

Cost Estimates for Four Centralized Extended Storage Facility Alternatives for Used Nuclear Fuel

A Report prepared by CTECH for Ontario Power Generation,
New Brunswick Power, Hydro-Québec and Atomic Energy of
Canada Limited.

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“This document has been prepared by CTECH Radioactive Materials Management, a joint venture of Canatom NPM Inc. and RWE NUKEM Ltd. (“Consultant”), to provide conceptual designs and cost estimates for Extended Storage Facilities (ESF) for the long term storage of used nuclear fuel. The scope is more fully described in the body of the document. The Consultant has used its professional judgment and exercised due care, pursuant to a purchase order dated October 2001 (the “Agreement”) with Ontario Power Generation Inc. acting on behalf of the Canadian nuclear fuel owners (“the Client”), and has followed generally accepted methodology and procedures in generating the design and estimate. It is therefore the Consultant’s professional opinion that the design and estimate represent a viable concept consistent with the intended level of accuracy appropriate to a conceptual design, and that, subject to the assumptions and qualifications set out in this document, there is a high probability that actual costs related to the implementation of the proposed design concept will fall within the specified error margin.

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Summary

This report presents the cost estimates for the Centralized Extended Storage facility alternatives under consideration which can accept used fuel from Ontario Power Generation, New Brunswick Power, Hydro-Québec, and Atomic Energy of Canada Limited. The estimates are based on the conceptual designs for the facility alternatives developed during 2002/2003.

The four alternatives are:

- Casks and Vaults in Storage Buildings (CVSB)
- Surface Modular Vaults (SMV)
- Casks and Vaults in Shallow Trenches (CVST)
- Casks in Rock Caverns (CRC)

The estimates include the cost of siting, design and construction of the Centralized Extended Storage facility, and the extended operation of the facility, which would include the periodic replacement of the storage complexes and the repackaging of the fuel bundles into replacement fuel containers.

The cost estimates are for a stand-alone and self-sufficient storage facility, with a capacity to store 3.6 million fuel bundles. The cost estimate excludes the cost of used fuel retrieval from the fuel owners' storage locations, preparation of the fuel for transport and transportation of the fuel bundles to the Centralized Extended Storage facility location. These costs are documented in other reports.

To allow comparison of total costs, the life cycle costs have been compiled for siting, initial construction and operation, and for two major refurbishments and one fuel repackaging event. However the facility would be required to operate indefinitely with periodic refurbishment of the storage facilities and periodic repackaging of the fuel bundles.

Total estimated cost for the four alternatives over a 350-year period (at 2002 constant dollar prices) are:

- CVSB \$12.69 B
- SMV \$16.58 B
- CVST \$15.62 B
- CRC \$14.08 B

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1 Introduction

This report presents the cost estimates for the Centralized Extended Storage (CES) facility alternatives under consideration which can accept used fuel from Ontario Power Generation, New Brunswick Power, Hydro-Québec, and Atomic Energy of Canada Limited.

The estimates are based on CES conceptual designs that only receive CANDU used fuel bundles from OPG, NBP, HQ and AECL, which are detailed in Ref. 1. The design capacity of the CES facility is 3.6 million fuel bundles. The overall inventory comprises fuel received from the four fuel owners in the following approximated percentages:

Ontario Power Generation (OPG)	92%
New Brunswick Power (NBP)	3.4%
Hydro-Québec (HQ)	3.7%
Atomic Energy of Canada Limited (AECL)	0.9%

The majority of the fuel, received from OPG arrives at the CES facility in OPG-design fuel module format, and is stored in storage casks or module canisters. The remainder of the fuel, received from NBP, HQ and AECL is received in AECL-designed baskets. Thus, each conceptual design makes provision for the storage of fuel in both formats.

The four alternatives costed are:

- Casks and Vaults in Storage Buildings (CVSB)
- Surface Modular Vaults (SMV)
- Casks and Vaults in Shallow Trenches (CVST)
- Casks in Rock Caverns (CRC)

The estimates are based on the conceptual designs for the facility alternatives developed during 2002/2003.

