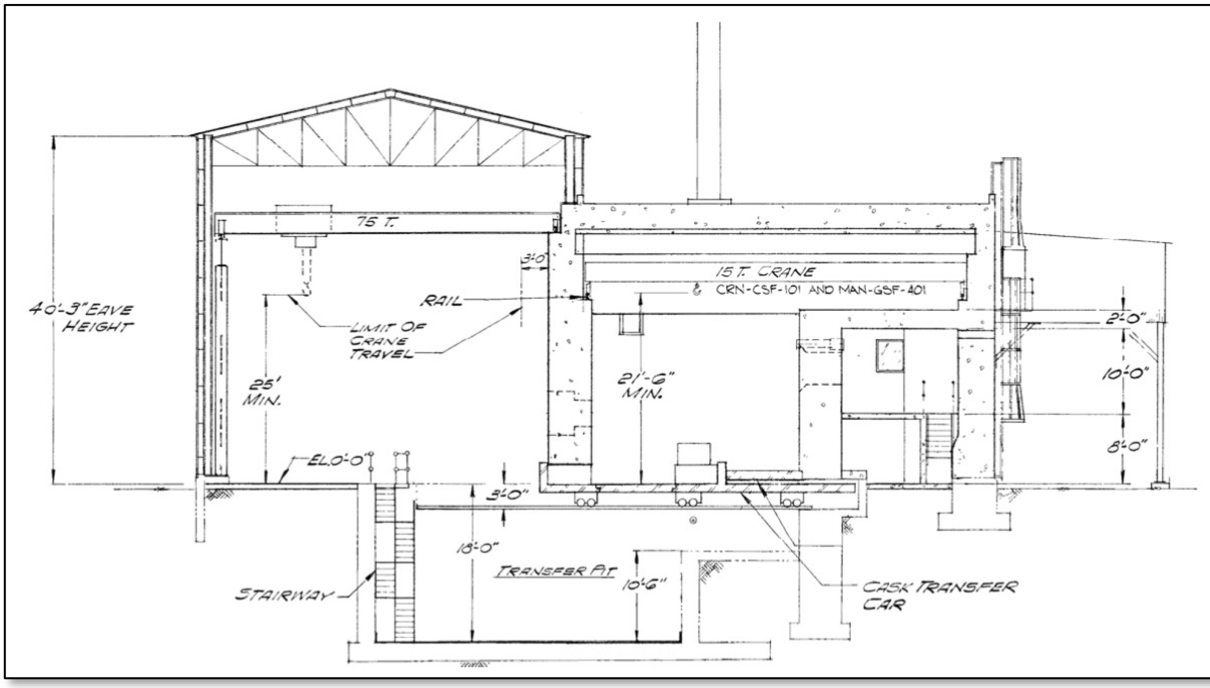

Figure 9. Section View CPP-603, the PCS over the transfer pit not shown, (from Wahnschaffe, 2011, Figure 3).

