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Design Evolution Study–Aging Options

PREDECISIONAL STUDY

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DISCLAIMER

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EXECUTIVE SUMMARY

The purpose of this study is to identify options and issues for aging commercial spent nuclear fuel received for disposal at the Yucca Mountain Mined Geologic Repository. Some early shipments of commercial spent nuclear fuel to the repository may be received with high-heat-output (younger) fuel assemblies that will need to be managed to meet thermal goals for emplacement. The capability to age as much as 40,000 metric tons of heavy metal of commercial spent nuclear fuel would provide more flexibility in the design to manage this younger fuel and to decouple waste receipt and waste emplacement.

The following potential aging location options are evaluated:

- Surface aging at four locations near the North Portal
- Subsurface aging in the permanent emplacement drifts
- Subsurface aging in a new subsurface area

The following aging container options are evaluated:

- Complete Waste Package
- Stainless Steel inner liner of the waste package
- Dual Purpose Canisters
- Multi-Purpose Canisters
- New disposable canister for uncanistered commercial spent nuclear fuel

Each option is compared to a "Base Case," which is the expected normal waste packaging process without aging. A Value Engineering approach is used to score each option against nine technical criteria and rank the options. Open issues with each of the options and suggested future actions are also presented.

Costs for aging containers and aging locations are evaluated separately. Capital costs are developed for direct costs and distributable field costs. To the extent practical, unit costs are presented. Indirect costs, operating costs, and total system life cycle costs will be evaluated outside of this study.

Three recommendations for aging commercial spent nuclear fuel – subsurface, surface, and combined surface and subsurface are presented for further review in the overall design re-evaluation effort. Options that were evaluated but not recommended are: subsurface aging in a new subsurface area (high cost); surface aging in the complete waste package (risk to the waste package and impact on the Waste Handling Facility); and aging in the stainless steel liner (impact on the waste package design and new high risk operations added to the waste packaging process). The selection of a design basis for aging will be made in conjunction with the other design re-evaluation studies.

1. Subsurface Aging

   Recommendation–Age commercial spent nuclear fuel packaged in the complete waste package in the permanent emplacement drifts. Subsurface aging differs from the Base

Case subsurface emplacement by spacing waste packages at a greater distance than the design emplacement spacing. After the commercial spent nuclear fuel in the waste package has thermally cooled, the waste packages would be moved closer together to place them at the design waste package emplacement spacing.

This subsurface recommendation has the following advantages compared to surface aging:

a. Safety and health risks are minimized compared to surface aging locations. Worker radiological exposure and additional handling operations are similar to the Base Case design.

b. The design is more resistant to terrorist activities.

c. As evaluated in this study, there are no additional capital costs over the Base Case. The capital cost for surface aging is greater than for subsurface aging in the emplacement drifts since additional surface aging facilities, shield casks, and cask transportation equipment will be needed.

d. The licensing approach is similar to the Base Case and does not require new designs to be licensed.

e. The design is compatible with the Waste Handling Facility current scope and does not impose new handling or equipment requirements on the Waste Handling Facility.

2. Surface Aging

Recommendation–Age commercial spent nuclear fuel in a dual-purpose canister, multi-purpose canister, or disposable canister in any of the four surface locations considered.

This surface aging recommendation has the following advantages compared to subsurface aging:

a. Surface aging is more flexible than subsurface aging in decoupling receipt from emplacement.

b. Surface aging sites can be developed in stages, as needed to support aging requirements.

c. The design will not require complete processing of waste packages prior to aging. This will be less of a constraint to operations and plant throughput than subsurface aging in the waste package.

d. The design is more flexible in accommodating changes to the repository thermal operating mode.

e. The design allows for slower underground emplacement, without restricting receipt rates.

f. The waste containers included in this option are ranked highest in the technical evaluation.

3. Combination of limited surface aging and subsurface aging

Recommendation–Rather than only surface or subsurface aging, use a combination of limited surface aging with the remaining commercial spent nuclear fuel aged in the permanent emplacement drifts.

This limited surface and subsurface recommendation has the following advantages:

a. Compared to all subsurface aging:

1) Improves the ability to decouple waste receipt from emplacement.
2) Reduces the need to process waste packages prior to aging.

b. Compared to all surface aging:

1) Reduces safety and health risks associated with worker radiological dose and additional handling operations.

2) Is more resistant to terrorist activities because of the smaller surface aging footprint.

3) Reduces capital costs.

CHANGE HISTORY

Revision Number	Interim Change No.	Effective Date	Description of Change
0	0	N/A JF 4/25/02	Initial Issue

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ACRONYMS AND ABBREVIATIONS

BSC	Bechtel SAIC Company, LLC
CRWMS	Civilian Radioactive Waste Management System
CSNF	Commercial Spent Nuclear Fuel
DOE	U.S. Department of Energy
DPC	Dual-Purpose Canister
DSNF	DOE-Managed Spent Nuclear Fuel
FAST	Function Analysis System Technique
FEIS	Final Environmental Impact Statement
HLW	High-Level Radioactive Waste
LA	License Application
MPC	Multi-Purpose Canister
MTHM	Metric Tons of Heavy Metal
MVDS	Modular Vault Dry Store
NRC	U.S. Nuclear Regulatory Commission
OCRWM	Office of Civilian Radioactive Waste Management
PWR	Pressurized Water Reactor
SNF	Spent Nuclear Fuel
SR	Site Recommendation
SS	Stainless Steel
VE	Value Engineering
WHF	Waste Handling Facility
WP	Waste Package
YM	Yucca Mountain

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1. PURPOSE

The purpose of this document is to identify options and issues associated with aging waste received at the Yucca Mountain (YM) Waste Handling Facility (WHF). Commercial spent nuclear fuel (CSNF) would be the major contributor of heat in the repository. It would have a wide range of thermal outputs. One option for dealing with high-heat-output (younger) CSNF is to place the younger fuel in an aging facility to allow its heat output to dissipate so it could meet thermal goals for later emplacement. The addition of an aging capability would provide more flexibility in the design to manage younger CSNF and to decouple waste receipt and waste emplacement. The results of this study will be provided to policy makers who will determine the aging approach used in the repository design.

1.1 BACKGROUND

The current model for waste received at YM assumes that the waste will be processed for disposal as it is received. The *Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (FEIS) (DOE 2002) baseline includes design features for aging 5,000 metric tons of heavy metal (MTHM) in a fuel storage pool. Depending on the emplacement thermal criteria, as much as 40,000 MTHM of CSNF may need to be aged during a 50 year period (emplacement with aging is assumed to require 50 years). This study provides conceptual designs for surface and subsurface aging of CSNF in various container types.

Aging locations evaluated are:

- Surface aging at four locations near the North Portal
- Subsurface aging in the permanent emplacement drifts
- Subsurface aging in a new subsurface aging area

Aging containers evaluated are:

- Complete Waste Package (WP)
- Stainless Steel inner liner (SS) of the WP
- Dual-Purpose Canisters (DPC)
- Multi-Purpose Canisters (MPC), currently not licensed for CSNF disposal
- New disposable canister, supplied by YM and licensed for storage and disposal (currently not available)

1.2 QUALITY ASSURANCE

This technical product was prepared in accordance with AP-3.11Q, *Technical Reports*. The report has been determined not to be quality affecting in accordance with the activity evaluation report, *Technical Work Plan for Surface Design Non-Q FY 02 Work Activities for License Application (LA)* (BSC 2001, Addendum A, p. A2). Therefore, this report is not subject to the requirements of the *Quality Assurance Requirements and Description* document (DOE 2000).

The control of the electronic management of information is in accordance with the technical work plan for this task, BSC 2001 p. 10.

1.3 MAJOR ASSUMPTIONS

1.3.1 Commercial Spent Nuclear Fuel

CSNF may require aging to meet thermal emplacement criteria. The quantity of CSNF is relatively large (63,000 MTHM or 90% of the waste received) and fuel assemblies that have not been sufficiently aged at reactor sites may need to be aged at YM.

1.3.2 U.S. Department of Energy (DOE) High Level Waste/DOE-Managed Spent Nuclear Fuel

DOE waste, which includes high-level radioactive waste (HLW) and DOE-managed spent nuclear fuel (DSNF), will not require aging to meet thermal emplacement criteria. The quantity of DOE waste shipments will be relatively small (7,000 MTHM or 10% of the waste received) compared to the quantity of CSNF shipments. CSNF would be the major contributor of heat in the repository and is the only waste being considered for aging, as stated in the FEIS (DOE 2002).

1.3.3 Subsurface Aging Container

Subsurface aging will only be done in complete WPs. For normal operations, once a WP is placed subsurface, the assumption has been made it will not be returned to the WHF for additional processing. This avoids double handling the WP. In addition, by only using WPs in the subsurface, the pre-closure safety case evaluation basis is not affected; the pre-closure safety may need to be revised if other forms of waste containers were used subsurface.

1.3.4 Surface Aging Container

Surface aging may be done in DPCs, MPCs, disposable canisters, SS inner liners, and complete WPs. All of these waste containers (if used for aging) will need to be licensed for storage.

2. EVALUATION METHOD

2.1 BASE CASE COMPARISON

Each option is compared to a "Base Case," which is the expected normal waste packaging process without aging. Five waste streams are included in the Base Case: CSNF in a DPC; CSNF in an MPC; uncanistered CSNF; canistered DOE HLW and DSNF; and canistered Naval spent fuel. These are the waste streams that will be processed for disposal. Figure 1 shows the Base Case, and the following simplified processing steps describe how each waste stream would be packaged for final emplacement with no aging. In summary, the Base Case process includes:

- Waste Stream 1 - CSNF received in DPC
    - DPC with CSNF removed from shipping cask

  - Open DPC
  - CSNF removed from the DPC and placed in the WP
  - WP transported to emplacement

- Waste Stream 2 - CSNF received in MPC

  - MPC with CSNF removed from shipping cask
  - MPC placed in the WP
  - WP transported to emplacement

- Waste Stream 3 - CSNF received uncanistered

  - Uncanistered CSNF removed from shipping cask
  - CSNF placed in the WP
  - WP transported to emplacement

- Waste Stream 4 - DOE SNF and HLW (including pour cylinders and glass logs) canisters

  - DOE canister removed from shipping cask
  - DOE canister placed in the WP
  - WP transported to emplacement

- Waste Stream 5 - Naval canister

  - Naval canister removed from shipping cask
  - Naval canister placed in the WP
  - WP transported to emplacement

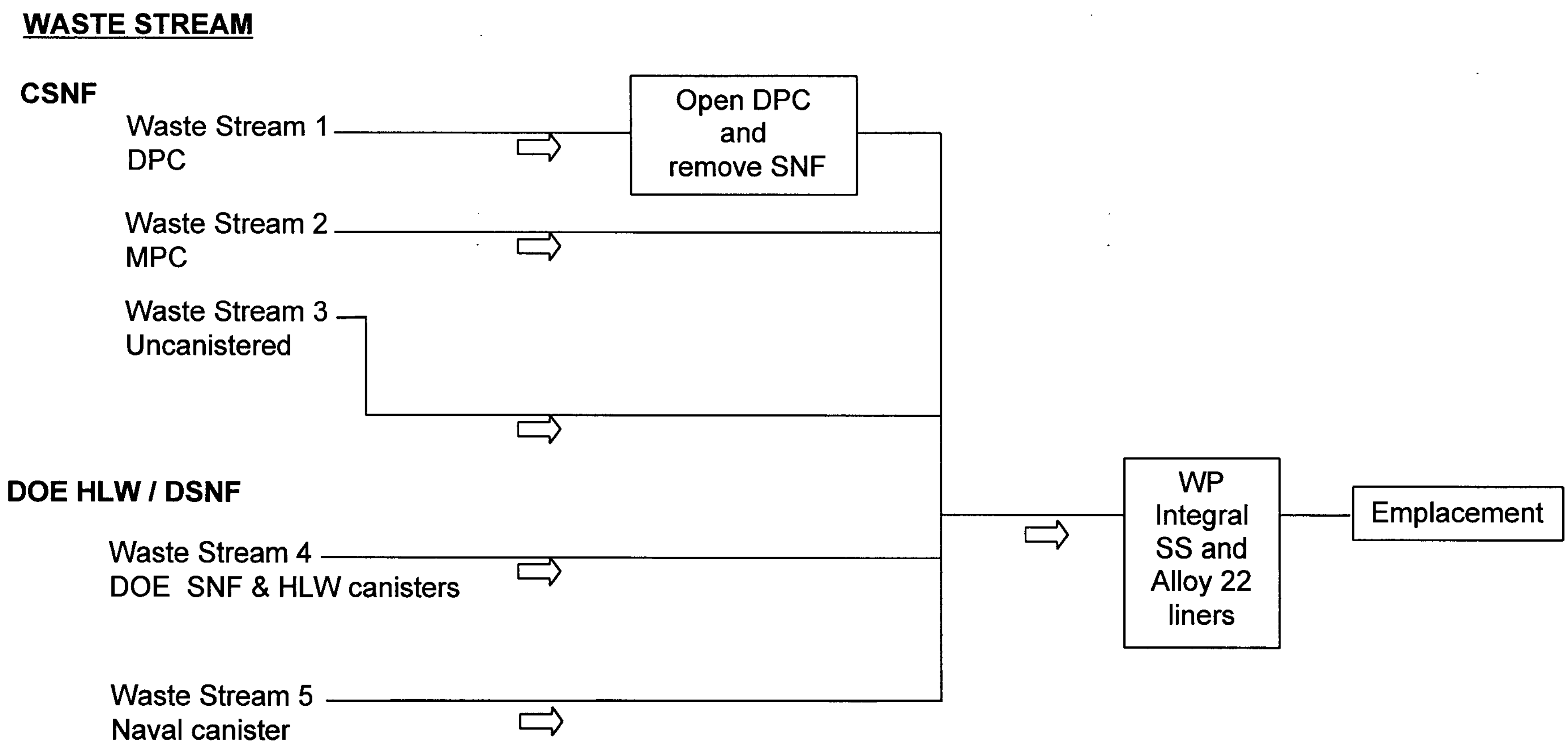


Figure 1. Aging Study Base Case

2.2 TECHNICAL EVALUATION

Nine technical evaluation criteria are used as a basis to review and compare each option. Issues related to these criteria are listed in Table A1.

1. Health and safety
2. Licensability
3. Schedule
4. Receipt/emplacement capabilities
5. Flexibility
6. Non-safety risk (programmatic risk)
7. Compatibility with other surface and subsurface system designs
8. Operability
9. Use of existing studies and analyses

Cost is a criterion that is evaluated separately in Section 4 of this study.

A Value Engineering (VE) approach is used to evaluate the options against the nine technical criteria. First, the criteria are assigned relative weighting factors. Next, the options are scored on a 1 to 5 scale (1 - poor to 5 - excellent) against each criterion. A total score for each option is calculated by multiplying the criteria weighting factor by the score and summing the results. Appendix A, Technical Evaluation, provides the results of the technical evaluation.

3. COMPARATIVE ANALYSIS DISCUSSION

In this section, each of the aging options is discussed in detail. Each option is described and compared to the Base Case of no aging. The option description includes the associated waste packaging, aging, and emplacement work processes and the required equipment and facilities. Each option is evaluated against the nine technical evaluation criteria to establish a basis for compliance with the YM design requirements and to allow comparison with other aging options and design engineering studies currently being performed. Related engineering and licensing issues along with suggested future actions are also discussed.

Five container and six location aging options are evaluated.

Five options for aging containers, see Figure 2:

1. WP1 - WP for surface or subsurface aging, potential option for all Waste Streams
2. WP2 - SS inner liner for surface aging, potential option for all Waste Streams
3. C1 - DPC for surface aging, option for Waste Stream 1
4. C2 - MPC for surface aging, option for Waste Stream 2
5. C3 - New disposable canister for surface aging, option for Waste Stream 3

Six options for aging locations, see Figure 3:

1. S1 - Surface aging at the Exile Hill location
2. S2 - Surface aging at the Midway Valley location
3. S3 - Surface aging at the North Portal location

4. S4 - Surface aging at the North Portal Pad
5. SS1 - Subsurface aging in the permanent emplacement drifts
6. SS2 - Subsurface aging in a new subsurface aging area

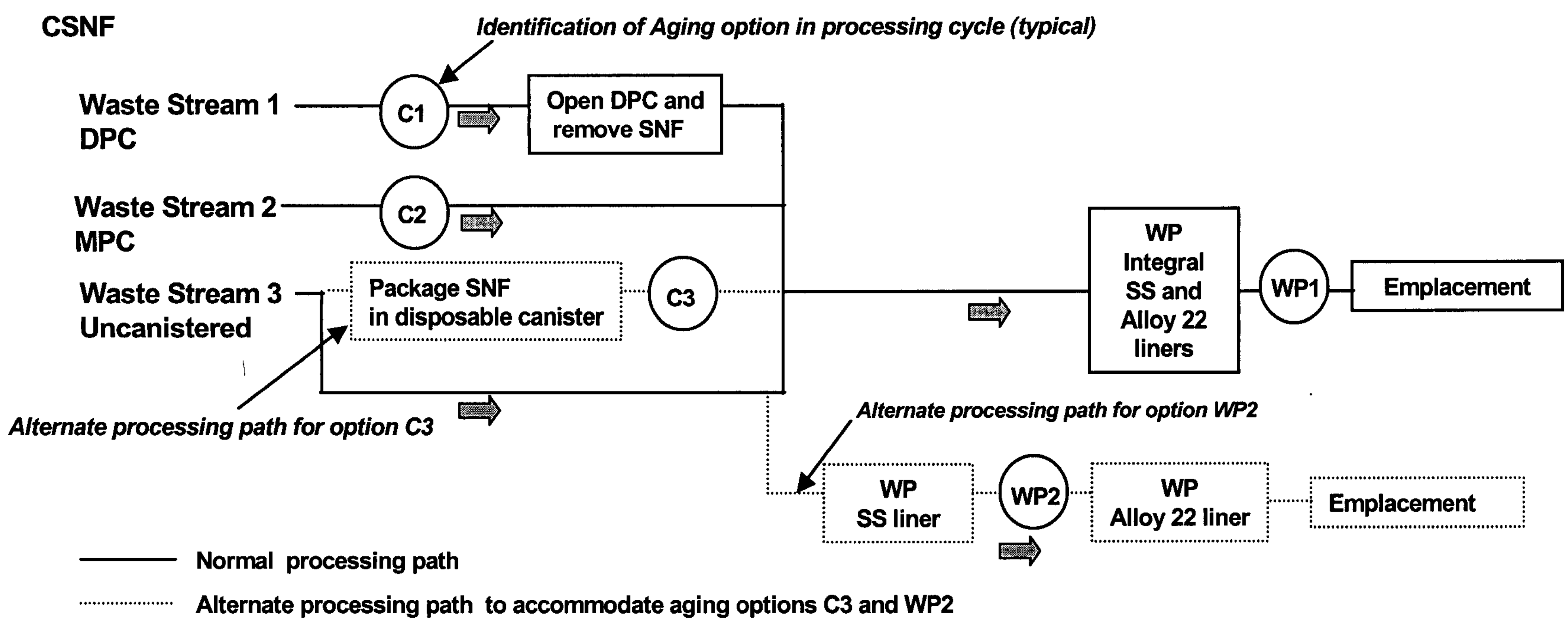
3.1 AGING CONTAINER DISCUSSION

Containers used for aging fall into two categories:

1. Containers that are received from others (e.g. nuclear utilities, DOE sites, etc.)
2. Containers that are supplied by DOE YM

Containers in category 1 include DPCs, licensed for transport and storage, and MPCs, licensed for transport, storage, and disposal. CSNF in DPCs and MPCs would be received and placed into aging, if licensed by the Nuclear Regulatory Commission (NRC) for storage at YM. Final processing, including loading into WPs, would be completed after aging.

The YM supplied containers in category 2 could include disposable canisters, WPs, and the SS inner liner of the WP. CSNF would be received and packaged in the YM supplied container prior to aging. After aging, the container, which is suitable for storage and disposal, would be processed as required for emplacement. For example, a disposable canister would be packaged inside a WP prior to emplacement. With this approach, CSNF fuel assemblies would only be handled once, at receipt. If the CSNF were received uncanistered and aged in a container that was not suitable for disposal (e.g. a DPC) the spent fuel assemblies would be handled twice, once at receipt prior to aging and again after aging to load the WP.

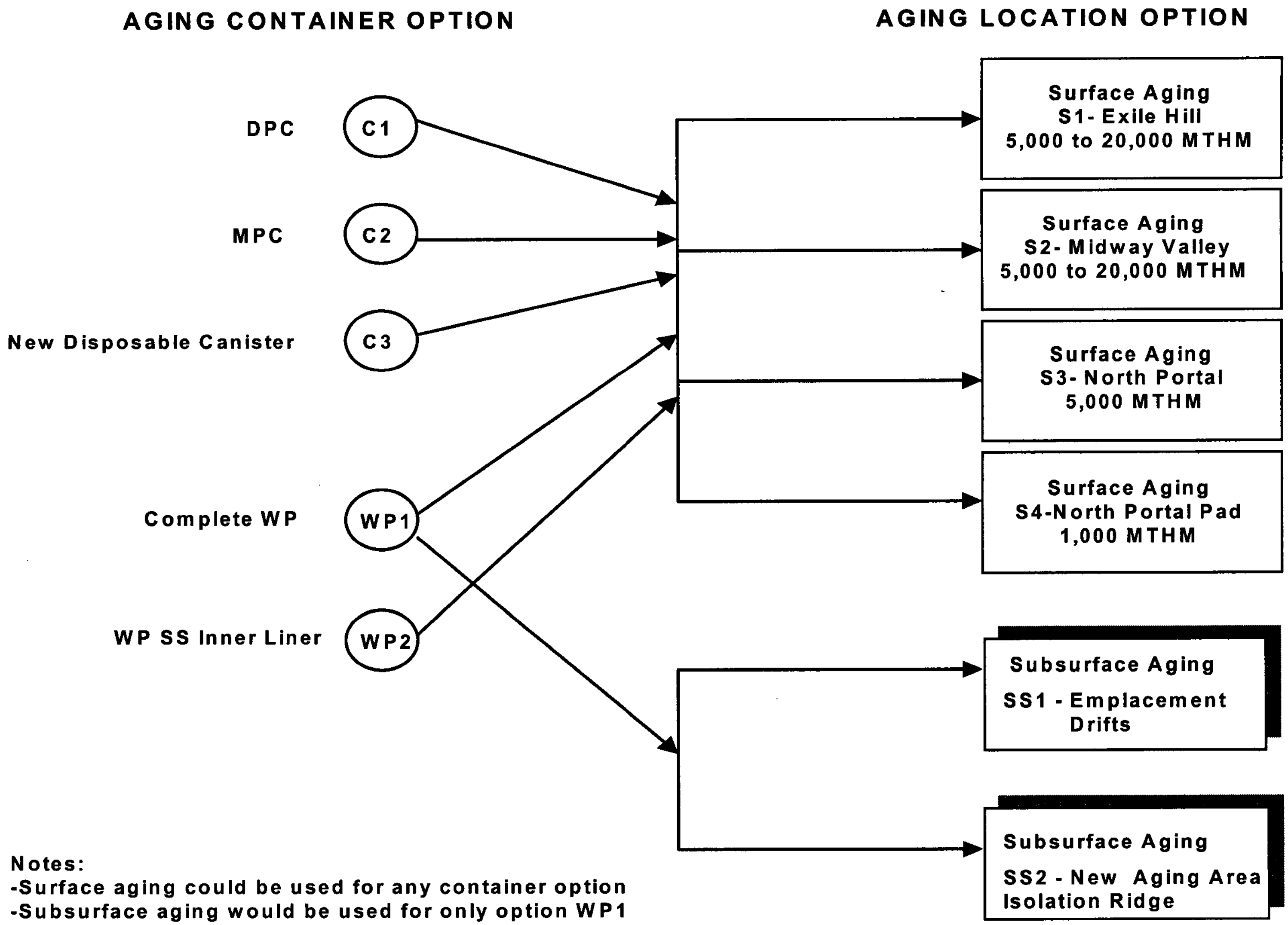


OPTIONS
Aging options are shown at possible locations in the waste packaging process. If waste requires aging, only one option would be selected in a given processing cycle, e.g. for CSNF received uncanistered only option C3 or WP1 or WP2 would be selected.

C1 CSNF received in DPC, **aged in DPC**, processed to WP and emplacement.
C2 CSNF received in MPC, **aged in MPC**, processed to WP and emplacement.
C3 CSNF received uncanistered, packaged in disposable canister, **aged in disposable canister**, processed to WP and emplacement.
WP1 SNF loaded into complete WP (SS inner liner and alloy 22 outer liner), **aged in complete WP**, emplacement.
WP2 SNF loaded into WP SS inner liner, **aged in SS inner liner**, alloy 22 outer liner added, emplacement.

Note:
•DOE waste streams 4 and 5 are not shown since they will not need to be aged.

Figure 2. Aging Study Summary of Aging Container Options



Notes:
-Surface aging could be used for any container option
-Subsurface aging would be used for only option WP1

Figure 3. Aging Study Summary of Aging Location Options

3.1.1 Option WP1, Waste Package

Option WP1 uses the WP for aging, see Figure 4. For this option, the Base Case (no aging) packaging process is followed and a completed WP is sent to aging.

WP1 Subsurface Aging

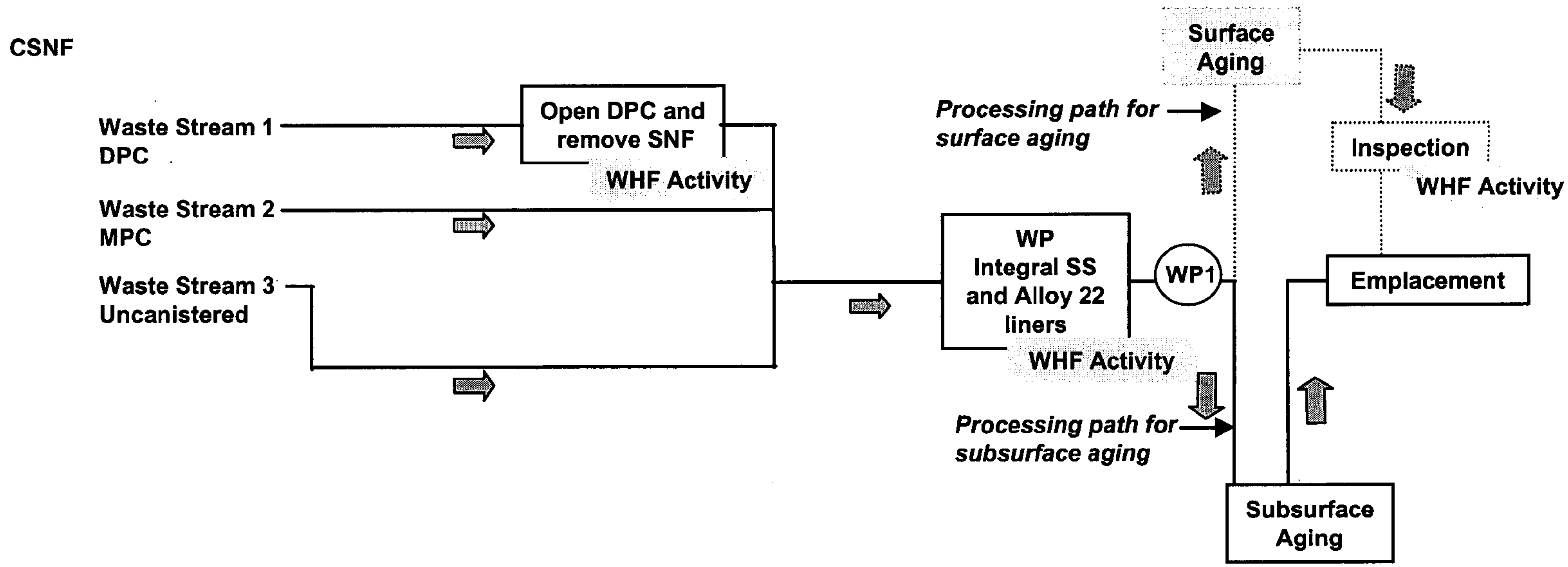
If the WP is placed in subsurface aging, all inspections would be completed and a certified WP would be transported to aging either in the permanent emplacement drifts (Option SS1) or the new subsurface aging area (Option SS2). WPs sent to subsurface aging would not return to the WHF unless repair or reinspections were required. Transportation and handling of the WP from the WHF to the subsurface aging location and subsequent subsurface handling are discussed in the Options SS1 and SS2 write-ups in this study.

WP1 Surface Aging

If the WP is placed in surface aging, a preliminary inspection suitable for aging would be completed prior to aging. The complete WP with all closure welds completed is used for option WP1. Transport and handling of the WP from the WHF to the aging location are discussed in the Options S1, S2, S3, and S4 write-ups in this study.

3.1.1.1 Option WP1 Evaluation Criteria

- Health and Safety
    - Subsurface aging would require fewer WP rehandling operations than surface aging. Generally, the completed WP would be moved from one subsurface location (aging location) to another subsurface location (emplacement location). There would be a corresponding reduction in the risk of operational accidents and worker radiation exposure compared to surface aging.
    - Surface aging in a WP would increase the risk compared to the Base Case of potential operational accidents because of the additional handling required to transport the WP to the aging area, stage the WP in a storage cask, and return the WP to the WHF for final processing. There would also be an increase in worker radiation exposure associated with the increased handling requirements for aging.
    - Surface aging in a WP may result in the identification of new design basis events or changes to existing design basis events. This may result in a more stoutly designed (and costly) WP.
- Licensability
    - Aging in a completed WP may introduce new key technical issues related to WP performance. The potential for compromising the integrity of the WP would be increased by surface aging the WP in an outdoor environment for up to 50 years. In addition, the risk of damaging the Alloy 22 outer liner would be increased because of the additional handling operations required by surface aging.



Notes:

- For subsurface aging, all welding would be completed and a certified WP would be transported to aging either in the permanent emplacement drifts (Option SS1) or the new subsurface aging area (Option SS2). WPs sent to subsurface aging would not return to the WHF unless repair or reinspection were required.
- For surface aging, all welding would be completed and a complete WP would be transported to a surface aging location. After aging and prior to emplacement, the WP will be returned to the WHF to be inspected and tested to verify that it is acceptable for emplacement.
- DOE waste streams 4 and 5 are not shown since they will not need to be aged.

Figure 4. Aging Study Container Option WP1 Complete WP

- If changes to the WP design are required for aging, new WP designs may need to be licensed.
- If new storage cask designs are required for surface aging in WPs, there will be an impact regarding licensing new storage casks.

- Schedule
  - Surface aging in a WP would require that the WP design(s) and associated storage casks be licensed prior to use. This is a risk associated with beginning receipt in 2010, as any significant change in WP design may require additional licensing reviews.
- Receipt/Emplacement
  - Aging in a WP may improve the ability of the waste packaging process to accept a larger number and quantity of waste forms.
  - A minimum number of new waste packaging process steps would need to be added to the Base Case, and rehandling of CSNF fuel assemblies would be minimized.
- Cost
  - See Section 4.
  - There would be an increased cost risk of "damaged" WPs because of the additional handling activities during aging.
- Flexibility
  - The use of a WP for aging would be less flexible than aging in other containers because the entire waste packaging process would need to be completed prior to aging. This would impose more constraints on WHF operations.
- Programmatic Risk
  - For WPs placed in surface aging, the extent of re-inspection required after aging and prior to emplacement is a risk. The re-inspection must verify that the aged WP continues to meet all criteria for emplacement.
- Compatibility
  - Because a minimal number of new steps are added to the existing waste process, this design is comparable to the Base Case.

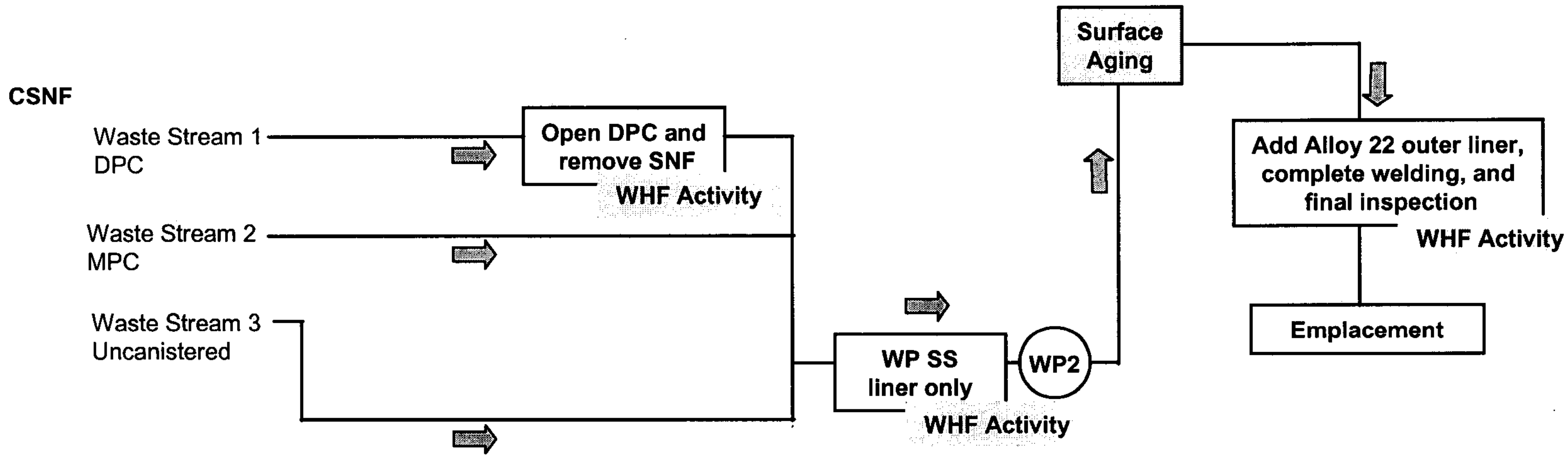
- Operability
  - Surface aging in the WP will require complete processing of the WP prior to aging. This will constrain WHF operations and plant throughput compared to aging in a DPC, MPC, or disposable canister which requires less processing in the WHF prior to aging.
- Existing Studies and Analyses
  - This option is an evolutionary improvement to the site recommendation (SR) design. It provides a means to age waste to meet thermal criteria prior to emplacement.

3.1.1.2 Option WP1 Issues

- The licensed disposal characteristics (for example surface finish) of the WPs must be protected and maintained during the up to 50 years of aging and handling between the aging area and permanent emplacement.
- The initial design of the WHF must anticipate and allow for additional handling/inspections/verifications of the WP that will be necessary after up to 50 years of surface aging and prior to emplacement.
- Surface aging in the WP will result in more constraints to operations and plant throughput compared to aging in other types of canisters.
- The use of a WP for surface aging would require parallel licensing of both the waste container and the storage cask. This might be: 1) under 10 CFR 63, with due consideration of 10 CFR 72 requirements; or 2) under a separate 10 CFR 72 licensing review. In either case, this would require close coordination between the DOE design and NRC review.

3.1.2 Option WP2, SS inner liner

Option WP2 uses the SS inner liner of the WP for aging, see Figure 5. For this option, the Base Case (no aging) packaging process is followed up to the point where waste is placed in the WP. Instead of the Base Case integral WP design (SS inner liner and Alloy 22 liner are assembled), the WP design is modified to have the SS inner liner as one piece and the Alloy 22 outer liner as a separate piece. Waste is loaded into the SS inner liner and the associated inner liner lid weld is completed prior to aging. After completion of the weld and inspection, the SS inner liner is released to surface aging (see Figure 3). Transport and handling of the WP from the WHF to the aging location are discussed in the Options S1, S2, S3, and S4 write-ups in this study. After aging is completed, the SS inner liner package is returned to the WHF, the Alloy 22 outer liner is added, WP processing is completed (lid welding, final inspections, etc.), and the WP is transported to emplacement.



Note:

- **DOE waste streams 4 and 5 are not shown since they will not need to be aged.**

Figure 5. Aging Study Container Option WP2 WP SS Inner Liner

3.1.2.1 Option WP2 Evaluation Criteria

- Health and Safety
  - Surface aging in the WP SS inner liner would increase the risk of potential operational accidents over the Base Case because of the additional handling required to transport the SS inner liner to the aging area, age it in a storage cask for up to 50 years, and return it to the WHF for final processing. There would also be an increase in worker radiation exposure associated with the increased handling requirements for aging.
- Licensability
  - Aging in the SS liner portion of the WP may introduce new key technical issues related to WP performance.
  - A new WP design will be required, including the associated licensing, to allow separate loading of the SS liner and Alloy 22 shell.
  - If new storage cask designs are required for surface aging in the SS liner, there will be an impact regarding licensing new storage casks.
- Schedule
  - Aging in the SS inner liner would require that the design and associated storage casks be licensed prior to use. This is a risk associated with beginning receipt in 2010. A change in WP design may affect the LA schedule.
- Receipt/Emplacement
  - New process steps would need to be added to the Base Case to handle the SS inner liner separate from the WP.
- Cost
  - See Section 4.
  - There may be an increased cost risk of "damaged" WPs because of the additional handling activities during aging and the possibility that some SS inner liners may not be able to be installed inside the Alloy 22 outer liner after aging because of bowing, twisting, or changes to the SS liner during aging.
- Flexibility
  - See Option WP1.

- Programmatic Risk
  - The extent of re-inspection required prior to completing the WP is a risk. The re-inspection must verify that no unacceptable damage occurred to the SS inner liner during aging.
  - After aging, the difficulty in loading a fully laden inner liner into an outer shell is expected to add significant operations risk to the program.
- Compatibility
  - New steps would be added to the existing waste handling process to install the SS liner in the WP after aging. This is a potentially high-risk change and would need to be studied in detail to determine the impact on the WHF.
- Operability
  - Operations processing steps and complexity would be increased by having to install a fully laden SS inner liner into an Alloy 22 outer shell.
- Existing Studies and Analyses
  - This option is a change to the SR design. It introduces new risks to the design by changing the WP design and changing the WHF processing requirements.

3.1.2.2 Option WP2 Issues

- Because of the significant design and operation issues associated with Option WP2, the SS liner is determined to be not technically favorable. Supporting reasons for this conclusion are:
  - The overall technical review of Option WP2 performed in the technical evaluation, see Section 2.2 and Appendix A, was the lowest of all container options and therefore was determined to be not acceptable.
  - Use of the SS liner for aging will require a new WP design.
  - The WHF must include new processing steps to load the SS liner into the Alloy 22 outer liner after aging and confirm that the assembled WP meets design requirements. This is a significant risk addition to the program.
  - The design of the WHF would have to include new provisions for the handling/inspections/verifications that would be required after up to 50 years of aging and prior to assembly into the Alloy 22 outer liner.