The estimates include the cost of siting, design and construction of the CES facility, and the extended operation of the facility, which will include the periodic replacement of the storage complexes and the repackaging of the fuel bundles into replacement fuel containers. The cost estimates are for a stand-alone and self-sufficient storage facility. The cost estimate excludes the cost of used fuel retrieval from the fuel owners' storage locations, preparation of the fuel for transport and transportation of the fuel bundles to the CES facility location. These costs are estimated elsewhere.

To allow comparison of total costs, the life cycle costs have been compiled for siting, initial construction and operation, and for two major refurbishments and one fuel repackaging event. These activities would span a 350-year period. However the facility would be required to operate indefinitely with periodic refurbishment of the storage facilities and periodic repackaging of the fuel bundles.

1.1 PURPOSE OF COST ESTIMATE

The purpose of this report is to document the four alternative estimates for an assumed program to site, develop, and operate a centralized extended storage facility that will accept used fuel from OPG, NBP, HQ and AECL.

The cost estimate data in this report is intended to allow comparisons to be made with cost estimates for reactor-site extended storage, or with geologic disposal in an underground repository, which are the subjects of separate reports.

1.2 STORAGE OF USED FUEL

The used fuel from Canada's power reactors is currently stored by the owners in water-filled pools (wet storage), or concrete structures (dry storage). Most of the fuel is stored at the locations it was produced. The storage locations are shown in Figure 1. Assumed total fuel inventory is presented in Section 3.1 of this report.

Figure 1: Existing Fuel Storage Locations in Canada



1.3 ESTIMATING ASSUMPTIONS

To estimate future costs for a program site, design, construct and operate a facility for the centralized extended storage of used fuel, the following assumptions were made:

Siting Phase

- All CES facility technical development work will be completed by the time a CNSC Construction Licence is obtained.
- The estimate considers costs relating to the implementation of a stand-alone CES facility located on a green field site.
- The estimate assumes the program will be continuous with no hold points and periods of inactivity whilst awaiting say, funding approvals, management reviews or licensing decisions.

Construction Phase

- Detailed final design and the preparation of working drawings for the facility will commence immediately following EA approval and the acquisition of a CNSC Construction Licence.
- The CES facility will be located sufficiently close to centres of population such that a purpose built townsite, local to the facility for construction labour will not be required.

Operation Phase

- The CES facility operations will commence following the construction of the Process Building, ancillary facilities, initial storage complex capacity. Further stages of capacity will be constructed during the Operations Phase.
- The design throughput of the CES facility will be a nominal 120,000 fuel bundles per year. Fuel will be received over a 30-year period.
- All fuel bundles arrive at CES in transportation casks and/or storage casks. The cost of transportation to the CES facility is excluded.
- The CES facility will have all necessary staff and equipment to unload a transportation cask or storage cask from the transport vehicle, conduct radiological surveys, unload nuclear fuel waste from the transportation cask and to prepare the empty transportation cask for the return journey. The cost of these facilities and activities is included in the CES facility estimate.
- During operations all labour will be deemed indigenous and will not receive any allowance for housing.
- The storage containers (storage casks, module canisters or baskets) will be fabricated at an unspecified off-site location(s) and then shipped 500 kms to the CES facility site. The cost of the container will include the cost of transportation to the site.
- Security is required during facility operations. The level of required security would depend on security risk during the various periods of operation; i.e. fuel packaging or repackaging events versus extended monitoring [Note cost of security has been based on the best information at the time the CES estimates were prepared].

General

- All labour, equipment and material costs are inclusive of any profit.
- The estimate is based on CES designs that only receive CANDU used fuel bundles from OPG, NBP, HQ and AECL. The design capacity of the CES facility is 3.6 million fuel bundles.
- The scope of this cost study excludes consideration of non-standard fuels.
- Allowances for property tax and provincial sales tax for the CES facility are included in the cost estimate.
- All costs will reflect the cost of local labour and materials.
- The estimate is prepared and budgeted in current Canadian dollars, base January 2002, and is scheduled in elapsed time.

1.4 LEVEL OF COST ESTIMATION

The CES facility designs and other elements of the program are defined at a conceptual level of detail. Therefore the CES cost estimates are based on incomplete design information, information about technology that is in the early stages of development, and many assumptions about the program and how it will be executed. As a result there is uncertainty associated with various elements of the CES cost estimates. However, as the CES program would develop so the uncertainty in future estimates would be reduced and the accuracy of the estimates increased.