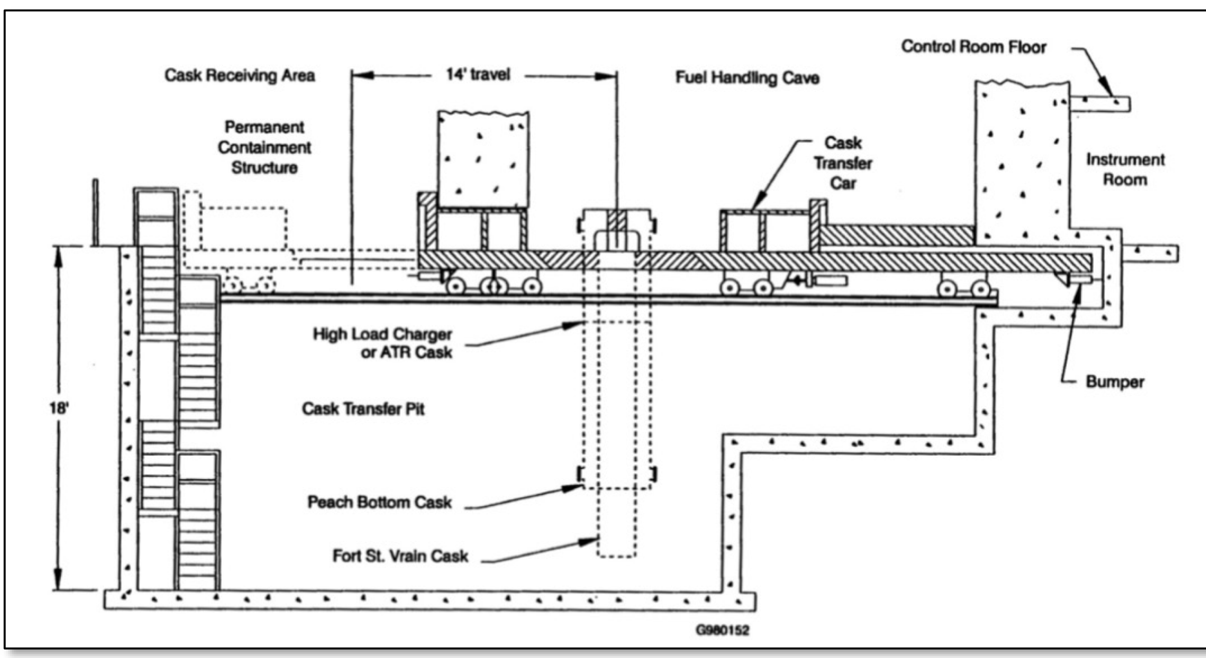

Figure 10. Side view showing the cask transfer car over the transfer pit (from Wahnschaffe, 2011, Figure 5).

Referring to Figure 10 above, the transfer pit, which also contains the cask transfer car, extends under the south wall of the fuel-handling cave, with approximately one-half of the pit located under the PCS and the other half under the fuel-handling cave. The transfer pit, along with the cask transfer car, provides radiation shielding during the transfer of fuel casks between the cask receiving area and the fuel-handling cave.

The cask transfer car, in combination with its associated transfer equipment (i.e., inserts, adapters, sliding saddles, and transfer devices), is used to support the cask and transfer it between the cask receiving area and fuel-handling cave. The top plate of the cask transfer car provides a continuous floor when it is in the PCS, and, when moved into the fuel-handling cave, the top plate of the cask transfer car becomes the south-east floor of the cave.

Once inside the fuel-handling cave, the HBDC lid can be removed and set aside using the two cranes inside of the fuel-handling cave, and the desired fuel for examination can be retrieved.

The fuel-handling cave (see Figure 1), having received the HBDC and had the lid components removed, enables initial fuel examinations to occur using the in-cave examination system equipment that is remotely operated from the control room. The fuel-handling cave is equipped with two cranes, one with the PaR, an electromechanical manipulator with a hoist, mounted on a common trolley and bridge; wall-mounted manipulators; two shielding windows; a video camera system; and floor wells for temporarily storing fuel storage canisters.