3.1.3 Option C1, DPC

Option C1 uses the DPC for aging, see Figure 6. A DPC is licensed under 10 CFR 71 and 10 CFR 72 for transport and storage. In the Base Case (no aging), a DPC containing CSNF is received; the DPC is opened and the CSNF is removed and placed in a WP. In Option C1 after receipt, the DPC is placed in aging prior to the DPC being opened. This option takes advantage of the fact that the DPC is licensed as a storage canister (the license would be modified by DOE for storage at YM) and postpones the WHF processes of opening the DPC and removing the CSNF fuel assemblies until after aging is completed. Transport and handling of the DPC from the WHF to the aging location are discussed in the Options S1, S2, S3, and S4 write-ups in this study. After the appropriate aging, the DPC is returned to the WHF, the DPC is opened and the CSNF removed and placed into a WP. The WP is processed (welding is completed, final inspections, etc.) and transported to emplacement.

3.1.3.1 Option C1 Evaluation Criteria

- Health and Safety
  - Surface aging in a DPC would increase the risk of potential operational accidents over the Base Case because of the additional handling required to transport the DPC to the aging area, age it in a storage cask for up to 50 years, and return it to the WHF for final processing. There would also be an increase in worker radiation exposure associated with the increased handling requirements for aging.
- Licensability
  - There are licensed DPC designs available now that will probably be received at the YM during the early years of operation. This will likely place an additional burden on YM to license the DPCs for the repository design conditions, primarily a higher seismic zone.
- Schedule
  - Aging in DPCs may have an impact on schedule if new licensing is needed for DPCs and storage casks.
- Receipt/Emplacement
  - Aging in a DPC will assist in decoupling waste receipt from emplacement.
- Cost
  - See Section 4.
  - The Base Case design includes processes for handling DPCs in the WHF.

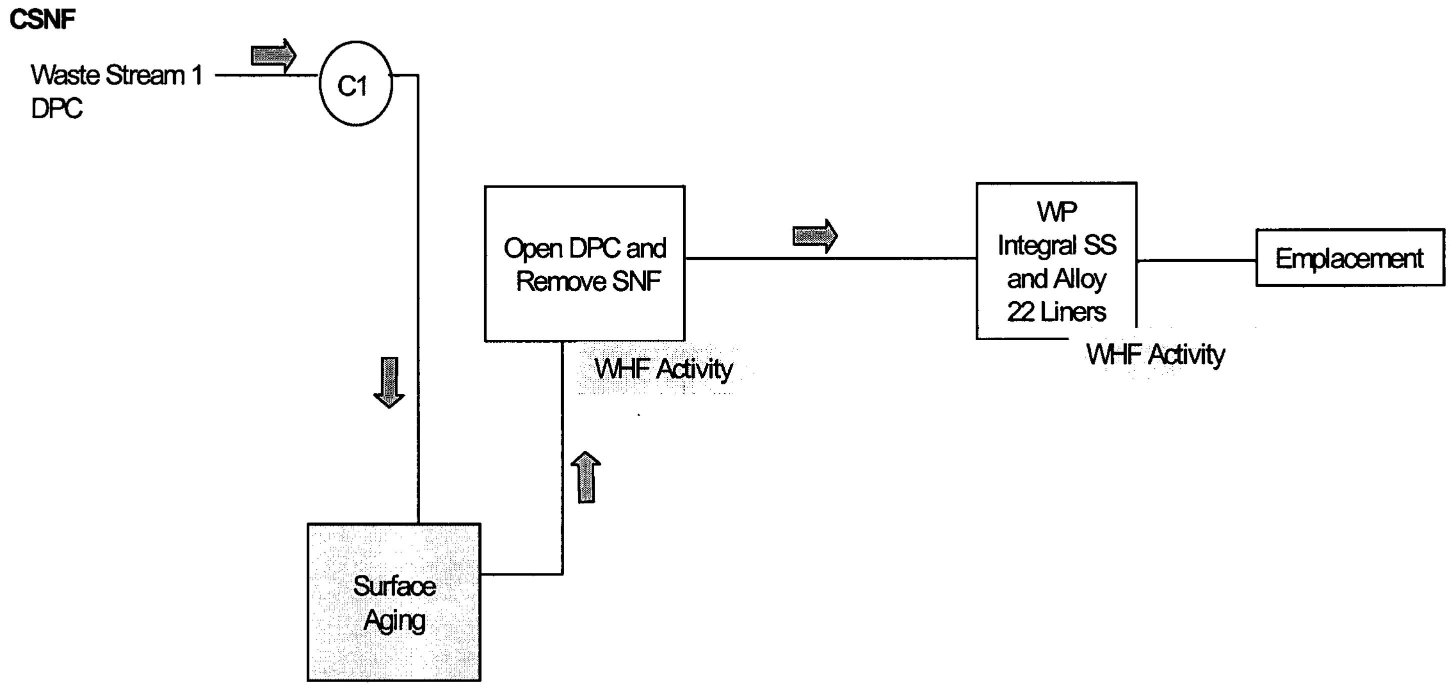


Figure 6. Aging Study Container Option C1 DPC

- Flexibility
  - DPC aging would provide additional flexibility in the waste handling process by providing more options for processing waste prior to emplacement.
- Programmatic Risk
  - This container option is a low risk addition to waste packaging operations, since the WHF already includes provisions for processing DPCs.
- Compatibility
  - Because a minimal number of new steps are added to the existing waste process, new constraints imposed on others by this design and synergies between this design and others is comparable to the Base Case design.
- Operability
  - Aging in DPCs allows the WHF to be expanded in relatively small increments and also allows for an extended period of slow underground emplacement.
- Existing Studies and Analyses
  - This option is an evolutionary improvement to the SR design. It allows increased flexibility in decoupling waste receipt and emplacement as well as providing a means to age waste to meet thermal criteria prior to emplacement.

3.1.3.2 Option C1 Issues

- There are currently several licensed and deployed designs for commercial DPCs (on-site dry storage followed by transport of the canistered fuel without repackaging). These DPC designs vary considerably in capacity, licensing requirements, size, materials, handling requirements, etc. DPCs received at YM would most likely be of varying dimensions and capacities that may require significant flexibility in WHF receipt and transfer equipment.
- The licensed dry storage systems using DPCs could probably be modified for aging at YM as several DPC dry storage systems have been licensed for locations with stringent seismic criteria.
- Commercial DPCs are currently stored in both horizontal and vertical orientations at owner/generator sites; probably both would be needed at a YM surface aging area because both are used by Standard Contract Holders.

3.1.4 Option C2, MPC

Option C2 uses the MPC for aging, see Figure 7. At present, a licensed MPC for CSNF does not exist and a license would have to be obtained under 10 CFR 71, 10 CFR 72, and 10 CFR 63 for transport, storage, and disposal. In the Base Case (no aging), an MPC is received containing CSNF. The MPC with CSNF is placed directly into a WP. Since the MPC will be licensed for disposal, the CSNF does not need to be removed from the MPC prior to placement in the WP. In Option C2, the MPC is transported to aging prior to being placed in the WP. This option takes advantage of the fact that the MPC is licensed as a storage canister and postpones the WHF processes of placing the MPC into the WP until after aging is completed. Transport and handling of the MPC from the WHF to the aging location are discussed in the Options S1, S2, S3, and S4 write-ups in this study. After aging is completed, the MPC is returned to the WHF and placed into a WP. The WP is processed (welding is completed, final inspections, etc.) and transported to emplacement.

3.1.4.1 Option C2 Evaluation Criteria

- Health and Safety
  - See Option C1.
- Licensability
  - There are no licensed MPC designs currently available for CSNF.
  - If new storage cask designs are required for MPCs, there will be a licensing impact.
- Schedule
  - Aging in MPCs may have a scheduling impact on the program since licensed MPC designs for the disposal of CSNF do not yet exist.
- Receipt/Emplacement
  - See Option C1.
- Cost
  - See Option C1.
- Flexibility
  - See Option C1.
- Programmatic Risk
  - See Option C1.
- Compatibility
  - See Option C1.

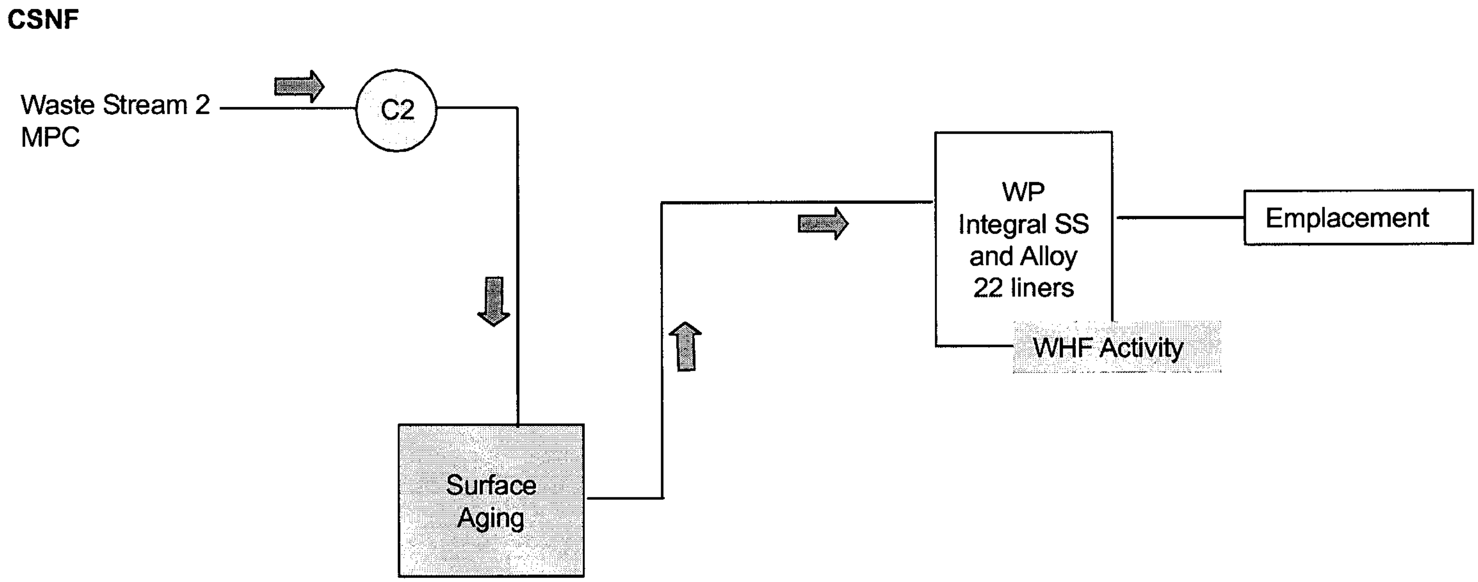


Figure 7. Aging Study Container Option C2 MPC

- Operability
    - See Option C1.
- Existing Studies and Analyses
    - See Option C1.

3.1.4.2 Option C2 Issues

- Although there is not currently a licensed MPC design (licensed for storage, transport, and disposal), there could be a range of commercial MPCs available in the early years of repository operation. The number of MPCs provided to the DOE by the holders of a Standard Contract may depend upon when an MPC license is obtained and what incentives are offered to the Contract Holders for providing CSNF in MPCs.
- If MPCs were provided to the repository, aging option C2 could involve a range of storage cask sizes and the need for flexible handling equipment in the WHF. This is similar to the DPC issue but probably not as severe since design variations for future MPCs could be minimized to be compatible with licensed WP designs.
- The required aging orientation of the MPCs at YM would probably require both horizontal and vertical aging as many of the owner/generators have already committed to a specific orientation at their facility.

3.1.5 Option C3, New Disposable Canister

Option C3 uses a new disposable canister to package uncanistered CSNF for aging, see Figure 8. In the Base Case (no aging), uncanistered CSNF is removed from the transportation cask and placed in a WP. In Option C3, the uncanistered CSNF is placed in a new disposable canister and transported to aging. The disposable canister would be designed as a storage and disposal canister, so that once CSNF is placed in the canister, the canister would not need to be opened again. Transport and handling of the disposable canister from the WHF to the aging location are discussed in the Options S1, S2, S3, and S4 write-ups in this study. After aging is completed, the disposable canister is returned to the WHF and processed the same as an MPC (placed directly into the WP). The WP is processed (welding is completed, final inspections, etc.) and transported to emplacement.

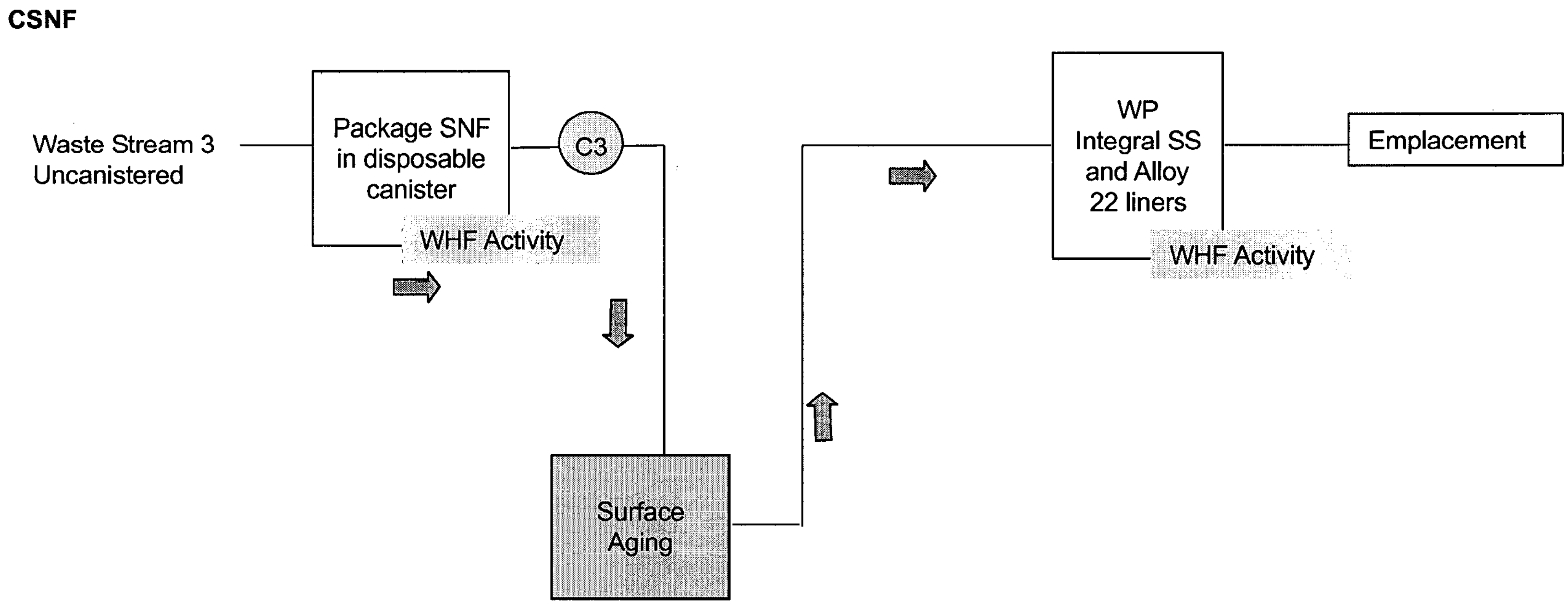


Figure 8. Aging Study Container Option C3 Disposable Canister

3.1.5.1 Option C3 Evaluation Criteria

- Health and Safety
  - See option C1.
- Licensability
  - See option C2.
- Schedule
  - See Option C2.
- Receipt/Emplacement
  - See option C1.
- Cost
  - See Section 4.
- Flexibility
  - See Option C1.
- Programmatic Risk
  - See Option C1.
- Compatibility
  - Option C3 is a significant change to the design since the Base Case does not include a separate disposable canister. However, the new steps added to the waste packaging process (placing CSNF in a disposable canister and sealing the canister) are similar to the current waste process.
- Operability
  - See Option C1.
- Existing Studies and Analyses
  - See Option C1.

3.1.5.2 Option C3 Issues

- Under Option C3, the disposable canister design and licensing could parallel the design and licensing of the WPs. This would minimize the number of storage systems that would need to be licensed and deployed. A storage and disposal license would be required for the new disposable canister.

- If a disposable canister option were selected for aging, a benefit would be that only one orientation (vertical or horizontal) would be required to be designed, licensed, and deployed for uncanistered CSNF received at the repository.

- The WHF would need to include new process steps for handling, inspecting, and welding the new disposable canisters.

- Uncanistered CSNF could be aged using metal storage casks without a separate canister. Metal casks currently are licensed for the dry storage of some types of CSNF. Because metal cask storage would involve double handling CSNF fuel assemblies (from the transportation cask to the storage cask and from the storage cask to the WP), the use of uncanistered metal storage casks was not considered in detail in this study. Uncanistered metal storage cask costs are presented in Section 4, for information.

3.2 AGING LOCATION DISCUSSION

Surface and subsurface aging locations are considered in this study. The surface aging locations are selected based on a previous evaluation, *White Paper: Staging Pad Siting Study*, REV 00 (CRWMS M&O 2001) which compared three sites near the North Portal; a fourth surface aging location in the North Portal Pad area has been added in this study. Subsurface aging location options are the permanent emplacement drifts and a new subsurface aging area.

A potentially significant issue with aging location selection is resistance to terrorist activities. These criteria and design requirements are under review. For the purpose of this study, resistance to terrorist activities is part of the Health and Safety technical criterion evaluation and is used to compare options, not to evaluate options against a design requirement.

3.2.1 Options S1 to S4, Surface

The surface aging sites were chosen based on relatively flat sites located close to the North Portal WHF, see Figures 9 and 10. Sites considered for surface aging are within 1 mile of the WHF. A large cask transporter used to move shielded waste containers is expected to travel at approximately ½-mile per hour. Based on an assumed maximum one way travel time of 2 hours, 1 mile was used as the maximum distance between the aging area and the WHF. With these selection criteria, three sites were identified: Exile Hill, Midway Valley, and the North Portal; a fourth aging site in the North Portal Pad is also included, see Figure 10. An additional portal for construction access to the MGR is being considered. This new portal location is approximately 0.5 mile north of the Exile Hill site and 0.75 mile northwest of the Midway Valley site and is not expected to interfere with surface aging operations.

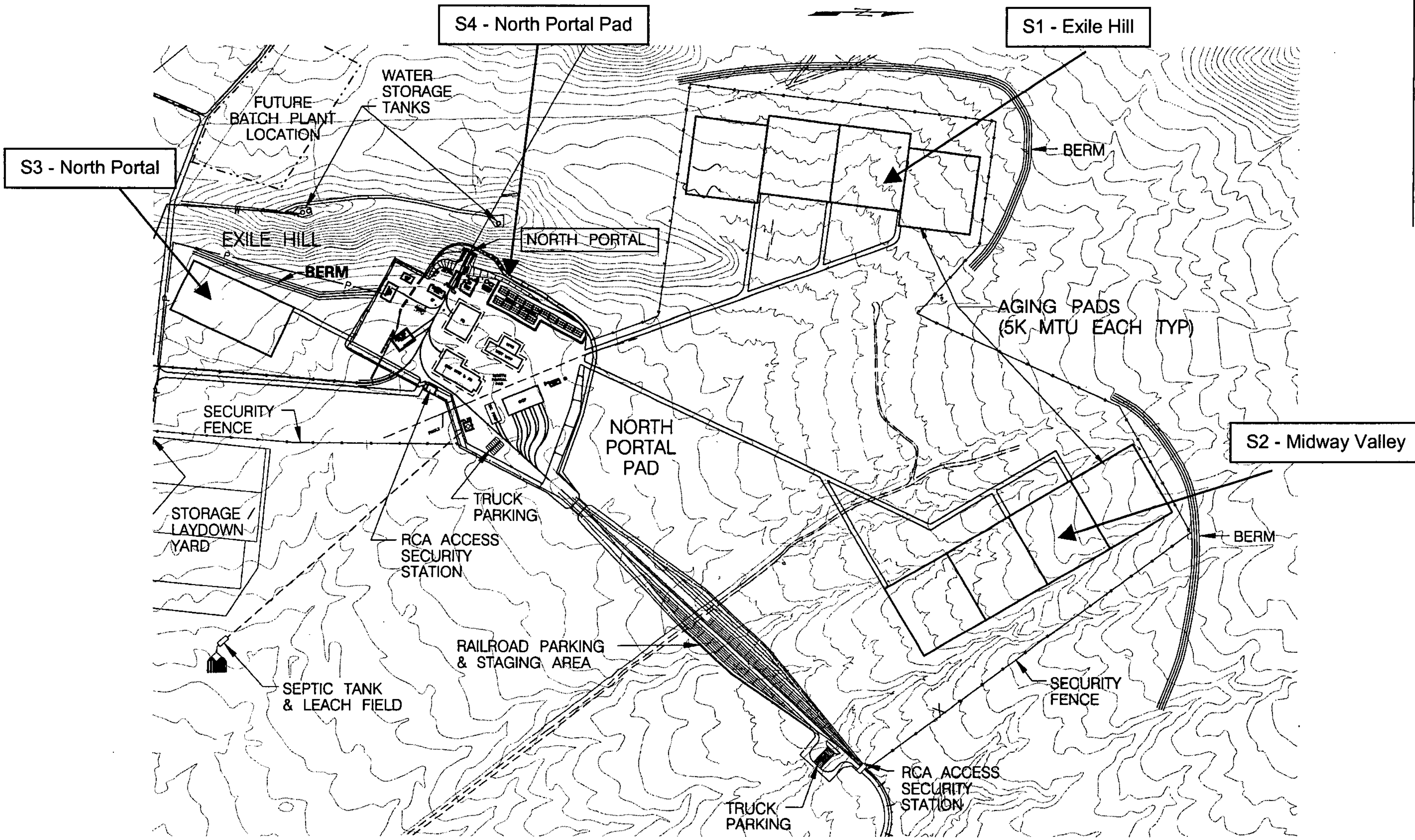


Figure 9. Surface Aging Locations Options S1, S2, S3, and S4

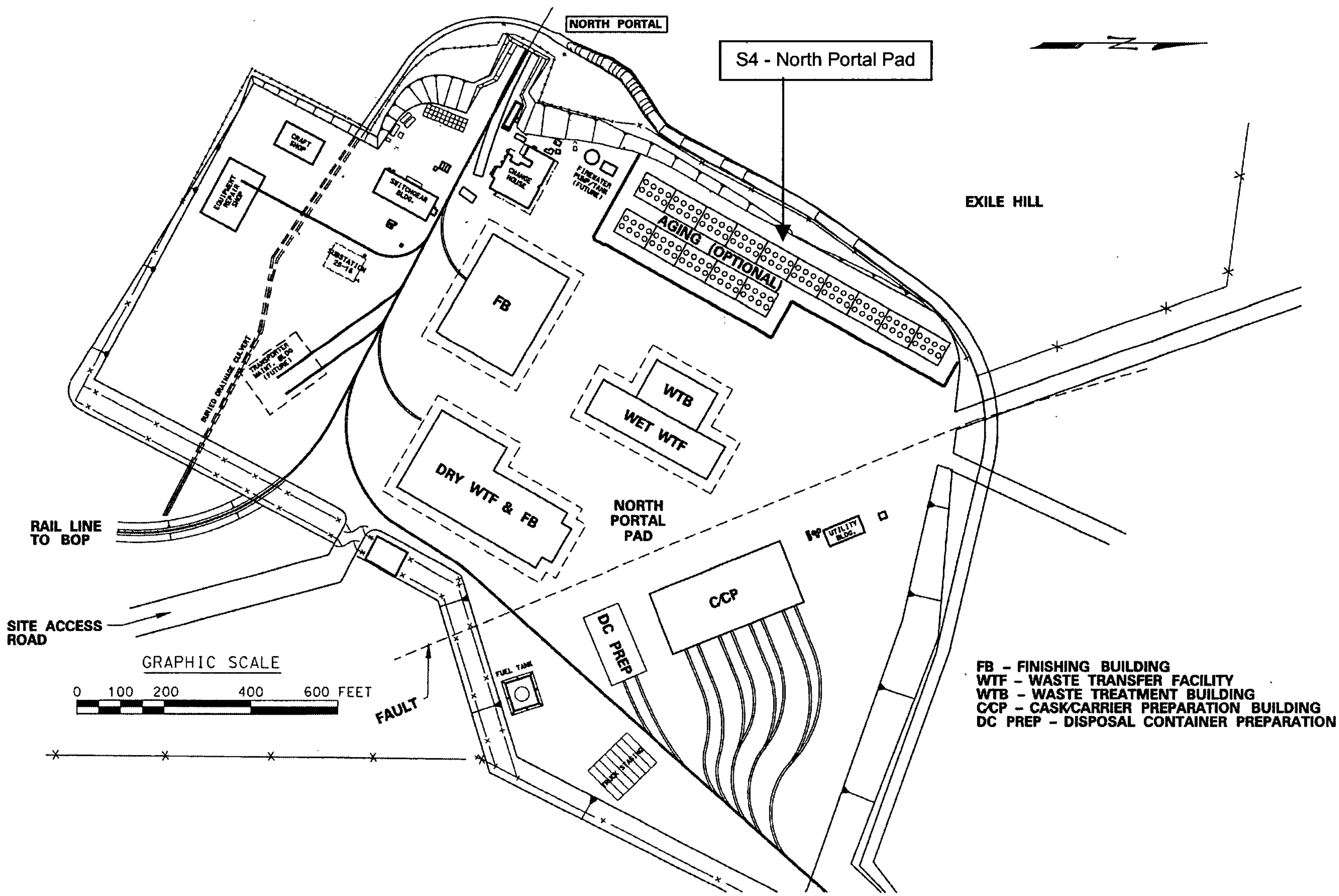


Figure 10. North Portal Pad Location Option S4

For surface aging, a waste container must be contained in a shielded storage cask for worker radiological protection. Two design variations of surface storage casks (overpacks) are considered – vertical and horizontal. A significant difference between the vertical and horizontal cask systems is the transfer process. The vertical storage system, which may include a metal or concrete cask, is transported and stored in a vertical orientation. This is consistent with the vertical cask transfer process proposed for the WHF. No additional downending/upending would be required for the cask transporter to interface with the WHF systems. Typically in the horizontal storage system, the waste container is transported horizontally and then transferred from a transfer cask to a storage cask. Additional downending/upending operations and equipment would be required in the WHF to interface with a horizontal storage system.

The concrete aging pads are sized considering current commercial vendor designs for five different dry storage cask systems and one vertical WP aging configuration. Since the size of the aging area and its layout depends on the storage system selected, the storage system with the greatest demand for site space is used to establish the aging pad space requirements. Vertical concrete cask aging requires the most space and Figure 11, CRWMS M&O 2001, shows the sizing basis for the aging pads. The aging pads are sized for 5000 MTHM of storage; this results in 504 storage casks on a 665 ft by 609 ft pad. Pad design details are discussed in CRWMS M&O 2001.

Each vertical concrete storage cask is approximately 11 feet in diameter and 20 feet long (high). It weighs approximately 180 tons fully loaded with a canister. A typical cask wall includes 3 inches of steel and 27 inches of concrete or shielding equivalent to approximately 36 inches of concrete. The waste container is passively cooled by ambient air drawn by natural convection through shielded ducts in the bottom of the cask and vented through shielded ducts at the top of the cask.

For a vertical aging orientation, the storage cask and waste container are packaged at the WHF and transported to the storage pad in a vertical orientation. A specially designed storage cask transporter, equipped with a lifting beam and rolling tracks, is used to move each storage cask from the WHF and place it in position on the storage pad. The same transporter is used to pick up the storage cask at the aging pad and return it to the WHF.

For a horizontal aging orientation, a transfer cask and waste container are packaged at the WHF in a vertical orientation and placed on the transporter in a horizontal orientation. A specially designed horizontal cask transporter is used to move the transfer cask from the WHF to the storage pad. At the storage pad, the waste container is transferred from the transfer cask to the horizontal storage module. The horizontal storage module is constructed in place. After aging, the waste container is transferred from the storage module to the horizontal transfer cask, returned to the WHF, and upended to a vertical position for final processing prior to emplacement.

CRWMS M&O 2001 evaluated aging sites for up to 20,000 MTHM in 5000 MTHM modules. Based on this earlier study, the Exile Hill and Midway Valley sites could each accommodate 20,000 MTHM. The North Portal site is only large enough for 5000 MTHM. As stated in the FEIS (DOE 2002), as much as 40,000 MTHM of CSNF aging may be needed. Further evaluations would be required to determine if either the Exile Hill and Midway Valley sites could be expanded beyond 20,000 MTHM of aging.

A new surface aging area, the North Portal Pad, is included in this study. The North Portal Pad area is large enough for approximately 1,000 MTHM.

Systems, structures, and components associated with surface aging include:

- Aging Pad–used to locate and support the casks and waste containers, see Figure 11. A 5000 MTHM pad is sized to handle vertical concrete casks (the bounding case), vertical metal casks, and horizontal concrete storage modules.

- Paving Between Pads–aisles between the storage casks are paved to support the selected cask transporter. Paving options are compacted gravel (for crawler type transporters) and concrete or asphalt (for wheeled transporters).

- Fencing–two 12-ft high security fences, prison grade, with egress gates surround the storage pad area.

- Lighting–perimeter lighting is placed at the fence line.

- Monitoring and Security–temperature sensors on the storage casks (two for each cask) monitor the heat removal system performance. The security system includes intrusion detection and closed circuit television.

- New road–road from the WHF is paved to support the selected cask transporter. Paving options are compacted gravel (for crawler type transporters) and concrete or asphalt (for wheeled transporters).

- Surface water drain system–each 5,000 MTHM storage pad includes a 1.2 acre detention basin to collect surface water run-off. The aging pad is assumed to not be a radiological controlled area for surface contamination, and water collected in the detention basin is allowed to either evaporate or percolate into the ground.

- Flood diversion berm–as required based on the aging pad location, a flood diversion berm is constructed to divert surface water runoff from the upstream watershed around the aging pad.

Centralized Interim Storage Facility, Topical Safety Analysis Report, Revision 1 (DOE 1998), evaluated the expected radiation dose rates from a 40,000 MTHM array of CSNF in concrete storage casks. At 2 meters the dose rate was approximately 10 mrem/hr; and at 50 meters the dose rate was approximately 2 mrem/hr. A surface aging area for YM is expected to have similar dose rates.

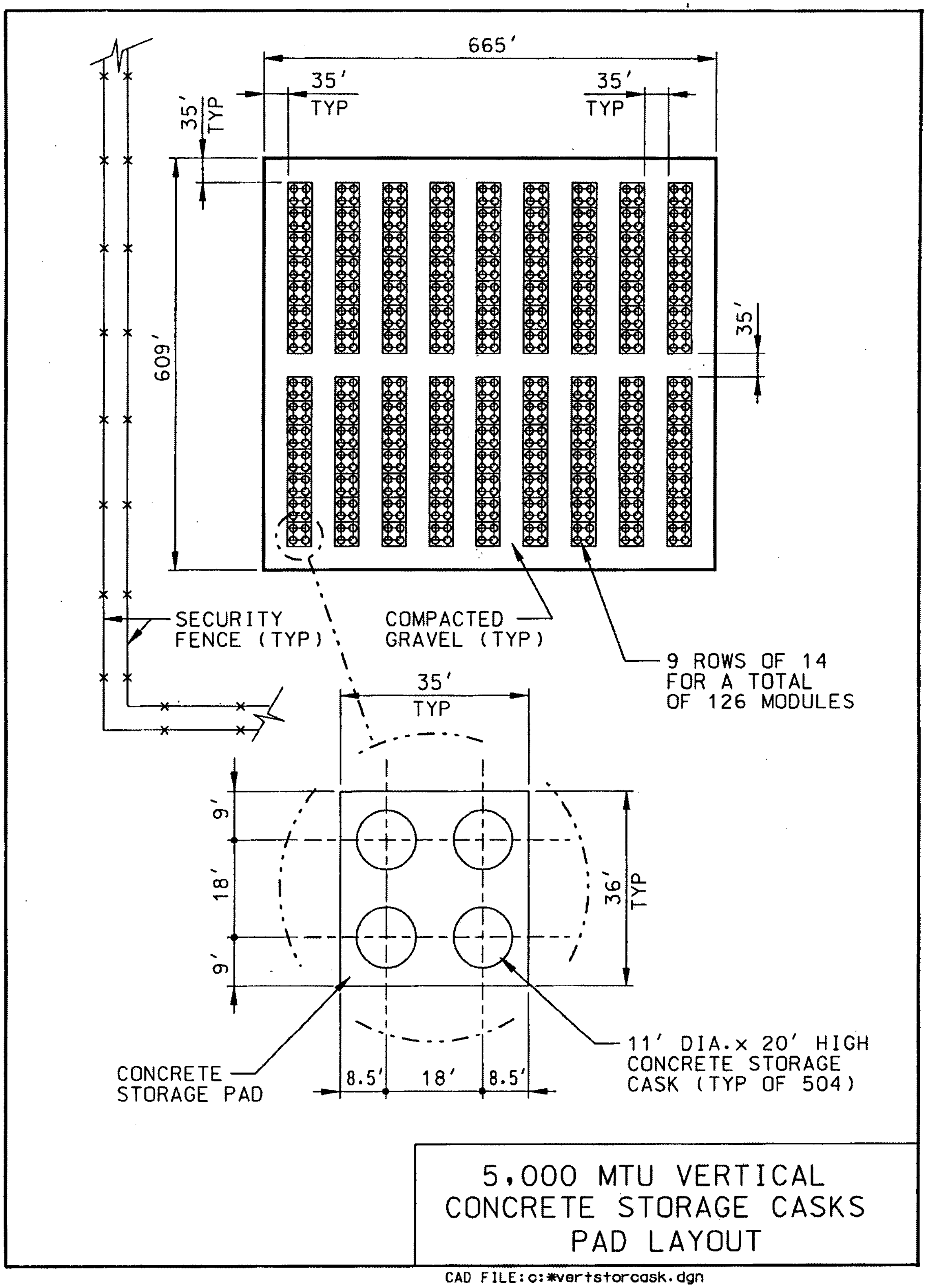


Figure 11. 5,000 MTHM Vertical Concrete Storage Casks Pad Layout

3.2.1.1 Exile Hill

The Exile Hill site is an area of over 40 acres northwest of Exile Hill. The approximate average elevation is 3,795 feet. The distance from the WHF to the center of this site is approximately 3,700 feet. The resulting grade for a roadway from the WHF to Exile Hill is 3%. The associated one way travel time is approximately 1.4 hours @ 44 ft/min. A road is constructed from the North Portal to the Exile Hill site. In CRWMS M&O 2001, this site was sized for storage pads capable of handling up to 20,000 MTHM in 5,000 MTHM increments. If aging of up to 40,000 MTHM were required, the expansion of the Exile Hill site would need to be evaluated.

3.2.1.2 Midway Valley

The Midway Valley site is over 40 acres located west of the North Portal area across Midway Valley. The highest site elevation is approximately 3,825 feet. The distance from the WHF location to the center of the Midway Valley site is approximately 5,200 feet. The resulting grade for a roadway is 3%. One way travel time is approximately 2 hours.

To reduce the work needed to prepare this site, the storage site would be placed between two washes formed by water runoff from higher elevations. This minimizes the amount of fill needed to provide an area with a 2% slope.

This site can be sized for storage pads capable of handling up to 20,000 MTHM in 5,000 MTHM increments. If aging of up to 40,000 MTHM were required, the expansion of the Midway Valley site would need to be evaluated.

3.2.1.3 North Portal

The North Portal storage area is located south of the North Portal along the side of Exile Hill. This area is limited in size due to the WHF processing facilities that may be constructed in this area. The distance from the WHF to the center of this site is approximately 1,000 feet. The resulting roadway grade would be approximately 1%. The one way travel time is approximately 23 minutes.

Due to space limitations, this site can only be sized to handle 5,000 MTHM.

3.2.1.4 North Portal Pad

The North Portal Pad area is located near the WHF, see Figure 10. This area has space for approximately 100 storage casks or 1,000 MTHM. Since this site is adjacent to the WHF, time for cask transportation would be minimal compared to the other surface aging sites. Also, because this site is part of the WHF work area, additional shielding is needed for worker radiation protection. A conceptual design for a shield wall to limit worker radiation exposure (25-ft-high, 3-ft-wide, 1,500-ft-long) is included in this evaluation.

3.2.1.5 Surface Aging Evaluation Criteria

All four surface locations are evaluated against the criteria below. Comments specific to a given site location are noted.

- Health and Safety
  - Surface aging will result in additional worker radiation exposure. Radiation dose rates are expected to be approximately 10 mrem/hr at 2 meters and 2 mrem/hr at 50 meters, without additional shielding.
  - Surface aging will increase the number and variety of handling operations.
  - Surface aging is less resistant to terrorist attacks than the Base Case of subsurface emplacement.
- Licensability and Regulatory Acceptance
  - Pads of this nature have been designed and installed at commercial nuclear power facilities, DOE facilities, and Naval Facilities.
- Schedule
  - Addition of surface aging to the design will increase the engineering and licensing effort required for LA; the schedule impact will need to be evaluated.
- Receipt/Emplacement Capabilities
  - Use of surface aging will provide additional flexibility in the design to decouple waste receipt from emplacement.
- Cost
  - See Section 4.
- Flexibility
  - The surface aging options support a modular and scalable design, with the exception of the North Portal and North Portal Pad area, the pads can be expanded beyond 5000 MTHM, depending on need.
  - The design allows for changes in the repository thermal operating mode by providing the ability to age CSNF prior to emplacement.
  - The design provides the flexibility to accommodate early receipt and variations in the receipt rate.
  - The ability of either the Midway Valley or Exile Hill sites to accommodate up to 40,000 MTHM may need to be evaluated.
- Programmatic Risk
  - The aging pad design is constructable using proven techniques.

- The design improves the ability to manage waste after receipt and prior to emplacement.

- Compatibility with other components

    - The storage pad is compatible with either the vertical or horizontal storage cask designs and the associated transport system(s).

    - The design adds complexity to the Base Case by increasing the number of processing steps in the WHF.

- Operability

    - The design allows for expansion of the repository design in relatively small increments.

    - The design allows for slow underground emplacement.

    - The design is an improvement over the SR design by enhancing the flexibility to manage waste.

- Use of Existing Studies and Analyses

    - The Exile Hill, Midway Valley, and North Portal surface aging areas considered have not yet been characterized for soils and seismic engineering information. The North Portal Pad site has been characterized.

3.2.2 Options SS1 and SS2, Subsurface

Two subsurface aging areas are considered, see Figure 12. Option SS1 is the existing emplacement drifts. Option SS2 is a new subsurface aging drift area that will provide a temporary aging area for WPs.

All subsurface aging would use completed WPs, see assumption Section 1.3.3. After completion of WP processing, the WP is loaded on the transporter in a horizontal orientation in the WHF. The WP is transported to the selected subsurface aging area – either the permanent emplacement drifts or the new subsurface aging drifts.

