

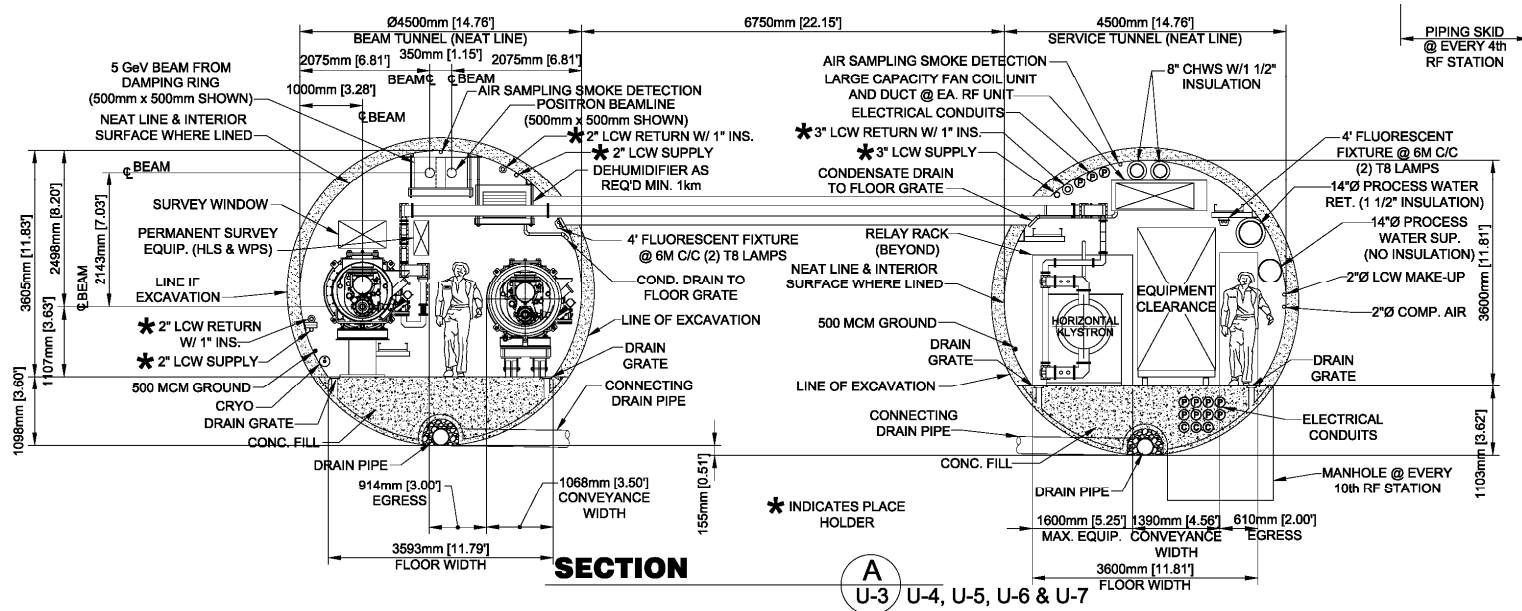


# Impact of Single Tunnel or Near Surface Sites



# RDR Layout

- The RDR provides a unique set of design solutions for a deep, rock bored (mined), twin tunnel layout.
- This design is not optimized for cost or performance.





## RDR

- The RDR criteria was based on information from the Technical Groups. Where the details were not provided by the Technical group, the CF&S engineers used their collective experiences and knowledge to complete the designs which forms the basis for the cost estimate. In most cases the RDR text defines this basis of estimate.