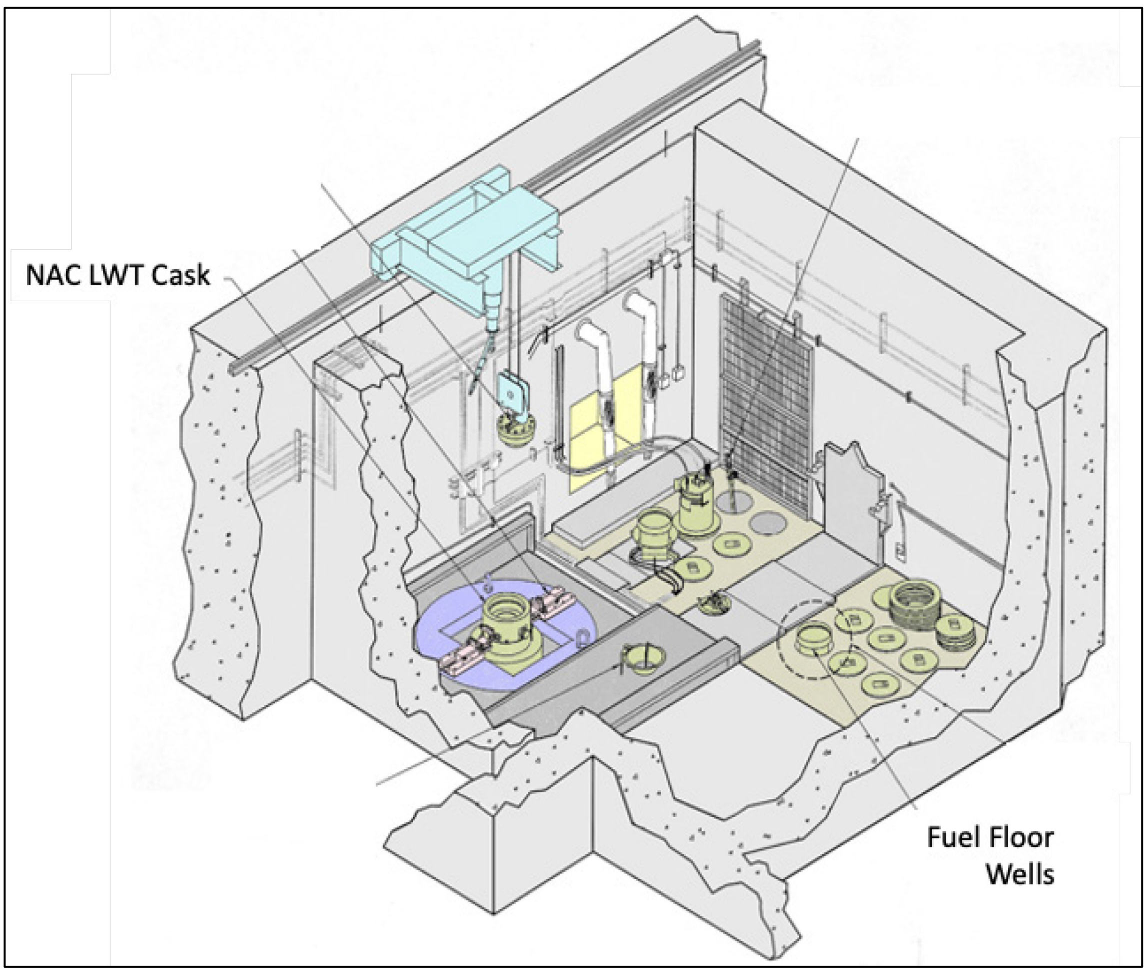

Figure 11. Fuel-handling cave depiction with NAC-LWT cask.

Beyond the in-cave fuel examination capabilities, selected rods may be removed and prepared for transfer out of the INTEC CPP-603 fuel-handling cave and moved to other fuel examination facilities within the INL MFC, thereby enabling fuel investigations analogous to the tests and examinations performed on the "sibling pins" noted in Section 1. For the purpose of this report, it is assumed that, while in the fuel-handling cave, a HBDC fuel assembly is removed from the TN-32B and temporarily placed in an in-cave floor well. Selected fuel rods are removed from an assembly and placed in a transfer cask-specific internal basket, for later placement in a canister specific to the chosen transfer cask that will be used to move the rods to the HFEF (see Section 2.3.3).

2.3.3 Material Transfer from CPP-603 to MFC

MFC maintains a number of post-irradiation examination and testing capabilities potentially relevant to the examination of the HBDC contents, including the Irradiated Materials Characterization Laboratory, the Sample Preparation Laboratory, the Electron Microscopy Laboratory, the Fuel Conditioning Facility, and HFEF.

HFEF (see Figure 12 and 13), is the only facility in the U.S. Department of Energy complex that can accommodate full pressurized-water reactor and boiling-water reactor fuel assemblies, is central to supporting examinations of SNF from the HBDC. This will necessitate the retrieval of selected material from the HBDC while in the fuel-handling cave for preparation and transfer from the CPP-603 facility to the MFC HFEF.

Figure 12. Hot Fuel Examination Facility.