3.2.2.1 Emplacement drifts

The design of the 70,000 MTHM subsurface repository layout consists of emplacement drifts excavated to an 18-ft diameter at a center-to-center drift spacing of 263 ft. The design WP emplacement spacing is 4 in to 21 ft, FEIS (DOE 2002). If the emplacement drifts were used for aging, the WPs would most likely be spaced near the upper end of this range. A separate design re-evaluation study is being performed to determine if this additional spacing would reduce the thermal load on the mountain to an acceptable limit until the CSNF in the WP had thermally cooled. After cooling, the WPs would be moved closer together to place them at the design WP emplacement spacing.

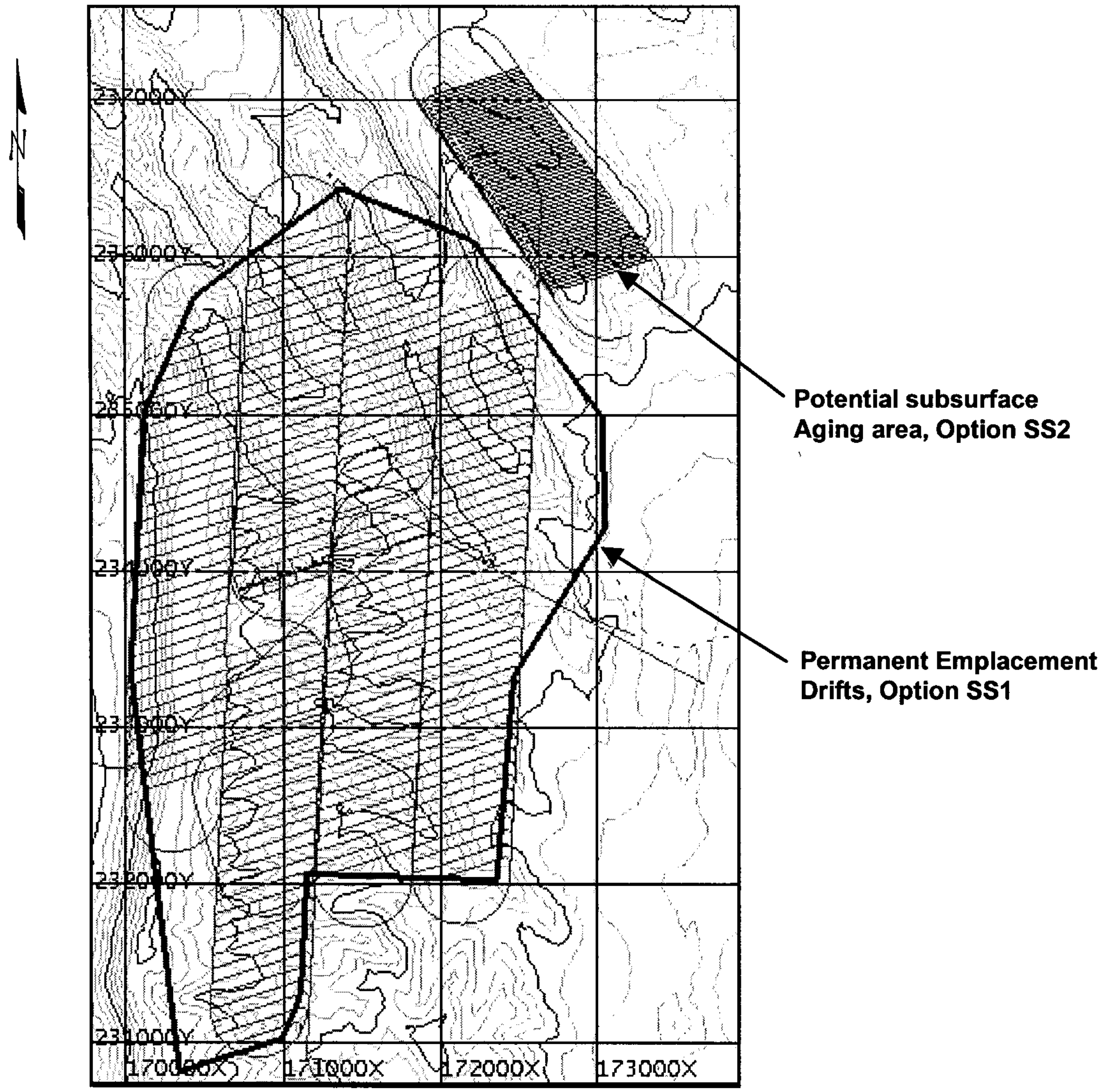


Figure 12. Subsurface Aging Areas Options SS1 and SS2

3.2.2.2 New subsurface aging area

The new subsurface aging area would be located in the area of Isolation Ridge. Isolation Ridge is located approximately 1.5 miles north-northeast of the North Portal. Isolation Ridge is considered to be an acceptable location for a new subsurface aging area because of the close proximity to the WHF and the minimal number of fault zones in the area. In addition, the entrance area to this new subsurface aging area would be located at a three-sided box canyon that would be used as the egress points for the main tunnels. The opposite sides of the canyon would be used as the tunnel portal points.

The new subsurface aging area would have space available for aging 40,000 MTHM. Up to 24.9 miles of emplacement drift space could be excavated to an 18-ft diameter at a center-to-center drift spacing of 79 ft. The new subsurface area would not have the same thermal load restrictions as the permanent emplacement drifts and therefore the WP spacing configuration could be closer together during the CSNF aging/cooling process. For conceptual design purposes, 32.5 ft of space is allocated for each 10 MTHM WP which requires approximately 24.9 miles of drift for 40,000 MTHM of aging. Once the WP aging process is completed, the WP would be moved to the emplacement drift using the subsurface transporter.

The Isolation Ridge subsurface aging area and the permanent emplacement drifts are located at different elevations. The Isolation Ridge aging area is at a higher elevation than the emplacement drifts. Even at this higher elevation there is approximately 650-feet of earth for shielding. Underground tunnels could be constructed to connect the Isolation Ridge aging area and the emplacement drifts.

Transport from the WHF to the Isolation Ridge subsurface area would require negotiating a grade of 3%, which is approximately the same grade as the current design to the permanent emplacement drift area.

3.2.2.3 Subsurface Evaluation Criteria

The evaluation criteria discussions provided below are related to both the permanent emplacement and Isolation Ridge subsurface locations. Any discussion item specific to a given site location is noted.

- Health and Safety
  - Subsurface aging would reduce worker radiation exposure because there would be fewer handling activities and there would be no surface radiation control zone associated with aging.
  - Subsurface aging provides greater protection from terrorist activities and accidents.
  - The number and variety of handling operations is similar to the Base Case. Isolation Ridge would require more operations and handling than the permanent emplacement drifts.
  - Construction of the Isolation Ridge subsurface area would increase mining and other underground activities thereby increasing worker safety risks.
  - The Isolation Ridge construction sequence and activities need to be developed to separate construction workers from aging operations once subsurface aging begins.
- Licensability
  - The acceptability of aging in the permanent emplacement drifts needs to be confirmed. A thermal evaluation of the heat load imposed on the mountain by aging is being performed in a separate study.
  - The impact of constructing Isolation Ridge would need to be evaluated to determine if the pre-closure or post closure models were impacted.

- Schedule
  - Isolation Ridge would need to be evaluated to determine the impact on LA.
  - The schedule for drift construction and the quantity of drifts needed for subsurface aging need to be confirmed.
- Receipt/Emplacement Capabilities
  - Both the emplacement drift and the Isolation Ridge aging areas need to be evaluated to determine the receipt/emplacement rates that could be supported.
- Cost
  - See Section 4.
- Flexibility
  - The Isolation Ridge subsurface aging area is scalable and can be constructed in phases.
  - The Isolation Ridge design provides the flexibility to accommodate changes to the thermal operating modes. The permanent emplacement drifts provide the same flexibility to a lesser extent.
- Programmatic Risk
  - Use of either subsurface design entails the same risk related to construction methods and techniques.
  - Additional actions may be required to decommission the Isolation Ridge subsurface aging area prior to closure of the repository.
- Compatibility with other components
  - The permanent emplacement drifts and Isolation Ridge subsurface aging areas are compatible with the existing design waste handling process.
- Operability
  - Subsurface aging is an evolutionary improvement over the SR design by providing flexibility into the design.
- Use of Existing Studies and Analyses
  - The Isolation Ridge area is within the characterized area.

3.2.3 Aging Location Issues

- Aging in either surface or subsurface locations for up to 50 years prior to disposal would require the development of an associated licensing and deployment strategy.
- The acceptability of aging in the permanent emplacement drifts is to be confirmed.
- For subsurface aging, a thermal evaluation is being performed separately to determine the spacing required between WPs in the permanent emplacement drifts. This information will be used in conjunction with waste receipt rates to determine the schedule and quantity of drifts needed for subsurface aging.
- The use of a subsurface aging area different from the disposal area may require additional decommissioning prior to closure of the repository.
- Supplemental shielding would be required for any surface aging option. This shielding (the storage cask or "overpack") would require an NRC licensing review of each storage system design.
- The NRC and the DOE may reconsider requirements for the protection of CSNF storage facilities from terrorist activities and an aircraft crash. Any new or more stringent requirements could significantly influence the relative advantage/disadvantage evaluation between surface and subsurface aging.
- The geotechnical and other data available for potential surface aging areas is presently limited. The data, when available, may eliminate an area(s) or show a clear advantage to a specific area. Seismic requirements could be a major factor in deciding both between surface/subsurface and among surface locations.
- Horizontal surface aging requires less pad space than vertical aging. The final pad sizing basis will need to consider the mix of vertical and horizontal aging.
- Surface aging imposes new requirements on the WHF design and operations. After selection of an aging design, the WHF design will need to be evaluated for compatibility.
- For this study, it has been assumed that the surface aging pads will not be radiologically controlled for surface contamination. This is consistent with the approach used in a recent design, NRC 2001. This assumption will need to be evaluated and confirmed for the YM design.
- The selected aging design will need to be evaluated for radiation dose rates and required shielding for personnel protection.
- The Exile Hill and Midway Valley surface aging locations are sized for 20,000 MTHM. Aging may be required for up to 40,000 MTHM. Expansion of the

Exile Hill and/or Midway Valley sites may be needed to meet the design basis aging requirements.

- Waste container cooling will be "free" for surface aging (ambient cooling) but will require an HVAC system for subsurface aging.

- Vault type surface aging was not considered in this study. Summary of Interim Storage Facility Option – 7 Vault Storage (Stringer 1995) compared surface storage in vertical concrete casks to vault storage (Modified Foster Wheeler MVDS System). The storage vault system cost was found to be approximately 1.6 times the cost of the modular concrete storage cask system. Conclusions from the study were:

  - The vault system provided a viable option for storage

  - The vault system appeared to not be the preferred option from a scheduling and cost perspective

  - Existing technologies favor concrete cask or modular system

  A conceptual high-level radioactive waste vault design is also described in the FEIS (DOE 2002) and consists of below grade vaults, an enclosure building and an HVAC system.

4. COST EVALUATION

Capital costs for aging containers and aging locations are evaluated separately. Capital costs are developed for direct costs and distributable field costs. Engineering, construction management, indirect markups, and contingency are excluded from this study and will be evaluated separately in an overall system evaluation report. To the extent practical, unit costs are presented. Operating costs, cost impacts on the WHF and associated equipment, and total system life cycle costs will also be evaluated outside of this study. The accuracy of the cost estimates presented is order of magnitude, or ± 40% or greater.

4.1 AGING CONTAINER CAPITAL COSTS

4.1.1 Dual-Purpose Canister, Multi-Purpose Canister, and Disposable Canister

Pricing information for the spent fuel storage equipment is provided by system vendors, fabricators of canisters and casks, and experienced industry consultants, see Appendix B, JAI Corp. Memo.

One supplier indicated that large quantities of casks and canisters (100+ units) could result in price decreases in the range of 10-30%, but stated that government contract requirements (government oversight of fabrication and assembly, termination for convenience of the government, project management requirements, and the like) could erase any such savings and even possibly result in higher costs.

The cost of canisters and baskets are essentially the same, according to the vendors. Baskets are the components inside a canister or waste container that structurally support the fuel assemblies. The basket for each canister or container is customized to meet the requirements for the size, type, and number of fuel assemblies it can hold. The estimated cost of canister and basket fabrication as obtained from the fabricators ranges from $200-400K. The difference between these costs and the estimated prices of system vendors ($400-550K) probably includes elements of cost for design, licensing, and profit on the part of the system vendors.

In view of the foregoing, the following costs shown in Table 1 are used in this study.

Table 1. Container Costs

Item	**Estimated Cost for Spent Fuel Aging Systems ($000)**		
	Vertical Concrete Cask Systems	**Horizontal Concrete Cask Systems**	**Vertical Metal Cask Systems**
Concrete Aging Cask Overpack[1, 2, 4]	250	150	-
Canister/Basket[1, 4]	450	400	-
Metal Storage-Only Cask	-	-	1200[3]
Transfer Cask & Associated Equipment (trailer, hydraulics, ram, etc.)		3200	-
Carrier (for moving cask to storage)	1000		1000

NOTES: [1] Nominal 24 PWR assembly capacity
[2] Excluding canister/basket cost
[3] Nominal 32 PWR assembly capacity
[4] Cask and canister/basket are nominally sized for 10 MTHM

4.1.2 Waste Package and Stainless Steel Liner

The container related cost for aging in the WP, Option WP1, is the same capital cost as the Base Case and was not evaluated further. However, if a new WP design were required to accommodate aging, the associated cost for design and licensing is assumed to be $10 million, *Determination of Waste Package Design Configurations* (CRWMS M&O 1997). In addition, new WP designs (sizes and geometrics) may require changes to the closure welding system to handle these new geometrics. With the evolving closure system design, it may not be possible to incorporate welding system design changes in time to meet the 2010 date for emplacement.

The cost for aging in the SS liner, Option WP2, was not evaluated because this option is determined to be technically unfavorable, see Section 3.1.2.2.

4.1.3 Unit Capital Costs Aging Containers

The following represents the additional unit costs for the aging container options over the Base Case of no aging. Additional operating costs and total system life cycle costs will be evaluated in a separate report.

Table 2. Unit Capital Costs for Aging Containers ($000)

Option	Canister/Basket, 10 MTHM [1]	Storage Cask, 10 MTHM [2]	Carrier/Equip, 20,000 MTHM [3]	Unit Capital Cost for Container Surface Aging 1 MTHM [4]
C1 – DPC Vertical	0	250	4,000	25.2
C1 – DPC Horizontal	0	150	12,800	15.6
C2 – MPC Vertical	0	250	4,000	25.2
C2 – MPC Horizontal	0	150	12,800	15.6
C3 – Disp Can Vertical	450	250	4,000	70.2
C3 – Disp Can Horizontal	400	150	12,800	55.6
WP1 – WP Vertical	0	250	4,000	25.2
WP1 – WP Horizontal	0	150	12,800	15.6
WP2 – SS liner (Not evaluated)	-	-	-	-

NOTES: [1] Canister/basket costs for 10 MTHM are selected from Table 1 based on the cask configuration. For example, C3- disposal canister is $450,000 each for a vertical configuration and $400,000 each for a horizontal configuration. Canister/basket costs for Options C1-DPC and C2-MPC are $0, since these containers are supplied by others, not Yucca Mountain. Canister/baskets for Option C3-Disposable Canister are supplied by YM and therefore are additional costs to the Base Case.

[2] Aging cask costs for 10 MTHM are selected from Table 1 based on the cask configuration. For example, C1-DPC vertical cask is $250,000 and horizontal cask is $150,000.

[3] Cask carrier and related equipment costs are calculated based on 4 carriers for each 20,000 MTHM, see Table 1. For example, 4 vertical configuration carriers are $4,000,000 and 4 horizontal carriers are $12,800,000 for 20,000 MTHM.

[4] Unit costs for 1 MTHM of container surface aging are calculated by summing the component costs as follows:

- Canister/basket 10 MTHM cost, divided by 10
- Storage cask 10 MTHM cost, divided by 10
- Carrier equipment 20,000 MTHM cost, divided by 20,000

Assumptions used to develop Table 2:

- 4 cask carrier/transporters will be required for 20,000 MTHM aging operations
- 10 MTHM capacity per canister/cask

4.1.4 Aging Container Cost Issues

- Most utilities will use a concrete overpack or module to meet their dry storage needs, and thus will canister the spent fuel before storage. If the utility delivers the loaded canisters (such as a DPC or MPC) to DOE, it would probably be expeditious to age them in the same type of module (e.g. vertical concrete cask, horizontal concrete cask, etc.) that was used at the reactor site, in order to simplify the licensing involved.

- Utilities that canister and store spent fuel in concrete casks will probably not deliver this canistered fuel to DOE until after other uncanistered fuel that is 5 or more years old has been delivered. This means that, absent an incentive to canister the spent fuel that is not destined for dry storage at the reactor site, the utilities will probably deliver to DOE 1) uncanistered fuel assemblies and, 2) canisters of failed fuel assemblies that have an envelope slightly larger than the assembly. Thus, most of the spent fuel shipped in the early years may be in the form of uncanistered fuel assemblies.

- When uncanistered fuel assemblies are received at the repository, it would be desirable to put them in canisters prior to aging, since the canister cost would be about equal to the cost of a basket for the metal storage casks, and handling after removal from aging would be simplified. The cost of seal welding the canister would be an added operation and cost.

- The cost of the metal storage cask is higher than for a concrete cask and its respective canister/basket. However, the capacity of the metal storage cask is about 33% greater than for the concrete casks. Moreover, the metal storage cask does not require a transfer device or canister welding equipment. Thus, this metal storage cask does not involve as many up-front operations. Utilities have been buying these casks.

4.2 AGING LOCATION COSTS

4.2.1 Surface Aging Capital Costs

Capital costs are developed for surface aging by estimating material quantities and associated direct costs and distributable field costs. The detailed cost estimate information is provided in Appendix C, Cost Estimate for Surface Aging. The scope of these cost estimates include:

- Pad related earthwork and site development
- Flood diversion berms
- Roads
- Detention pond and drain system
- Concrete pads
- Paving
- Utility support systems
- Monitoring and security

Table 3. Unit Capital Costs for Surface Aging ($000)

Option	Field Construction Costs	Unit Field Construction Cost for 1 MTHM
S1 – Exile Hill 5,000 MTHM	22,057	4.4
S1 – Exile Hill 20,000 MTHM	86,301	4.3
S2 – Midway Valley 5,000 MTHM	22,544	4.5
S2 – Midway Valley 20,000 MTHM	86,829	4.3
S3 – North Portal 5,000 MTHM	21,645	4.3
S4 – North Portal Pad 1,000 MTHM	7,479	7.5

4.2.2 Subsurface aging costs

Costs for Option SS1, aging in the permanent emplacement drifts, are the same as the Base Case. Costs for Option SS2, aging in the Isolation Ridge subsurface aging area, are estimated by assuming that the capital cost for a new subsurface drift is the same as the capital cost for the permanent emplacement drift. A capital cost of $877,000,000 for 24.9 miles (40,000 meters) of drift is used, see Appendix D, Cost Estimate for Subsurface Aging. In Section 3.2.2.2, it is assumed that 24.9 miles of drift are constructed for the new subsurface aging area.

Table 4. Unit Capital Costs for Subsurface Aging ($000)

Option	Direct Field Construction Cost for Aging 40,000 MTHM	Unit Field Construction Cost for Aging 1 MTHM
SS1 – Permanent Emplacement Drifts	0	0
SS2 – New subsurface aging area, Isolation Ridge	877,000	22[1]

NOTE: [1] Unit cost for aging 1 MTHM in Isolation Ridge will depend upon the spacing required between WPs. The cost shown, $22,000/MTHM, is for a 16-ft spacing and an average 16-ft long WP. If the WP spacing were reduced, the $/MTHM would also be reduced.

4.2.3 Aging Location Cost Issues

- Costs for surface aging do not include subcontract engineering and services, BSC engineering and services, BSC indirect costs, and National Lab labor costs. These additional costs will be evaluated outside of this study.

- A conservative approach has been taken in developing surface aging pad costs. For example the following cost items have been included, but further detailed design development may determine that the associated design features are not required.
  - Concrete paving (instead of compacted gravel) on the pad and the access roads
  - Fire protection system consisting of fire water piping from the North Portal and fire hydrants at the aging pad
  - Security grade, 12 ft high double fencing around the pad
  - Security monitoring system connected to the North Portal
  - Temperature sensors, 2 per cask, connected to a cask monitoring system
  - Communication system installed at the pad
- The cost for the Isolation Ridge new subsurface aging area is assumed to be equivalent to the cost for constructing the permanent emplacement drifts. This is a conservative approach and should be re-evaluated if Isolation Ridge is considered further.
- There will be a premium cost with any construction activities inside radiation controlled areas after 2010, when operations begin. These premium costs are not included in any of the estimates prepared for this study.
- The 1000 MTHM aging area on the North Portal Pad, Option S4, will need to be shielded for worker radiation protection. The extent and type of shielding will be determined during design development. For the purpose of this study, a conservative design is used of a concrete wall 3 ft wide, 25 ft high and 1500 ft long. The field construction cost for the wall is approximately $2,000 per ft. An alternate design for shielding using an earthen berm was considered, but not evaluated because of the space requirements for the berm base and the corresponding loss of space in the WHF work area. For example using the flood diversion berm at Exile Hill (15 ft high and 45 ft wide base) as a reference, a 25-ft high shield berm would be approximately 65 ft wide at the base.
- Costs for characterizing the Exile Hill and Midway Valley surfacing aging locations are not included in this cost estimate and will need to be determined if either of these sites is selected.

5. SUMMARY AND RECOMMENDATIONS

5.1 CONTAINER SUMMARY

The aging container options are first compared in the general categories of 1) DPC/MPC/Disposable Canister, 2) WP, and 3) SS Liner. A comparison of the technical criteria (cost comparison not included) shows that for surface aging the DPC/MPC/Disposable

Canister option is preferred, with WP second and SS Liner last, see Appendix A. Subsurface aging will only be done in completed WPs, see Section 1.3.3.

Comparable capital costs for containers for surface aging compared to the Base Case (WP as a container) are listed below. Included are costs for the waste container, cask, and associated transport/transfer equipment needed for surface aging.

- $25,200/MTHM for vertical aging of DPC/MPC.
- $15,600/MTHM for horizontal aging of DPC/MPC.
- $70,200/MTHM for vertical aging of a Disposable Canister.
- $55,600/MTHM for horizontal aging of a Disposable Canister.
- $25,200/MTHM for vertical aging of WP.
- $15,600/MTHM for horizontal aging of WP. Note that additional equipment may be needed (which is not included in this cost estimate) to protect a WP when inserting and removing the WP from a horizontal storage module.
- A cost for the SS liner option was not determined, since this option was found to be not technically favorable. See Section 3.1.2.2 for a discussion.

5.2 LOCATION SUMMARY

The aging location options are first compared in the general categories of surface and subsurface. A comparison of the technical criteria (cost comparison not included) shows that both surface and subsurface options are essentially equal, see Appendix A.

Capital costs for aging locations compared to the Base Case (no aging) are:

- Based on a zero cost for funding (i.e., no time cost of money), there are no additional capital costs for subsurface aging in the permanent emplacement drifts. This is the same capital cost as the Base Case.
- $22,000/MTHM for subsurface aging in a new subsurface aging area. This unit capital cost assumes the cost/kilometer for the new subsurface aging area is approximately the same as the permanent emplacement drifts.
- $4,500/MTHM for surface aging using Options S1, S2 or S3 and $7,500/MTHM for surface aging using Option S4 at the North Portal Pad. This is the approximate unit capital cost for new facilities and equipment including: aging pad; site preparation; roads; flood diversion berms; drainage systems; and security and monitoring systems.

5.3 RECOMMENDATION

The purpose of this study is to evaluate options and issues with aging waste for further review in the overall design re-evaluation effort. The following recommendations are based on the results of this study. There are three recommendations for aging CSNF–subsurface, surface, and combined surface and subsurface.

5.3.1 Subsurface Aging

- Recommendation – Option SS1, permanent emplacement drifts with CSNF aging in the complete WP

  This subsurface recommendation has the following advantages compared to surface aging:

  1 Safety and health risks are minimized compared to surface aging locations. Worker radiological exposure and additional handling operations are similar to the Base Case design.

  2. The design is more resistant to terrorist activities and accidents than surface aging because it is underground.

  3. As evaluated in this study, there are no additional capital costs over the Base Case. The capital cost for subsurface aging at Isolation Ridge is greater than the Base Case because it is new underground construction. The capital cost for surface aging is greater than for subsurface aging in the emplacement drifts since additional surface aging facilities, shield casks, and cask transportation equipment will be needed.

  4. The licensing approach is similar to the Base Case and does not require new designs to be licensed.

  5. The design is compatible with the WHF current scope and does not impose new handling or equipment requirements on the WHF.

- Issues with the subsurface aging recommendation requiring further evaluation:

  1. The acceptability of aging in the permanent emplacement drifts and the associated thermal loads on the repository and ventilation requirements are being evaluated in a separate study.

  2. The schedule for drift construction to support subsurface aging and the quantity of drifts needed for subsurface aging need to be determined. This is a schedule risk for the program.

  3. Subsurface aging in a WP will require complete processing through the WHF prior to aging which will impose more constraints on operations and plant throughput compared to aging in other types of canisters.

- Subsurface aging options considered but not recommended:
  - Option SS2, aging in a new subsurface area, Isolation Ridge; not recommended based on cost.

5.3.2 Surface Aging

- Recommendation – All surface location options should be considered – Option S1 Exile Hill, Option S2 Midway Valley, Option S3 North Portal, and Option S4 North Portal Pad – with CSNF aging in a DPC, MPC, or disposable canister (Options C1, C2, or C3).

  This surface aging recommendation has the following advantages:

  1. Surface aging is more flexible than subsurface aging in decoupling receipt from emplacement.
  2. Surface aging sites can be developed in stages, as needed to support aging requirements.
  3. The design will not require complete processing of WPs prior to aging. This will be less of a constraint to operations and plant throughput than subsurface aging in the WP.
  4. The design is more flexible in accommodating changes to the repository thermal operating mode.
  5. The design allows for slower underground emplacement without restricting receipt rates.
  6. The waste containers included in this option are ranked highest in the technical evaluation (see Appendix A).
  7. Cooling of the waste containers during surface aging will be "free" (ambient cooling). For subsurface aging, there will be a cost for cooling associated with the HVAC equipment and operations.

- Issues with the surface aging recommendation requiring further evaluation:

  1. Each of the Exile Hill and Midway Valley sites was originally sized for 20,000 MTHM of aging. As much as 40,000 MTHM of aging may be needed, and the selected surface aging site(s) will need to be reviewed against this requirement.
  2. Determine design requirements for accidents and terrorist activity mitigation.
  3. Finalize the geotechnical data for surface aging areas outside of the North Portal Pad area.
  4. Determine the WHF operations and equipment needed to support surface aging.

5. Determine the radiological control design requirements for surface aging areas.

- Options considered but not recommended

  Surface aging in the complete WP, Option WP1; not recommended based on:

  1. Increased risk of compromising the integrity of the WP by surface aging in an outdoor environment and additional handling operations.
  2. Additional WHF re-handling and re-inspections needed after aging to confirm the aged WP meets emplacement requirements.
  3. More WHF operations needed prior to placing a waste container in surface aging, compared to the recommended option. This would entail a greater risk of constraining operations and plant throughput.
  4. Option WP1 scored significantly lower in the technical evaluation (see Appendix A) than the recommended option of surface aging in a DPC, MPC or disposable canister.

  Surface aging in the WP SS liner, Option WP2; not recommended based on:

  1. A new WP design is required for this option.
  2. Loading the SS liner into the alloy 22 outer liner after aging adds new WHF processing steps and equipment. This is a significant risk addition to the program.
  3. This is the lowest ranked option in the technical evaluation (see Appendix A).

5.3.3 Combination of limited surface aging and subsurface aging

Recommendation–Rather than only surface or subsurface aging, use a combination of limited surface aging (e.g. Option S4 North Portal Pad, for aging approximately 1000 MTHM of CSNF) with the remaining CSNF aged in the permanent emplacement drifts, Option SS1.

This limited surface and subsurface recommendation has the following advantages:

1. Compared to all subsurface aging:
   a. Improves the ability to decouple waste receipt from emplacement
   b. Reduces the need to process WPs prior to aging
2. Compared to all surface aging:
   a. Reduces safety and health risks associated with worker radiological dose and additional handling operations
   b. Is more resistant to accidents and terrorist activities because of the smaller surface aging footprint

c. Reduces capital costs

Issues with combined surface and subsurface aging recommendation requiring further evaluation:

1. See subsurface issues 1, 2, and 3, listed above.
2. See surface issues 2, 4 and 5, listed above.

6. REFERENCES

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6.2 CODES, STANDARDS, REGULATIONS, AND PROCEDURES

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10 CFR 71. 1999. Energy: Packaging and Transportation of Radioactive Material. Readily available. [DIRS 144736]

10 CFR 72. 1999. Energy: Licensing Requirements for the Independent Storage of Spent Nuclear Fuel and High-Level Radioactive Waste. Readily available. [DIRS 103541]

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APPENDIX A

TECHNICAL EVALUATION

TECHNICAL EVALUATION

A Value Engineering (VE) approach is used to evaluate the aging options against the selected technical criteria.

VE STUDY PHASES

There are six stages in a VE study–the information, function analysis, creative, evaluation, development, and presentation phases. The activities for each phase are discussed below.

- Information Phase

  During the information phase of the study, information from previous studies and objectives of the study are reviewed. Earlier waste storage studies and designs applicable to the Yucca Mountain Project are listed in Section 6.0 and include the *Final Environmental Impact Statement for the Construction and Operation of an Independent Spent Fuel Storage Installation on the Reservation of the Skull Valley Band of Goshute Indians and the Related Transportation Facility in Tooele County, Utah* (NRC 2001), Summary of Interim Storage Facility Option – 7 Vault Storage (Stringer 1995), CRWMS M&O 2001, and DOE 1998.

- Function Analysis Phase

  During this phase, the high order function and the basic functions of aging are identified. A function analysis system technique (FAST) diagram is used to graphically show the inter-relationships of various aging functions, see Figure 13.

- Creative Phase

  In the creative phase of the study ideas are generated. Descriptions of the aging options considered in the study are provided in Section 3.

- Evaluation Phase

  The purpose of the evaluation phase is to determine the feasibility of the options and to thoroughly evaluate each option against the criteria. The evaluations of the aging options are presented in Section 3 and in this appendix.

- Development Phase

  During the development phase, the selected options are developed. Since the purpose of this study is to present technically acceptable aging options for further evaluation, all of the original options except the SS liner container Option WP2, are developed at the conceptual level. Issues for further evaluation and opportunities for improving the options are discussed in Section 3.

- Presentation Phase

  During this phase, the findings of the study are presented to the decision-makers that have the authority to approve their implementation. The results of this study will be presented as part of the design re-evaluation summary paper.

OPTION EVALUATIONS

Evaluation criteria for the aging study are consistent with the evaluation criteria used for the other design re-evaluation studies. For this study, specific questions for each criterion are identified to help better define the issues related to aging. The evaluation criteria and associated questions are listed in Table A1.

The next step in the VE evaluation is to rate the options against the criteria. First, a relative weighting factor is established for each criterion. Next, the options are scored on a 1 to 5 scale (1 - poor to 5 - excellent) against each criterion. A total score for each option is calculated by multiplying the criteria weighting factor by the score and summing the results. The relative advantages of each option are presented in tables A2 and A3. The criteria weightings and option scores from this evaluation are shown in Tables A4 and A5. The location and container options are presented in separate tables because the weighted scores should only be used to compare like options. For example, a weighted score for surface aging can only be compared against a weighted score for subsurface aging. Surface aging cannot be directly compared to a container option.

The VE evaluation scores for the surface and subsurface location options are essentially the same (within 10%). Therefore, from the VE evaluation perspective, these options are considered equally desirable.

The VE evaluation scores for the container options rank the options in a preferred order of:

1. DPC/MPC/Disposable Canister
2. WP
3. SS liner

The SS liner is determined to be an unfavorable option based on its low overall score. For surface aging, the preferred option is DPC/MPC/Disposal Canister aging. For subsurface aging, only WPs would be used (see Section 1.3.3).

Another VE technique considered but not included in this study is the evaluation of life cycle costs. Life cycle costs for aging will be evaluated outside of this study in the summary design re-evaluation study. The capital cost estimates in Section 4 will be incorporated into the summary paper overall life cycle cost assessment.

Table A1. Aging Study Evaluation Criteria

Criteria	Questions
1-Health and Safety	Will the design change the number, types, or consequences of potential operational accidents/incidents? Will the design change the number and variety of handling operations? Will the design change the impact on total expected aggregate worker radiological exposures? Will the design change the resistance to terrorist activities?[1]
2-Licensability	Will the design change or impact FEPs? Will the design change or impact Key Technical Issues? Are there precedents for the design involving regulatory as well as engineering issues?
3-Schedule	Does the design change the time required to complete the license application? Does the design change the risk associated with the license application schedule? Does the design change the time required or schedule risk for receipt? Does the design change the time required or schedule risk for initial emplacement?
4-Receipt/Emplacement	For the initial design module, does the design have the ability to accept the expected number and quantities of waste forms? After construction of full capabilities, does the design have the ability to accept the expected number and quantities of waste forms?
5-Flexibility	Is the design scalable to provide significant increases in functionality in a stepwise manner? Does the design allow for changes in the WP design? Does the design allow for changes in the repository design including thermal operating modes? What is the capability of the design to accept less than 10 year old fuel? Is the design flexible enough to store CSNF prior to emplacement? Are the surface facilities compatible with separate 10 CFR 72 licensing, if needed?
6-Programmatic Risk	Does the design require new or unproven construction techniques? Are there engineering precedents for the design? Does the design require new or unproven operating techniques? Does the design affect retrievability? Does the design require new or unproven maintenance techniques?
7-Compatibility	Does the design impose new constraints on other systems? Are there synergies between the design and other systems?
8-Operability	Does the design allow for expansion of the repository facilities in relatively small increments? Does the design allow for an extended period of slow underground emplacement? Does the design represent a clear evolutionary improvement of the SR design?
9-Existing Studies	Is the design consistent with the design and operating assumptions in the FEIS? Is the design siting region restricted to the existing characterized area?

[1] The basis for designing the MGR to be resistant to terrorist activities is under review. This study considered the resistance to terrorist activities only to the extent of relative comparison between options.

Table A2. VE Evaluation Location Option Advantages

Criteria	Location Option Advantages	
	Surface	Subsurface
1-Health and Safety		• Minimizes worker Rad exposure • Minimizes rehandling operations • More resistant to terrorist activities
2-Licensability	• Surface pads similar to the proposed design are currently licensed and in use	• Licensing is similar to the Base Case of no aging.
3-Schedule		• Subsurface aging is most similar to the current plan
4-Receipt/Emplacement	• Surface aging provides the most flexibility to decouple receipt from emplacement	
5-Flexibility	• Supports a modular and scalable design • Best allows for changes in the repository thermal operating mode • Provides flexibility to accommodate early receipt and variations in receipt rate	• Subsurface designs are scalable
6-Programmatic Risk	• Surface designs are constructable with existing techniques • Improves the ability to manage waste prior to emplacement	
7-Compatibility		• Minimizes changes to the Base Case design of no aging
8-Operability	• Allows for expansion of the design in small increments • Allows for slow underground emplacement • Waste container cooling is "free" (ambient cooling)	• Improves the Base Case by providing flexibility in the design • Does not impose new handling or equipment requirements on WHF.
9-Existing Studies		• Permanent emplacement drift area is characterized

APPENDIX D

COST ESTIMATE FOR SUBSURFACE AGING

BSC Estimating Department Ken Carver (702)-295-4412 FAX: (702)-295-5191 - M/S: 423 Email: ken_carver@ymp.gov	**BECHTEL SAIC COMPANY, LLC** ***COST ESTIMATE APPROVAL***	Date 03/21/2002 Estimate No. 2-041

ESTIMATE REQUESTED BY: Valerie Obie

ESTIMATE PREPARED BY: Daniel Hong

ESTIMATE TITLE / DESCRIPTION: Underground Aging Area, Design Evolution Study

PURPOSE OF ESTIMATE: ROM estimate of construction cost for Underground Aging Area to support Design Evolution Study.

SCOPE OF WORK: Isolation Ridge Underground Aging Facility Includes an New Portal, Access Main, Ventilation Shafts & Air Access Drifts, and Emplacement Drifts & Its Turnouts; the construction support operations of Muck Disposal, Concrete Batch Plant, and Precast Concrete Plant are also included.

ESTIMATE SUMMARY:

	($ X 1,000)
Direct Costs (1X, 2X, 3X)	$833,404
Distributable Field Costs (5X)	$6,616
Professional Services (7X)	Excluded
Other Project Costs (8X)	Excluded
Escalation, ~~Contingency, Fee~~ (9X)	$36,981 (Incl'g.Escalation 4.4% Only)
Total Estimate	$876,981

TYPE OF ESTIMATE:

Order of Magnitude Estimate (+ / - 40%)	X
Budget or Conceptual Design Estimate (+ / - 30%)	
Preliminary Design Estimate (+ / - 20%)	
Detailed Design Estimate (- 5% to + 15%)	
Engineer's Estimate / Fair Price Estimate (+ / - 10%)	
Estimate for Minor Project / Scope of Work (Varies)	

ESTIMATE APPROVAL:

DOE - OCRWM		
DOE - YMP		
BSC GENERAL MANAGER		
BSC DEPUTY GENERAL MANAGER		
MANAGER - LICENSING & ENGR'G PROJECTS		
MANAGER - REPOSITORY DESIGN		
MANAGER - ENGINEERING		
MANAGER - PROCUREMENT		
MANAGER - SITE SVCS & FIELD SPPT		
MANAGER - FUNCTIONAL DEPARTMENT		
MANAGER - PROJECT CONTROLS		
PROJECT CONTROLS MANAGER - PROJECTS		
PROJECT CONTROLS MANAGER - ESTIMATING	X	[signature] 3/21/02
CHIEF FINANCIAL OFFICER		
COST ESTIMATOR	X	[signature] 3/21/02

BECHTEL SAIC COMPANY, LLC

ESTIMATE BASIS

Estimate No: 2-041
Date: 03/21/02

PURPOSE OF ESTIMATE:

ROM estimate of construction costs for Underground Aging Area to support Design Evolution Study.

SCOPE DEFINITION:

Based on the e-mail messages from Valerie Obie to Daniel Hong dated 03/19/02, and its attachments including sketch of underground aging area layout & quantities of portal, access main, emplacement drift & turnout, and ventilation shaft & air access drift for isolation ridge underground aging facility, this estimate includes only construction direct costs; including the construction support operations of muck disposal, concrete batch plant, and precast concrete plant.

PROJECT SCHEDULE / EXECUTION PLAN:

N/A

QUANTITY DEVELOPMENT:

In addition to the attachments of e-mail messages from Valerie Obie to Daniel Hong dated 03/19/02 which provided the footages of access main & emplacement drift, and quanties of ventilation shafts & air access drifts, and emplacement turnout, the features & components of access mains, ventilation shafts & air access drifts, and emplacement drift & turnout in Panel # 2 of Estimate No. 2 - 037 for Repository Underground Layout are referenced and used for this estimate.