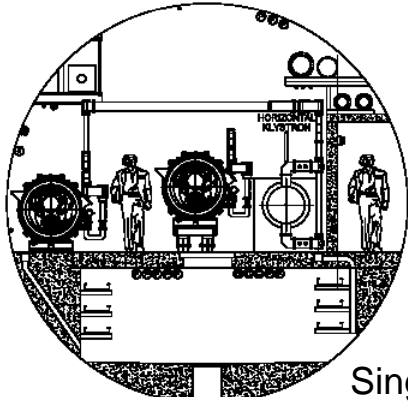


## RDR

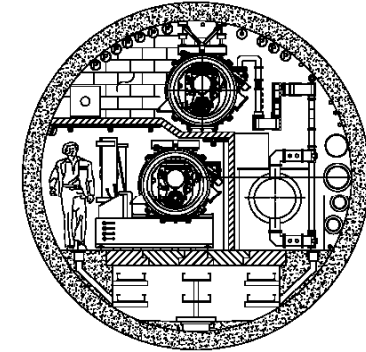
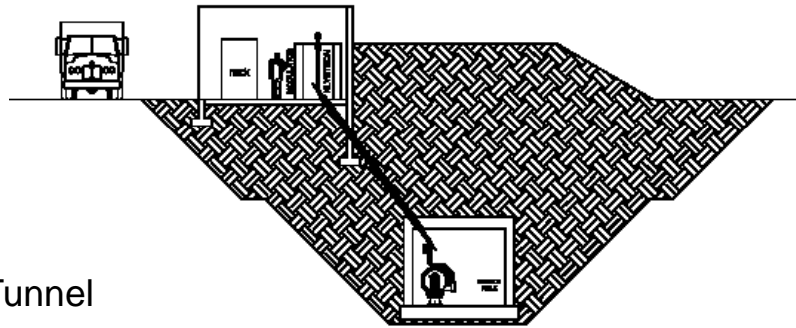
- The RDR does provide a good starting point, a baseline to look for cost drivers. Simple stated the RDR is the basis for Value Engineering.
- The RDR developed an organizational framework both within CF&S and between CFS and the Technical Groups. This organization is being further developed and refined with the support and guidance of the Project Management office.



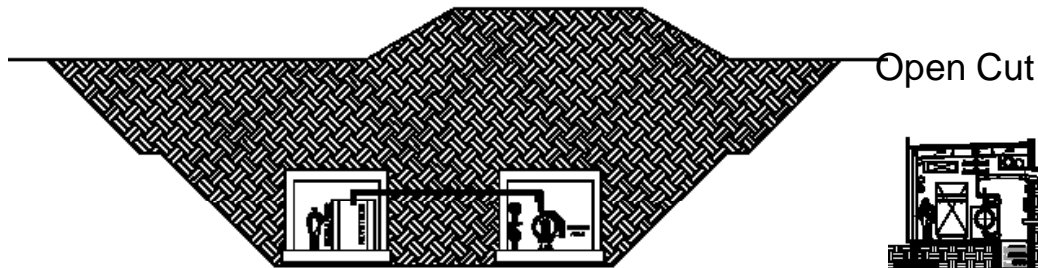
# Potential Cross-Sections



Single Tunnel

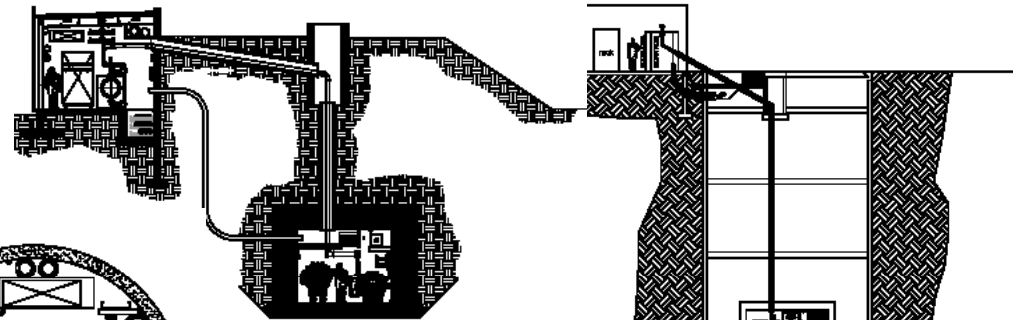


Single Tunnel

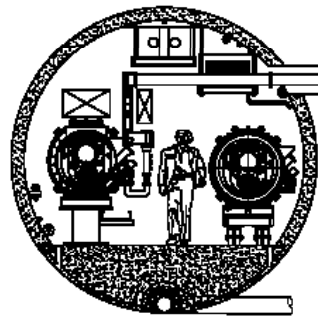


Open Cut

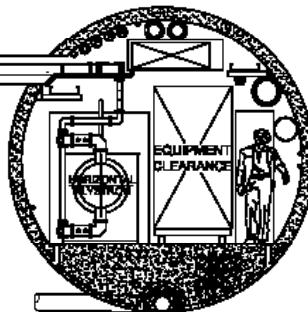
Open Cut Twin Enclosures



Open Cut



Twin  
Tunnels



Braced Excavation



# Partial Requirement Matrix

|                                      | Twin Deep Bored Tunnels | Single Deep Bored Tunnel | Near Surfaced Mined | Near Surface Open Cut |
|--------------------------------------|-------------------------|--------------------------|---------------------|-----------------------|
| Shielding                            |                         |                          |                     |                       |
| Egress Distance                      |                         |                          |                     |                       |
| Equipment Arrangement                |                         |                          |                     |                       |
| Location of Heat Sources             |                         |                          |                     |                       |
| Stability; Isolation from Vibrations |                         |                          |                     |                       |
| Equipment Access                     |                         |                          |                     |                       |
| Installation                         |                         |                          |                     |                       |
| Site Impacts                         |                         |                          |                     |                       |
| Cost                                 |                         |                          |                     |                       |