The purpose of contingency is to improve accuracy of a cost estimate by compensating for the inherent inaccuracies due to uncertainties in a program of this size, complexity and duration. The contingency should be large enough to compensate for the maximum range of uncertainty associated with an estimate. Therefore each CES cost estimate will be equal to the sum of all work element estimates and their associated contingencies.

2 Overview of Programs for CES Facility Alternatives

2.1 OVERVIEW

This section provides a high-level description of the work that would be carried out in a work program, irrespective of the CES alternative selected. The following section describes the work scope of each work element at Level 2 of a typical Work Breakdown Structure (WBS). Separate appendices list all the work elements at the lowest level of the WBS and the costs associated with each work element.

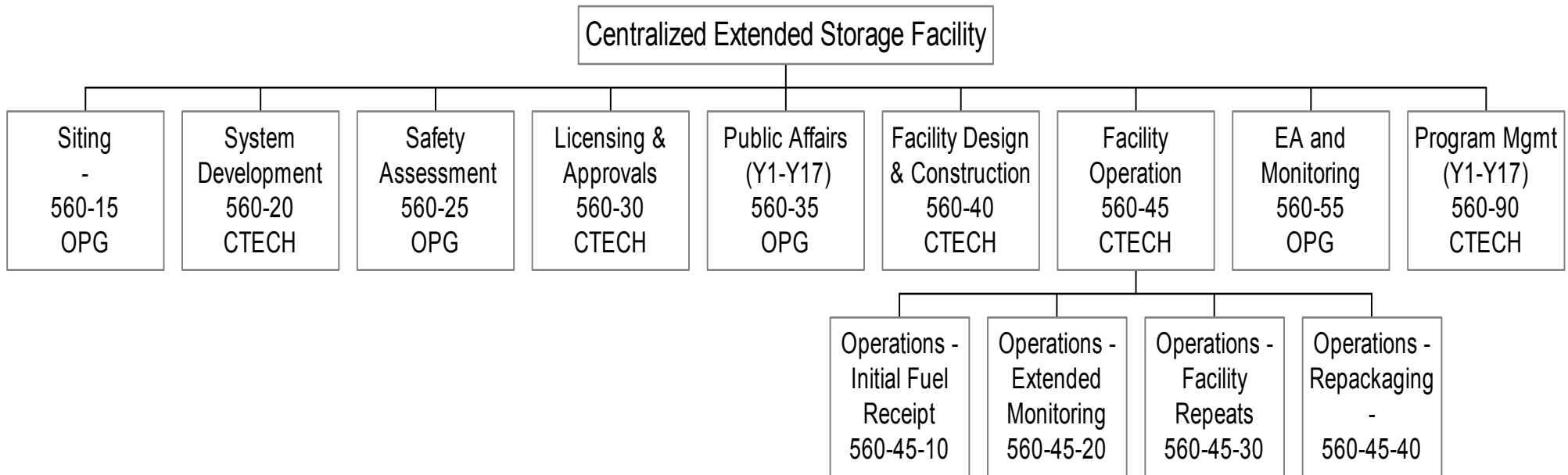
2.2 LEVEL 2 WORK BREAKDOWN STRUCTURE

Figure 2 shows the work elements at Level 2 of the program WBS. There are 9 Level 2 work elements, which cover all the aspects of a program to site, develop and operate a centralized extended storage facility. A generic WBS is shown in Figure 2, and identified by the prefix number 560.

Figure 2: Typical Level 2 Work Breakdown Structure (560)

Centralized Extended Storage Facility Cost Estimate

Work Breakdown Structure, Coding
 and Estimating Responsibilities



560-15 Siting

Siting includes all activities related to planning and implementing of a siting programme for the CES facility. Planning activities include development of a siting strategy, development of a siting process, development of siting criteria and public consultation. Implementation activities include site screening, environmental studies and site investigation at candidate sites and at the preferred site.

560-20 System Development

System development includes all activities related to the optimisation of the conceptual design, and the development of the preliminary designs of the CES facility. The work activities include the preparation of drawings, descriptions, lists of materials, work force requirements, equipment requirements and associated calculations, and the output of these activities will get progressively more detailed as the facility design evolves. It provides design information necessary to support environmental assessments and site licence applications.