PRICING:

The pricing is based on the cost data of Subsurface Panel #1 and South Portal Package in MGR Subsurface 2000TSLCC estimates; as used for Estimate No. 2 - 037 of Repository Underground Layout.

CONSTRUCTION WAGE RATES / UNIT MANHOUR RATES:

Construction wage rates are based on 2000 union agreements used for 2000TSLCC estimates, and the unit manhour rates are based on MGR 2000TSLCC estimates for subsurface panel #1 and south portal package.

FIELD DISTRIBUTABLE COSTS:

16.2% of overhead and 10% of profit are added for construction support operations of muck disposal, concrete batch plant & precast concrete plant only which are estimated as support operations of M&O contractor, while subsurface construction is estimated as fixed price construction packages.

ENGINEERING, PROCUREMENT, CONSTRUCTION MANAGEMENT:(EPCM)

The estimates are for direct costs only; EPCM not included.

ESTIMATE ALLOWANCES:

No estimate allowance is included in the estimates, however 4.4% of escalation is added to convert the costs to 1st. Quarter 2002 costs.

CONTINGENCY:

No contingency is included in the estimates.

ESTIMATE ASSUMPTIONS AND EXCLUSIONS:

All estimate assumptions and exclusions are similar to MGR Subsurface 2000TSLCC estimates.

ESTIMATE SUMMARY
ISOLATION RIDGE UNDERGROUND AGING FACILITY - MARCH 2002
DESIGN EVOLUTION STUDY

		MANHOURS						
		DIRECT HIRE	SUB CONTRACT	PLANT EQUIPMENT	BULK MATERIALS	LABOR	SUB CONTRACT	TOTAL
	DIRECT COSTS							
110	New Portal & Construction Support Facilities, Plant, and Systems				23,782,786		42,208,173	65,990,959
211	ESF North Ramp, East Main, and South Ramp		-				-	-
212	ECRB Cross Drift							
221	Access Ramps, and Its Extensions & Connecting Drifts		-				-	-
222	Access Mains		535,104				125,996,700	125,996,700
223	Crossblock Drifts, and Its Turnouts & Vent Raises							
231	Exhaust Main							
241	Large Electrical Alcoves							
242	Small Electrical Alcoves							
243	Personnel/Refuge Chambers							
244	Collection Sump/Storage Alcoves							
245	Equipment Decontamination Chambers							
246	Personnel Decontamination Chambers							
251	Intake Air Shafts		301,376				61,700,146	61,700,146
252	Exhaust Air Shafts		303,227				75,496,577	75,496,577
261	Intake Air Access Drifts		73,303				13,392,401	13,392,401
262	Exhaust Air Access Drifts		131,879				24,094,748	24,094,748
271	Emplacement Drift Turnouts		681,371				125,331,081	125,331,081
272	Emplacement Drifts		1,840,729				341,401,133	341,401,133
273	Emplacement Drift Ventilation Raises		-				-	-
281	Post Closure Test Drifts, and Its Turnouts & Vent Raises							
282	Performance Confirmation Observation Drifts, and Its Vent Raises		-				-	-
283	Performance Confirmation Test Alcoves							
								-
								-
	NTS Productivity Factor @ 30%	-				-		-
	Nuclear Quality Productivity Factor - n/a							-
	SUB TOTAL	-	3,866,989	-	23,782,786	-	809,620,959	833,403,745
	DISTRIBUTABLE FIELD COSTS							
	Mat'l & Labor @ 80% of Direct Labor Cost (50% M	-			-			-
	(Weighted average of Bechtel historical projects)							
	Per Diem - Direct Craft @ $1.50 / MH	-			-			-
	Per Diem - Indirect Craft @ $1.50 / MH	-			-			-
	Per Diem - Staff @ $1.50 / MH (Staff MH 25% Dire	-			-			-
	(Weighted average of Bechtel historical projects)							
	Busing @ $15.00 / Man-Day (Craft & Staff)	-			-			-
	Additional Costs for S/C:							
	Performance & Payment Bond @ 2.3% (L) RSMeans				-			-
	Builder's Risk & Public Liability (Incl w/ Wage Rates)				-			-
	Overhead (Main Office) @ 16.2% (L) RSMeans				3,852,811			3,852,811
	Profit @ 10% (Total Cost w/o Materials)				2,763,560			2,763,560
	SUB TOTAL	-		-	6,616,371	-	-	6,616,371
	S/C ENGINEERING & SERVICES							
	Engineering & Services	0%			0			0
	(DOE Cost Estimate Guideline Range = 15 - 25%)							
	SUB TOTAL			-	0	-	-	0
	BSC ENGINEERING & SERVICES							
	Engineering & Services @ __% of Direct Costs	0%			-			-
	Design Management @ __% of Engineering &	0%			0			0
	Construction Management @ __% of TPC	0%			0			0
	(DOE Cost Estimate Guideline Range = 5 - 15%)							
	SUB TOTAL	-	-	-	0	-	-	0
	BSC INDIRECT COST POOLS							
	Site Support @ __% (Offsite = Las Vegas Office) (	0.0%			-			-
	NTS Support Services - Allowance 3%	0%			0			0
	G & A @ __% (FY02 Rates)	0%			0			0
	SUB TOTAL			-	0	-	-	0
	NATIONAL LABS							
	Labor Costs							-
	SUB TOTAL			-	-	-	-	-
	SUB TOTAL - PROJECT			-	30,399,157	-	809,620,959	840,020,116
	ESCALATION	4.4%		-	1,337,563	-	35,623,322	36,960,885
	CONTINGENCY @ __%	0%		-	0	-	0	0
	(DOE Cost Estimate Guideline Range = 20-30% up to 50%)							
	'OTAL - Isolation Ridge Underground Aging Facility							876,981,001

Table A3. VE Evaluation Container Option Advantages

Criteria	Container Option Advantages		
	DPC/MPC/Disp Can	WP	SS Liner
1-Health and Safety		• Requires fewer rehandling operations	
2-Licensability	• Licensed DPCs are available	• Licensing is similar to the Base Case (no new containers need to be licensed)	
3-Schedule	• Equipment for surface aging is available		
4-Receipt/Emplacement	• Best option to decouple waste receipt and emplacement		
5-Flexibility	• Most flexible option		
6-Programmatic Risk	• Lower risk option for operations and retrievability		
7-Compatibility		• Does not impose new handling or equipment requirements on the WHF	
8-Operability	• Allows the WHF to be expanded in relatively small increments • Fewer WHF operations needed prior to aging		
9-Existing Studies		• Design is consistent with FEIS	

Table A4. VE Evaluation Location Option Scores

Criteria	Criteria Weight	Location Option Weighted Score (weight x score)	
		Surface	Subsurface
1-Health and Safety	28%	0.84	1.40
2-Licensability	24%	1.00	0.75
3-Schedule	11%	0.44	0.33
4-Receipt/Emplacement	10%	0.50	0.30
5-Flexibility	10%	0.50	0.10
6-Non-safety Risk	5%	0.25	0.15
7-Compatibility	8%	0.16	0.32
8-Operability	3%	0.12	0.15
9-Existing Studies	1%	0.03	0.01
Total Score		3.84	3.51

Table A5. VE Evaluation Container Option Scores

Criteria	Criteria Weight	Container Option Weighted Score (weight x score)		
		DPC/MPC/Disp Can	WP	SS Liner
1-Health and Safety	28%	0.84	1.40	0.28
2-Licensability	24%	1.25	0.25	0.25
3-Schedule	11%	0.55	0.11	0.11
4-Receipt/Emplacement	10%	0.50	0.20	0.30
5-Flexibility	10%	0.50	0.20	0.20
6-Non-safety Risk	5%	0.20	0.05	0.10
7-Compatibility	8%	0.24	0.24	0.08
8-Operability	3%	0.12	0.06	0.03
9-Existing Studies	1%	0.04	0.04	0.01
Total Score		4.24	2.55	1.36

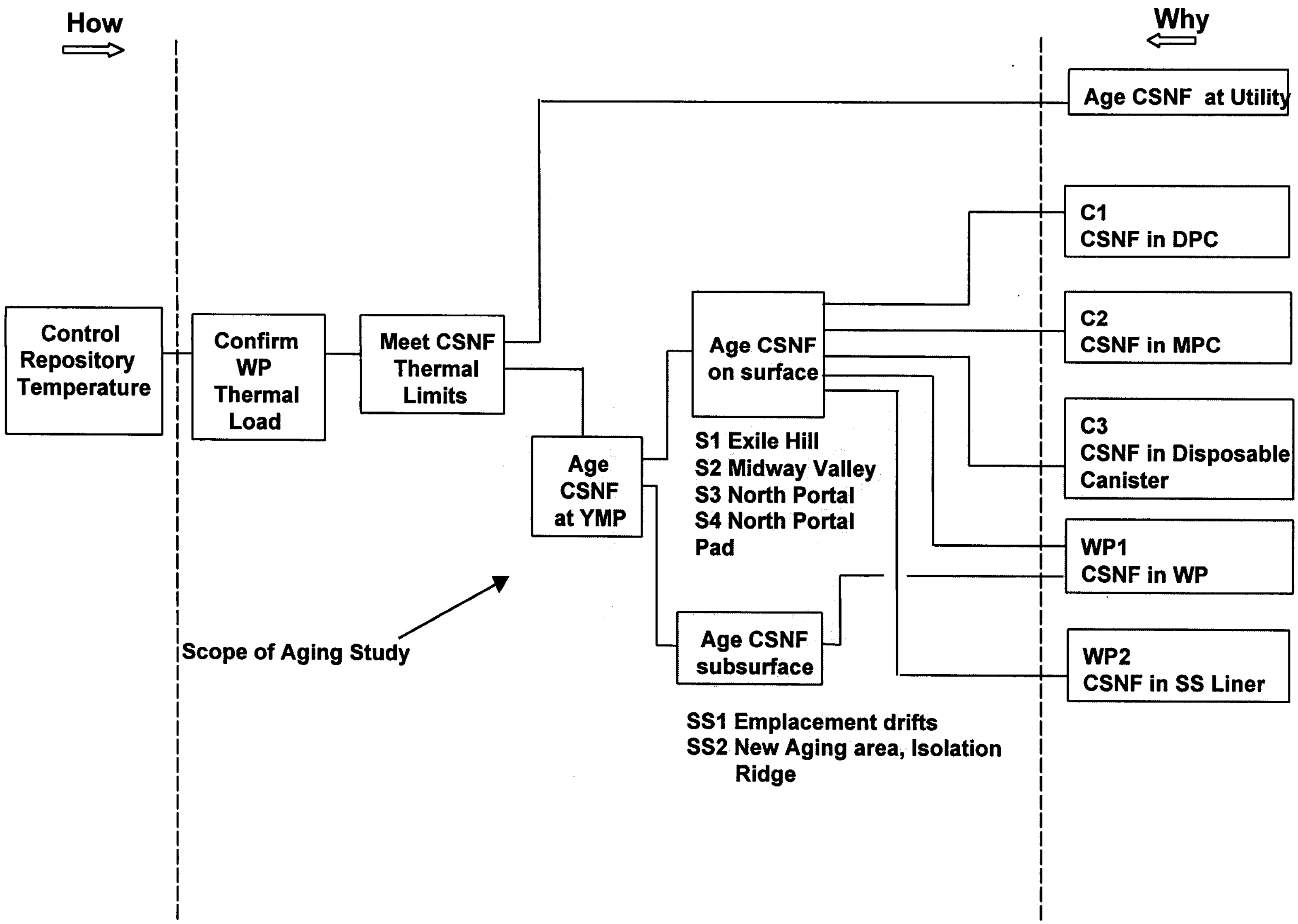

Figure 13. Aging Study FAST Diagram

APPENDIX B

JAI CORP. MEMO

PREDECISIONAL STUDY

MEMORANDUM

DATE: January 31, 2002

TO: Preston McDaniel

FROM: E. R. Johnson

SUBJECT: Cost of Spent Fuel Storage Equipment

This is the final report on our efforts to obtain updated information on the cost of spent fuel storage equipment, under Charge No. 24520, Activity 4N2066, that you authorized by telephone on January 22, 2002.

We obtained pricing information for the spent fuel storage equipment provided by various system vendors through discussions with system vendors and fabricators of canisters and casks -- and from the experience of JAI staff members. Much of the information was provided on a confidential basis with the understanding that the source of the information not be revealed. A summary of the pricing information so developed is shown in Table 1.

The price estimates in Table 1 for storage casks and canisters generally apply to orders of 5-10 units (the usual order quantity for vendors/fabricators). Price estimates for transfer casks, impact limiters and other auxiliary equipment are for single units (fewer of these will be required than storage cask and canisters). One supplier indicated that large quantities of casks and canisters (100+ units) could result in price decreases in the range of 10-30%, but opined that Government contract requirements (Government oversight of fabrication and assembly, termination for convenience of the Government, project management requirements, and the like) could erase any such savings and even possibly result in higher costs.

For the purposes of your study, the metal storage/transport casks and impact limiters will probably not be of any interest, but have been included here for informational purposes. These casks are probably prohibitively expensive (10 times as expensive as concrete casks) for storage at Yucca Mountain unless the Government wants to use them because of possible increased protection from terrorist threats.

The cost of canisters and baskets are about the same, according to the vendors. The estimated cost of canister and basket fabrication as obtained from the fabricators ranges from $200-400K. The difference between these costs and the estimated prices of system vendors ($400-550K) probably includes elements of cost for design, licensing, and profit on the part of the system vendors.

In view of the foregoing, we recommend using the costs shown in Table 2 for your study.

TABLE 1
ESTIMATED PRICES FOR SPENT FUEL STORAGE EQUIPMENT

Item	Estimated Cost ($000)							
	System Vendors					Fabricators		
	Holtec	NAC	BNFL	NUHOMS	TNI	Raynor	PCC	Amer Tank
Concrete Overpack [a,b] (Vertical cask or horizontal storage module)	$250	$225	$250	$125-150	-			
Canister (or Basket)[a]	550	400	450	200-400		$250-400	$200-325	$200
Metal Storage-Only Cask[c]	-	-	-	-	$1000-1200			
Metal Storage/Transport Cask[a,b,d]	2200	2500	-	2500	-			
Vacuum Drying & Welding Equipment for Canisters	-	-	-	350	-			
Transfer Cask[e]	1600-1700	1000[g]	1150	1500	-		2000	
Transfer Cask Equipment (trailer, hydraulics, ram, etc.)	1500	-	2875	1650	-			
Impact Limiters (for S/T cask)[f]	1000	700			-			

[a] Nominal 24 PWR assembly capacity
[b] Excluding canister/basket cost
[c] Nominal 32 PWR assembly capacity; TNI is only vendor actively marketing metal storage-only casks
[d] Excluding cost of impact limiters
[e] For canister transfer
[f] For use on casks that are transported off-site
[g] 1200K if used in hot cell

TABLE 2
RECOMMENDED COSTS FOR USE IN BSC STUDY

Item	Recommended Cost for Spent Fuel Storage Systems ($000)		
	Vertical Concrete Cask Systems	**NUHOMS® System**	**Vertical Metal Cask Systems**
Concrete Overpack[a,b]	$250	$150	-
Canister/Basket[a]	450	400	-
Vacuum Drying & Welding Equipment	350	350	-
Metal Storage-Only Cask	-	-	$1200[c]
Transfer Cask & Associated Equipment (trailer, hydraulics, ram, etc.)	3200	3200	-
Carrier (for moving cask to storage)	1000[d]		1000

[a] Nominal 24 PWR assembly capacity
[b] Excluding canister/basket cost
[c] Nominal 32 PWR assembly capacity
[d] This is applicable only if transfer cask is not used

In using the above costs in connection with the prospective long term storage of spent fuel at Yucca Mountain, the following should be considered:

1. Most utilities will use a concrete overpack or module to meet their dry storage needs, and thus will canister the spent fuel before storage. If the utility delivers the loaded canisters to DOE, it would probably be wise to store them in the same type of module that they were stored at the reactor site -- in order to simplify the licensing involved.

2. Utilities that canister and store spent fuel in concrete casks will probably not deliver the thus stored fuel to DOE until after it has delivered all the other of its fuel that is 5 or more years old. This means that, absent an incentive to canister the spent fuel that is not destined for dry storage at the reactor site, the utilities will probably deliver to DOE (i) bare fuel assemblies and, (ii) canisters of failed fuel assemblies that have an envelope slightly larger than the assembly. Thus, most of the spent fuel can be expected to be delivered for shipment from the utilities in the form of uncanistered fuel assemblies, particularly in the early years of operation of DOE storage facilities.

3. Where bare fuel assemblies are received at the DOE storage site, it would be desirable to put them in canisters prior to storage in a concrete cask, since the canister cost would be about equal to the cost of a basket for the concrete storage casks, and handling after removal from storage would be simplified. However, the cost of seal welding the canister would be an added operation and cost. Also, whenever the design of the disposal package has been finalized, a canister could be used that would be compatible with the disposal package, thus eliminating the need for canistering the fuel at the time of insertion into the disposal package.

4. The cost of the TNI metal storage cask is higher than for concrete modules and their respective canisters/baskets. However, the capacity of the metal storage cask priced is about 50% greater than for the concretre casks. Moreover, the metal storage cask does not require a transfer device or canister welding equipment. Thus, this metal storage cask is only slightly more expensive than concrete storage modules and doesn't involve as many up-front operations. Utilities have been buying these casks -- so they can't (as a system) be much more expensive than concrete storage modules.

Regarding the design of the storage facility, we reiterate some general suggestions that we made in our memorandum of January 28, 2002 which might be considered, as follows:

- The storage pad should be about 3-foot thick reinforced concrete. It might be a good idea to provide open drainage in the pad for jet fuel in the event of a plane crashing into the facility (slanting the pad, etc.)

- The "Physical Protection Plan for the Yucca Mountain Monitored Geological Repository," Revision 1, dated January 2001, was based on NRC regulations that were applicable prior to the September 11, 2001 terrorist attack on the U.S. However, the document entitled "Assessment of Impact of DOE Spent Fuel and Other Wastes and IAEA Requirements on the Safeguards and Security of the Repository System", Revision 1, dated February 9, 2001, contained a description of the increased security requirements caused by acceptance of certain DOE strategic materials at Yucca Mountain. These documents may be accessed by authority of Macaye Smith at DOE/YMSCO on a need-to-know basis. The latter document describes a security system that would probably be adequate for September 11 enhancements.

- Consideration should be given to placing a high berm around the storage area (bulldozed site earth) to provide a protective barrier against the threat of ground launched missiles (TOW, etc.) and low flying plane crashes.

APPENDIX C

COST ESTIMATE FOR SURFACE AGING

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BSC Estimating Department
Ken Carver (702) 295-4412
FAX: (702) 295-5191 - M/S: 423
Email: ken_carver@ymp.gov

BECHTEL SAIC COMPANY, LLC

COST ESTIMATE APPROVAL

Date: 20-Feb-02

Estimate No. 2-022

Estimate Requested By: Preston McDaniel : 295 0000

Estimate Prepared By: John Steiger 295-3804

Estimate Description:
Prepare conceptial estimate for alternative staging areas including access roads. There were three sizes of staging areas 1,000 Mtu, 5,000 MTU, and 20,000 MTU. The pads are a series of concrete slabs 3 ft thick by 35 ft long and 36 ft wide. The estimate includes site grading, fencing, utilities, security and monitoring systems, and drainage control.

Purpose of Estimate:
To provide a cost for comparing the alterative sites and to allow scheduling to construction, to fit the proposed budgets

Scope of Work:

Grading and Road Construction based in quantities provided by engineering
Concrete Pads based in 3.0 ft x 35.0 ft x 36.0 ft size and the number of pads
Fencing Prison fencing cost from RS Means
Utilities concepitualized by the estimating staff Micky Perez and John Steiger
Monitoring and Security developed from previous work done by Micky Perez

ESTIMATE SUMMARY:

Case 1 - 5,000 MTU	$ 22,057,131
Case 1 - 20,000 MTU	$ 86,300,990
Case 2 - 5,000 MTU	$ 22,544,258
Case 2 - 20,000 MTU	$ 86,828,649
Case 3 - 5,000 MTU	$ 21,644,730
Case 4 - 1,000 MtU	$ 7,479,113

TYPE OF ESTIMATE:

- [X] Order of Magnitude (+/- 40%)
- [ ] Budget or Conceptual Des. Est.(+/-30%)
- [ ] Title I Design Estimate (+/- 20%)
- [ ] Title II Design Estimate (-5% to +15%)
- [ ] Engrs Est./ Fair Price Est. (+/- 10%)
- [ ] Est. for Minor Projects (Varies)

Approval	Checked	Signature
DOE - OCRWM	[ ]	
DOE - YMP	[ ]	
BSC GENERAL MANAGER	[ ]	
BSC DEPUTY GENERAL MANAGER	[ ]	
MANAGER - LICENSING & ENGR'G PROJECTS	[ ]	
MANAGER - REPOSITORY DESIGN	[ ]	
MANAGER - ENGINEERING	[ ]	
MANAGER - PROCUREMENT	[ ]	
MANAGER - SITE SVCS & FIELD SPPT	[ ]	
MANAGER - FUNCTIONAL DEPARTMENT	[ ]	
MANAGER - PROJECT CONTROLS	[ ]	
PROJECT CONTROLS MANAGER - PROJECTS	[ ]	
PROJECT CONTROLS MANAGER - ESTIMATING	[X]	K. Carver (signature)
CHIEF FINANCIAL OFFICER	[ ]	
COST ESTIMATOR	[X]	John F. Steiger (signature)

OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
ESTIMATE BASIS

Purpose of Estimate:

To compare the cost differences between 4 alternative staging sites.

Scope Definition:

Pre-conceptional a sketch of a typical pad, and a list of required appurtenances.

Proj. Schedule/Execution Plan:

A schedule was not provided

Quantity Development:

Quantities were developed by the estimator. Most of the quantity development is contained in the Comments on the Master worksheet, or comments in the work sheets or the Storagefinishes.xls Spreadsheet

Pricing:

From RS Means with adjustments for location or Micky Perez based on his previous power plant experience.

Constr. Wage Rates/Unit Man-hour Rates:

From RS Means with adjustments for location or Micky Perez based on his previous power plant experience. The direct construction man-hours were increased by 30% to allow for NTS conditions, and the concrete related man hours were increased an additional 50% to reflect the requirements of nuclear quality work.

Field Distribution Cost:

Mat'l & Labor was included at 80% of Direct Labor Cost including an allowance of 50% of the direct man-hours for indirect craft labor based on Bechtels historical experience with similar projects. A Per Diem of a $1.50 per man-hour was added to cover the NTS labor Agreements. An allowances $15.00 per Maundy added to cover transportation to the site. A performance bond was included at 2.3 % of the Direct Labor. Contractors overhead was add at 16.2% of direct labor, The contractors profit was added as 10% of the total cost without materials.

Engrg, Procurement, Constr. Mgt.:

Computed by others

Estimate Allowances:

Because the lack of design detail a allowance of 10% to 25% was included in each line item to allow for those items which were not detailed and for design growth,

Contingency:

Provide by Others

Estimate Assumptions & Exclusions:

This estimate is very conceptual, the estimator has tried to include a list of line items that are required, without a design required items have been omitted. This includes items such as valves and valve boxes in the fire water system, The design detail allowance is an attempt to cover the costs for these details.

Summary of Staging Pads

Case 1 - 5,000 MTU	22,057,131
Case 1 - 20,000 MTU	86,300,990
Case 2 - 5,000 MTU	22,544,258
Case 2 - 20,000 MTU	86,828,649
Case 3 - 5,000 MTU	21,644,730
Case 4 - 1,000 MtU	7,479,113

ESTIMATE SUMMARY
INDIRECT CALCULATION MODEL
STAGING STUDY Case 1 - 5,000 MTU

Estimate No.
Date : Feb.19, 2002

	MANHOURS DIRECT HIRE	MANHOURS SUB CONTRACT	PLANT EQUIPMENT	BULK MATERIALS	LABOR	SUB CONTRACT	TOTAL
DIRECT COSTS							
Pad Related Earthwork	1,530			13,740	58817		72,557
Flood Control Berm Related Earthwork	732			21,172	28753		49,925
Road Related Earthwork	545			69,926	21034		90,960
Construct Detention Pond	700			13,328	27278.75		40,606
Concrete Pads	42,942			2,519,826	2,036,040		4,555,866
Paving Between Pads	1,049			596,410	40,509		636,919
Fire Protection	2,355			44,708	95,136		139,844
Fencing	10,245			180,798	382,603		563,401
Grounding	1,500			59,086	73,704		132,790
Lighting Systems	2,464			244,184	119,720		363,904
Monitoring & Security	13,839			3,563,705	691,443		4,255,148
Communications	393			63,198	19,674		82,871
Roads	3,825			359,209	166,292		525,501
NTS Productivity Factor @ 30%	24,635.64	-			1,128,301	-	1,128,301
Nuclear Quality Productivity Factor @50%	27,912	-			1,323,426	-	1,323,426
SUB TOTAL	134,667	-	-	7,749,289	6,212,728	-	13,962,018
DISTRIBUTABLE FIELD COSTS							
Mat'l & Labor @ 80% of Direct Labor Cost (50% MH) (Weighted average of Bechtel historical projects)	67,333	-		4,970,183			4,970,183
Per Diem - Direct Craft @ $1.50 / MH	134,667	-		202,000		-	202,000
Per Diem - Indirect Craft @ $1.50 / MH	67,333	-		101,000		-	101,000
Per Diem - Staff @ $1.50 / MH (Staff MH 25% Direct) (Weighted average of Bechtel historical projects)	33,667	-		50,500		-	50,500
Busing @ $15.00 / Man-Day (Craft & Staff)	235,667	-		353,500		-	353,500
Additional Costs for S/C:							
Performance & Payment Bond @ 2.3% (L) RSMeans				142,893			142,893
Builder's Risk & Public Liability (Incl w/ Wage Rates)				-			-
Overhead (Main Office) @ 16.2% (L) RSMeans				1,006,462			1,006,462
Profit @ 10% (Total Cost w/o Materials)				1,268,577			1,268,577
SUB TOTAL	101,000		-	8,095,114	-	-	8,095,114
S/C ENGINEERING & SERVICES							
Engineering & Services (DOE Cost Estimate Guideline Range = 15 - 25%)	-						-
SUB TOTAL			-	-	-	-	-
BSC ENGINEERING & SERVICES							
Engineering & Services @ __% of Direct Costs	-			-			-
Design Management @ __% of Engineering & Servi	-			-			-
Construction Management @ __% of TPC (DOE Cost Estimate Guideline Range = 5 - 15%)	-			-		-	-
SUB TOTAL	-	-	-	-	-	-	-
BSC INDIRECT COST POOLS							
Site Support @ __% (Offsite = Las Vegas Office) (FY0:	-			-			-
NTS Support Services - Allowance 3%	-			-			-
G & A @ __% (FY02 Rates)	-			-			-
SUB TOTAL			-	-	-	-	-
NATIONAL LABS							
Labor Costs							-

BECHTEL SAIC

JOB NO. & TITLE : 24535-000 YUCCA MOUNTAIN PROJECT
CLIENT : DEPARTMENT OF ENERGY
JOB LOCATION : LAS VEGAS, NEVADA
TYPE OF ESTIMATE : Order of Magnitude
WBS # and DESCRIPTION : Staging Area Finishes Site 1 - 5000 MTU

DATE : 08-Mar-02
Estimate No.
Take-off: J.Steiger
Priced: J. Steiger
Checked:
Approved:

Bechtel or CSI CODE	ITEM & DESCRIPTION	QUANTITY	UNIT MEAS	UNIT COST EQUIP.	UNIT COST BULK	UNIT COST S/C	D. HIRE UNIT MHR	TOTAL MHRS	WAGE RATES	TOTAL COSTS IN U.S $ EQUIPMENT	BULK	LABOR	SUBCON.	TOTAL
	Concrete Pads													
	Excavate Sand & Gravel Backhoe 1cy	11756	C.Y.		-		0.133	1,564	41.94	-	-	65,598		65,598
	Loading Sand & Gravel into Trucks	11756	C.Y.		-		0.020	235	41.87	-	-	9,840		9,840
	Forms in Place Mat Footing 4 use	53676	SFCA		0.61		0.137	7,354	41.90	-	32,742	308,100		340,842
	Reinf. In Place A615 G60 Slab-Grade	1764	Tons		532.88		13.910	24,537	51.76	-	940,000	1,269,992		2,209,992
	Purchase Concrete 3500 Psi	19404	Cy		66.99		-	-	0.00	-	1,299,874	-		1,299,874
	Conc. Placing Foundation Mat Pump	17640	C.Y.		-		0.160	2,822	36.32	-	-	102,488		102,488
	Finishing Flrs-Screed, Float & Broom	158760	SF		-		0.013	2,064	38.46	-	-	79,380		79,380
	Curing - Burlap 12 oz	1588	CSF		11.42		0.291	462	33.65	-	18,135	15,547		33,682
	Design Detail Allowance	10	%					3,904	47.41		229,075	185,095		414,170
	Subtotal Concrete Pads	126	Each					42,942			2,519,826	2,036,040		4,555,866
	Paving Between Pads													
	Concrete Paving 6" unreinforced	27400	S.Y.		16.49		0.029	795	38.60		451,826	30,688		482,514
	Continuous Welded Wire >10' wide	27400	S.Y.		3.30		0.006	159	38.60		90,365	6,138		96,503
	Design Detail Allowance	10	%					95	38.60		54,219	3,683		57,902
	Total Cost for Road Related Costs	27400	S.Y.					1,049			596,410	40,509	-	636,919
	Fire Protection													
	Trencher 12" x36" Deep w/ Backfill	3,350	LF		-		0.011	37	$42.57		-	1,575		1,575
	Compact w/ vibratory Plate	3,350	LF		-		0.006	18	$43.72		-	787		787
	Compacting Bedding In Trench	60	C.Y.		-		0.089	5	$35.80		-	179		179
	Pipe Bedding-Screened Bank run	60	C.Y.		17.26		0.160	10	$35.00		1,036	350		1,386
	Pipe Blk Stl p. ends.wld, 1/4" wall10"	3,350	LF		9.24		0.538	1,802	$40.36		30,954	72,729		103,683
	Fire Hydrant 5 1/4" 4'-0" Valve Depth	4	Each		943.95		3.111	12	$40.75		3,776	489		4,265
	Design Detail Allowance	25	%					471	$40.40		8,942	19,027		27,969
	Total Cost Fire Protection 1 5000 MTU	1	Each					2,355			44,708	95,136	-	139,844
	Fencing	•												
	Security Fence Prison Grade 12' high	7,100	LF		21.82		1.280	9,088	$37.36		154,922	339,522		494,444
	Gate 12 High w/ 20 FT Opening	6	Opening		1,573.25		37.647	226	$36.72		9,440	8,299		17,739
	Design Detail Allowance	10	%					931	$37.34		16,436	34,782		51,218
	Total Cost Fencing 1 5000 MTU	1	Each					10,245			180,798	382,603		563,401
	Grounding													
	Chain Trencher 4"wide x12"deep	7,100	LF		-		0.010	71	$43.00		-	3,053		3,053
	Bsckfill & Compact by Hand 4"wx12"d	7,100	LF		-		0.010	71	$34.00		-	2,414		2,414
	Bare Copper Gr'd Wire 4/0 Stranded	71	C.L.F.		166.46		2.807	199	$50.72		11,819	10,093		21,912
	Copper Electrolytic Ground Rod 20'	24	Each		1,116.50		4.598	110	$50.73		26,796	5,580		32,376
	Water Pipe Clamp 1 1/4 to 2"	325	Each		15.53		1.000	325	$50.77		5,047	16,500		21,547
	Exothermic Weld 4/0 to #4	325	Each		5.48		1.143	371	$50.27		1,781	18,652		20,433
	Bare Copper Gr'd Wire #2 Stranded	33	C.L.F.		55.32		1.600	53	$50.40		1,826	2,671		4,497
	Design Detail Allowance	25	%					300	$49.14		11,817	14,741		26,558
	Total Cost Grounding 1 5000 MTU	1	Each					1,500			59,086	73,704		132,790
	Lighting System													
	Excavate Trench Backhoe 1cy	680	C.Y.		-		0.040	27	$42.30		-	1,142		1,142
	Backfill Trench FEL 1cy wheel mtd	415	C.Y.		-		0.030	12	$42.92		-	515		515
	Hauling 12 cy Truck 1 mile	265	C.Y.		-		0.038	10	$35.50		-	355		355
	PVC Duct Ready for Conc 2 @ 2"	3,350	LF		1.35		0.067	224	$50.40		4,523	11,290		15,813
	Place Conc Footing Deep chute	265	C.Y.		5.68		0.343	91	$35.35		1,505	3,217		4,722
	Purchase Concrete 3500 Psi	290	Cy		66.99		-	-	-		19,427	-		19,427
	Bare Copper Gr'd Wire #2 Stranded	34	C.L.F.		55.32		1.600	54	$50.96		1,881	2,752		4,633
	600 volt type THW stranded #4	101	C.L.F.		42.63		1.509	152	$50.85		4,306	7,729		12,035
	Footings under 1 cy	67	C.Y.		97.44		2.942	197	$41.04		6,528	8,085		14,613
	Aluminum pole 40 ft high	42	Each		1,497.13		10.000	420	$50.03		62,879	21,013		83,892
	Bracket Arms 2 arms	42	Each		164.43		1.000	42	$50.76		6,906	2,132		9,038
	Pole Mounted Flood HP sodium 1000w	84	Each		507.50		4.000	336	$50.40		42,630	16,934		59,564
	Xfmr 5KV/480-1000KVA 3 Phase	1	Each		30,145.50		180.000	180	$50.77		30,146	9,138		39,284
	Xfmr 480/120-45KVA 3 Phase	1	Each		1,268.75		40.000	40	$50.78		1,269	2,031		3,300
	Motor Control Center	1	Each		10,150.00		120.000	120	$50.77		10,150	6,092		16,242
	Distr-Pnl Ltg 480v	1	Each		2,436.00		30.000	30	$50.77		2,436	1,523		3,959
	Distr-Pnl Inst 120v	1	Each		761.25		36.000	36	$50.78		761	1,828		2,589
	Design Detail Allowance	25	%					493	$48.59		48,837	23,944		72,781
	Total Cost Lighting System 1 5000 MTU	1	Each					2,464			244,184	119,720		363,904

BECHTEL SAIC

JOB NO. & TITLE :	24535-000 YUCCA MOUNTAIN PROJECT
CLIENT :	DEPARTMENT OF ENERGY
JOB LOCATION :	LAS VEGAS, NEVADA
TYPE OF ESTIMATE :	Order of Magnitude
WBS # and DESCRIPTION :	Staging Area Finishes Site 1 - 5000 MTU

DATE :	08-Mar-02
Estimate No.	
Take-off:	J.Steiger
Priced:	J. Steiger
Checked:	
Approved:	

Bechtel or CSI CODE	ITEM & DESCRIPTION	QUANTITY	UNIT MEAS	UNIT COST EQUIP.	UNIT COST BULK	UNIT COST S/C	D. HIRE UNIT MHR	TOTAL MHRS	WAGE RATES	TOTAL COSTS IN U.S $ EQUIPMENT	BULK	LABOR	SUBCON.	TOTAL
	Monitoring & Security													
	Pad Monitoring				-									
	Duct Bank 2-3" Dia Rigid Galv Steel	18,540	L.F.		21.32		0.160	2,966	$50.57		395,273	149,989		545,262
	Category 3 #24 4 pair Solid pvc	42	C.L.F.		5.58		1.143	48	$50.21		234	2,410		2,644
	Allow for Temp Sensors	1,008	Each		2,000.00		3.000	3,024	$50.77		2,016,000	153,528		2,169,528
	Excavate Sand & Gravel Backhoe 1cy	705	C.Y.		-		0.133	94	$41.85		-	3,934		3,934
	Loading Sand & Gravel into Trucks	396	C.Y.		-		0.020	8	$41.38		-	331		331
	Hauling 12 cy Truck 1 mile	396	C.Y.		-		0.038	15	$35.40		-	531		531
	PVC Duct Ready for Conc 4 @ 4"	1,530	LF		5.68		0.200	306	$50.40		8,690	15,422		24,112
	Place Conc Footing Deep chute	309	C.Y.		5.68		0.343	106	$35.39		1,755	3,751		5,506
	Purchase Concrete 3500 Psi	340	Cy		66.99		-	-	$0.00		22,777	-		22,777
	Bare Copper Gr'd Wire 4/0 Stranded	16	C.L.F.		166.46		2.807	45	$50.53		2,663	2,274		4,937
	Multiplexers	18	Each		2,500.00		6.000	108	$34.50		45,000	3,726		48,726
	Fiber Optic & Data Cables	6,885	L.F.		2.23		0.220	1,515	$50.76		15,354	76,905		92,259
	Design Detail Allowance	25	%					2,059	$50.13		626,937	103,200		730,137
	Perimeter CC TV	0	0		-									
	Excavate Sand & Gravel Backhoe 1cy	840	C.Y.		-		0.133	112	$41.85		-	4,687		4,687
	Loading Sand & Gravel into Trucks	560	C.Y.		-		0.020	11	$42.64		-	469		469
	Hauling 12 cy Truck 1 mile	560	C.Y.		-		0.038	21	$35.71		-	750		750
	Duct Bank 4-2" Dia Rigid Galv Steel	3,350	L.F.		19.54		0.178	596	$50.47		65,459	30,083		95,542
	Place Conc Footing Deep chute	280	C.Y.		5.68		0.343	96	$35.41		1,590	3,399		4,989
	Purchase Concrete 3500 Psi	308	Cy		66.99		-	-	$0.00		20,633	-		20,633
	Bare Copper Gr'd Wire 4/0 Stranded	34	C.L.F.		166.46		2.807	95	$50.87		5,660	4,833		10,493
	CCTV 10:1 Zoom Lens w/Preset	8	Each		2,030.00		2.000	16	$50.75		16,240	812		17,052
	Fiber Optic Xmtr	8	Each		1,218.00		1.000	8	$50.75		9,744	406		10,150
	Fiber Optic Reciever	8	Each		1,218.00		1.000	8	$50.75		9,744	406		10,150
	Pan & Tilt Unit w/ Presets	8	Each		2,436.00		1.000	8	$50.75		19,488	406		19,894
	Reciever/Driver w/Presets	8	Each		1,522.50		1.000	8	$50.75		12,180	406		12,586
	Custom Camera Pole	8	Each		1,015.00		1.000	8	$50.75		8,120	406		8,526
	Video Switching Matrix	1	Each		8,120.00		4.000	4	$50.75		8,120	203		8,323
	VCR 1/8 Crameras	1	Each		5,075.00		4.000	4	$50.75		5,075	203		5,278
	Monitors	1	Each		1,268.75		4.000	4	$50.75		1,269	203		1,472
	Prefabricated Cable Assemblies	8	Each		1,015.00		4.000	32	$50.78		8,120	1,625		9,745
	Fiber Optic & Data Cables	2,500	L.F.		2.23		0.220	550	$50.77		5,575	27,925		33,500
	Design Detail Allowance	25	%					395	$48.84		49,254	19,306		68,560
	Fence Security													
	Fence Security Transmitter	16	Each		964.25		4.000	64	$50.77		15,428	3,249		18,677
	4 5' Pole for Xmtr	16	Each		1,218.00		6.000	96	$50.77		19,488	4,874		24,362
	Infra Red Detectors	16	Each		761.25		4.000	64	$50.77		12,180	3,249		15,429
	Perimeter Fence Security Alarm Pnl	1	Each		2,537.50		1.000	1	$51.00		2,538	51		2,589
	Card Readers @ Gate	4	Each		1,522.50		8.000	32	$50.78		6,090	1,625		7,715
	600V Cable - 1-3c#12AWG	1,500	L.F.		0.55		0.041	62	$50.32		825	3,120		3,945
	Terminations	360	Each		0.51		0.340	122	$50.93		184	6,214		6,398
	Detectors (Nuclear)	16	Each		3,248.00		4.000	64	$50.77		51,968	3,249		55,217
	Allow for Monitor Building	1	Each		37,500.00		750.000	750	$50.00		37,500	37,500		75,000
	Design Detail Allowance	25	%					314	$50.30		36,550	15,783		52,333
	Total Cost Monitoring & Security 1 Site							13,839			3,563,705	691,443		4,255,148
	0													
	Communications													
	Allow for Telephones	10	Each		5,000.00		20.000	200	$50.00		50,000	10,000		60,000
	Category 3 #24 4 pair Solid pvc	100	C.L.F.		5.58		1.143	114	$50.34		558	5,739		6,297
	Design Detail Allowance	25	%					79	$50.12		12,640	3,935		16,574
	Total Cost Communications 1 Site							393			63,198	19,674		82,871
Subtotal Site Related Costs Direct Costs		1	Site					78,294			7,390,080	3,594,710		10,984,790