- Development of either a single tunnel or near surface models will require continued interaction with the Technical groups.
- For a particular option, CF&S will identify the criteria that is needed. CF&S Engineers will use their experience or analytical models to determine the criteria that will have the largest impact on the cost.



– **Example: Open cut enclosure cost are impacted by the spans and loadings on the walls, roof and base slab.**

- The interior space requirements determined by the equipment arrangement, installation requirements, and the aisles will directly determine the spans.
- Wall and slab loads are determined by the earth shielding.
  - Cost drivers: Excavation and backfill quantities, and concrete quantities..
- CF&S will identify impact on technical systems and will rate those impacts as Plus, minus or neutral..
- CF&S will challenge the current requirements: An open cut options will benefit from an alignments that allow following existing topographical features by marinating the minimum required shielding along its length.





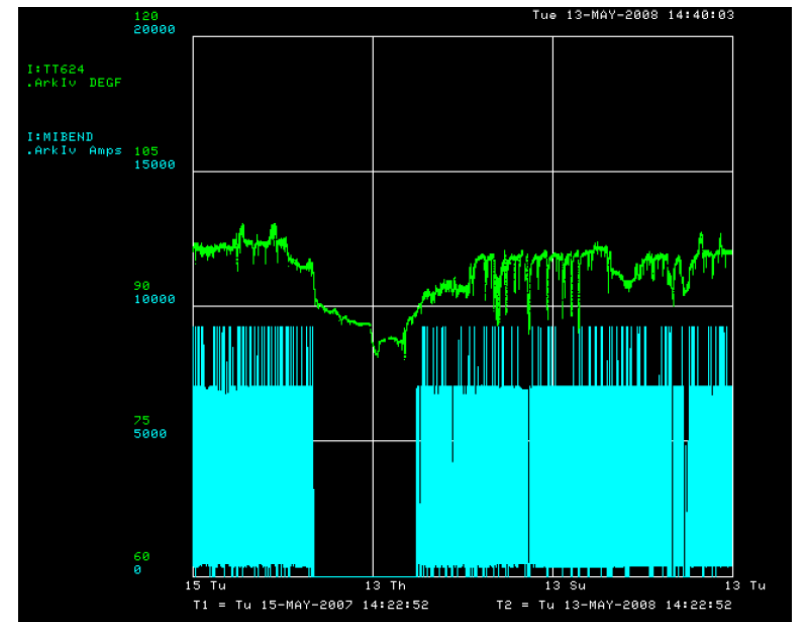
# Cost Comparison

- **Methods to compare various options incorporating both direct costs and the impacts on technical systems needs to be developed.**
  - **Items such as reliability, complexity of installation and operations can be translated into a cost. An inclusive comparison can not be accomplished by CF&S alone.**
  - **How far to develop the various option studies will need the guidance of Project Management and depend on the resources available.**
  - **Deep twin tunnels, near surface and single tunnel options have been discussed for years. We need to conclusively resolve which options are feasible and provide the best value. This may require defining more than one “uniform site”. Ultimately Project Management will need to feel comfortable concurring with the analysis.**



- We want to be identify “show stoppers” as early as possible.
  - The current twin tunnel design separates the large heat to air producing equipment from the beamline. By adding the air heat load of the klystron, electrical components and other equipment will cause large flux of the air temperature and thus cause expansion / contraction of the beam components exposed to air.

Deg  
F



Plot of Main Injector air temperature over a year.



# Conclusion

- Project Management and available resources will be key to identify where effort will be placed.
- Need to develop methods to compare options.
- Option studies are to resolve issues, not create new issues.
- We can not stop the misuse, abuse, or mishandling of the costs that we develop, so we will need to state clearly what our work represents.



## Conclusion Cont.

- “Uniform site” requirements are to be documented.
- Regional efforts must continue to be organized as a single CF&S effort.
- A WBS will be created for Project Management review and approval to manage the Option Studies effort.