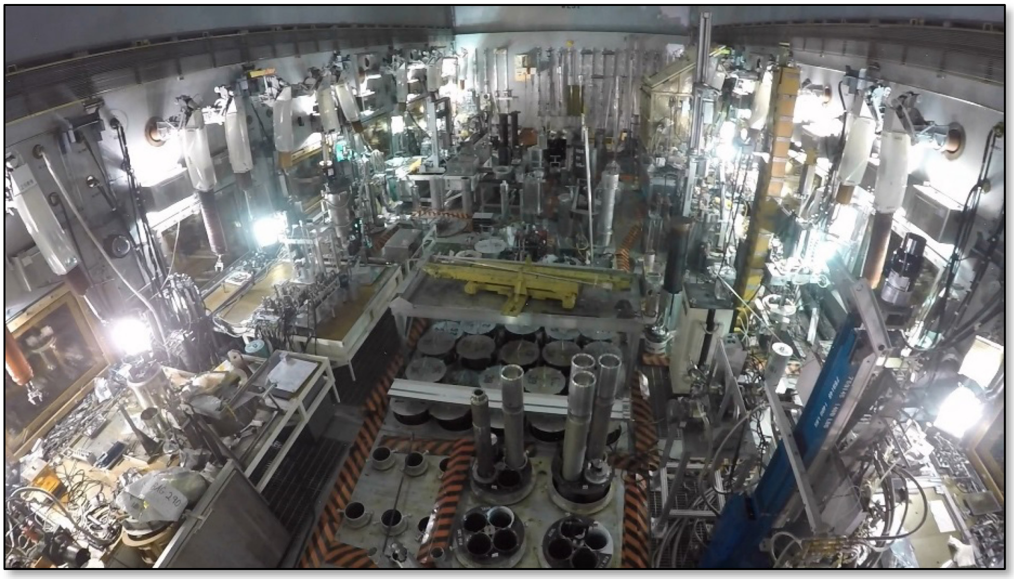

Figure 13. Hot Fuels Examination Facility hot cell.

The transfer of commercial used fuel components from CPP-603 to a testing facility, such as the HFEF, can be done using either the NAC International, Inc. Legal Weight Truck (NAC-LWT) or the Transnuclear Ft. St. Vrain (TN-FSV) casks. Both of these smaller, more easily transported casks have been used to transfer fuel into the HFEF. Marschman (2015) provides a review of the readiness of the HFEF to receive the NAC-LWT, using a 25-fuel rod canister and fuel rod storage cans. Use of the TN-FSV transfer cask to move select fuel rods from CPP-603 to the HFEF would be similar.

To effect the transfer of fuel rods from the HBDC assemblies into a fuel rod transfer canister and chosen transfer cask, it is necessary to swap the HBDC for one of the chosen transfer casks because the CPP-603 facility is configured to handle only one cask at a time. With the selected HBDC rods removed from the fuel assemblies and placed in the transfer cask-specific internal baskets for subsequent transport to the MFC HFEF, the HBDC is then removed from the fuel-handling cave. The HBDC will need to be configured for interim storage at CPP-2707 as it exits the CPP-603 facility (see Section 2.3.4).

With the HBDC transferred out of the CPP-603 facility, the chosen transfer cask will be brought in, lowered into the cask transfer car (fitted with the proper insert) using the cask receiving area crane. The transfer cask lid bolts will be removed, and the cask transfer car will be moved into the fuel-handling cave. Once inside the cave, the cask lid will be rigged to the cave's crane hook, lifted off the cask, and set aside. The empty transfer cask basket will be removed from the cask and placed in one of the 24-in. cave wells using the auxiliary hoist (Bohachek 2013). The selected fuel rods will be loaded into the basket using electromechanical manipulators and auxiliary hoist. The basket will be lifted back into the chosen transfer cask using the auxiliary hoist. With the basket in place, the shipping cask lid will be replaced using the fuel-handling cave crane. The cask transfer car will be moved back into the PCS, where technicians will replace and tighten the shipping cask lid bolts and perform radiological surveys. With the lid bolts secured and decontamination completed (if any is needed), the transfer cask leak check can be performed. Once approved, the PCS will be opened, and the transfer cask will be rigged to the cask receiving area crane for placement on the transport trailer staged in the truck bay.

Transfer casks going from the CPP-603 facility to MFC use an onsite transport haul road and thus avoid travel over public highways. Following the receipt inspection at MFC, the cask will be driven to the HFEF truck lock. Bohachek (2013) provides insights into the handling, examination, and preparation of fuel elements once received at the HFEF. At this point, the MFC site manager has 'custody' and the MFC site manager will coordinate with the High Burnup Spent Fuel Data Project Team for the examinations and testing performed within the HFEF.

2.3.4 HBDC Closure and Storage

Once all operations involving the HBDC are complete and any returned or remaining contents (assemblies, baskets, internals) are loaded, the HBDC is expected to be moved to the CPP-2707 cask storage location in a 'road-ready' configuration.

The concrete pad area, CPP-2707, is used for storage casks containing SNF. The pad size is sufficient to accommodate 20 cask systems. Currently, eight fuel loaded casks are located on the concrete pad (see Figure 14). Once initial HBDC fuel rods are removed for the expected testing, it may be decided to either terminate this aspect of the High-Burnup Spent Fuel Data Project or to continue monitoring and additional testing. Whether the HBDC monitoring continues or is terminated can affect the specific pad location and the licensing and authorizations needed.

Figure 14. Six of eight casks on CPP-2707 cask pad.