BECHTEL SAIC

JOB NO. & TITLE : 24535-000 YUCCA MOUNTAIN PROJECT
CLIENT : DEPARTMENT OF ENERGY
JOB LOCATION : LAS VEGAS, NEVADA
TYPE OF ESTIMATE : Order of Magnitude
WBS # and DESCRIPTION : Staging Area Finishes Site 1 - 5000 MTU

DATE : 08-Mar-02
Estimate No.
Take-off: J.Steiger
Priced: J. Steiger
Checked:
Approved:

Bechtel or CSI CODE	ITEM & DESCRIPTION	QUANTITY	UNIT MEAS	UNIT COST EQUIP.	UNIT COST BULK	UNIT COST S/C	D. HIRE UNIT MHR	TOTAL MHRS	WAGE RATES	TOTAL COSTS IN U.S $ EQUIPMENT	BULK	LABOR	SUBCON.	TOTAL
	Road Related Cost													
	Trencher 12" x36" Deep w/ Backfill	2,500	L.S.		-		0.011	28	$41.96		-	1,175		1,175
	Compact w/ vibratory Plate	2,500	L.S.		-		0.006	14	$42.00		-	588		588
	Compacting Bedding In Trench	42	0		-		0.089	4	$31.50		-	126		126
	Pipe Bedding-Screened Bank run	42	LS		17.26		0.160	7	$35.00		725	245		970
	Pipe Blk Stl p. ends.wld, 1/4" wall10"	2,500	0		9.24		0.538	1,345	$40.35		23,100	54,275		77,375
	Excavate Sand & Gravel Backhoe 1cy	1,152	0		-		0.133	153	$42.01		-	6,428		6,428
	Loading Sand & Gravel into Trucks	504	LF		-		0.020	10	$42.20		-	422		422
	Compact w/ vibratory Plate	648	LF		-		0.006	4	$38.00		-	152		152
	PVC Duct Ready for Conc 4 @ 4"	2,500	C.Y.		5.68		0.200	500	$50.40		14,200	25,200		39,400
	Place Conc Footing Deep chute	504	C.Y.		5.68		0.343	173	$35.37		2,863	6,119		8,982
	Purchase Concrete 3500 Psi	554	LF		66.99		-	-	$0.00		37,112	-		37,112
	Hand Hole precast Conc 4'x4'x4'	8	C.Y.		598.85		14.286	114	$50.09		4,791	5,710		10,501
	Fiber Optic & Data Cables	81	C.Y.		2.23		0.220	18	$50.28		181	905		1,086
	600 volt type THW stranded 250KCM	81	LF		231.42		4.000	324	$50.40		18,745	16,330		35,075
	Bare Copper Gr'd Wire 4/0 Stranded	27	LF		166.46		2.807	76	$50.50		4,494	3,838		8,332
	Allow for Undifined Items 10% of Total	1	C.Y.		8,238.60		137.200	137	$47.45		8,239	6,510		14,749
	Concrete Paving 6" unreinforced	9,600	Cy		16.49		0.029	278	$38.68		158,304	10,752		169,056
	Continuous Welded Wire >10' wide	9,600	Each		3.30		0.006	56	$38.39		31,661	2,150		33,811
	Design Detail Allowance	18	%					583			54,795	25,367		80,161
Total Direct Cost for Related to Road		2,400	LF					3,825			359,209	166,292		525,501
Total Direct Cost 5000 MTU Site 1 including Road								82,119			7,749,289	3,761,002		11,510,291

ESTIMATE SUMMARY
INDIRECT CALCULATION MODEL
STAGING STUDY Case 1 - 20,000 MTU

Estimate No.
Date : Feb.19, 2002

	MANHOURS						
	DIRECT HIRE	SUB CONTRACT	PLANT EQUIPMENT	BULK MATERIALS	LABOR	SUB CONTRACT	TOTAL
DIRECT COSTS							
Pad Related Earthwork	5,323			47840	204625		252,465
Flood Control Berm Related Earthwork	2,475			72548	97187		169,735
Road Related Earthwork	41,190			136939	41190		178,129
Construct Detention Pond	2,800			53310	109115		162,425
Concrete Pads	171,764			10,079,281	8,144,131		18,223,412
Paving Between Pads	4,195			2,385,642	162,032		2,547,674
Fire Protection	9,424			178,826	380,544		559,370
Fencing	40,982			723,191	1,530,415		2,253,605
Grounding	6,000			236,205	294,610		530,815
Lighting Systems	9,866			976,735	478,879		1,455,614
Monitoring & Security	55,344			14,253,718	2,765,056		17,018,774
Communications	1,571			252,790	78,695		331,485
Roads	7,369			699,076	320,627		1,019,703
NTS Productivity Factor @ 30%	107,491	-			4,382,131	-	4,382,131
Nuclear Quality Productivity Factor @50%	111,647	-			5,293,685	-	5,293,685
SUB TOTAL	577,439	-	-	30,096,100	24,282,921	-	54,379,021
DISTRIBUTABLE FIELD COSTS							
Mat'l & Labor @ 80% of Direct Labor Cost (50% MH)	288,719	-		19,426,337			19,426,337
(Weighted average of Bechtel historical projects)							
Per Diem - Direct Craft @ $1.50 / MH	577,439	-		866,158		-	866,158
Per Diem - Indirect Craft @ $1.50 / MH	288,719	-		433,079		-	433,079
Per Diem - Staff @ $1.50 / MH (Staff MH 25% Direct)	144,360	-		216,540		-	216,540
(Weighted average of Bechtel historical projects)							
Busing @ $15.00 / Man-Day (Craft & Staff)	1,010,518	-		1,515,777		-	1,515,777
Additional Costs for S/C:							
Performance & Payment Bond @ 2.3% (L) RSMeans				558,507			558,507
Builder's Risk & Public Liability (Incl w/ Wage Rates)				-			-
Overhead (Main Office) @ 16.2% (L) RSMeans				3,933,833			3,933,833
Profit @ 10% (Total Cost w/o Materials)				4,971,738			4,971,738
SUB TOTAL	433,079		-	31,921,969	-	-	31,921,969
S/C ENGINEERING & SERVICES							
Engineering & Services	-						-
(DOE Cost Estimate Guideline Range = 15 - 25%)							
SUB TOTAL			-	-	-	-	-
BSC ENGINEERING & SERVICES							
Engineering & Services @ __% of Direct Costs	-			-			-
Design Management @ __% of Engineering & Se	-			-			-
Construction Management @ __% of TPC	-			-		-	-
(DOE Cost Estimate Guideline Range = 5 - 15%)							
SUB TOTAL	-	-	-	-	-	-	-
BSC INDIRECT COST POOLS							
Site Support @ __% (Offsite = Las Vegas Office) (FY	-			-			-
NTS Support Services - Allowance 3%	-			-			-
G & A @ __% (FY02 Rates)	-			-			-
SUB TOTAL			-	-	-	-	-
NATIONAL LABS							
Labor Costs							-
SUB TOTAL			-	-	-	-	-
SUB TOTAL - PROJECT			-	62,018,069	24,282,921	-	86,300,990
ESCALATION	-		-	-	-	-	-
CONTINGENCY @ __%	-						-
(DOE Cost Estimate Guideline Range = 20-30% up to 50%)							
TOTAL - PROJECT	1,010,518						86,300,990

BECHTEL SAIC

JOB NO. & TITLE :	24535-000 YUCCA MOUNTAIN PROJECT
CLIENT :	DEPARTMENT OF ENERGY
JOB LOCATION :	LAS VEGAS, NEVADA
TYPE OF ESTIMATE :	Order of Magnitude
WBS # and DESCRIPTION :	Staging Area Finishes Site 1 - 20,000 MTU

DATE :	08-Mar-02
Estimate No.	
Take-off:	J.Steiger
Priced:	J. Steiger
Checked:	
Approved:	

Bechtel or CSI CODE	ITEM & DESCRIPTION	QUANTITY	UNIT MEAS	UNIT COST EQUIP.	UNIT COST BULK	UNIT COST S/C	D. HIRE UNIT MHR	TOTAL MHRS	WAGE RATES	TOTAL COSTS IN U.S $ EQUIPMENT	BULK	LABOR	SUBCON	TOTAL
	Haul & Excavate													
	21 cy Scraper 1500 ft Haul	153,100	Cy		-		0.012	1,837	38.33		0	70,426		70,426
	Ripping Very Hard 460 hp Dozer	38,275	Cy		-		0.020	766	39.50		0	30,237		30,237
	6000 gal Water Truck 3 mile Haul	153,100	Cy		0.20		0.004	612	35.00		30,620	21,434		52,054
	Total Cost for Excavate & Haul	153,100	Cy					3,215			30,620	122,097		152,717
	Spread and Compact													
	Spread Dumped Material by Dozer	81,100	Cy		-		0.012	973	39.17		0	38,117		38,117
	Vibrating Roller 6" Lift 4 Passes	81,100	Cy		-		0.01	730	41.11		0	30,007		30,007
	6000 gal Water Truck 3 mile Haul	81,100	Cy		0.20		0.00	324	35.00		16,220	11,354		27,574
	Total Cost Spread and Compact	81,100	Cy					2,028			16,220	79,478		95698
	Waste Excess Material													
	Spread Dumped Material by Dozer	5,000	Cy		-		0.01	60	39.17		0	2,350		2,350
	6000 gal Water Truck 3 mile Haul	5,000	Cy		0.20		0.00	20	35.00		1,000	700		1,700
	Total Cost Spread and Compact	5,000	Cy					80			1,000	3,050		4050
	Subtotal Pad Construction	1	LS					5,323			47,840	204,625		252,465
	Construct Flood Berm													
	Spread and Compact													
	Spread Dumped Material by Dozer	67,000	Cy		-		0.012	804	39.17		0	31,490		31,490
	Vibrating Roller 6" Lift 4 Passes	67,000	Cy		-		0.009	603	41.11		0	24,790		24,790
	6000 gal Water Truck 3 mile Haul	67,000	Cy		0.20		0.004	268	35.00		13,400	9,380		22,780
	Total Cost Spread and Compact	67,000	Cy					1,675			13,400	65,660		79060
	Place Rip-Rap													
	Rip-Rap Machine Placed	3,100	Cy		19.08		0.26	800	39.42		59,148	31,527		90,675
	Subtotal Flood Berm Construction	1	LS					2,475			72,548	97,187		169735
	Road Construction													
	Excavate & Haul													
	21 cy Scraper 1500 ft Haul	7,520	Cy		-		0.46	3,459	1.00		0	3,459		3,459
	Ripping Very Hard 460 hp Dozer	1,880	Cy		-		0.79	1,485	1.00		0	1,485		1,485
	6000 gal Water Truck 3 mile Haul	7,520	Cy		0.20		0.14	1,053	1.00		1,504	1,053		2,557
	Total Cost for Excavate & Haul	**7,520**	**Cy**					5,997			1,504	5,997		7501
	Spread and Compact													
	Spread Dumped Material by Dozer	7,520	Cy		-		0.47	3,534	1.00		0	3,534		3,534
	Vibrating Roller 6" Lift 4 Passes	7,520	Cy		-		0.37	2,782	1.00		0	2,782		2,782
	6000 gal Water Truck 3 mile Haul	7,520	Cy		0.20		0.14	1,053	1.00		1,504	1,053		2,557
	Total Cost Spread and Compact	7,520	Cy					7,369			1,504	7,369		8873
	Place Gravel Surfacing													
	Crushed Stone 1-1/2 inch	7,520	Cy		17.81		3.70	27,824	1.00		133,931	27,824		161,755
	Subtotal Road Construction	1	LS					41,190			136,939	41,190		178,129

BECHTEL SAIC

JOB NO. & TITLE : 24535-000 YUCCA MOUNTAIN PROJECT
CLIENT : DEPARTMENT OF ENERGY
JOB LOCATION : LAS VEGAS, NEVADA
TYPE OF ESTIMATE : Order of Magnitude
WBS # and DESCRIPTION : Staging Area Finishes Site 1 - 20,000 MTU

DATE : 08-Mar-02
Estimate No.
Take-off: J.Steiger
Priced: J. Steiger
Checked:
Approved:

Bechtel or CSI CODE	ITEM & DESCRIPTION	QUANTITY	UNIT MEAS	UNIT COST EQUIP.	UNIT COST BULK	UNIT COST S/C	D. HIRE UNIT MHR	TOTAL MHRS	WAGE RATES	TOTAL COSTS IN U.S $ EQUIPMENT	BULK	LABOR	SUBCON.	TOTAL
	Construct Detention Basin	4	Each											
	21 cy Scraper 1500 ft Haul	57,260	Cy		-		0.012	688			0	26,340		26,340
	Ripping Very Hard 460 hp Dozer	14,315	Cy		-		0.020	288			0	11,308		11,308
	Spread Dumped Material by Dozer	57,260	Cy		-		0.012	688			0	26,912		26,912
	Rip-Rap Machine Placed	2,235	Cy		19.08		0.258	576			42,648	22,732		65,380
	Allow for Design Development 25%	4	L.S.		-		-	560			10,662	21,823		32,485
	Subtotal Detention Basin Const'n	4	L.S.					2,800			53,310	109,115		162,425
	Concrete Pads													
	Excavate Sand & Gravel Backhoe 1cy	47023	C.Y.		-		0.133	6,254	41.96	-	0	262,388		262,388
	Loading Sand & Gravel into Trucks	47023	C.Y.		-		0.020	938	41.96	-	0	39,358		39,358
	Forms in Place Mat Footing 4 use	214704	SFCA		0.61		0.137	29,414	41.90	-	130,969	1,232,401		1,363,370
	Reinf. In Place A615 G60 Slab-Grade	7056	Tons		532.88		13.910	98,149	51.76	-	3,760,001	5,079,967		8,839,968
	Purchase Concrete 3500 Psi	77616	Cy		66.99		-	-	0.00	-	5,199,496	-		5,199,496
	Conc. Placing Foundation Mat Pump	70560	C.Y.		-		0.160	11,290	36.31	-	0	409,954		409,954
	Finishing Fl'rs-Screed, Float & Broom	635040	SF		-		0.013	8,256	38.46	-	0	317,520		317,520
	Curing - Burlap 12 oz	6350	CSF		11.42		0.291	1,848	33.64	-	72,517	62,167		134,684
	Design Detail Allowance	10	%					15,615	47.41		916,298	740,376		1,656,674
	Subtotal Concrete Pads	504	Each					171,764			########	8,144,131		18,223,412
	Paving Between Pads													
	Concrete Paving 6" unreinforced	109600	S.Y.		16.49		0.029	3,178	38.63		1,807,304	122,752		1,930,056
	Continuous Welded Wire >10' wide	109600	S.Y.		3.30		0.006	636	38.60		361,461	24,550		386,011
	Design Detail Allowance	10	%					381	38.62		216,877	14,730		231,607
	Total Cost for Paving between Pads	4	L.S.					4,195			2,385,642	162,032	-	2,547,674
	Fire Protection													
	Trencher 12" x36" Deep w/ Backfill	13,400	LF		-		0.011	147	$42.84		0	6,298		6,298
	Compact w/ vibratory Plate	13,400	LF		-		0.006	74	$42.55		0	3,149		3,149
	Compacting Bedding In Trench	240	C.Y.		-		0.089	21	$34.19		0	718		718
	Pipe Bedding-Screened Bank run	240	C.Y.		17.26		0.160	38	$36.89		4,142	1,402		5,544
	Pipe Blk Stl p. ends.wld. 1/4" wall10"	13,400	LF		9.24		0.538	7,209	$40.35		123,816	290,914		414,730
	Fire Hydrant 5 1/4" 4'-0" Valve Depth	16	Each		943.95		3.111	50	$39.08		15,103	1,954		17,057
	Design Detail Allowance	25	%					1,885	$40.38		35,765	76,109		111,874
	Total Cost Fire Protection 4 5000 MTU	1	Each					9,424			178,826	380,544	-	559,370
	Fencing													
	Security Fence Prison Grade 12' high	28,400	LF		21.82		1.280	36,352	$37.36		619,688	1,358,088		1,977,776
	Gate 12 High w/ 20 FT Opening	24	Opening		1,573.25		37.647	904	$36.72		37,758	33,198		70,956
	Design Detail Allowance	10	%					3,726	$37.34		65,745	139,129		204,873
	Total Cost Fencing 4 5000 MTU	1	Each					40,982			723,191	1,530,415		2,253,605
	Grounding													
	Chain Trencher 4"wide x12"deep	28,400	LF		-		0.010	284	$43.00		0	12,212		12,212
	Bsckfill & Compact by Hand 4"wx12"d	28,400	LF		-		0.010	284	$34.00		0	9,656		9,656
	Bare Copper Gr'd Wire 4/0 Stranded	284	C.L.F.		166.46		2.807	797	$50.65		47,275	40,371		87,646
	Copper Electrolytic Ground Rod 20'	96	Each		1,116.50		4.598	441	$50.61		107,184	22,320		129,504
	Water Pipe Clamp 1 1/4 to 2"	1,300	Each		15.53		1.000	1,300	$50.77		20,189	66,001		86,190
	Exothermic Weld 4/0 to #4	1,300	Each		5.48		1.143	1,486	$50.21		7,124	74,607		81,731
	Bare Copper Gr'd Wire #2 Stranded	130	C.L.F.		55.32		1.600	208	$50.58		7,192	10,521		17,713
	Design Detail Allowance	25	%					1,200	$49.10		47,241	58,922		106,163
	Total Cost Grounding 4 5000 MTU	4	Each					6,000			236,205	294,610		530,815

BECHTEL SAIC	JOB NO. & TITLE :	24535-000 YUCCA MOUNTAIN PROJECT			
	CLIENT :	DEPARTMENT OF ENERGY		DATE :	08-Mar-02
	JOB LOCATION :	LAS VEGAS, NEVADA		Estimate No.	
	TYPE OF ESTIMATE :	Order of Magnitude		Take-off:	J.Steiger
				Priced:	J. Steiger
	WBS # and DESCRIPTION :	Staging Area Finishes Site 1 - 20,000 MTU		Checked:	
				Approved:	

Bechtel or CSI CODE	ITEM & DESCRIPTION	QUANTITY	UNIT MEAS	UNIT COST EQUIP.	UNIT COST BULK	UNIT COST S/C	D. HIRE UNIT MHR	TOTAL MHRS	WAGE	TOTAL COSTS IN U.S $ EQUIPMENT	BULK	LABOR	SUBCON.	TOTAL
	Lighting System													
	Excavate Trench Backhoe 1cy	2,720	C.Y.		-		0.040	109	$41.93		0	4,570		4,570
	Backfill Trench FEL 1cy wheel mtd	1,660	C.Y.		-		0.030	50	$41.16		0	2,058		2,058
	Hauling 12 cy Truck 1 mile	1,060	C.Y.		-		0.038	40	$35.50		0	1,420		1,420
	PVC Duct Ready for Conc 2 @ 2"	13,400	LF		1.35		0.067	898	$50.29		18,090	45,158		63,248
	Place Conc Footing Deep chute	1,060	C.Y.		5.68		0.343	364	$35.35		6,021	12,868		18,889
	Purchase Concrete 3500 Psi	1,160	Cy		66.99		-	-	-		77,708	-		77,708
	Bare Copper Gr'd Wire #2 Stranded	136	C.L.F.		55.32		1.600	218	$50.49		7,524	11,006		18,530
	600 volt type THW stranded #4	404	C.L.F.		42.63		1.509	610	$50.68		17,223	30,914		48,137
	Footings under 1 cy	268	C.Y.		97.44		2.942	788	$41.04		26,114	32,340		58,454
	Aluminum pole 40 ft high	168	Each		1,497.13		10.000	1,680	$50.03		251,518	84,054		335,572
	Bracket Arms 2 arms	168	Each		164.43		1.000	168	$50.77		27,624	8,529		36,153
	Pole Mounted Flood HP sodium 1000w	336	Each		507.50		4.000	1,344	$50.40		170,520	67,738		238,258
	Xfmr 5KV/480-1000KVA 3 Phase	4	Each		30,145.50		180.000	720	$50.77		120,582	36,553		157,135
	Xfmr 480/120-45KVA 3 Phase	4	Each		1,268.75		40.000	160	$50.77		5,075	8,123		13,198
	Motor Control Center	4	Each		10,150.00		120.000	480	$50.77		40,600	24,369		64,969
	Distr-Pnl Ltg 480v	4	Each		2,436.00		30.000	120	$50.77		9,744	6,092		15,836
	Distr-Pnl Inst 120v	4	Each		761.25		36.000	144	$50.77		3,045	7,311		10,356
	Design Detail Allowance	25	%					1,973	$48.54		195,347	95,776		291,123
	Total Cost Lighting System 4 5000 MTU	1	Each					9,866			976,735	478,879		1,455,614
	Monitoring & Security													
	Pad Monitoring				-									
	Duct Bank 2-3" Dia Rigid Galv Steel	74,160	L.F.		21.32		0.160	11,866	$50.56		1,581,091	599,954		2,181,045
	Category 3 #24 4 pair Solid pvc	168	C.L.F.		5.58		1.143	192	$50.22		937	9,642		10,579
	Allow for Temp Sensors	4,032	Each		2,000.00		3.000	12,096	$50.77		8,064,000	614,114		8,678,114
	Excavate Sand & Gravel Backhoe 1cy	2,821	C.Y.		-		0.133	375	$41.98		0	15,741		15,741
	Loading Sand & Gravel into Trucks	1,587	C.Y.		-		0.020	32	$41.50		0	1,328		1,328
	Hauling 12 cy Truck 1 mile	1,587	C.Y.		-		0.038	60	$35.45		0	2,127		2,127
	PVC Duct Ready for Conc 4 @ 4"	6,120	LF		5.68		0.200	1,224	$50.40		34,762	61,690		96,452
	Place Conc Footing Deep chute	1,234	C.Y.		5.68		0.343	423	$35.42		7,009	14,981		21,990
	Purchase Concrete 3500 Psi	1,357	Cy		66.99		-	-	$0.00		90,905	-		90,905
	Bare Copper Gr'd Wire 4/0 Stranded	62	C.L.F.		166.46		2.807	174	$50.65		10,321	8,813		19,134
	Multiplexers	72	Each		2,500.00		6.000	432	$34.50		180,000	14,904		194,904
	Fiber Optic & Data Cables	27,540	L.F.		2.23		0.220	6,059	$50.77		61,414	307,622		369,036
	Design Detail Allowance	25	%					8,233	$50.13		2,507,610	412,729		2,920,339
	Perimeter CC TV	0	0		-									
	Excavate Sand & Gravel Backhoe 1cy	3,360	C.Y.		-		0.133	447	$41.94		0	18,749		18,749
	Loading Sand & Gravel into Trucks	2,240	C.Y.		-		0.020	45	$41.67		0	1,875		1,875
	Hauling 12 cy Truck 1 mile	2,240	C.Y.		-		0.038	85	$35.32		0	3,002		3,002
	Duct Bank 4-2" Dia Rigid Galv Steel	13,400	L.F.		19.54		0.178	2,385	$50.45		261,836	120,332		382,168
	Place Conc Footing Deep chute	1,120	C.Y.		5.68		0.343	384	$35.41		6,362	13,597		19,959
	Purchase Concrete 3500 Psi	1,232	Cy		66.99		-	-	$0.00		82,532	-		82,532
	Bare Copper Gr'd Wire 4/0 Stranded	134	C.L.F.		166.46		2.807	376	$50.66		22,306	19,048		41,354
	CCTV 10:1 Zoom Lens w/Preset	32	Each		2,030.00		2.000	64	$50.77		64,960	3,249		68,209
	Fiber Optic Xmtr	32	Each		1,218.00		1.000	32	$50.78		38,976	1,625		40,601
	Fiber Optic Reciever	32	Each		1,218.00		1.000	32	$50.78		38,976	1,625		40,601
	Pan & Tilt Unit w/ Presets	32	Each		2,436.00		1.000	32	$50.78		77,952	1,625		79,577
	Reciever/Driver w/Presets	32	Each		1,522.50		1.000	32	$50.78		48,720	1,625		50,345
	Custom Camera Pole	32	Each		1,015.00		1.000	32	$50.78		32,480	1,625		34,105
	Video Switching Matrix	4	Each		8,120.00		4.000	16	$50.75		32,480	812		33,292
	VCR 1/8 Crameras	4	Each		5,075.00		4.000	16	$50.75		20,300	812		21,112
	Monitors	4	Each		1,268.75		4.000	16	$50.75		5,075	812		5,887
	Prefabricated Cable Assemblies	32	Each		1,015.00		4.000	128	$50.77		32,480	6,498		38,978
	Fiber Optic & Data Cables	10,000	L.F.		2.23		0.220	2,200	$50.77		22,300	111,700		134,000
	Design Detail Allowance	25	%					1,581	$48.82		196,934	77,153		274,087

BECHTEL SAIC

JOB NO. & TITLE :	24535-000 YUCCA MOUNTAIN PROJECT
CLIENT :	DEPARTMENT OF ENERGY
JOB LOCATION :	LAS VEGAS, NEVADA
TYPE OF ESTIMATE :	Order of Magnitude
WBS # and DESCRIPTION :	Staging Area Finishes Site 1 - 20,000 MTU

DATE :	08-Mar-02
Estimate No.	
Take-off:	J.Steiger
Priced:	J. Steiger
Checked:	
Approved:	

Bechtel or CSI CODE	ITEM & DESCRIPTION	QUANTITY	UNIT MEAS	UNIT COST EQUIP.	UNIT COST BULK	UNIT COST S/C	D. HIRE UNIT MHR	TOTAL	WAGE	TOTAL COSTS IN U.S $ EQUIPMENT	BULK	LABOR	SUBCON	TOTAL
	Fence Security	0	0		-									
	Fence Security Transmitter	64	Each		964.25		4.000	256	$50.77		61,712	12,996		74,708
	4.5' Pole for Xmtr	64	Each		1,218.00		6.000	384	$50.77		77,952	19,495		97,447
	Infra Red Detectors	64	Each		761.25		4.000	256	$50.77		48,720	12,996		61,716
	Perimeter Fence Security Alarm Pnl	4	Each		2,537.50		1.000	4	$50.75		10,150	203		10,353
	Card Readers @ Gate	16	Each		1,522.50		8.000	128	$50.77		24,360	6,498		30,858
	600V Cable - 1-3c#12AWG	6,000	L.F.		0.55		0.041	246	$50.73		3,300	12,480		15,780
	Terminations	1,440	Each		0.51		0.340	490	$50.72		734	24,854		25,588
	Detectors (Nuclear)	64	Each		3,248.00		4.000	256	$50.77		207,872	12,996		220,868
	Allow for Monitor Building	4	Each		37,500.00		750.000	3,000	$50.00		150,000	150,000		300,000
	Design Detail Allowance	25	%					1,255	$50.30		146,200	63,130		209,330
	Total Cost Monitoring & Security 4 Site							55,344			14,253,718	2,765,056		17,018,774
	0													
	Communications													
	Allow for Telephones	40	Each		5,000.00		20.000	800	$50.00		200,000	40,000		240,000
	Category 3 #24 4 pair Solid pvc	400	C.L.F.		5.58		1.143	457	$50.23		2,232	22,956		25,188
	Design Detail Allowance	25	%					314	$50.08		50,558	15,739		66,297
	Total Cost Communications 4 Site							1,571			252,790	78,695		331,485
Subtotal Site Related Costs Direct Costs		1	Site					350,933			########	14,286,478		43,683,502
	Road Related Cost													
	Trencher 12" x36" Deep w/ Backfill	4,800	LF		-		0.011	53	$42.57		0	2,256		2,256
	Compact w/ vibratory Plate	4,800	LF		-		0.006	26	$43.38		0	1,128		1,128
	Compacting Bedding In Trench	81	C.Y.		-		0.089	7	$34.57		0	242		242
	Pipe Bedding-Screened Bank run	81	C.Y.		17.26		0.160	13	$36.38		1,398	473		1,871
	Pipe Blk Stl p. ends.wld, 1/4" wall10"	4,800	LF		9.24		0.538	2,582	$40.36		44,352	104,208		148,560
	Excavate Sand & Gravel Backhoe 1cy	2,212	C.Y.		-		0.133	294	$41.98		0	12,343		12,343
	Loading Sand & Gravel into Trucks	968	C.Y.		-		0.020	19	$42.63		0	810		810
	Compact w/ vibratory Plate	1,244	LF		-		0.006	7	$41.71		0	292		292
	PVC Duct Ready for Conc 4 @4"	4,800	LF		5.68		0.200	960	$50.40		27,264	48,384		75,648
	Place Conc Footing Deep chute	968	C.Y.		5.68		0.343	332	$0.00		5,498	11,752		17,250
	Purchase Concrete 3500 Psi	1,065	Cy		66.99		-	-	$0.00		71,344	-		71,344
	Hand Hole precast Conc 4'x4'x4'	16	Each		598.85		14.286	229	$49.86		9,582	11,419		21,001
	Fiber Optic & Data Cables	156	L.F.		2.23		0.220	34	$51.26		348	1,743		2,091
	600 volt type THW stranded 250KCM	156	C.L.F.		231.42		4.000	624	$50.40		36,102	31,450		67,552
	Bare Copper Gr'd Wire 4/0 Stranded	52	C.L.F.		166.46		2.807	146	$50.63		8,656	7,392		16,048
	Allow for Undifined Items 10% of Total	1	allow		15,879.40		264.50	265	$47.48		15,879	12,559		28,438
	Concrete Paving 6" unreinforced	18,800	S.Y.		16.49		0.029	545	$38.63		310,012	21,056		331,068
	Continuous Welded Wire >10' wide	18,800	S.Y.		3.30		0.006	109	$38.63		62,002	4,211		66,213
	Design Detail Allowance	18	%					1,124			106,639	48,909		155,548
Total Direct Cost for Related to Road		4,700	LF					7,369			699,076	320,627		1,019,703
Total Direct Cost 20,000 MTU Site 1 Including Road								358,302			30,096,100	14,607,105		44,703,205

ESTIMATE SUMMARY
INDIRECT CALCULATION MODEL
STAGING STUDY Case 2 - 5,000 MTU

Estimate No.
Date : Feb.19, 2002

	MANHOURS DIRECT HIRE	MANHOURS SUB CONTRACT	PLANT EQUIPMENT	BULK MATERIALS	LABOR	SUB CONTRACT	TOTAL
DIRECT COSTS							
Pad Related Earthwork	2,088			18880	80494		99,374
Road Related Earthwork	824			105618	31770		137,388
Construct Detention Pond	700			13328	27279		40,606
Concrete Pads	42,942			2,519,826	2,036,040		4,555,866
Paving Between Pads	1,049			596,410	40,509		636,919
Fire Protection	2,355			44,708	95,136		139,844
Fencing	10,245			180,798	382,603		563,401
Grounding	1,500			59,086	73,704		132,790
Lighting Systems	2,464			244,184	119,720		363,904
Monitoring & Security	13,839			3,563,705	691,443		4,255,148
Communications	393			63,198	19,674		82,871
Roads	5,839			551,850	254,103		805,953
NTS Productivity Factor @ 30%	25,271.17	-			1,155,742	-	1,155,742
Nuclear Quality Productivity Factor @50%	27,912	-			1,323,426	-	1,323,426
SUB TOTAL	137,421	-	-	7,961,589	6,331,641	-	14,293,230
DISTRIBUTABLE FIELD COSTS							
Mat'l & Labor @ 80% of Direct Labor Cost (50% MH)	68,710	-		5,065,313			5,065,313
(Weighted average of Bechtel historical projects)							
Per Diem - Direct Craft @ $1.50 / MH	137,421	-		206,131		-	206,131
Per Diem - Indirect Craft @ $1.50 / MH	68,710	-		103,065		-	103,065
Per Diem - Staff @ $1.50 / MH (Staff MH 25% Direct)	34,355	-		51,533		-	51,533
(Weighted average of Bechtel historical projects)							
Busing @ $15.00 / Man-Day (Craft & Staff)	240,486	-		360,729		-	360,729
Additional Costs for S/C:							
Performance & Payment Bond @ 2.3% (L) RSMeans				145,628			145,628
Builder's Risk & Public Liability (Incl w/ Wage Rates)				-			-
Overhead (Main Office) @ 16.2% (L) RSMeans				1,025,726			1,025,726
Profit @ 10% (Total Cost w/o Materials)				1,292,904			1,292,904
SUB TOTAL	103,065		-	8,251,028	-	-	8,251,028
S/C ENGINEERING & SERVICES							
Engineering & Services	-						-
(DOE Cost Estimate Guideline Range = 15 - 25%)							
SUB TOTAL			-	-	-	-	-
BSC ENGINEERING & SERVICES							
Engineering & Services @ __% of Direct Costs	-			-			-
Design Management @ __% of Engineering & Se	-			-			-
Construction Management @ __% of TPC	-			-		-	-
(DOE Cost Estimate Guideline Range = 5 - 15%)							
SUB TOTAL	-	-	-	-	-	-	-
BSC INDIRECT COST POOLS							
Site Support @ __% (Offsite = Las Vegas Office) (FY	-			-			-
NTS Support Services - Allowance 3%	-			-			-
G & A @ __% (FY02 Rates)	-			-			-
SUB TOTAL			-	-	-	-	-
NATIONAL LABS							
Labor Costs							-
SUB TOTAL			-	-	-	-	-
SUB TOTAL - PROJECT			-	16,212,617	6,331,641	-	22,544,258
ESCALATION	-		-	-	-	-	-
CONTINGENCY @ __%	-						-
(DOE Cost Estimate Guideline Range = 20-30% up to 50%)							
TOTAL - PROJECT	240,486						22,544,258

BECHTEL SAIC

JOB NO. & TITLE : 24535-000 YUCCA MOUNTAIN PROJECT
CLIENT : DEPARTMENT OF ENERGY
JOB LOCATION : LAS VEGAS, NEVADA
TYPE OF ESTIMATE : Order of Magnitude
WBS # and DESCRIPTION : Staging Area Finishes Site 2 - 5,000 MTU

DATE : 08-Mar-02
Estimate No.
Take-off: J.Steiger
Priced: J. Steiger
Checked:
Approved:

Bechtel or CSI CODE	ITEM & DESCRIPTION	QUANTITY	UNIT MEAS	UNIT COST EQUIP.	UNIT COST BULK	UNIT COST S/C	D. HIRE UNIT MHR	TOTAL MHRS	WAGE RATES	TOTAL COSTS IN U.S $ EQUIPMENT	BULK	LABOR	SUBCON.	TOTAL
	Haul & Excavate													
	21 cy Scraper 1500 ft Haul	47,200	Cy		-		0.012	566	38.33		-	21,712		21712
	Ripping Very Hard 460 hp Dozer	11,800	Cy		-		0.020	236	39.50		-	9,322		9322
	6000 gal Water Truck 3 mile Haul	47,200	Cy		0.20		0.004	189	35.00		9,440	6,608		16048
	Total Cost for Excavate & Haul	47,200	Cy					991			9,440	37,642		47082
	Spread and Compact													
	Spread Dumped Material by Dozer	38,000	Cy		-		0.012	456	39.17		-	17,860		17860
	Vibrating Roller 6" Lift 4 Passes	38,000	Cy		-		0.009	342	41.11		-	14,060		14060
	6000 gal Water Truck 3 mile Haul	38,000	Cy		0.20		0.004	152	35.00		7,600	5,320		12920
	Total Cost Spread and Compact	38,000	Cy					950			7,600	37,240		44840
	Waste Excess Material													
	Spread Dumped Material by Dozer	9,200	Cy		-		0.012	110	39.17		-	4,324		4324
	6000 gal Water Truck 3 mile Haul	9,200	Cy		0.20		0.004	37	35.00		1,840	1,288		3128
	Total Cost Spread and Compact	9,200	Cy					147			1,840	5,612		7452
	Subtotal Pad Construction	1	LS					2,088			18,880	80,494		99374
	Road Construction													
	Excavate & Haul													
	21 cy Scraper 1500 ft Haul	5,800	Cy		-		0.012	70	38.33		-	2,668		2668
	Ripping Very Hard 460 hp Dozer	1,450	Cy		-		0.020	29	39.52		-	1,146		1146
	6000 gal Water Truck 3 mile Haul	5,800	Cy		0.20		0.004	23	35.00		1,160	812		1972
	Total Cost for Excavate & Haul	5,800	Cy					122			1,160	4,626		5786
	Spread and Compact													
	Spread Dumped Material by Dozer	5,800	Cy		-		0.012	70	39.17		-	2,726		2726
	Vibrating Roller 6" Lift 4 Passes	5,800	Cy		-		0.009	52	41.11		-	2,146		2146
	6000 gal Water Truck 3 mile Haul	5,800	Cy		0.20		0.004	23	35.00		1,160	812		1972
	Total Cost Spread and Compact	5,800	Cy					145			1,160	5,684		6844
	Place Gravel Surfacing													
	Crushed Stone 1-1/2 inch	5,800	Cy		17.81		0.096	557	38.54		103,298	21,460		124758
	Subtotal Road Construction	1	LS					824			105,618	31,770		137,388
	Construct Detention Basin													
	21 cy Scraper 1500 ft Haul	14,315	Cy		-		0.012	172	**38.28**		-	6,585		6,585
	Ripping Very Hard 460 hp Dozer	3,579	Cy		-		0.02	72	**39.26**		-	2,827		2,827
	Spread Dumped Material by Dozer	14,315	Cy		-		0.012	172	**39.12**		-	6,728		6,728
	Rip-Rap Machine Placed	559	Cy		19.08		0.258	144	**39.47**		10,662	5,683		16,345
	Allow for Design Development 25%	1	L.S.		-		0	140	**38.97**		2,666	5,456		8,121
	Subtotal Detention Basin Const'n	1	Each					700			13,328	27,279		40,606
	Concrete Pads													
	Excavate Sand & Gravel Backhoe 1cy	11756	C.Y.		-		0.133	1,564	41.94	-	-	65,598		65,598
	Loading Sand & Gravel into Trucks	11756	C.Y.		-		0.020	235	41.87	-	-	9,840		9,840
	Forms in Place Mat Footing 4 use	53676	SFCA		0.61		0.137	7,354	41.90	-	32,742	308,100		340,842
	Reinf. In Place A615 G60 Slab-Grade	1764	Tons		532.88		13.910	24,537	51.76	-	940,000	1,269,992		2,209,992