Specifically system development includes (where appropriate):

- Container system development work
- Preparation of geo-technical design and specifications
- Preparation of site-dependant designs during the siting process
- System applications including assessment of constructability, development and demonstrations of systems
- Development of performance specifications
- Security and safeguards

System development excludes final design for the CES facility. It also excludes engineering support during the construction and operation phases of the facility.

560-25 Safety Assessment

Safety Assessment includes all activities related to predicting the safety of CES facility and its potential impact. Safety assessments would be carried out through all phases of the development and operation of the CES facility. Safety assessments would have to be completed in support of licence applications.

560-30 Licensing and Approvals

Licensing and Approvals includes interactions with all provincial and federal regulators, preparation and submission of licence applications for siting, construction and operation.

560-35 Public Affairs (Y1-Y17)

Public Affairs work includes the development of a public affairs strategy to support the development and implementation of the public affairs strategy. The public affairs programme is implemented through all phases of development and operation of the facility. A public affairs programme provides information to key-decision makers, stakeholders, potential host communities, media and the general public.

The scope of the public affairs programme would include the following:

- Public involvement programme
- Volunteer/host community programme
- Impact management programme
- Aboriginal affairs programme
- Community information programme
- Socio-economic impact assessment programme
- Government relations programme
- Interest group programme
- Employee programme

560-40 Facility Design and Construction

Facility Design and Construction includes all activities that are required to prepare the detailed final design drawings of the CES facility. The scope of work includes the provision of facilities necessary to receive and store used fuel bundles, but excludes the on-going construction of storage capacity constructed during facility operations.

560-45 Facility Operation

Facility Operations comprises four activities:

- 560-45-10 Operations – Initial Fuel Receipt
- 560-45-20 Operations – Extended Monitoring
- 560-45-30 Operations – Facility Repeats
- 560-45-40 Operations – Repackaging

Initial fuel receipt covers the activities necessary to receive, condition and store fuel at the CES facility.

Extended monitoring covers the long-term management of the stored fuel inventory.

Facility repeats covers the refurbishment or renewal of the storage complex facilities, which periodically reach the end of their service lives. Fuel bundles will be transferred from one storage structure to another, and the time served storage structure demolished (or refurbished) and replacement structures constructed, within the overall 'footprint' of storage complex.

Repackaging covers the periodic removal of fuel bundles from existing storage containers which have reached the end of their service life. Fuel containers are transferred from the storage complex to a repackaging facility, where fuel bundles are transferred from an existing storage container to another.

560-55 Environmental Assessment and Monitoring

This includes the preparation of environmental assessment documents to support application for a Construction Licence and updates to the environmental assessment documents in advance of major refurbishment and repackaging events. Work includes compilation of data, preparation of documents, document printing and attendance at a Hearing.

Environmental monitoring provides the tools and processes for monitoring the environmental performance of the CES facility. The monitoring program would be directed by the CES's Environmental Management System (EMS) and the EMS would ensure that the implementing organisation's environmental policy is managed, implemented, checked and periodically reviewed within the overall context of continual improvement. It would provide both the process, and assurance, to ensure that the policy is improving the environmental performance of the DGR facility, while also demonstrating management's due diligence with respect to managing the corporation's environmental impacts.

For the purpose of the CES cost estimate it shall be assumed that the EMS is based on ISO 14001. ISO 14001 describes a system based on continual improvement in the following five key areas: environmental policy; planning; implementation and operation; checking and corrective actions; and management review.

The EMS would require monitoring and continually improving environmental performance. The EMS would encompass all environmental aspects of the CES facility including monitoring of radiological and non-radiological emissions to:

- Air
- Surface water and groundwater
- Soil
- Flora and Fauna
- Produce

The program would also include on-going monitoring of human health of the population in the vicinity of the CES.

It is assumed that the implementing organisation's staff will manage and co-ordinate the overall EMS program. However a specialised consultant will prepare the EMS plan. Specialised consultants will also carry out the collection, analyses and reporting of all data.

The scope of environmental monitoring is restricted to monitoring the potential environmental impacts due to the day-to-day operations of the CES facility. The scope of this work element excludes monitoring of the storage container and storage structure performance (included in 560-45).