Operations to move the HBDC from CPP-603 to CPP-2707 are essentially the reverse of the receipt and movement into CPP-603. The internals and lid are placed back onto the HBDC and transferred back to the PCS for decontamination, lid bolt installation, surveys, and removal from the cask transfer car. The cask receiving area crane is again used to pull the HBDC from the cask transfer car and PCS for placement onto an appropriate low-boy trailer. The HBDC would then be transferred out of the cask receiving area, retrieved from the trailer and placed into interim storage at the nearby CPP-2707 cask storage facility.

Whether cask monitoring and data collection is to be continued after the HBDC is moved from the CPP-603 facility to the CPP-2707 cask storage pad has not been determined. As noted earlier, the HBDC and contents are added to the INL DOE-managed SNF inventory and would be placed in a 'road-ready' storage configuration awaiting removal per the Idaho Settlement Agreement (assuming the HBDC testing program is terminated) or other configuration if additional HBDC research and development is then desired.

3. Summary

While CPP-603 was built to receive and handle spent nuclear fuel, several modifications and adaptations need to be implemented in order to manage the size and weight of commercial used fuel storage and transportation casks, such as the TN-32B. In addition to existing upgrades, several of the modifications for functional areas of CPP-603 (e.g. filling the truck ramp, cask transfer car adaptors, cask receiving area doors, PCS, etc.) still require the completion of design, engineering, safety analyses sufficient for subsequent procurement and construction, in addition to the development of operational and safety procedures specific to receiving the HBDC. Many of these prerequisites are noted in Bohachek (2013) and Price (2015), among others.

Bohachek (2013) provides a substantial list of assumptions and operational issues that must be resolved for receiving commercial casks, such as the TN-32B, and notes an early estimate of costs to mobilize the necessary resources and examine the first cask and its contents at $10–20M (inflated to current dollars). The report notes further that the project definition and cost estimate are insufficient to conform to American Association of Cost Engineering standards but does conform to criteria required of a Preliminary Class 5 estimate as described by INL procedures.

Price (2015) provides status and details (e.g. Operational Overview, Structure, System, and Component Quality Level, Functional and Performance Requirements) of most equipment and facilities involved in handling the TN-32B and other casks. It further elaborates design alternatives for receiving and working with said casks, noting physical modifications, tools, cranes, etc. that need to be implemented before receipt of large casks would be possible. In addition, cost estimates on several approaches for the retrieval of rods from the REA-2023 and Castor V/21 casks located on CPP-2707 have been performed in Winston (2018) and (2019) and may be relevant to HBDC planning.

Transport of the HBDC from NAPS and receipt at INL facilities for fuel examination requires a substantial effort with considerable lead times for resolving all engineering, procurement, and construction activities, in addition to coordination with multiple parties to resolve administrative and legal issues (e.g. the Idaho Settlement Agreement restrictions, HBDC test configuration for transport). Many of the preparation activities involve issues with potentially long lead times. Assuming the HBDC is desired to be transported within the 2028 timeframe, many of the logistical, licensing, technical and legal preparations should be pursued forthwith.

4. Conclusion

In light of the issues discussed above, and the nominal target date for receipt of the HBDC in 2028 or earlier, the following recommendations are offered:

1. The DOE consider invoking DOE Order O 251.1D (Departmental Directives Program) to direct the formation of an "Integrated Project Team" (IPT) that would engage all relevant project participants, including DOE/INL, INL management, High-Burnup Spent Fuel Data Project Team, etc. As required, the IPT would develop a decision memorandum that would elaborate the desired end-state, anticipated costs and benefits, and identify major issues or conflicts with existing directives and departmental operations. The decision memorandum and required implementation strategy would be beneficial to identifying key milestones and the organizations responsible for each action.
2. Similarly, the High-Burnup Spent Fuel Data Project Team could consider engaging all relevant project participants to develop a comprehensive understanding of critical path decisions and milestones (e.g. a matured Gantt chart), with an effort to manage any assumptions as actionable tasks. Such a product could be invaluable to managing the multiple dimensions and coordination of activities with long lead times.
3. While the Bohachek (2013) and Price (2015) reports and others are useful to describing specific aspects of receiving the HBDC at INL, they are preliminary and may not fully reflect more recent considerations. Thus, it is suggested that DOE consider directing INL to develop current and comprehensive documentation of sufficient detail and maturity to support the contracting and implementation of any engineering, procurement, and construction projects specific to the receipt of the TN-32B HBDC.

5. References

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