BECHTEL SAIC

JOB NO. & TITLE : 24535-000 YUCCA MOUNTAIN PROJECT
CLIENT : DEPARTMENT OF ENERGY
JOB LOCATION : LAS VEGAS, NEVADA
TYPE OF ESTIMATE : Order of Magnitude
WBS # and DESCRIPTION : Staging Area Finishes Site 2 - 5,000 MTU

DATE : 08-Mar-02
Estimate No.
Take-off: J.Steiger
Priced: J. Steiger
Checked:
Approved:

Bechtel or CSI CODE	ITEM & DESCRIPTION	QUANTITY	UNIT MEAS	UNIT COST EQUIP.	UNIT COST BULK	UNIT COST S/C	D. HIRE UNIT MHR	TOTAL	WAGE	TOTAL COSTS IN U.S $ EQUIPMENT	BULK	LABOR	SUBCON.	TOTAL
	Purchase Concrete 3500 Psi	19404	Cy		66.99		-	-	0.00	-	1,299,874	-		1,299,874
	Conc. Placing Foundation Mat Pump	17640	C.Y.		-		0.160	2,822	36.32	-	-	102,488		102,488
	Finishing Fl'rs-Screed, Float & Broom	158760	SF		-		0.013	2,064	38.46	-	-	79,380		79,380
	Curing - Burlap 12 oz	1588	CSF		11.42		0.291	462	33.65	-	18,135	15,547		33,682
	Design Detail Allowance	10	%					3,904	47.41		229,075	185,095		414,170
	Subtotal Concrete Pads	126	Each					42,942			2,519,826	2,036,040		4,555,866
	Paving Between Pads													
	Concrete Paving 6" unreinforced	27400	S.Y.		16.49		0.029	795	38.60		451,826	30,688		482,514
	Continuous Welded Wire >10' wide	27400	S.Y.		3.30		0.006	159	38.60		90,365	6,138		96,503
	Design Detail Allowance	10	%					95	38.60		54,219	3,683		57,902
	Total Cost for Paving between Pads	1	L.S.					1,049			596,410	40,509	-	636,919
	Fire Protection													
	Trencher 12" x36" Deep w/ Backfill	3,350	LF		-		0.011	37	$42.57		-	1,575		1,575
	Compact w/ vibratory Plate	3,350	LF		-		0.006	18	$43.72		-	787		787
	Compacting Bedding In Trench	60	C.Y.		-		0.089	5	$35.80		-	179		179
	Pipe Bedding-Screened Bank run	60	C.Y.		17.26		0.160	10	$35.00		1,036	350		1,386
	Pipe Blk Stl p. ends wld, 1/4" wall10"	3,350	LF		9.24		0.538	1,802	$40.36		30,954	72,729		103,683
	Fire Hydrant 5 1/4" 4'-0" Valve Depth	4	Each		943.95		3.111	12	$40.75		3,776	489		4,265
	Design Detail Allowance	25	%					471	$40.40		8,942	19,027		27,969
	Total Cost Fire Protection 1 5000 MTU	1	Each					2,355			44,708	95,136	-	139,844
	Fencing													
	Security Fence Prison Grade 12' high	7,100	LF		21.82		1.280	9,088	$37.36		154,922	339,522		494,444
	Gate 12 High w/ 20 FT Opening	6	Opening		1,573.25		37.647	226	$36.72		9,440	8,299		17,739
	Design Detail Allowance	10	%					931	$37.34		16,436	34,782		51,218
	Total Cost Fencing 1 5000 MTU	1	Each					10,245			180,798	382,603		563,401
	Grounding													
	Chain Trencher 4"wide x12"deep	7,100	LF		-		0.010	71	$43.00		-	3,053		3,053
	Bsckfill & Compact by Hand 4"wx12"d	7,100	LF		-		0.010	71	$34.00		-	2,414		2,414
	Bare Copper Gr'd Wire 4/0 Stranded	71	C.L.F.		166.46		2.807	199	$50.72		11,819	10,093		21,912
	Copper Electrolytic Ground Rod 20'	24	Each		1,116.50		4.598	110	$50.73		26,796	5,580		32,376
	Water Pipe Clamp 1 1/4 to 2"	325	Each		15.53		1.000	325	$50.77		5,047	16,500		21,547
	Exothermic Weld 4/0 to #4	325	Each		5.48		1.143	371	$50.27		1,781	18,652		20,433
	Bare Copper Gr'd Wire #2 Stranded	33	C.L.F.		55.32		1.600	53	$50.40		1,826	2,671		4,497
	Design Detail Allowance	25	%					300	$49.14		11,817	14,741		26,558
	Total Cost Grounding 1 5000 MTU	1	Each					1,500			59,086	73,704		132,790
	Lighting System													
	Excavate Trench Backhoe 1cy	680	C.Y.		-		0.040	27	$42.30		-	1,142		1,142
	Backfill Trench FEL 1cy wheel mtd	415	C.Y.		-		0.030	12	$42.92		-	515		515
	Hauling 12 cy Truck 1 mile	265	C.Y.		-		0.038	10	$35.50		-	355		355
	PVC Duct Ready for Conc 2 @ 2"	3,350	LF		1.35		0.067	224	$50.40		4,523	11,290		15,813
	Place Conc Footing Deep chute	265	C.Y.		5.68		0.343	91	$35.35		1,505	3,217		4,722
	Purchase Concrete 3500 Psi	290	Cy		66.99		-	-	-		19,427	-		19,427
	Bare Copper Gr'd Wire #2 Stranded	34	C.L.F.		55.32		1.600	54	$50.96		1,881	2,752		4,633
	600 volt type THW stranded #4	101	C.L.F.		42.63		1.509	152	$50.85		4,306	7,729		12,035
	Footings under 1 cy	67	C.Y.		97.44		2.942	197	$41.04		6,528	8,085		14,613
	Aluminum pole 40 ft high	42	Each		1,497.13		10.000	420	$50.03		62,879	21,013		83,892
	Bracket Arms 2 arms	42	Each		164.43		1.000	42	$50.76		6,906	2,132		9,038
	Pole Mounted Flood HP sodium 1000w	84	Each		507.50		4.000	336	$50.40		42,630	16,934		59,564
	Xfmr 5KV/480-1000KVA 3 Phase	1	Each		30,145.50		180.000	180	$50.77		30,146	9,138		39,284
	Xfmr 480/120-45KVA 3 Phase	1	Each		1,268.75		40.000	40	$50.78		1,269	2,031		3,300
	Motor Control Center	1	Each		10,150.00		120.000	120	$50.77		10,150	6,092		16,242

BECHTEL SAIC

JOB NO. & TITLE :	24535-000 YUCCA MOUNTAIN PROJECT
CLIENT :	DEPARTMENT OF ENERGY
JOB LOCATION :	LAS VEGAS, NEVADA
TYPE OF ESTIMATE :	Order of Magnitude
WBS # and DESCRIPTION :	Staging Area Finishes Site 2 - 5,000 MTU

DATE :	08-Mar-02
Estimate No.	
Take-off:	J.Steiger
Priced:	J. Steiger
Checked:	
Approved:	

Bechtel or CSI CODE	ITEM & DESCRIPTION	QUANTITY	UNIT MEAS	UNIT COST EQUIP.	UNIT COST BULK	UNIT COST S/C	D. HIRE UNIT MHR	TOTAL	WAGE	TOTAL COSTS IN U.S $ EQUIPMENT	BULK	LABOR	SUBCON.	TOTAL
	Distr-Pnl Ltg 480v	1	Each		2,436.00		30.000	30	$50.77		2,436	1,523		3,959
	Distr-Pnl Inst 120v	1	Each		761.25		36.000	36	$50.78		761	1,828		2,589
	Design Detail Allowance	25	%					493	$48.59		48,837	23,944		72,781
	Total Cost Lighting System 1 5000 MTU	1	Each					2,464			244,184	119,720		363,904
	Monitoring & Security													
	Pad Monitoring				-									
	Duct Bank 2-3" Dia Rigid Galv Steel	18,540	L.F.		21.32		0.160	2,966	$50.57		395,273	149,989		545,262
	Category 3 #24 4 pair Solid pvc	42	C.L.F.		5.58		1.143	48	$50.21		234	2,410		2,644
	Allow for Temp Sensors	1,008	Each		2,000.00		3.000	3,024	$50.77		2,016,000	153,528		2,169,528
	Excavate Sand & Gravel Backhoe 1cy	705	C.Y.		-		0.133	94	$41.85		-	3,934		3,934
	Loading Sand & Gravel into Trucks	396	C.Y.		-		0.020	8	$41.38		-	331		331
	Hauling 12 cy Truck 1 mile	396	C.Y.		-		0.038	15	$35.40		-	531		531
	PVC Duct Ready for Conc 4 @4"	1,530	LF		5.68		0.200	306	$50.40		8,690	15,422		24,112
	Place Conc Footing Deep chute	309	C.Y.		5.68		0.343	106	$35.39		1,755	3,751		5,506
	Purchase Concrete 3500 Psi	340	Cy		66.99		-	-	$0.00		22,777	-		22,777
	Bare Copper Gr'd Wire 4/0 Stranded	16	C.L.F.		166.46		2.807	45	$50.53		2,663	2,274		4,937
	Multiplexers	18	Each		2,500.00		6.000	108	$34.50		45,000	3,726		48,726
	Fiber Optic & Data Cables	6,885	L.F.		2.23		0.220	1,515	$50.76		15,354	76,905		92,259
	Design Detail Allowance	25	%					2,059	$50.13		626,937	103,200		730,137
	Perimeter CC TV	0	0		-									
	Excavate Sand & Gravel Backhoe 1cy	840	C.Y.		-		0.133	112	$41.85		-	4,687		4,687
	Loading Sand & Gravel into Trucks	560	C.Y.		-		0.020	11	$42.64		-	469		469
	Hauling 12 cy Truck 1 mile	560	C.Y.		-		0.038	21	$35.71		-	750		750
	Duct Bank 4-2" Dia Rigid Galv Steel	3,350	L.F.		19.54		0.178	596	$50.47		65,459	30,083		95,542
	Place Conc Footing Deep chute	280	C.Y.		5.68		0.343	96	$35.41		1,590	3,399		4,989
	Purchase Concrete 3500 Psi	308	Cy		66.99		-	-	$0.00		20,633	-		20,633
	Bare Copper Gr'd Wire 4/0 Stranded	34	C.L.F.		166.46		2.807	95	$50.87		5,660	4,833		10,493
	CCTV 10:1 Zoom Lens w/Preset	8	Each		2,030.00		2.000	16	$50.75		16,240	812		17,052
	Fiber Optic Xmtr	8	Each		1,218.00		1.000	8	$50.75		9,744	406		10,150
	Fiber Optic Reciever	8	Each		1,218.00		1.000	8	$50.75		9,744	406		10,150
	Pan & Tilt Unit w/ Presets	8	Each		2,436.00		1.000	8	$50.75		19,488	406		19,894
	Reciever/Driver w/Presets	8	Each		1,522.50		1.000	8	$50.75		12,180	406		12,586
	Custom Camera Pole	8	Each		1,015.00		1.000	8	$50.75		8,120	406		8,526
	Video Switching Matrix	1	Each		8,120.00		4.000	4	$50.75		8,120	203		8,323
	VCR 1/8 Crameras	1	Each		5,075.00		4.000	4	$50.75		5,075	203		5,278
	Monitors	1	Each		1,268.75		4.000	4	$50.75		1,269	203		1,472
	Prefabricated Cable Assemblies	8	Each		1,015.00		4.000	32	$50.78		8,120	1,625		9,745
	Fiber Optic & Data Cables	2,500	L.F.		2.23		0.220	550	$50.77		5,575	27,925		33,500
	Design Detail Allowance	25	%					395	$48.84		49,254	19,306		68,560
	Fence Security	0	0		-									
	Fence Security Transmitter	16	Each		964.25		4.000	64	$50.77		15,428	3,249		18,677
	4.5' Pole for Xmtr	16	Each		1,218.00		6.000	96	$50.77		19,488	4,874		24,362
	Infra Red Detectors	16	Each		761.25		4.000	64	$50.77		12,180	3,249		15,429
	Perimeter Fence Security Alarm Pnl	1	Each		2,537.50		1.000	1	$51.00		2,538	51		2,589
	Card Readers @ Gate	4	Each		1,522.50		8.000	32	$50.78		6,090	1,625		7,715
	600V Cable - 1-3c#12AWG	1,500	L.F.		0.55		0.041	62	$50.32		825	3,120		3,945
	Terminations	360	Each		0.51		0.340	122	$50.93		184	6,214		6,398
	Detectors (Nuclear)	16	Each		3,248.00		4.000	64	$50.77		51,968	3,249		55,217
	Allow for Monitor Building	1	Each		37,500.00		750.000	750	$50.00		37,500	37,500		75,000
	Design Detail Allowance	25	%					314	$50.30		36,550	15,783		52,333
	Total Cost Monitoring & Security 1 Site							13,839			3,563,705	691,443		4,255,148

BECHTEL SAIC	JOB NO. & TITLE :	24535-000 YUCCA MOUNTAIN PROJECT	
	CLIENT :	DEPARTMENT OF ENERGY	DATE : 08-Mar-02
	JOB LOCATION :	LAS VEGAS, NEVADA	Estimate No.
	TYPE OF ESTIMATE :	Order of Magnitude	Take-off: J.Steiger
			Priced: J. Steiger
	WBS # and DESCRIPTION :	Staging Area Finishes Site 2 - 5,000 MTU	Checked:
			Approved:

Bechtel or CSI CODE	ITEM & DESCRIPTION	QUANTITY	UNIT MEAS	UNIT COST EQUIP.	UNIT COST BULK	UNIT COST S/C	D. HIRE UNIT MHR	TOTAL	WAGE	TOTAL COSTS IN U.S $ EQUIPMENT	BULK	LABOR	SUBCON.	TOTAL
	Communications													
	Allow for Telephones	10	Each		5,000.00		20.000	200	$50.00		50,000	10,000		60,000
	Category 3 #24 4 pair Solid pvc	100	C.L.F.		5.58		1.143	114	$50.34		558	5,739		6,297
	Design Detail Allowance	25	%					79	$50.12		12,640	3,935		16,574
	Total Cost Communications 1 Site							393			63,198	19,674		82,871
Subtotal Site Related Costs Direct Costs		1	Site					78,399			7,409,740	3,598,370		11,008,110
	Road Related Cost													
	Trencher 12" x36" Deep w/ Backfill	3,800	LF		-		0.011	42	$42.52		-	1,786		1,786
	Compact w/ vibratory Plate	3,800	LF		-		0.006	21	$42.52		-	893		893
	Compacting Bedding In Trench	64	C.Y.		-		0.089	6	$31.83		-	191		191
	Pipe Bedding-Screened Bank run	64	C.Y.		17.26		0.160	10	$37.40		1,105	374		1,479
	Pipe Blk Stl p. ends.wld, 1/4" wall10"	3,800	LF		9.24		0.538	2,044	$40.36		35,112	82,498		117,610
	Excavate Sand & Gravel Backhoe 1cy	1,751	C.Y.		-		0.133	233	$41.94		-	9,771		9,771
	Loading Sand & Gravel into Trucks	766	C.Y.		-		0.020	15	$42.73		-	641		641
	Compact w/ vibratory Plate	985	LF		-		0.006	5	$46.20		-	231		231
	PVC Duct Ready for Conc 4 @ 4"	3,800	LF		5.68		0.200	760	$50.40		21,584	38,304		59,888
	Place Conc Footing Deep chute	766	C.Y.		5.68		0.343	263	$0.00		4,351	9,299		13,650
	Purchase Concrete 3500 Psi	843	Cy		66.99		-	-	$0.00		56,473	-		56,473
	Hand Hole precast Conc 4'x4'x4'	13	Each		598.85		14.286	186	$49.88		7,785	9,278		17,063
	Fiber Optic & Data Cables	124	L.F.		2.23		0.220	27	$51.30		277	1,385		1,662
	600 volt type THW stranded 250KCM	124	C.L.F.		231.42		4.000	496	$50.40		28,696	24,998		53,694
	Bare Copper Gr'd Wire 4/0 Stranded	41	C.L.F.		166.46		2.807	115	$50.68		6,825	5,828		12,653
	Allow for Undifined Items 10% of Total	1	allow		12,599.10		210.000	210	$47.49		12,599	9,974		22,573
	Concrete Paving 6" unreinforced	14,800	S.Y.		16.49		0.029	429	$38.64		244,052	16,576		260,628
	Continuous Welded Wire >10' wide	14,800	S.Y.		3.30		0.006	86	$38.55		48,810	3,315		52,125
	Design Detail Allowance	18	%					891			84,180	38,761		122,942
Total Direct Cost for Related to Road		2,400	LF					5,839			551,850	254,103		805,953
Total Direct Cost 5000 MTU Site 2 including Road								84,237			7,961,589	3,852,473		11,814,063

ESTIMATE SUMMARY
INDIRECT CALCULATION MODEL
STAGING STUDY Case 2 - 20,000 MTU

Estimate No.
Date : Feb.19, 2002

	MANHOURS DIRECT HIRE	MANHOURS SUB CONTRACT	PLANT EQUIPMENT	BULK MATERIALS	LABOR	SUB CONTRACT	TOTAL
DIRECT COSTS							
Pad Related Earthwork	5,721			50450	220,488		270,938
Flood Control Berm Related Earthwork	1,907			223152	74,921		298,073
Road Related Earthwork	1,420			182100	54,775		236,875
Construct Detention Pond	2,800			53310	109,115		162,425
Concrete Pads	171,764			10,079,281	8,144,131		18,223,412
Paving Between Pads	4,195			2,385,642	162,032		2,547,674
Fire Protection	9,424			178,826	380,544		559,370
Fencing	40,982			723,191	1,530,415		2,253,605
Grounding	6,000			236,205	294,610		530,815
Lighting Systems	9,866			976,735	478,879		1,455,614
Monitoring & Security	55,344			14,253,718	2,765,056		17,018,774
Communications	1,571			252,790	78,695		331,485
Roads	9,998			950,579	435,040		1,385,619
NTS Productivity Factor @ 30%	96,298	-			4,418,610	-	4,418,610
Nuclear Quality Productivity Factor @50%	111,647	-			5,293,685	-	5,293,685
SUB TOTAL	528,936	-	-	30,545,978	24,440,995	-	54,986,973
DISTRIBUTABLE FIELD COSTS							
Mat'l & Labor @ 80% of Direct Labor Cost (50% MH) (Weighted average of Bechtel historical projects)	264,468	-		19,552,796			19,552,796
Per Diem - Direct Craft @ $1.50 / MH	528,936	-		793,404		-	793,404
Per Diem - Indirect Craft @ $1.50 / MH	264,468	-		396,702		-	396,702
Per Diem - Staff @ $1.50 / MH (Staff MH 25% Direct) (Weighted average of Bechtel historical projects)	132,234	-		198,351		-	198,351
Busing @ $15.00 / Man-Day (Craft & Staff)	925,638	-		1,388,457		-	1,388,457
Additional Costs for S/C:							
Performance & Payment Bond @ 2.3% (L) RSMeans				562,143			562,143
Builder's Risk & Public Liability (Incl w/ Wage Rates)				-			-
Overhead (Main Office) @ 16.2% (L) RSMeans				3,959,441			3,959,441
Profit @ 10% (Total Cost w/o Materials)				4,990,383			4,990,383
SUB TOTAL	396,702		-	31,841,676	-	-	31,841,676
S/C ENGINEERING & SERVICES							
Engineering & Services	-						-
(DOE Cost Estimate Guideline Range = 15 - 25%)							
SUB TOTAL			-	-	-	-	-
BSC ENGINEERING & SERVICES							
Engineering & Services @ __% of Direct Costs	-			-			-
Design Management @ __% of Engineering & Se	-			-			-
Construction Management @ __% of TPC	-			-		-	-
(DOE Cost Estimate Guideline Range = 5 - 15%)							
SUB TOTAL	-	-	-	-	-	-	-
BSC INDIRECT COST POOLS							
Site Support @ __% (Offsite = Las Vegas Office) (FY	-			-			-
NTS Support Services - Allowance 3%	-			-			-
G & A @ __% (FY02 Rates)	-			-			-
SUB TOTAL			-	-	-	-	-
NATIONAL LABS							
Labor Costs							-
SUB TOTAL			-	-	-	-	-
SUB TOTAL - PROJECT			-	62,387,654	24,440,995	-	86,828,649

BECHTEL SAIC

JOB NO. & TITLE : 24535-000 YUCCA MOUNTAIN PROJECT
CLIENT : DEPARTMENT OF ENERGY
JOB LOCATION : LAS VEGAS, NEVADA
TYPE OF ESTIMATE : Order of Magnitude
WBS # and DESCRIPTION : Staging Area Finishes Site 2 - 20,000 MTU

DATE : 15-Feb-02
Estimate No.
Take-off: J.Steiger
Priced: J. Steiger
Checked:
Approved:

Bechtel or CSI CODE	ITEM & DESCRIPTION	QUANTITY	UNIT MEAS	UNIT COST			D. HIRE UNIT			TOTAL COSTS IN U.S $				
				EQUIP.	BULK	S/C	MHR	TOTAL MHRS	WAGE RATES	EQUIPMENT	BULK	LABOR	SUBCON.	TOTAL
	Haul & Excavate													
	21 cy Scraper 1500 ft Haul	146,400	Cy		-		0.012	1,757	38.33		-	67,344		67,344
	Ripping Very Hard 460 hp Dozer	36,600	Cy		-		0.020	732	39.50		-	28,914		28,914
	6000 gal Water Truck 3 mile Haul	146,400	Cy		0.20		0.004	586	35.00		29,280	20,496		49,776
	Total Cost for Excavate & Haul	146,400	Cy					3,074			29,280	116,754		146,034
	Spread and Compact													
	Spread Dumped Material by Dozer	105,850	Cy		-		0.012	1,270	39.17		-	49,750		49,750
	Vibrating Roller 6" Lift 4 Passes	105,850	Cy		-		0.009	953	41.11		-	39,165		39,165
	6000 gal Water Truck 3 mile Haul	105,850	Cy		0.20		0.004	423	35.00		21,170	14,819		35,989
	Total Cost Spread and Compact	105,850	Cy					2,646			21,170	103,734		124,904
	Subtotal Pad Construction	1	LS					5,721			50,450	220,488		270,938
	Construct Flood Berm													
	Spread and Compact													
	Spread Dumped Material by Dozer	40,550	Cy		-		0.012	487	39.17		0	19,059		19,059
	Vibrating Roller 6" Lift 4 Passes	40,550	Cy		-		0.009	365	41.11		0	15,004		15,004
	6000 gal Water Truck 3 mile Haul	40,550	Cy		0.20		0.004	162	35.00		8,110	5,677		13,787
	Total Cost Spread and Compact	40,550	Cy					1,014			8,110	39,740		47,850
	Bank run Gravel	9,450	Cy		17.91		0.029	274	39.31		169,250	10,773		180,023
	Place Rip-Rap													
	Rip-Rap Machine Placed	2,400	Cy		19.08		0.258	619	39.42		45,792	24,408		70,200
	Subtotal Flood Berm Construction	1	LS					1,907			223,152	74,921		298,073
	Road Construction													
	Excavate & Haul													
	21 cy Scraper 1500 ft Haul	10,000	Cy		-		0.012	120	38.33		-	4,600		4,600
	Ripping Very Hard 460 hp Dozer	2,500	Cy		-		0.020	50	39.50		-	1,975		1,975
	6000 gal Water Truck 3 mile Haul	10,000	Cy		0.20		0.004	40	35.00		2,000	1,400		3,400
	Total Cost for Excavate & Haul	10,000	Cy					210			2,000	7,975		9,975
	Spread and Compact													
	Spread Dumped Material by Dozer	10,000	Cy		-		0.012	120	39.17		-	4,700		4,700
	Vibrating Roller 6" Lift 4 Passes	10,000	Cy		-		0.009	90	41.11		-	3,700		3,700
	6000 gal Water Truck 3 mile Haul	10,000	Cy		0.20		0.004	40	35.00		2,000	1,400		3,400
	Total Cost Spread and Compact	10,000	Cy					250			2,000	9,800		11,800
	Place Gravel Surfacing													
	Crushed Stone 1-1/2 inch	10,000	Cy		17.81		0.096	960	38.54		178,100	37,000		215,100
	Subtotal Road Construction	1	LS					1,420			182,100	54,775		236,875
	Construct Detention Basin	4	Each											
	21 cy Scraper 1500 ft Haul	57,260	Cy		-		0.012	688	38.28		0	26,340		26,340
	Ripping Very Hard 460 hp Dozer	14,315	Cy		-		0.020	288	39.26		0	11,308		11,308
	Spread Dumped Material by Dozer	57,260	Cy		-		0.012	688	39.12		0	26,912		26,912
	Rip-Rap Machine Placed	2,235	Cy		19.08		0.258	576	39.47		42,648	22,732		65,380
	Allow for Design Development 25%	4	L.S.		-		-	560	38.97		10,662	21,823		32,485
	Subtotal Detention Basin Const'n	4	Each					2,800			53,310	109,115		162,425

BECHTEL SAIC

JOB NO. & TITLE : 24535-000 YUCCA MOUNTAIN PROJECT
CLIENT : DEPARTMENT OF ENERGY
JOB LOCATION : LAS VEGAS, NEVADA
TYPE OF ESTIMATE : Order of Magnitude
WBS # and DESCRIPTION : Staging Area Finishes Site 2 - 20,000 MTU

DATE : 15-Feb-02
Estimate No.
Take-off: J.Steiger
Priced: J. Steiger
Checked:
Approved:

Bechtel or CSI CODE	ITEM & DESCRIPTION	QUANTITY	UNIT MEAS	UNIT COST EQUIP.	UNIT COST BULK	UNIT COST S/C	D. HIRE UNIT MHR	TOTAL	WAGE	TOTAL COSTS IN U.S $ EQUIPMENT	BULK	LABOR	SUBCON.	TOTAL
	Concrete Pads													
	Excavate Sand & Gravel Backhoe 1cy	47023	C.Y.		-		0.133	6,254	41.96	-	-	262,388		262,388
	Loading Sand & Gravel into Trucks	47023	C.Y.		-		0.020	938	41.96	-	-	39,358		39,358
	Forms in Place Mat Footing 4 use	214704	SFCA		0.61		0.137	29,414	41.90	-	130,969	1,232,401		1,363,370
	Reinf. In Place A615 G60 Slab-Grade	7056	Tons		532.88		13.910	98,149	51.76	-	3,760,001	5,079,967		8,839,968
	Purchase Concrete 3500 Psi	77616	Cy		66.99		-	-	0.00	-	5,199,496	-		5,199,496
	Conc. Placing Foundation Mat Pump	70560	C.Y.		-		0.160	11,290	36.31	-	-	409,954		409,954
	Finishing Flrs-Screed, Float & Broom	635040	SF		-		0.013	8,256	38.46	-	-	317,520		317,520
	Curing - Burlap 12 oz	6350	CSF		11.42		0.291	1,848	33.64	-	72,517	62,167		134,684
	Design Detail Allowance	10	%					15,615	47.41		916,298	740,376		1,656,674
	Subtotal Concrete Pads	504	Each					171,764			10,079,281	8,144,131		18,223,412
	Paving Between Pads													
	Concrete Paving 6" unreinforced	109600	S.Y.		16.49		0.029	3,178	38.63		1,807,304	122,752		1,930,056
	Continuous Welded Wire >10' wide	109600	S.Y.		3.30		0.006	636	38.60		361,461	24,550		386,011
	Design Detail Allowance	10	%					381	38.62		216,877	14,730		231,607
	Total Cost for Paving between Pads	4	L.S.					4,195			2,385,642	162,032	-	2,547,674
	Fire Protection													
	Trencher 12" x36" Deep w/ Backfill	13,400	LF		-		0.011	147	$42.84		-	6,298		6,298
	Compact w/ vibratory Plate	13,400	LF		-		0.006	74	$42.55		-	3,149		3,149
	Compacting Bedding In Trench	240	C.Y.		-		0.089	21	$34.19		-	718		718
	Pipe Bedding-Screened Bank run	240	C.Y.		17.26		0.160	38	$36.89		4,142	1,402		5,544
	Pipe Blk Stl p. ends.wld, 1/4" wall10"	13,400	LF		9.24		0.538	7,209	$40.35		123,816	290,914		414,730
	Fire Hydrant 5 1/4" 4'-0" Valve Depth	16	Each		943.95		3.111	50	$39.08		15,103	1,954		17,057
	Design Detail Allowance	25	%					1,885	$40.38		35,765	76,109		111,874
	Total Cost Fire Protection 4 5000 MTU	1	Each					9,424			178,826	380,544	-	559,370
	Fencing													
	Security Fence Prison Grade 12' high	28,400	LF		21.82		1.280	36,352	$37.36		619,688	1,358,088		1,977,776
	Gate 12 High w/ 20 FT Opening	24	Opening		1,573.25		37.647	904	$36.72		37,758	33,198		70,956
	Design Detail Allowance	10	%					3,726	$37.34		65,745	139,129		204,873
	Total Cost Fencing 4 5000 MTU	1	Each					40,982			723,191	1,530,415		2,253,605
	Grounding													
	Chain Trencher 4"wide x12"deep	28,400	LF		-		0.010	284	$43.00		-	12,212		12,212
	Bsckfill & Compact by Hand 4"wx12"d	28,400	LF		-		0.010	284	$34.00		-	9,656		9,656
	Bare Copper Gr'd Wire 4/0 Stranded	284	C.L.F.		166.46		2.807	797	$50.65		47,275	40,371		87,646
	Copper Electrolytic Ground Rod 20'	96	Each		1,116.50		4.598	441	$50.61		107,184	22,320		129,504
	Water Pipe Clamp 1 1/4 to 2"	1,300	Each		15.53		1.000	1,300	$50.77		20,189	66,001		86,190
	Exothermic Weld 4/0 to #4	1,300	Each		5.48		1.143	1,486	$50.21		7,124	74,607		81,731
	Bare Copper Gr'd Wire #2 Stranded	130	C.L.F.		55.32		1.600	208	$50.58		7,192	10,521		17,713
	Design Detail Allowance	25	%					1,200	$49.10		47,241	58,922		106,163
	Total Cost Grounding 4 5000 MTU	4	Each					6,000			236,205	294,610		530,815

BECHTEL SAIC

JOB NO. & TITLE : 24535-000 YUCCA MOUNTAIN PROJECT
CLIENT : DEPARTMENT OF ENERGY
JOB LOCATION : LAS VEGAS, NEVADA
TYPE OF ESTIMATE : Order of Magnitude

WBS # and DESCRIPTION : Staging Area Finishes Site 2 - 20,000 MTU

DATE : 15-Feb-02
Estimate No.
Take-off: J.Steiger
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Bechtel or CSI CODE	ITEM & DESCRIPTION	QUANTITY	UNIT MEAS	UNIT COST EQUIP.	UNIT COST BULK	UNIT COST S/C	D. HIRE UNIT MHR	TOTAL	WAGE	TOTAL COSTS IN U.S $ EQUIPMENT	BULK	LABOR	SUBCON.	TOTAL
	Lighting System													
	Excavate Trench Backhoe 1cy	2,720	C.Y.		-		0.040	109	$41.93		-	4,570		4,570
	Backfill Trench FEL 1cy wheel mtd	1,660	C.Y.		-		0.030	50	$41.16		-	2,058		2,058
	Hauling 12 cy Truck 1 mile	1,060	C.Y.		-		0.038	40	$35.50		-	1,420		1,420
	PVC Duct Ready for Conc 2 @ 2"	13,400	LF		1.35		0.067	898	$50.29		18,090	45,158		63,248
	Place Conc Footing Deep chute	1,060	C.Y.		5.68		0.343	364	$35.35		6,021	12,868		18,889
	Purchase Concrete 3500 Psi	1,160	Cy		66.99		-	-	-		77,708	-		77,708
	Bare Copper Gr'd Wire #2 Stranded	136	C.L.F.		55.32		1.600	218	$50.49		7,524	11,006		18,530
	600 volt type THW stranded #4	404	C.L.F.		42.63		1.509	610	$50.68		17,223	30,914		48,137
	Footings under 1 cy	268	C.Y.		97.44		2.942	788	$41.04		26,114	32,340		58,454
	Aluminum pole 40 ft high	168	Each		1,497.13		10.000	1,680	$50.03		251,518	84,054		335,572
	Bracket Arms 2 arms	168	Each		164.43		1.000	168	$50.77		27,624	8,529		36,153
	Pole Mounted Flood HP sodium 1000w	336	Each		507.50		4.000	1,344	$50.40		170,520	67,738		238,258
	Xfmr 5KV/480-1000KVA 3 Phase	4	Each		30,145.50		180.000	720	$50.77		120,582	36,553		157,135
	Xfmr 480/120-45KVA 3 Phase	4	Each		1,268.75		40.000	160	$50.77		5,075	8,123		13,198
	Motor Control Center	4	Each		10,150.00		120.000	480	$50.77		40,600	24,369		64,969
	Distr-Pnl Ltg 480v	4	Each		2,436.00		30.000	120	$50.77		9,744	6,092		15,836
	Distr-Pnl Inst 120v	4	Each		761.25		36.000	144	$50.77		3,045	7,311		10,356
	Design Detail Allowance	25	%					1,973	$48.54		195,347	95,776		291,123
	Total Cost Lighting System 4 5000 MTU	1	Each					9,866			976,735	478,879		1,455,614
	Monitoring & Security													
	Pad Monitoring				-									
	Duct Bank 2-3" Dia Rigid Galv Steel	74,160	L.F.		21.32		0.160	11,866	$50.56		1,581,091	599,954		2,181,045
	Category 3 #24 4 pair Solid pvc	168	C.L.F.		5.58		1.143	192	$50.22		937	9,642		10,579
	Allow for Temp Sensors	4,032	Each		2,000.00		3.000	12,096	$50.77		8,064,000	614,114		8,678,114
	Excavate Sand & Gravel Backhoe 1cy	2,821	C.Y.		-		0.133	375	$41.98		-	15,741		15,741
	Loading Sand & Gravel into Trucks	1,587	C.Y.		-		0.020	32	$41.50		-	1,328		1,328
	Hauling 12 cy Truck 1 mile	1,587	C.Y.		-		0.038	60	$35.45		-	2,127		2,127
	PVC Duct Ready for Conc 4 @ 4"	6,120	LF		5.68		0.200	1,224	$50.40		34,762	61,690		96,452
	Place Conc Footing Deep chute	1,234	C.Y.		5.68		0.343	423	$35.42		7,009	14,981		21,990
	Purchase Concrete 3500 Psi	1,357	Cy		66.99		-	-	$0.00		90,905	-		90,905
	Bare Copper Gr'd Wire 4/0 Stranded	62	C.L.F.		166.46		2.807	174	$50.65		10,321	8,813		19,134
	Multiplexers	72	Each		2,500.00		6.000	432	$34.50		180,000	14,904		194,904
	Fiber Optic & Data Cables	27,540	L.F.		2.23		0.220	6,059	$50.77		61,414	307,622		369,036
	Design Detail Allowance	25	%					8,233	$50.13		2,507,610	412,729		2,920,339

BECHTEL SAIC

JOB NO. & TITLE : 24535-000 YUCCA MOUNTAIN PROJECT
CLIENT : DEPARTMENT OF ENERGY
JOB LOCATION : LAS VEGAS, NEVADA
TYPE OF ESTIMATE : Order of Magnitude
WBS # and DESCRIPTION : Staging Area Finishes Site 2 - 20,000 MTU

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Perimeter CC TV	0	0	-						
Excavate Sand & Gravel Backhoe 1cy	3,360	C.Y.	-	0.133	447	$41.94	-	18,749	18,749
Loading Sand & Gravel into Trucks	2,240	C.Y.	-	0.020	45	$41.67	-	1,875	1,875
Hauling 12 cy Truck 1 mile	2,240	C.Y.	-	0.038	85	$35.32	-	3,002	3,002
Duct Bank 4-2" Dia Rigid Galv Steel	13,400	L.F.	19.54	0.178	2,385	$50.45	261,836	120,332	382,168
Place Conc Footing Deep chute	1,120	C.Y.	5.68	0.343	384	$35.41	6,362	13,597	19,959
Purchase Concrete 3500 Psi	1,232	Cy	66.99	-	-	$0.00	82,532	-	82,532
Bare Copper Gr'd Wire 4/0 Stranded	134	C.L.F.	166.46	2.807	376	$50.66	22,306	19,048	41,354
CCTV 10:1 Zoom Lens w/Preset	32	Each	2,030.00	2.000	64	$50.77	64,960	3,249	68,209
Fiber Optic Xmtr	32	Each	1,218.00	1.000	32	$50.78	38,976	1,625	40,601
Fiber Optic Reciever	32	Each	1,218.00	1.000	32	$50.78	38,976	1,625	40,601
Pan & Tilt Unit w/ Presets	32	Each	2,436.00	1.000	32	$50.78	77,952	1,625	79,577
Reciever/Driver w/Presets	32	Each	1,522.50	1.000	32	$50.78	48,720	1,625	50,345
Custom Camera Pole	32	Each	1,015.00	1.000	32	$50.78	32,480	1,625	34,105
Video Switching Matrix	4	Each	8,120.00	4.000	16	$50.75	32,480	812	33,292
VCR 1/8 Crameras	4	Each	5,075.00	4.000	16	$50.75	20,300	812	21,112
Monitors	4	Each	1,268.75	4.000	16	$50.75	5,075	812	5,887
Prefabricated Cable Assemblies	32	Each	1,015.00	4.000	128	$50.77	32,480	6,498	38,978
Fiber Optic & Data Cables	10,000	L.F.	2.23	0.220	2,200	$50.77	22,300	111,700	134,000
Design Detail Allowance	25	%			1,581	$48.82	196,934	77,153	274,087
Fence Security	0	0	-						
Fence Security Transmitter	64	Each	964.25	4.000	256	$50.77	61,712	12,996	74,708
4.5' Pole for Xmtr	64	Each	1,218.00	6.000	384	$50.77	77,952	19,495	97,447
Infra Red Detectors	64	Each	761.25	4.000	256	$50.77	48,720	12,996	61,716
Perimeter Fence Security Alarm Pnl	4	Each	2,537.50	1.000	4	$50.75	10,150	203	10,353
Card Readers @ Gate	16	Each	1,522.50	8.000	128	$50.77	24,360	6,498	30,858
600V Cable - 1-3c#12AWG	6,000	L.F.	0.55	0.041	246	$50.73	3,300	12,480	15,780
Terminations	1,440	Each	0.51	0.340	490	$50.72	734	24,854	25,588
Detectors (Nuclear)	64	Each	3,248.00	4.000	256	$50.77	207,872	12,996	220,868
Allow for Monitor Building	4	Each	37,500.00	750.000	3,000	$50.00	150,000	150,000	300,000
Design Detail Allowance	25	%			1,255	$50.30	146,200	63,130	209,330
Total Cost Monitoring & Security 4 Site					55,344		14,253,718	2,765,056	17,018,774
0									
Communications									
Allow for Telephones	40	Each	5,000.00	20.000	800	$50.00	200,000	40,000	240,000
Category 3 #24 4 pair Solid pvc	400	C.L.F.	5.58	1.143	457	$50.23	2,232	22,956	25,188
Design Detail Allowance	25	%			314	$50.08	50,558	15,739	66,297
Total Cost Communications 4 Site					1,571		252,790	78,695	331,485
Subtotal Site Related Costs Direct Costs	1	Site			310,994		29,595,399	14,293,660	43,889,059

BECHTEL SAIC

JOB NO. & TITLE :	24535-000 YUCCA MOUNTAIN PROJECT
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WBS # and DESCRIPTION :	Staging Area Finishes Site 2 - 20,000 MTU

DATE :	15-Feb-02
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Road Related Cost														
Trencher 12" x36" Deep w/ Backfill	6,500	LF		-			0.011	72	$42.43		-	3,055		3,055
Compact w/ vibratory Plate	6,500	LF		-			0.006	36	$42.44		-	1,528		1,528
Compacting Bedding In Trench	110	C.Y.		-			0.089	10	$32.90		-	329		329
Pipe Bedding-Screened Bank run	110	C.Y.		17.26			0.160	18	$35.67		1,899	642		2,541
Pipe Blk Stl p. ends.wld, 1/4" wall10"	6,500	LF		9.24			0.538	3,497	$40.35		60,060	141,115		201,175
Excavate Sand & Gravel Backhoe 1cy	2,996	C.Y.		-			0.133	398	$42.01		-	16,718		16,718
Loading Sand & Gravel into Trucks	1,311	C.Y.		-			0.020	26	$42.19		-	1,097		1,097
Compact w/ vibratory Plate	1,685	LF		-			0.006	9	$44.00		-	396		396
PVC Duct Ready for Conc 4 @ 4"	6,500	LF		5.68			0.200	1,300	$50.40		36,920	65,520		102,440
Place Conc Footing Deep chute	1,311	C.Y.		5.68			0.343	450	$0.00		7,446	15,916		23,362
Purchase Concrete 3500 Psi	1,442	Cy		66.99			-	-	$0.00		96,600	-		96,600
Hand Hole precast Conc 4'x4'x4'	22	Each		598.85			14.286	314	$50.00		13,175	15,701		28,876
Fiber Optic & Data Cables	212	L.F.		2.23			0.220	47	$50.38		473	2,368		2,841
600 volt type THW stranded 250KCM	212	C.L.F.		231.42			4.000	848	$50.40		49,061	42,739		91,800
Bare Copper Gr'd Wire 4/0 Stranded	71	C.L.F.		166.46			2.807	199	$50.72		11,819	10,093		21,912
Allow for Undifined Items 10% of Total	1	allow		21,549.40			359.100	359	$47.49		21,549	17,055		38,604
Concrete Paving 6" unreinforced	25,600	S.Y.		16.49			0.029	742	$38.64		422,144	28,672		450,816
Continuous Welded Wire >10' wide	25,600	S.Y.		3.30			0.006	148	$38.74		84,429	5,734		90,163
Design Detail Allowance	18	%						1,525			145,004	66,362		211,366
Total Direct Cost for Related to Road	6,400	LF						9,998			950,579	435,040		1,385,619
Total Direct Cost 20,000 MTU Site 2 including Road								320,992			30,545,978	14,728,700		45,274,678

ESTIMATE SUMMARY
INDIRECT CALCULATION MODEL
STAGING STUDY Case 3 - 5,000 MTU

Estimate No.
Date : Feb.19, 2002

	MANHOURS DIRECT HIRE	MANHOURS SUB CONTRACT	PLANT EQUIPMENT	BULK MATERIALS	LABOR	SUB CONTRACT	TOTAL
DIRECT COSTS							
Pad Related Earthwork	2,145			19,240	82,414		101,654
Flood Control Berm Related Earthwork	1,232			35,380	48,379		83,759
Road Related Earthwork	227			29,136	8,764		37,900
Construct Detention Pond	700			13,328	27,279		40,606
Concrete Pads	42,942			2,519,826	2,036,040		4,555,866
Paving Between Pads	1,049			596,410	40,509		636,919
Fire Protection	2,355			44,708	95,136		139,844
Fencing	10,245			180,798	382,603		563,401
Grounding	1,500			59,086	73,704		132,790
Lighting Systems	2,464			244,184	119,720		363,904
Monitoring & Security	13,839			3,563,705	691,443		4,255,148
Communications	393			63,198	19,674		82,871
Roads	1,684			153,363	73,391		226,754
NTS Productivity Factor @ 30%	24,232	-			1,109,716	-	1,109,716
Nuclear Quality Productivity Factor @50%	27,912	-			1,323,426	-	1,323,426
SUB TOTAL	132,920	-	' -	7,522,361	6,132,196	-	13,654,557
DISTRIBUTABLE FIELD COSTS							
Mat'l & Labor @ 80% of Direct Labor Cost (50% MH)	66,460	-		4,905,757			4,905,757
(Weighted average of Bechtel historical projects)							
Per Diem - Direct Craft @ $1.50 / MH	132,920	-		199,379		-	199,379
Per Diem - Indirect Craft @ $1.50 / MH	66,460	-		99,690		-	99,690
Per Diem - Staff @ $1.50 / MH (Staff MH 25% Direct)	33,230	-		49,845		-	49,845
(Weighted average of Bechtel historical projects)							
Busing @ $15.00 / Man-Day (Craft & Staff)	232,609	-		348,914		-	348,914
Additional Costs for S/C:							
Performance & Payment Bond @ 2.3% (L) RSMeans				141,041			141,041
Builder's Risk & Public Liability (Incl w/ Wage Rates)				-			-
Overhead (Main Office) @ 16.2% (L) RSMeans				993,416			993,416
Profit @ 10% (Total Cost w/o Materials)				1,252,132			1,252,132
SUB TOTAL	99,690		-	7,990,173	-	-	7,990,173
S/C ENGINEERING & SERVICES							
Engineering & Services	-						-
(DOE Cost Estimate Guideline Range = 15 - 25%)							
SUB TOTAL			-	-	-	-	-
BSC ENGINEERING & SERVICES							
Engineering & Services @ __% of Direct Costs	-			-			-
Design Management @ __% of Engineering & Sei	-			-			-
Construction Management @ __% of TPC	-			-		-	-
(DOE Cost Estimate Guideline Range = 5 - 15%)							
SUB TOTAL	-	-	-	-	-	-	-
BSC INDIRECT COST POOLS							
Site Support @ __% (Offsite = Las Vegas Office) (FY	-			-			-
NTS Support Services - Allowance 3%	-			-			-
G & A @ __% (FY02 Rates)	-			-			-
SUB TOTAL			-	-	-	-	-
NATIONAL LABS							
Labor Costs							-
SUB TOTAL			-	-	-	-	-
SUB TOTAL - PROJECT			-	15,512,534	6,132,196	-	21,644,730
ESCALATION	-		-	-	-	-	-
CONTINGENCY @ __%	-						-
(DOE Cost Estimate Guideline Range = 20-30% up to 50%)							
TOTAL - PROJECT	232,609						21,644,730

BECHTEL SAIC

JOB NO. & TITLE : 24535-000 YUCCA MOUNTAIN PROJECT
CLIENT : DEPARTMENT OF ENERGY
JOB LOCATION : LAS VEGAS, NEVADA
TYPE OF ESTIMATE : Order of Magnitude
WBS # and DESCRIPTION : Staging Area Finishes Site 3 - 6000 MTU

DATE : 8-Mar-02
Estimate No.
Take-off: J.Steiger
Priced: J. Steiger
Checked:
Approved:

Bechtel or CSI CODE	ITEM & DESCRIPTION	QUANTITY	UNIT MEAS	UNIT COST EQUIP.	UNIT COST BULK	UNIT COST S/C	D. HIRE UNIT MHR	TOTAL MHRS	WAGE RATES	TOTAL COSTS IN U.S $ EQUIPMENT	BULK	LABOR	SUBCON.	TOTAL
	Haul & Excavate													
	21 cy Scraper 1500 ft Haul	65,000	Cy		-		0.012	780	38.33		-	29,900		29,900
	Ripping Very Hard 460 hp Dozer	16,250	Cy		-		0.020	325	39.50		-	12,838		12,838
	6000 gal Water Truck 3 mile Haul	65,000	Cy		0.20		0.004	260	35.00		13,000	9,100		22,100
	Total Cost for Excavate & Haul	65,000	Cy					1,365			13,000	51,838		64,838
	Spread and Compact													
	Spread Dumped Material by Dozer	31,200	Cy		-		0.012	374	39.17		-	14,664		14,664
	Vibrating Roller 6" Lift 4 Passes	31,200	Cy		-		0.009	281	41.11		-	11,544		11,544
	6000 gal Water Truck 3 mile Haul	31,200	Cy		0.20		0.004	125	35.00		6,240	4,368		10,608
	Total Cost Spread and Compact	31,200	Cy					780			6,240	30,576		36,816
	Subtotal Pad Construction	1	LS					2,145			19,240	82,414		101,654
	Construct Flood Berm													
	Spread and Compact													
	Spread Dumped Material by Dozer	33,800	Cy		-		0.012	406	39.17		-	15,886		15,886
	Vibrating Roller 6" Lift 4 Passes	33,800	Cy		-		0.009	304	41.11		-	12,506		12,506
	6000 gal Water Truck 3 mile Haul	33,800	Cy		0.20		0.004	135	35.00		6,760	4,732		11,492
	Total Cost Spread and Compact	33,800	Cy					845			6,760	33,124		39,884
	Place Rip-Rap													
	Rip-Rap Machine Placed	1,500	Cy		19.08		0.258	387	39.42		28,620	15,255		43,875
	Subtotal Flood Berm Construction	1	LS					1,232			35,380	48,379		83,759
	Road Construction													
	Excavate & Haul													
	21 cy Scraper 1500 ft Haul	1,600	Cy		-		0.012	19	38.33		-	736		736
	Ripping Very Hard 460 hp Dozer	400	Cy		-		0.020	8	39.50		-	316		316
	6000 gal Water Truck 3 mile Haul	1,600	Cy		0.20		0.004	6	35.00		320	224		544
	Total Cost for Excavate & Haul	1,600	Cy					34			320	1,276		1,596
	Spread and Compact													
	Spread Dumped Material by Dozer	1,600	Cy		-		0.012	19	39.17		-	752		752
	Vibrating Roller 6" Lift 4 Passes	1,600	Cy		-		0.009	14	41.11		-	592		592
	6000 gal Water Truck 3 mile Haul	1,600	Cy		0.20		0.004	6	35.00		320	224		544
	Total Cost Spread and Compact	1,600	Cy					40			320	1,568		1,888
	Place Gravel Surfacing													
	Crushed Stone 1-1/2 inch	1,600	Cy		17.81		0.096	154	38.54		28,496	5,920		34,416
	Subtotal Road Construction	1	LS					227			29,136	8,764		37,900

BECHTEL SAIC

JOB NO. & TITLE : 24535-000 YUCCA MOUNTAIN PROJECT
CLIENT : DEPARTMENT OF ENERGY
JOB LOCATION : LAS VEGAS, NEVADA
TYPE OF ESTIMATE : Order of Magnitude
WBS # and DESCRIPTION : Staging Area Finishes Site 3 - 5000 MTU

DATE : 8-Mar-02
Estimate No.
Take-off: J.Steiger
Priced: J. Steiger
Checked:
Approved:

Bechtel or CSI CODE	ITEM & DESCRIPTION	QUANTITY	UNIT MEAS	UNIT COST EQUIP.	UNIT COST BULK	UNIT COST S/C	D. HIRE UNIT MHR	TOTAL MHRS	WAGE RATES	TOTAL COSTS IN U.S $ EQUIPMENT	BULK	LABOR	SUBCON	TOTAL
	Construct Detention Basin													
	21 cy Scraper 1500 ft Haul	14,315	Cy		-		0.012	172	38.28		-	6,585		6,585
	Ripping Very Hard 460 hp Dozer	3,579	Cy		-		0.02	72	39.26		-	2,827		2,827
	Spread Dumped Material by Dozer	14,315	Cy		-		0.012	172	39.12		-	6,728		6,728
	Rip-Rap Machine Placed	559	Cy		19.08		0.258	144	39.47		10,662	5,683		16,345
	Allow for Design Development 25%	1	L.S.		-		0	140	38.97		2,666	5,456		8,121
	Subtotal Detention Basin Const'n	1	L.S.					700			13,328	27,279		40,606
	Concrete Pads													
	Excavate Sand & Gravel Backhoe 1cy	11756	C.Y.		-		0.133	1,564	41.94	-	-	65,598		65,598
	Loading Sand & Gravel into Trucks	11756	C.Y.		-		0.020	235	41.87	-	-	9,840		9,840
	Forms in Place Mat Footing 4 use	53676	SFCA		0.61		0.137	7,354	41.90	-	32,742	308,100		340,842
	Reinf. In Place A615 G60 Slab-Grade	1764	Tons		532.88		13.910	24,537	51.76	-	940,000	1,269,992		2,209,992
	Purchase Concrete 3500 Psi	19404	Cy		66.99		-	-	0.00	-	1,299,874	-		1,299,874
	Conc. Placing Foundation Mat Pump	17640	C.Y.		-		0.160	2,822	36.32	-	-	102,488		102,488
	Finishing Fl'rs-Screed, Float & Broom	158760	SF		-		0.013	2,064	38.46	-	-	79,380		79,380
	Curing - Burlap 12 oz	1588	CSF		11.42		0.291	462	33.65	-	18,135	15,547		33,682
	Design Detail Allowance	10	%					3,904	47.41		229,075	185,095		414,170
	Subtotal Concrete Pads	126	Each					42,942			2,519,826	2,036,040		4,555,866
	Paving Between Pads													
	Concrete Paving 6" unreinforced	27400	S.Y.		16.49		0.029	795	38.60		451,826	30,688		482,514
	Continuous Welded Wire >10' wide	27400	S.Y.		3.30		0.006	159	38.60		90,365	6,138		96,503
	Design Detail Allowance	10	%					95	38.60		54,219	3,683		57,902
	Total Cost for Paving between Pads	27400	S.Y.					1,049			596,410	40,509	-	636,919
	Fire Protection													
	Trencher 12" x36" Deep w/ Backfill	3,350	LF		-		0.011	37	$42.57		-	1,575		1,575
	Compact w/ vibratory Plate	3,350	LF		-		0.006	18	$43.72		-	787		787
	Compacting Bedding In Trench	60	C.Y.		-		0.089	5	$35.80		-	179		179
	Pipe Bedding-Screened Bank run	60	C.Y.		17.26		0.160	10	$35.00		1,036	350		1,386
	Pipe Blk Stl p. ends wld, 1/4" wall10"	3,350	LF		9.24		0.538	1,802	$40.36		30,954	72,729		103,683
	Fire Hydrant 5 1/4" 4'-0" Valve Depth	4	Each		943.95		3.111	12	$40.75		3,776	489		4,265
	Design Detail Allowance	25	%					471	$40.40		8,942	19,027		27,969
	Total Cost Fire Protection 1 5000 MTU	1	Each					2,355			44,708	95,136	-	139,844
	Fencing													
	Security Fence Prison Grade 12' high	7,100	LF		21.82		1.280	9,088	$37.36		154,922	339,522		494,444
	Gate 12 High w/ 20 FT Opening	6	Opening		1,573.25		37.647	226	$36.72		9,440	8,299		17,739
	Design Detail Allowance	10	%					931	$37.34		16,436	34,782		51,218
	Total Cost Fencing 1 5000 MTU	1	Each					10,245			180,798	382,603		563,401
	Grounding													
	Chain Trencher 4"wide x12"deep	7,100	LF		-		0.010	71	$43.00		-	3,053		3,053
	Bsckfill & Compact by Hand 4"wx12"d	7,100	LF		-		0.010	71	$34.00		-	2,414		2,414
	Bare Copper Gr'd Wire 4/0 Stranded	71	C.L.F.		166.46		2.807	199	$50.72		11,819	10,093		21,912
	Copper Electrolytic Ground Rod 20'	24	Each		1,116.50		4.598	110	$50.73		26,796	5,580		32,376
	Water Pipe Clamp 1 1/4 to 2"	325	Each		15.53		1.000	325	$50.77		5,047	16,500		21,547
	Exothermic Weld 4/0 to #4	325	Each		5.48		1.143	371	$50.27		1,781	18,652		20,433
	Bare Copper Gr'd Wire #2 Stranded	33	C.L.F.		55.32		1.600	53	$50.40		1,826	2,671		4,497
	Design Detail Allowance	25	%					300	$49.14		11,817	14,741		26,558
	Total Cost Grounding 1 5000 MTU	1	Each					1,500			59,086	73,704		132,790

BECHTEL SAIC

JOB NO. & TITLE : 24535-000 YUCCA MOUNTAIN PROJECT
CLIENT : DEPARTMENT OF ENERGY
JOB LOCATION : LAS VEGAS, NEVADA
TYPE OF ESTIMATE : Order of Magnitude
WBS # and DESCRIPTION : Staging Area Finishes Site 3 - 5000 MTU

DATE : 8-Mar-02
Estimate No.
Take-off: J.Steiger
Priced: J. Steiger
Checked:
Approved:

Bechtel or CSI CODE	ITEM & DESCRIPTION	QUANTITY	UNIT MEAS	UNIT COST EQUIP.	UNIT COST BULK	UNIT COST S/C	D. HIRE UNIT MHR	TOTAL	WAGE	TOTAL COSTS IN U.S $ EQUIPMENT	BULK	LABOR	SUBCON.	TOTAL
	Lighting System													
	Excavate Trench Backhoe 1cy	680	C.Y.		-		0.040	27	$42.30		-	1,142		1,142
	Backfill Trench FEL 1cy wheel mtd	415	C.Y.		-		0.030	12	$42.92		-	515		515
	Hauling 12 cy Truck 1 mile	265	C.Y.		-		0.038	10	$35.50		-	355		355
	PVC Duct Ready for Conc 2 @ 2"	3,350	LF		1.35		0.067	224	$50.40		4,523	11,290		15,813
	Place Conc Footing Deep chute	265	C.Y.		5.68		0.343	91	$35.35		1,505	3,217		4,722
	Purchase Concrete 3500 Psi	290	Cy		66.99		-	-	-		19,427	-		19,427
	Bare Copper Gr'd Wire #2 Stranded	34	C.L.F.		55.32		1.600	54	$50.96		1,881	2,752		4,633
	600 volt type THW stranded #4	101	C.L.F.		42.63		1.509	152	$50.85		4,306	7,729		12,035
	Footings under 1 cy	67	C.Y.		97.44		2.942	197	$41.04		6,528	8,085		14,613
	Aluminum pole 40 ft high	42	Each		1,497.13		10.000	420	$50.03		62,879	21,013		83,892
	Bracket Arms 2 arms	42	Each		164.43		1.000	42	$50.76		6,906	2,132		9,038
	Pole Mounted Flood HP sodium 1000w	84	Each		507.50		4.000	336	$50.40		42,630	16,934		59,564
	Xfmr 5KV/480-1000KVA 3 Phase	1	Each		30,145.50		180.000	180	$50.77		30,146	9,138		39,284
	Xfmr 480/120-45KVA 3 Phase	1	Each		1,268.75		40.000	40	$50.78		1,269	2,031		3,300
	Motor Control Center	1	Each		10,150.00		120.000	120	$50.77		10,150	6,092		16,242
	Distr-Pnl Ltg 480v	1	Each		2,436.00		30.000	30	$50.77		2,436	1,523		3,959
	Distr-Pnl Inst 120v	1	Each		761.25		36.000	36	$50.78		761	1,828		2,589
	Design Detail Allowance	25	%					493	$48.59		48,837	23,944		72,781
	Total Cost Lighting System 1 5000 MTU	1	Each					2,464			244,184	119,720		363,904
	Monitoring & Security													
	Pad Monitoring				-									
	Duct Bank 2-3" Dia Rigid Galv Steel	18,540	L.F.		21.32		0.160	2,966	$50.57		395,273	149,989		545,262
	Category 3 #24 4 pair Solid pvc	42	C.L.F.		5.58		1.143	48	$50.21		234	2,410		2,644
	Allow for Temp Sensors	1,008	Each		2,000.00		3.000	3,024	$50.77		2,016,000	153,528		2,169,528
	Excavate Sand & Gravel Backhoe 1cy	705	C.Y.		-		0.133	94	$41.85		-	3,934		3,934
	Loading Sand & Gravel into Trucks	396	C.Y.		-		0.020	8	$41.38		-	331		331
	Hauling 12 cy Truck 1 mile	396	C.Y.		-		0.038	15	$35.40		-	531		531
	PVC Duct Ready for Conc 4 @ 4"	1,530	LF		5.68		0.200	306	$50.40		8,690	15,422		24,112
	Place Conc Footing Deep chute	309	C.Y.		5.68		0.343	106	$35.39		1,755	3,751		5,506
	Purchase Concrete 3500 Psi	340	Cy		66.99		-	-	$0.00		22,777	-		22,777
	Bare Copper Gr'd Wire 4/0 Stranded	16	C.L.F.		166.46		2.807	45	$50.53		2,663	2,274		4,937
	Multiplexers	18	Each		2,500.00		6.000	108	$34.50		45,000	3,726		48,726
	Fiber Optic & Data Cables	6,885	L.F.		2.23		0.220	1,515	$50.76		15,354	76,905		92,259
	Design Detail Allowance	25	%					2,059	$50.13		626,937	103,200		730,137

BECHTEL SAIC	JOB NO. & TITLE :	24535-000 YUCCA MOUNTAIN PROJECT	DATE : 8-Mar-02
	CLIENT :	DEPARTMENT OF ENERGY	Estimate No.
	JOB LOCATION :	LAS VEGAS, NEVADA	Take-off: J.Steiger
	TYPE OF ESTIMATE :	Order of Magnitude	Priced: J. Steiger
	WBS # and DESCRIPTION :	Staging Area Finishes Site 3 - 5000 MTU	Checked:
			Approved:

Bechtel or CSI CODE	ITEM & DESCRIPTION	QUANTITY	UNIT MEAS	UNIT COST EQUIP.	UNIT COST BULK	UNIT COST S/C	D. HIRE UNIT MHR	TOTAL	WAGE	TOTAL COSTS IN U.S $ EQUIPMENT	BULK	LABOR	SUBCON	TOTAL
	Perimeter CC TV	0	0		-									
	Excavate Sand & Gravel Backhoe 1cy	840	C.Y.		-		0.133	112	$41.85		-	4,687		4,687
	Loading Sand & Gravel into Trucks	560	C.Y.		-		0.020	11	$42.64		-	469		469
	Hauling 12 cy Truck 1 mile	560	C.Y.		-		0.038	21	$35.71		-	750		750
	Duct Bank 4-2" Dia Rigid Galv Steel	3,350	L.F.		19.54		0.178	596	$50.47		65,459	30,083		95,542
	Place Conc Footing Deep chute	280	C.Y.		5.68		0.343	96	$35.41		1,590	3,399		4,989
	Purchase Concrete 3500 Psi	308	Cy		66.99		-	-	$0.00		20,633	-		20,633
	Bare Copper Gr'd Wire 4/0 Stranded	34	C.L.F.		166.46		2.807	95	$50.87		5,660	4,833		10,493
	CCTV 10:1 Zoom Lens w/Preset	8	Each		2,030.00		2.000	16	$50.75		16,240	812		17,052
	Fiber Optic Xmtr	8	Each		1,218.00		1.000	8	$50.75		9,744	406		10,150
	Fiber Optic Reciever	8	Each		1,218.00		1.000	8	$50.75		9,744	406		10,150
	Pan & Tilt Unit w/ Presets	8	Each		2,436.00		1.000	8	$50.75		19,488	406		19,894
	Reciever/Driver w/Presets	8	Each		1,522.50		1.000	8	$50.75		12,180	406		12,586
	Custom Camera Pole	8	Each		1,015.00		1.000	8	$50.75		8,120	406		8,526
	Video Switching Matrix	1	Each		8,120.00		4.000	4	$50.75		8,120	203		8,323
	VCR 1/8 Crameras	1	Each		5,075.00		4.000	4	$50.75		5,075	203		5,278
	Monitors	1	Each		1,268.75		4.000	4	$50.75		1,269	203		1,472
	Prefabricated Cable Assemblies	8	Each		1,015.00		4.000	32	$50.78		8,120	1,625		9,745
	Fiber Optic & Data Cables	2,500	L.F.		2.23		0.220	550	$50.77		5,575	27,925		33,500
	Design Detail Allowance	25	%					395	$48.84		49,254	19,306		68,560
	Fence Security	0	0		-									
	Fence Security Transmitter	16	Each		964.25		4.000	64	$50.77		15,428	3,249		18,677
	4.5' Pole for Xmtr	16	Each		1,218.00		6.000	96	$50.77		19,488	4,874		24,362
	Infra Red Detectors	16	Each		761.25		4.000	64	$50.77		12,180	3,249		15,429
	Perimeter Fence Security Alarm Pnl	1	Each		2,537.50		1.000	1	$51.00		2,538	51		2,589
	Card Readers @ Gate	4	Each		1,522.50		8.000	32	$50.78		6,090	1,625		7,715
	600V Cable - 1-3c#12AWG	1,500	L.F.		0.55		0.041	62	$50.32		825	3,120		3,945
	Terminations	360	Each		0.51		0.340	122	$50.93		184	6,214		6,398
	Detectors (Nuclear)	16	Each		3,248.00		4.000	64	$50.77		51,968	3,249		55,217
	Allow for Monitor Building	1	Each		37,500.00		750.000	750	$50.00		37,500	37,500		75,000
	Design Detail Allowance	25	%					314	$50.30		36,550	15,783		52,333
	Total Cost Monitoring & Security 1 Site							13,839			3,563,705	691,443		4,255,148
	0													
	Communications													
	Allow for Telephones	10	Each		5,000.00		20.000	200	$50.00		50,000	10,000		60,000
	Category 3 #24 4 pair Solid pvc	100	C.L.F.		5.58		1.143	114	$50.34		558	5,739		6,297
	Design Detail Allowance	25	%					79	$50.12		12,640	3,935		16,574
	Total Cost Communications 1 Site							393			63,198	19,674		82,871

BECHTEL SAIC	JOB NO. & TITLE :	24535-000 YUCCA MOUNTAIN PROJECT	
	CLIENT :	DEPARTMENT OF ENERGY	DATE : 8-Mar-02
	JOB LOCATION :	LAS VEGAS, NEVADA	Estimate No.
	TYPE OF ESTIMATE :	Order of Magnitude	Take-off: J.Steiger
			Priced: J. Steiger
	WBS # and DESCRIPTION :	Staging Area Finishes Site 3 - 5000 MTU	Checked:
			Approved:

Bechtel or CSI CODE	ITEM & DESCRIPTION	QUANTITY	UNIT MEAS	UNIT COST EQUIP.	UNIT COST BULK	UNIT COST S/C	D. HIRE UNIT MHR	TOTAL	WAGE	TOTAL COSTS IN U.S $ EQUIPMENT	BULK	LABOR	SUBCON.	TOTAL
Subtotal Site Related Costs Direct Costs		1	Site					79,091			7,368,998	3,625,663		10,994,661
	Road Related Cost													
	Trencher 12" x36" Deep w/ Backfill	1,100	LF		-		0.011	12	$43.08		-	517		517
	Compact w/ vibratory Plate	1,100	LF		-		0.006	6	$43.17		-	259		259
	Compacting Bedding In Trench	19	C.Y.		-		0.089	2	$28.50		-	57		57
	Pipe Bedding-Screened Bank run	19	C.Y.		17.26		0.160	3	$37.00		328	111		439
	Pipe Blk Stl p. ends.wld, 1/4" wall10"	1,100	LF		9.24		0.538	592	$40.34		10,164	23,881		34,045
	Excavate Sand & Gravel Backhoe 1cy	507	C.Y.		-		0.133	67	$42.22		-	2,829		2,829
	Loading Sand & Gravel into Trucks	222	C.Y.		-		0.020	4	$46.50		-	186		186
	Compact w/ vibratory Plate	285	LF		-		0.006	2	$33.50		-	67		67
	PVC Duct Ready for Conc 4 @4"	1,100	LF		5.68		0.200	220	$50.40		6,248	11,088		17,336
	Place Conc Footing Deep chute	222	C.Y.		5.68		0.343	76	$0.00		1,261	2,695		3,956
	Purchase Concrete 3500 Psi	244	Cy		66.99		-	-	$0.00		16,346	-		16,346
	Hand Hole precast Conc 4'x4'x4'	4	Each		598.85		14.286	57	$50.09		2,395	2,855		5,250
	Fiber Optic & Data Cables	36	L.F.		2.23		0.220	8	$50.25		80	402		482
	600 volt type THW stranded 250KCM	36	C.L.F.		231.42		4.000	144	$50.40		8,331	7,258		15,589
	Bare Copper Gr'd Wire 4/0 Stranded	12	C.L.F.		166.46		2.807	34	$50.18		1,998	1,706		3,704
	Allow for Undifined Items 10% of Total	1	allow		3,665.90		61.200	61	$47.53		3,666	2,909		6,575
	Concrete Paving 6" unreinforced	4,000	S.Y.		16.49		0.029	116	$38.62		65,960	4,480		70,440
	Continuous Welded Wire >10' wide	4,000	S.Y.		3.30		0.006	23	$38.96		13,192	896		14,088
	Design Detail Allowance	18	%					257			23,394	11,195		34,590
Total Direct Cost for Related to Road		1,000	LF					1,684			153,363	73,391		226,754
Total Direct Cost 5000 MTU Site 3 Including Road								80,775			7,522,361	3,699,054		11,221,415

ESTIMATE SUMMARY
INDIRECT CALCULATION MODEL
STAGING STUDY Case 4 - 1,000 MTU

	MANHOURS						
Estimate No. **Date : Feb.19, 2002**	DIRECT HIRE	SUB CONTRACT	PLANT EQUIPMENT	BULK MATERIALS	LABOR	SUB CONTRACT	TOTAL
DIRECT COSTS							
Pad Related Earthwork	N.R.			N.R.	N.R.		-
Flood Control Berm Related Earthwork	N.R.			N.R.	N.R.		-
Road Related Earthwork	N.R.			N.R.	N.R.		-
Construct Detention Pond	139			2,665	5,456		8,121
Construct Sheilding Wall	20,219			727,420	866,936		1,594,357
Concrete Pads	8,859			519,968	420,140		940,107
Paving Between Pads	210			119,282	8,103		127,384
Fire Protection	471			9,178	19,058		28,235
Fencing	N.R.			N.R.	N.R.		-
Grounding	300			12,081	14,805		26,886
Lighting Systems	485			48,088	23,660		71,748
Monitoring & Security	3,534			771,049	176,706		947,755
Communications	154			16,365	7,709		24,074
Roads	N.R.			N.R.	N.R.		-
NTS Productivity Factor @ 30%	10,311	-			462,772	-	462,772
Nuclear Quality Productivity Factor @50%	5,759	-			273,091	-	273,091
SUB TOTAL	50,441	-	-	2,226,095	2,278,435	-	4,504,529
DISTRIBUTABLE FIELD COSTS							
Mat'l & Labor @ 80% of Direct Labor Cost (50% MH)	25,221	-		1,822,748			1,822,748
(Weighted average of Bechtel historical projects)							
Per Diem - Direct Craft @ $1.50 / MH	50,441	-		75,662		-	75,662
Per Diem - Indirect Craft @ $1.50 / MH	25,221	-		37,831		-	37,831
Per Diem - Staff @ $1.50 / MH (Staff MH 25% Direct)	12,610	-		18,915		-	18,915
(Weighted average of Bechtel historical projects)							
Busing @ $15.00 / Man-Day (Craft & Staff)	88,272	-		132,408		-	132,408
Additional Costs for S/C:							
Performance & Payment Bond @ 2.3% (L) RSMeans				52,404			52,404
Builder's Risk & Public Liability (Incl w/ Wage Rates)				-			-
Overhead (Main Office) @ 16.2% (L) RSMeans				369,106			369,106
Profit @ 10% (Total Cost w/o Materials)				465,510			465,510
SUB TOTAL	37,831		-	2,974,584	-	-	2,974,584
S/C ENGINEERING & SERVICES							
Engineering & Services	-						-
(DOE Cost Estimate Guideline Range = 15 - 25%)							
SUB TOTAL			-	-	-	-	-
BSC ENGINEERING & SERVICES							
Engineering & Services @ __% of Direct Costs	-			-			-
Design Management @ __% of Engineering & Se	-			-			-
Construction Management @ __% of TPC	-			-		-	-
(DOE Cost Estimate Guideline Range = 5 - 15%)							
SUB TOTAL	-	-		-	-	-	-
BSC INDIRECT COST POOLS							
Site Support @ __% (Offsite = Las Vegas Office) (FY	-			-			-
NTS Support Services - Allowance 3%	-			-			-
G & A @ __% (FY02 Rates)	-			-			-
SUB TOTAL			-	-	-	-	-
NATIONAL LABS							
Labor Costs							-
SUB TOTAL			-	-	-	-	-
SUB TOTAL - PROJECT			-	5,200,678	2,278,435	-	7,479,113
ESCALATION	-		-	-	-	-	-
CONTINGENCY @ __%	-						-
(DOE Cost Estimate Guideline Range = 20-30% up to 50%)							
TOTAL - PROJECT	88,272						7,479,113

BECHTEL SAIC

JOB NO. & TITLE :	24535-000 YUCCA MOUNTAIN PROJECT
CLIENT :	DEPARTMENT OF ENERGY
JOB LOCATION :	LAS VEGAS, NEVADA
TYPE OF ESTIMATE :	Order of Magnitude
WBS # and DESCRIPTION :	Staging Area Finishes Site 4 - 1000 MTU

DATE :	08-Mar-02
Estimate No.	
Take-off:	J.Steiger
Priced:	J. Steiger
Checked:	
Approved:	

Bechtel or CSI CODE	ITEM & DESCRIPTION	QUANTITY	UNIT MEAS	UNIT COST EQUIP.	UNIT COST BULK	UNIT COST S/C	D. HIRE UNIT MHR	TOTAL MHRS	WAGE RATES	TOTAL COSTS IN U.S $ EQUIPMENT	BULK	LABOR	SUBCON	TOTAL
	Pad Construction	Not Required for this Case												
	Flood Berm Construction	Not Required for this Case												
	Road Construction	Not Required for this Case												
	Construct Detention Basin	0	Each											
	21 cy Scraper 1500 ft Haul	2,863	Cy		-		0.012	34	38.74		-	1,317		1,317
	Ripping Very Hard 460 hp Dozer	716	Cy		-		0.02	14	40.36		-	565		565
	Spread Dumped Material by Dozer	2,863	Cy		-		0.012	34	39.59		-	1,346		1,346
	Rip-Rap Machine Placed	112	Cy		19.08		0.258	29	39.21		2,132	1,137		3,269
	Allow for Design Development 25%	1	L.S.		-		0	28	39.32		533	1,091		1,624
	Subtotal Detention Basin Const'n	1	Each					139			2,665	5,456		8,121
	Construct Shielding Wall													
	Excavate Sand & Gravel Backhoe 1cy	1,920	C.Y.		-		0.133	255	42.02		-	10,714		10,714
	Loading Sand & Gravel into Trucks	1,920	C.Y.		-		0.020	38	42.29		-	1,607		1,607
	Hauling 12 cy Truck 1 mile	1,920	C.Y.		-		0.038	73	35.25		-	2,573		2,573
	Backfill Trench FEL 1cy wheel mtd	253	C.Y.		-		0.030	8	39.25		-	314		314
	Walkbeh'd vib Plate 18"wx6" lift 3 pass	253	C.Y.		-		0.043	11	33.55		-	369		369
	Forms in Place Mat Footing 4 use	17,100	SFCA		0.61		0.137	2,343	41.89		10,431	98,154		108,585
	Reinf. In Place A615 G60 Slab-Grade	83	Tons		532.88		13.910	1,159	51.77		44,407	59,996		104,403
	Purchase Concrete 3500 Psi	1,833	Cy		66.99		-	-	0.00		122,815	-		122,815
	Conc. Placing Foundation Mat Pump	1,667	C.Y.		-		0.160	267	36.27		-	9,683		9,683
	Finishing Fl'rs-Screed, Float & Broom	15,000	SF		-		0.013	195	38.46		-	7,500		7,500
	Curing - Burlap 12 oz	150	CSF		11.42		0.291	44	33.39		1,713	1,469		3,182
	FIP Plywood to 8' 4 use	77,025	SFCA		0.77		0.110	8,473	42.00		59,309	355,856		415,165
	For Gang Forms 192 SF deduct	77,025	0		0.10		-	-	0.00		7,703	11,554		19,257
	Reinf In Place A615 G60 Walls #8-18	208	Tons		532.88		8.000	1,667	51.81		111,017	86,367		197,384
	Purchase Concrete 3500 Psi	4,375	Cy		66.99		-	-	0.00		293,081	-		293,081
	Conc. Placing Walls 15" Thick	4,167	C.Y.		-		0.533	2,221	36.30		-	80,625		80,625
	Finishing Fl'rs-Screed, Float & Broom	4,500	SF		-		0.013	59	38.14		-	2,250		2,250
	Finishing Walls P&P - Burlap Rub	75,000	SF		0.03		0.018	1,350	38.33		2,250	51,750		54,000
	Curing - Burlap 12 oz	750	CSF		11.42		0.291	218	33.68		8,565	7,343		15,908
	Allow for Design Development	10%	Allow		-		-	1,838	42.88		66,129	78,812		144,942
	Subtotal Cost for Shielding Wall	1,500	L.F.					20,219			727,420	866,936		1,594,357
	Concrete Pads													
	Excavate Sand & Gravel Backhoe 1cy	2426	C.Y.		-		0.133	323	41.91		-	13,537		13,537
	Loading Sand & Gravel into Trucks	716	Cy		-		0.020	48	42.31		-	2,031		2,031
	Forms in Place Mat Footing 4 use	2863	Cy		0.61		0.137	1,517	41.91		6,756	63,576		70,332
	Reinf. In Place A615 G60 Slab-Grade	112	Cy		532.88		13.910	5,063	51.76		193,968	262,062		456,030
	Purchase Concrete 3500 Psi	1	L.S.		66.99		-	-	0.00		268,228	-		268,228
	Conc. Placing Foundation Mat Pump	1	L.S.		-		0.160	582	36.34		-	21,148		21,148
	Finishing Fl'rs-Screed, Float & Broom	0	0.00		-		0.013	426	38.45		-	16,380		16,380
	Curing - Burlap 12 oz	0	0.00		11.42		0.291	95	33.80		3,746	3,211		6,957
	Design Detail Allowance	10	%					805	47.42		47,270	38,195		85,464
	Subtotal Concrete Pads	1920	C.Y.					8,859			519,968	420,140		940,107

BECHTEL SAIC

JOB NO. & TITLE : 24535-000 YUCCA MOUNTAIN PROJECT
CLIENT : DEPARTMENT OF ENERGY
JOB LOCATION : LAS VEGAS, NEVADA
TYPE OF ESTIMATE : Order of Magnitude
WBS # and DESCRIPTION : Staging Area Finishes Site 4 - 1000 MTU

DATE: 08-Mar-02
Estimate No.
Take-off: J.Steiger
Priced: J. Steiger
Checked:
Approved:

Bechtel or CSI CODE	ITEM & DESCRIPTION	QUANTITY	UNIT MEAS	UNIT COST EQUIP.	UNIT COST BULK	UNIT COST S/C	D. HIRE UNIT MHR	TOTAL	WAGE	TOTAL COSTS IN US $ EQUIPMENT	BULK	LABOR	SUBCON	TOTAL
	Paving Between Pads													
	Concrete Paving 6" unreinforced	5480	S.Y.		16.49		0.029	159	38.60		90,365	6,138		96,503
	Continuous Welded Wire >10' wide	253	C.Y.		3.30		0.006	32	38.38		18,073	1,228		19,301
	Design Detail Allowance	10	%					19	38.57		10,844	737		11,580
	Total Cost for Road Related Costs	5480	S.Y.					210			119,282	8,103	-	127,384
	Fire Protection													
	Trencher 12"x36" Deep w/ Backfill	670	LF		-		0.011	7	$45.00		-	315		315
	Compact w/ vibratory Plate	670	LF		-		0.006	4	$39.25		-	157		157
	Compacting Bedding In Trench	12	C.Y.		-		0.089	1	$36.00		-	36		36
	Pipe Bedding-Screened Bank run	12	C.Y.		17.26		0.160	2	$35.00		207	70		277
	Pipe Blk Stl p. ends wld, 1/4" wall10"	670	LF		9.24		0.538	360	$40.41		6,191	14,546		20,737
	Fire Hydrant 5 1/4" 4'-0" Valve Depth	1	Each		943.95		3.111	3	$40.67		944	122		1,066
	Design Detail Allowance	25	%					94	$40.44		1,836	3,812		5,647
	Total Cost Fire Protection 1 1000 MTU	1	Each					471			9,178	19,058	-	28,235
	Total Cost Fencing 1 5000 MTU	Not Required for this Case												
	Grounding													
	Chain Trencher 4"wide x12"deep	1,420	LF		-		0.010	14	$43.64		-	611		611
	Bsckfill & Compact by Hand 4"wx12"d	1,420	LF		-		0.010	14	$34.50		-	483		483
	Bare Copper Gr'd Wire 4/0 Stranded	14	C.L.F.		166.46		2.807	39	$51.03		2,330	1,990		4,320
	Copper Electrolytic Ground Rod 20'	5	Each		1,116.50		4.598	23	$50.57		5,583	1,163		6,746
	Water Pipe Clamp 1 1/4 to 2"	65	Each		15.53		1.000	65	$50.77		1,009	3,300		4,309
	Exothermic Weld 4/0 to #4	65	Each		5.48		1.143	74	$50.41		356	3,730		4,086
	Bare Copper Gr'd Wire #2 Stranded	7	C.L.F.		55.32		1.600	11	$51.55		387	567		954
	Design Detail Allowance	25	%					60	$49.35		2,416	2,961		5,377
	Total Cost Grounding 1 5000 MTU	1	Each					300			12,081	14,805		26,886
	Lighting System													
	Excavate Trench Backhoe 1cy	136	C.Y.		-		0.040	5	$45.60		-	228		228
	Backfill Trench FEL 1cy wheel mtd	83	C.Y.		-		0.030	2	$51.50		-	103		103
	Hauling 12 cy Truck 1 mile	53	C.Y.		-		0.038	2	$35.50		-	71		71
	PVC Duct Ready for Conc 2 @ 2"	670	LF		1.35		0.067	45	$50.18		905	2,258		3,163
	Place Conc Footing Deep chute	53	C.Y.		5.68		0.343	18	$35.72		301	643		944
	Purchase Concrete 3500 Psi	58	Cy		66.99		-	-	#DIV/0!		3,885	-		3,885
	Bare Copper Gr'd Wire #2 Stranded	7	C.L.F.		55.32		1.600	11	$51.55		387	567		954
	600 volt type THW stranded #4	20	C.L.F.		42.63		1.509	30	$51.00		853	1,530		2,383
	Footings under 1 cy	13	C.Y.		97.44		2.942	38	$41.29		1,267	1,569		2,836
	Aluminum pole 40 ft high	8	Each		1,497.13		10.000	80	$50.04		11,977	4,003		15,980
	Bracket Arms 2 arms	8	Each		164.43		1.000	8	$50.75		1,315	406		1,721
	Pole Mounted Flood HP sodium 1000w	17	Each		507.50		4.000	68	$50.40		8,628	3,427		12,055
	Xfmr 5KV/480-1000KVA 3 Phase	0	Each		30,145.50		180.000	36	$50.78		6,029	1,828		7,857
	Xfmr 480/120-45KVA 3 Phase	0	Each		1,268.75		40.000	8	$50.75		254	406		660
	Motor Control Center	0	Each		10,150.00		120.000	24	$50.75		2,030	1,218		3,248
	Distr-Pnl Ltg 480v	0	Each		2,436.00		30.000	6	$50.83		487	305		792
	Distr-Pnl Inst 120v	0	Each		761.25		36.000	7	$52.29		152	366		518
	Design Detail Allowance	25	%					97	$48.78		9,618	4,732		14,350
	Total Cost Lighting System 1 5000 MTU	1	Each					485			48,088	23,660		71,748

BECHTEL SAIC

JOB NO. & TITLE : 24535-000 YUCCA MOUNTAIN PROJECT
CLIENT : DEPARTMENT OF ENERGY
JOB LOCATION : LAS VEGAS, NEVADA
TYPE OF ESTIMATE : Order of Magnitude
WBS # and DESCRIPTION : Staging Area Finishes Site 4 - 1000 MTU

DATE : 08-Mar-02
Estimate No.
Take-off: J.Steiger
Priced: J. Steiger
Checked:
Approved:

Bechtel or CSI CODE	ITEM & DESCRIPTION	QUANTITY	UNIT MEAS	UNIT COST EQUIP.	UNIT COST BULK	UNIT COST S/C	D. HIRE UNIT MHR	TOTAL	WAGE	TOTAL COSTS IN US $ EQUIPMENT	BULK	LABOR	SUBCON.	TOTAL
	Monitoring & Security													
	Pad Monitoring													
	Duct Bank 2-3" Dia Rigid Galv Steel	3,708	L.F.		21.32		0.160	593	$50.59		79,055	29,998		109,053
	Category 3 #24 4 pair Solid pvc	8	C.L.F.		5.58		1.143	9	$51.00		45	459		504
	Allow for Temp Sensors	202	Each		2,000.00		3.000	606	$50.77		404,000	30,767		434,767
	Excavate Sand & Gravel Backhoe 1cy	141	C.Y.		-		0.133	19	$41.42		-	787		787
	Loading Sand & Gravel into Trucks	79	C.Y.		-		0.020	2	$33.00		-	66		66
	Hauling 12 cy Truck 1 mile	79	C.Y.		-		0.038	3	$35.33		-	106		106
	PVC Duct Ready for Conc 4 @ 4"	306	LF		5.68		0.200	61	$50.56		1,738	3,084		4,822
	Place Conc Footing Deep chute	62	C.Y.		5.68		0.343	21	$35.86		352	753		1,105
	Purchase Concrete 3500 Psi	68	Cy		66.99		-	-	#DIV/0!		4,555	-		4,555
	Bare Copper Gr'd Wire 4/0 Stranded	3	C.L.F.		166.46		2.807	8	$53.25		499	426		925
	Multiplexers	4	Each		2,500.00		6.000	24	$34.50		10,000	828		10,828
	Fiber Optic & Data Cables	1,377	L.F.		2.23		0.220	303	$50.76		3,071	15,381		18,452
	Design Detail Allowance	79	allow					412	$50.12		125,829	20,664		146,493
	Perimeter CC TV	0	0		-		-	-	#DIV/0!		-	-		-
	Excavate Sand & Gravel Backhoe 1cy	168	C.Y.		-		0.133	22	$42.59		-	937		937
	Loading Sand & Gravel into Trucks	112	C.Y.		-		0.020	2	$47.00		-	94		94
	Hauling 12 cy Truck 1 mile	112	C.Y.		-		0.038	4	$37.50		-	150		150
	Duct Bank 4-2" Dia Rigid Galv Steel	670	L.F.		19.54		0.178	119	$50.56		13,092	6,017		19,109
	Place Conc Footing Deep chute	56	C.Y.		5.68		0.343	19	$35.79		318	680		998
	Purchase Concrete 3500 Psi	62	Cy		66.99		-	-	#DIV/0!		4,153	-		4,153
	Bare Copper Gr'd Wire 4/0 Stranded	7	C.L.F.		166.46		2.807	20	$49.75		1,165	995		2,160
	CCTV 10:1 Zoom Lens w/Preset	2	Each		2,030.00		2.000	4	$50.75		4,060	203		4,263
	Fiber Optic Xmtr	2	Each		1,218.00		1.000	2	$51.00		2,436	102		2,538
	Fiber Optic Reciever	2	Each		1,218.00		1.000	2	$51.00		2,436	102		2,538
	Pan & Tilt Unit w/ Presets	2	Each		2,436.00		1.000	2	$51.00		4,872	102		4,974
	Reciever/Driver w/Presets	2	Each		1,522.50		1.000	2	$51.00		3,045	102		3,147
	Custom Camera Pole	2	Each		1,015.00		1.000	2	$51.00		2,030	102		2,132
	Video Switching Matrix	1	Each		8,120.00		4.000	4	$50.75		8,120	203		8,323
	VCR 1/8 Crameras	1	Each		5,075.00		4.000	4	$50.75		5,075	203		5,278
	Monitors	1	Each		1,268.75		4.000	4	$50.75		1,269	203		1,472
	Prefabricated Cable Assemblies	2	Each		1,015.00		4.000	8	$50.75		2,030	406		2,436
	Fiber Optic & Data Cables	500	L.F.		2.23		0.220	110	$50.77		1,115	5,585		6,700
	Design Detail Allowance	2	allow					83	$49.05		13,804	4,047		17,851
	Fence Security	0	0											
	Fence Security Transmitter	3	Each		964.25		4.000	12	$50.75		2,893	609		3,502
	4.5' Pole for Xmtr	3	Each		1,218.00		6.000	18	$50.78		3,654	914		4,568
	Infra Red Detectors	3	Each		761.25		4.000	12	$50.75		2,284	609		2,893
	Perimeter Fence Security Alarm Pnl	0	Each		2,537.50		1.000	-	#DIV/0!		508	10		518
	Card Readers @ Gate	1	Each		1,522.50		8.000	8	$50.75		1,523	406		1,929
	600V Cable - 1-3c#12AWG	300	L.F.		0.55		0.041	12	$52.00		165	624		789
	Terminations	72	Each		0.51		0.340	24	$51.79		37	1,243		1,280
	Detectors (Nuclear)	3	Each		3,248.00		4.000	12	$50.75		9,744	609		10,353
	Allow for Monitor Building	1	Each		37,500.00		750.000	750	$50.00		37,500	37,500		75,000
	Design Detail Allowance	25	%					212	$50.15		14,577	10,631		25,208
	Total Cost Monitoring & Security 1 Site							3,534			771,049	176,706		947,755
	0													
	Communications													
	Allow for Telephones	2	Each		-		0.038	4	$37.50		-	150		150
	Category 3 #24 4 pair Solid pvc	20	C.L.F.		19.54		0.178	119	$50.56		13,092	6,017		19,109
	Design Detail Allowance	25	%					31	$50.14		3,273	1,542		4,815
	Total Cost Communications 1 Site							154			16,365	7,709		24,074
Subtotal Site Related Costs Direct Costs		1	Site					34,371			2,226,095	1,542,572		3,768,667
	Total Direct Cost for Related to Road	Not Required for this Case												
Total Direct Cost 1000 MTU Site 4								34,371			2,226,095	1,542,572		3,768,667

CIVILIAN RADIOACTIVE WASTE MANAGEMENT SYSTEM; MANAGEMENT & OPERATING CONTRACTOR

PROJECT NAME: YUCCA MOUNTAIN SITE CHARACTERIZATION
PROJECT ELEMENT: Site Recommendation; Repository Design
WBS NO.: 1.2.21.2
TASK NAME: Cost Estimate of Underground Aging Area for Design Evolution Study

ESTIMATOR: D. HONG — DATE: March 19, 2002
CHECKED BY: — DATE:

ESTIMATED DIRECT COST SUMMARY - ISOLATION RIDGE UNDERGROUND AGING FACILITY CONSTRUCTION

System Codes	Subsystem Activity	Description	Quantity	Units	Manhours Unit	Manhours MH	Labor Unit	Labor Amount	Permanent Material Unit	Permanent Material Amount	Construction Material Unit	Construction Material Amount	Equipment EOE Unit	Equipment EOE Amount	Equipment Rent/Own Unit	Equipment Rent/Own Amount	Subcontractors Unit	Subcontractors Amount	Total Direct Cost Unit	Total Direct Cost Amount	Indirect Charge Unit	Indirect Charge Amount	Total Estimated Cost Unit	Total Estimated Cost Amount
11		Construction Support Facilities, Plant, and Systems																						
	110	**New Portal Construction Support Facilities, Plant, and Systems**																						
	111	**Subsurface Construction Supports**																						
		Muck Disposal Operations	***1,530,892***	BCM	0.00	0	$0.00	$0	$0.00	$0	$0.00	$0	$0.00	$0	$0.00	$0	$11.932	$18,266,603	$11.93	$18,266,603	$1.45	$2,219,003	$13.38	$20,485,606
		O&M of Concrete Batch Plant & Equipment	***89,465***	CM	0.00	0	$0.00	$0	$0.00	$0	$0.00	$0	$0.00	$0	$0.00	$0	$15.657	$1,400,754	$15.66	$1,400,754	$1.90	$170,162	$17.56	$1,570,916
		O&M of Precast Concrete Plant & Equipment	***4,918***	EA	0.00	0	$0.00	$0	$0.00	$0	$0.00	$0	$0.00	$0	$0.00	$0	$312.988	$1,539,275	$312.99	$1,539,275	$38.02	$186,989	$351.01	$1,726,264
	113	South Portal Site Excavation (D&S)	847,270	CY	0.00	0	$3.14	$2,660,428	$0.33	$279,599	$1.34	$1,135,342	$2.41	$2,041,921	$0.00	$0	$0.00	$0	$7.22	$6,117,290	$3.24	$2,745,155	$10.46	$8,862,445
	113	Railroad Service Facilities & Trackwork	1	LS	0.00	0	$762,058.00	$762,058	$1,689,510.78	$1,689,511	$25,963.72	$25,964	$106,562.48	$106,562	$0.00	$0	$1,700,000.00	$1,700,000	$4,284,095.00	$4,284,095	$1,926,657.18	$1,926,657	$6,210,752.00	$6,210,752
	113	South Portal Area Granular Surfacing	106,450	SM	0.00	0	$0.88	$93,676	$3.76	$400,252	$0.22	$23,419	$0.59	$62,806	$0.00	$0	$0.00	$0	$5.45	$580,153	$2.45	$260,803	$7.90	$840,956
	113	Domestic and Fire Water Systems	1	LS	0.00	0	$468,934.02	$468,934	$479,278.45	$479,278	$35,345.40	$35,345	$83,746.57	$83,747	$0.00	$0	$0.00	$0	$1,067,304.00	$1,067,304	$479,991.64	$479,992	$1,547,296.00	$1,547,296
	113	Fuel Station, Truck Scale & Compressed Air Syste	1	LS	0.00	0	$0.00	$0	$0.00	$0	$0.00	$0	$0.00	$0	$0.00	$0	$425,297.00	$425,297	$425,297.00	$425,297	$191,265.96	$191,266	$616,563.00	$616,563
	113	Storm Sewerage & Wastewater Systems	1	LS	0.00	0	$1,510,071.63	$1,510,072	$182,718.00	$182,718	$530,402.23	$530,402	$1,340,973.79	$1,340,974	$0.00	$0	$50,000.00	$50,000	$3,614,166.00	$3,614,166	$1,625,374.38	$1,625,374	$5,239,540.00	$5,239,540
	113	Power Distribution, Lighting & Communication	1	LS	0.00	0	$208,916.00	$208,916	$810,804.00	$810,804	$21,453.00	$21,453	$13,248.00	$13,248	$0.00	$0	$3,584,242.00	$3,584,242	$4,638,663.00	$4,638,663	$2,086,114.67	$2,086,115	$6,724,778.00	$6,724,778
	113	Fences & Gates, and Field Offices & Sheds	1	LS	0.00	0	$0.00	$0	$0.00	$0	$0.00	$0	$0.00	$0	$0.00	$0	$4,192,402.00	$4,192,402	$4,192,402.00	$4,192,402	$1,885,420.72	$1,885,421	$6,077,823.00	$6,077,823
	114	Overland Conveyor	1,200	M	0.00	0	$1,214.28	$1,457,136	$1,044.00	$1,252,800	$626.13	$751,356	$204.79	$245,748	$0.00	$0	$410.33	$492,396	$3,499.53	$4,199,436	$1,573.82	$1,888,584	$5,073.35	$6,088,020
	Total	**Subsurface Construction Support Facilities, Plant, and Systems**	**1**	**LS**		**0**		**$7,161,220**		**$5,094,962**		**$2,523,281**		**$3,895,006**		**$0**		**$31,650,969**		**$50,325,438**		**$15,665,521**		**$65,990,959**
	222	**Access Mains, and Its Extensions & Connecting Drifts**																						
	02412021	150T Roadheader Tunnelling																						
	02413011	7.62M Dia. TBM Tunnelling	6,000	M	43.23	259,368	$2,326.85	$13,961,100	$2,125.65	$12,753,900	$1,130.29	$6,781,740	$722.68	$4,336,080	$950.38	$5,702,280	$0.00	$0	$7,255.85	$43,535,100	$2,676.91	$16,061,460	$9,932.76	$59,596,560
		273,624																						
	02425011 02433011	7.62M Dia. Tunnel CIP Concrete Arch Lining, and Precast Concrete Invert Grouting	6,000	M	23.19	139,140	$1,322.09	$7,932,540	$1,267.65	$7,605,900	$501.39	$3,008,340	$69.20	$415,200	$60.01	$360,060	$0.00	$0	$3,220.34	$19,322,040	$1,188.09	$7,128,540	$4,408.43	$26,450,580
		34,260																						
	02425012	7.62M Dia. Tunnel CIP Concrete Finish Invert	6,000	M	5.97	35,826	$346.38	$2,078,280	$332.10	$1,992,600	$97.14	$582,840	$64.87	$389,220	$20.01	$120,060	$0.00	$0	$860.50	$5,163,000	$317.46	$1,904,760	$1,177.96	$7,067,760
		8,634																						
	02425013	Horseshoe Shape Tunnel CIP Concrete Lining																						
		HS Tunnel CIP Concrete Arch Lining																						
		7.62M TBM Assembly Chambers	70	M																				
		1	0	EA																				
		7.62M TBM Disassembly Chambers	20	M																				
		1	0	EA																				
	02401011 02401012	Railroad Trackwork, and Trolley & Wiring	6,000	M	2.55	15,276	$142.63	$855,780	$365.67	$2,194,020	$13.74	$82,440	$22.03	$132,180	$28.68	$172,080	$0.00	$0	$572.75	$3,436,500	$196.36	$1,178,160	$769.11	$4,614,660
	02402011	Tunnel Power & Light	6,000	M	5.07	30,414	$300.40	$1,802,400	$1,700.00	$10,200,000	$16.88	$101,280	$23.99	$143,940	$32.08	$192,480	$0.00	$0	$2,073.35	$12,440,100	$710.82	$4,264,920	$2,784.17	$16,705,020
	02403011	Tunnel Utilities	6,000	M	7.30	43,824	$430.25	$2,581,500	$250.46	$1,502,760	$13.82	$82,920	$24.59	$147,540	$35.07	$210,420	$0.00	$0	$754.19	$4,525,140	$258.56	$1,551,360	$1,012.75	$6,076,500
	02406011	Tunnel Communication & Controls	6,000	M	1.88	11,256	$122.27	$733,620	$522.75	$3,136,500	$8.55	$51,300	$12.04	$72,240	$15.24	$91,440	$0.00	$0	$680.85	$4,085,100	$233.42	$1,400,520	$914.27	$5,485,620
	Subtotal	**Access Mains, and Extensions & Connecting Drifts**	**6,000**	**M**		**535,104**		**$29,945,220**		**$39,385,680**		**$10,690,860**		**$5,636,400**		**$6,848,820**		**$0**		**$92,506,980**		**$33,489,720**		**$125,996,700**
	Total	**Access Ramps & Mains, and Drifts**				**535,104**		**$29,945,220**		**$39,385,680**		**$10,690,860**		**$5,636,400**		**$6,848,820**		**$0**		**$92,506,980**		**$33,489,720**		**$125,996,700**

25	Ventilation Shafts																							
	251	Intake Air Shafts																						
	0220	Site Preparation Intake Air Shafts #1 & #2	2	EA	0.00	0	$8,773.00	$17,546	$0.00	$0	$3,945.00	$7,890	$9,877.33	$19,755	$0.00	$0	$49,500.00	$99,000	$72,095.50	$144,191	$29,114.00	$58,228	$101,209.50	$202,419
	0331	Foreshaft Construction Intake Air Shafts #1 & #2	20	VLM	0.00	0	$30,483.70	$609,674	$10,811.80	$216,236	$15,084.20	$301,684	$16,808.53	$336,171	$0.00	$0	$0.00	$0	$73,188.25	$1,463,765	$29,555.30	$591,106	$102,743.55	$2,054,871
	02414011	8.0M Dia. D&B Shaft Sinking	813	VLM	147.44	119,869	$7,774.21	$6,320,433	$0.00	$0	$2,929.05	$2,381,318	$2,063.61	$1,677,715	$2,390.22	$1,943,249	$0.00	$0	$15,157.09	$12,322,715	$6,120.82	$4,976,227	$21,277.91	$17,298,942
	02425021	CIP Concrete 7.4M I.D. Shaft Lining	813	VLM	90.98	73,966	$4,532.73	$3,685,109	$1,851.94	$1,505,627	$1,519.40	$1,235,272	$223.04	$181,332	$196.64	$159,868	$0.00	$0	$8,323.75	$6,767,208	$3,361.34	$2,732,769	$11,685.09	$9,499,977
		5,900																						
	02403021	Shaft Power&Light, Utilities, and Comm.&Controls	823	VLM	46.10	37,941	$2,085.46	$1,716,334	$724.31	$596,107	$98.39	$80,975	$271.00	$223,033	$266.30	$219,165	$0.00	$0	$3,445.46	$2,835,614	$1,391.36	$1,145,089	$4,836.82	$3,980,703
	02407061	Shaft Surface Plant & Equipment	2	EA	34,800.00	69,600	$1,898,441.00	$3,796,882	$5,013,119.50	$10,026,239	$462,846.00	$925,692	$182,991.50	$365,983	$207,730.00	$415,460	$2,443,846.00	$4,887,692	$10,208,974.00	$20,417,948	$4,122,643.00	$8,245,286	$14,331,617.00	$28,663,234
	Subtotal	**Intake Air Shafts**	2	EA		301,376		$16,145,978		$12,344,209		$4,932,831		$2,803,989		$2,737,742		$4,986,692		$43,951,441		$17,748,705		$61,700,146
	252	Exhaust Air Shafts																						
	0220	Site Preparation Exhaust Air Shafts #2 & #3	2	EA	0.00	0	$8,773.00	$17,546	$0.00	$0	$3,945.00	$7,890	$9,877.33	$19,755	$0.00	$0	$49,500.00	$99,000	$72,095.50	$144,191	$29,114.00	$58,228	$101,209.50	$202,419
	0331	Foreshaft Construction Exhaust Air Shafts #2 & #3	20	VLM	0.00	0	$30,483.70	$609,674	$10,811.80	$216,236	$15,084.20	$301,684	$16,808.53	$336,171	$0.00	$0	$0.00	$0	$73,188.25	$1,463,765	$29,555.30	$591,106	$102,743.55	$2,054,871
	02414011	8.0M Dia. D&B Shaft Sinking	777	VLM	147.44	114,561	$7,774.21	$6,040,561	$0.00	$0	$2,929.05	$2,275,872	$2,063.61	$1,603,425	$2,390.22	$1,857,201	$0.00	$0	$15,157.09	$11,777,059	$6,120.82	$4,755,877	$21,277.91	$16,532,936
	02425021	CIP Concrete 7.4M I.D. Shaft Lining	777	VLM	90.98	70,691	$4,532.73	$3,521,931	$1,851.94	$1,438,957	$1,513.40	$1,180,574	$223.04	$173,302	$196.64	$152,789	$0.00	$0	$8,323.75	$6,467,553	$3,361.34	$2,611,761	$11,685.09	$9,079,314
		5,639																						
	02403021	Shaft Power&Light, Utilities, and Comm.&Controls	787	VLM	45.00	35,415	$2,035.80	$1,602,175	$11,763.16	$9,257,607	$96.04	$75,583	$264.54	$208,193	$259.96	$204,589	$0.00	$0	$14,419.50	$11,348,147	$5,822.96	$4,582,670	$20,242.46	$15,930,817
	02407061	Shaft Surface Plant & Equipment	2	EA	41,280.00	82,560	$2,251,944.00	$4,503,888	$5,539,940.00	$11,079,880	$590,025.00	$1,180,050	$217,066.00	$434,132	$246,411.00	$492,822	$2,443,846.00	$4,887,692	$11,289,232.00	$22,578,464	$4,558,878.00	$9,117,756	$15,848,110.00	$31,696,220
	Subtotal	**Exhaust Air Shafts**	2	EA		303,227		$16,295,775		$21,992,680		$5,021,653		$2,774,978		$2,707,401		$4,986,692		$53,779,179		$21,717,398		$75,496,577
	Total	**Ventilation Shafts**	4	EA		604,603		$32,441,753		$34,336,889		$9,954,484		$5,578,967		$5,445,143		$9,973,384		$97,730,620		$39,466,103		$137,196,723
26	Ventilation Air Access Drifts																							
	261	Intake Air Access Drifts																						
	02412021	150T Roadheader Tunnelling																						
	Horseshoe	Shape Intake Air Access Drift (8mWx8.5mHx463m)	463	M	108.67	50,316	$6,205.97	$2,873,364	$620.67	$287,370	$989.46	$458,120	$1,994.32	$923,370	$2,742.25	$1,269,662	$0.00	$0	$12,552.67	$5,811,886	$5,069.09	$2,346,989	$17,621.76	$8,158,875
	02425013	HS Tunnel CIP Concrete Arch Lining & Finish Invert	463	M	32.85	15,210	$1,881.77	$871,260	$1,448.81	$670,799	$539.98	$250,011	$210.13	$97,290	$67.41	$31,211	$0.00	$0	$4,148.10	$1,920,571	$1,675.11	$775,576	$5,823.21	$2,696,147
		3,024																						
	02401011 02401012	Railroad Trackwork, and Trolley & Wiring	463	M	2.55	1,179	$142.63	$66,038	$365.67	$169,305	$13.74	$6,362	$22.03	$10,200	$28.68	$13,279	$0.00	$0	$572.75	$265,184	$196.36	$90,915	$769.11	$356,099
	02402011	Tunnel Power & Light	463	M	5.07	2,347	$300.40	$139,085	$1,700.00	$787,100	$16.88	$7,815	$23.99	$11,107	$32.08	$14,853	$0.00	$0	$2,073.35	$959,960	$710.82	$329,110	$2,784.17	$1,289,070
	02403011	Tunnel Utilities	463	M	7.30	3,382	$430.25	$199,206	$250.46	$115,963	$13.82	$6,399	$24.59	$11,385	$35.07	$16,237	$0.00	$0	$754.19	$349,190	$258.56	$119,713	$1,012.75	$468,903
	02406011	Tunnel Communication & Controls	463	M	1.88	869	$122.27	$56,611	$522.75	$242,033	$8.55	$3,959	$12.04	$5,575	$15.24	$7,056	$0.00	$0	$680.85	$315,234	$233.42	$108,073	$914.27	$423,307
	Subtotal	**Intake Air Access Drifts**	463	M		73,303		$4,205,564		$2,272,570		$732,666		$1,058,927		$1,352,298		$0		$9,622,025		$3,770,376		$13,392,401
	262	Exhaust Air Access Drifts																						
	02412021	150T Roadheader Tunnelling																						
	Horseshoe	Shape Exhaust Air Access Drift (8mWx8.5mHx833m)	833	M	108.67	90,525	$6,205.97	$5,169,573	$620.67	$517,018	$989.46	$824,220	$1,994.32	$1,661,269	$2,742.25	$2,284,294	$0.00	$0	$12,552.67	$10,456,374	$5,069.09	$4,222,552	$17,621.76	$14,678,926
	02425013	HS Tunnel CIP Concrete Arch Lining & Finish Invert	833	M	32.85	27,364	$1,881.77	$1,567,514	$1,448.81	$1,206,859	$539.98	$449,803	$210.13	$175,038	$67.41	$56,153	$0.00	$0	$4,148.10	$3,455,367	$1,675.11	$1,395,367	$5,823.21	$4,850,734
		5,440																						
	02401011 02401012	Railroad Trackwork, and Trolley & Wiring	833	M	2.55	2,121	$142.63	$118,811	$365.67	$304,603	$13.74	$11,445	$22.03	$18,351	$28.68	$23,890	$0.00	$0	$572.75	$477,100	$196.36	$163,568	$769.11	$640,668
	02402011	Tunnel Power & Light	833	M	5.07	4,222	$300.40	$250,233	$1,700.00	$1,416,100	$16.88	$14,061	$23.99	$19,984	$32.08	$26,723	$0.00	$0	$2,073.35	$1,727,101	$710.82	$592,113	$2,784.17	$2,319,214
	02403011	Tunnel Utilities	833	M	7.30	6,084	$430.25	$358,398	$250.46	$208,633	$13.82	$11,512	$24.59	$20,483	$35.07	$29,213	$0.00	$0	$754.19	$628,239	$258.56	$215,380	$1,012.75	$843,619
	02406011	Tunnel Communication & Controls	833	M	1.88	1,563	$122.27	$101,851	$522.75	$435,451	$8.55	$7,122	$12.04	$10,029	$15.24	$12,695	$0.00	$0	$680.85	$567,148	$233.42	$194,439	$914.27	$761,587
	Subtotal	**Exhaust Air Access Drifts**	833	M		131,879		$7,566,380		$4,088,664		$1,318,163		$1,905,154		$2,432,968		$0		$17,311,329		$6,783,419		$24,094,748
	Total	**Ventilation Air Access Drifts**	1,296	M		205,182		$11,771,944		$6,361,234		$2,050,829		$2,964,081		$3,785,266		$0		$26,933,354		$10,553,795		$37,487,149

27	Emplacement Drifts, and Its Turnouts & Vent Raises																							
	271	Emplacement Drifts' Turnouts																						
	02412021	150T Roadheader Tunnelling																						
			4,480	M	90.10	403,644	$5,144.91	$23,049,197	$613.82	$2,749,914	$968.26	$4,337,805	$1,626.23	$7,285,510	$2,232.82	$10,003,034	$0.00	$0	$10,586.04	$47,425,460	$3,905.53	$17,496,774	$14,491.57	$64,922,234
	02425013	Horseshoe Shape Tunnel CIP Concrete Lining																						
		HS Turnouts CIP Concrete Arch Lining	56	EA	2,976.00	166,656	$170,474.56	$9,546,575	$77,727.28	$4,352,728	$64,037.78	$3,586,116	$19,036.39	$1,066,038	$6,107.06	$341,995	$0.00	$0	$337,383.07	$18,893,452	$124,471.39	$6,970,398	$461,854.46	$25,863,850
		16,354																						
	02425012	CIP Concrete Finish Invert																						
		CIP Concrete Finish Invert (HS Turnouts)	56	EA	564.22	31,596	$32,736.67	$1,833,254	$47,723.17	$2,672,498	$23,318.33	$1,305,826	$6,129.72	$343,264	$1,890.50	$105,868	$0.00	$0	$111,798.39	$6,260,710	$41,246.00	$2,309,776	$153,044.39	$8,570,486
		10,214																						
	02401011	Railroad Trackwork, and Trolley & Wiring	56	EA	244.00	13,664	$13,689.35	$766,604	$56,796.05	$3,180,579	$1,309.60	$73,349	$2,108.85	$118,096	$2,744.00	$153,664	$0.00	$0	$76,648.07	$4,292,292	$26,277.65	$1,471,548	$102,925.71	$5,763,840
	02402011	Tunnel Power & Light	56	EA	481.20	26,947	$28,512.75	$1,596,714	$161,670.00	$9,053,520	$1,601.65	$89,692	$2,274.80	$127,389	$3,042.30	$170,369	$0.00	$0	$197,101.50	$11,037,684	$67,573.20	$3,784,099	$264,674.70	$14,821,783
	02403011	Tunnel Utilities	56	EA	694.00	38,864	$40,873.40	$2,288,910	$23,818.70	$1,333,847	$1,311.00	$73,416	$2,331.70	$130,575	$3,327.10	$186,318	$0.00	$0	$71,661.89	$4,013,066	$24,568.25	$1,375,822	$96,230.14	$5,388,888
	02407032	Isolation Doors																						
	Subtotal	Emplacement Drifts' Turnouts	56	EA		681,371		$39,081,254		$23,343,086		$9,466,204		$9,070,872		$10,961,248		$0		$91,922,664		$33,408,417		$125,331,081
	272	Emplacement Drifts																						
	02413021	5.5M Dia. TBM Tunnelling	40,320	M	39.42	1,589,253	$2,180.82	$87,930,662	$1,015.13	$40,930,042	$953.24	$38,434,637	$548.75	$22,125,600	$757.10	$30,526,272	$0.00	$0	$5,455.04	$219,947,213	$2,012.54	$81,145,613	$7,467.58	$301,092,826
		957,923																						
	02407042	Ballast Backfill	40,320	M	6.24	251,476	$363.14	$14,641,805	$54.05	$2,179,296	$39.26	$1,582,963	$122.56	$4,941,619	$151.28	$6,099,610	$0.00	$0	$730.29	$29,445,293	$269.42	$10,863,014	$999.71	$40,308,307
	02401022	Gantry Rails Electrification & Controls																						
	Subtotal	Emplacement Drifts	40,320	M		1,840,729		$102,572,467		$43,109,338		$40,017,600		$27,067,219		$36,625,882		$0		$249,392,506		$92,008,627		$341,401,133
	273	Emplacement Drifts' Vent Raises																						
	Subtotal	Emplacement Drifts' Vent Raises		EA		0		$0		$0		$0		$0		$0		$0		$0		$0		$0
	Total	Emplacement Drifts, and Turnouts & Vent Raises				2,522,100		$141,653,721		$66,452,424		$49,483,804		$36,138,091		$47,587,130		$0		$341,315,170		$125,417,044		$466,732,214

28	Post Closure Test Drift, and Performance Confirmation Observation Drifts & Test Alcoves										
281	Post Closure Test Drift, and Its Turnouts & Vent Raise										
Subtotal	Post Closure Test Drift, and Turnouts & Vent Raise	0	$0	$0	$0	$0	$0	$0	$0	$0	$0
282	Performance Confirmation Observation Drifts and Its Vent Raises										
	Recapitulation: (Construction Summary)										
11	South Portal & Construction Support Facilities	0	$7,161,220	$5,094,962	$2,523,281	$3,895,006	$0	$31,650,969	$50,325,438	$15,665,521	$65,990,959
21	Existing ESF Ramps & Main, and ECRB Cross Drift	0	$0	$0	$0	$0	$0	$0	$0	$0	$0
22	Access Ramp & Mains, and Drift	535,104	$29,945,220	$39,385,680	$10,690,860	$5,636,400	$6,848,820	$0	$92,506,980	$33,489,720	$125,996,700
23	Exhaust Main	0	$0	$0	$0	$0	$0	$0	$0	$0	$0
24	Operational Alcoves & Chambers	0	$0	$0	$0	$0	$0	$0	$0	$0	$0
25	Ventilation Shafts	604,603	$32,441,753	$34,336,889	$9,954,484	$5,578,967	$5,445,143	$9,973,384	$97,730,620	$39,466,103	$137,196,723
26	Ventilation Air Access Drifts	205,182	$11,771,944	$6,361,234	$2,050,829	$2,964,081	$3,785,266	$0	$26,933,354	$10,553,795	$37,487,149
27	Emplacement Drifts, and Turnouts & Vent Raises	2,522,100	$141,653,721	$66,452,424	$49,483,804	$36,138,091	$47,587,130	$0	$341,315,170	$125,417,044	$466,732,214
28	Post Closure Test Drift, and Performance Confirmation Observation Drifts & Test Alcoves	0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Total Isolation Ridge Underground Aging Facility (w/o New Portal & Construction Supports Package)	3,866,989	$215,812,638	$146,536,227	$72,179,977	$50,317,539	$63,666,359	$9,973,384	$558,486,124	$208,926,662	$767,412,786
	Grand Total	3,866,989	$222,973,858	$151,631,189	$74,703,258	$54,212,545	$63,666,359	$41,624,353	$608,811,562	$224,592,183	$833,403,745