560-90 Program Management (Y1-Y17)

Program Management includes senior-level staff direction to the programme as well as project management, financial and business support for the program. Program management will be provided by the implementation organisation. Corporate overheads, insurance costs, human resource services throughout the programme are also included.

Project management for the facility design and construction will be provided through the Architect Engineer.

Individual WBS for each CES facility alternative has been included in the Appendix specific to the alternative.

The following prefixes have been used for the alternative specific WBS.

561	CVSB Casks and Vaults in Storage Buildings
562	SMV Surface Modular Vaults
563	CVST Casks and Vaults in Shallow Trenches
564	CRC Casks in Rock Caverns

3 Descriptions of CES Facility Alternatives

3.1 GENERAL

The CES facility is envisaged as a self-contained, stand-alone facility, located in a greenfield site. The site is linked to the highway network by a purpose built spur road. There are no rail transport links with the CES facility. Fuel is shipped to the CES facility from the reactor sites. The CES facility has to accept fuel received in differing formats from the fuel owners. A breakdown of the fuel inventory is provided below.

Each CES facility alternative is briefly described in the following sections. Fuller descriptions of the receipt, fuel storage, facility repeats and repackaging events are given in Ref. 1.

3.2 DESCRIPTION OF USED FUEL INVENTORY

The cost estimates are based on the conceptual designs which assume the facility is self-contained, with a capacity to accept 3.6 million used fuel bundles. Each of the CES facility alternatives comprises a used fuel receipt and processing facility, and a fuel container storage complex.

Table 1 summarises the assumed used fuel bundle inventory that each waste owner would ship to the CES facility.

Table 1: Assumed Used Fuel Bundle Inventory for Centralized Extended Storage Facility

Waste Owner	Used Fuel Bundles	Percentage of Total (%)
OPG	3,274,431	92.045
NBP	119,500	3.359
HQ	132,838	3.734
AECL	30,682	0.862
Total	3,557,451	100

3.3 CVSB FACILITY ALTERNATIVE

The Casks and Vaults in Storage Buildings (CVSB) alternative comprises the storage of fuel bundles in one of two storage methods, either modules confined in self shielded storage casks, or fuel baskets confined in an array of concrete vaults. The storage casks and vaults are arranged within a series of independent storage buildings (Figure 3). Packages of fuel bundles are transferred from individual reactor sites to a central storage location via either the storage cask transportation mode, module transportation cask mode or the basket transportation cask mode.

Storage casks arriving at the CES facility are inspected on arrival. The storage casks are then directed to the relevant dedicated storage building.

Fuel bundles arriving in modules are transferred into storage casks in the shielded cell and then after storage cask processing, the storage casks are transferred to the relevant dedicated storage building.

Fuel that arrives in baskets is transferred to the CES facility in the basket transportation cask, designed to accommodate 3 baskets. The basket transportation cask is unloaded into the shielded cell and then the baskets are loaded individually into a transfer flask at the shielded cell, the transfer flask then delivers the basket to the dedicated vault in the relevant storage building.

Basket emplacement within the vaults is achieved using the transfer flask, this will be transferred to the duty vault building using a transfer bogie and the transfer flask will then be raised onto the storage vault using the vault building crane.

3.4 SMV FACILITY ALTERNATIVE

The Surface Modular Vault (SMV) alternative comprises the storage of fuel bundles confined in either baskets or module canisters and placed into an array of tubes in a series of engineered vaults within the storage buildings (Figure 4). The fuel baskets or module canisters are placed in a series of vertical storage tubes within the vault, which ensures that they are correctly aligned and remain in place. The upper end of each storage tube is closed off with a closure shield plug unit. The fuel within the storage tubes is cooled by natural ventilation flow around and through the storage tube array. The modular vaults within a storage building are serviced by a common canister handling machine (CHM), which provides coverage to each array of storage tubes across a shielded charge hall floor. The CHM can engage with each tube in the array, remove the closure plug, and lower fuel baskets and module canisters into the storage tube. The storage buildings are linked together by an access corridor below the charge face level for transporting fuel baskets and module canisters to the buildings. Local to each storage tube array are a series of receipt ports, accessible to the CHM, which link with the access corridor below. Individual module canisters are hoisted into the charge machine, through the appropriate receipt port. The fuel is transferred from reactor sites to the CES either via the module transportation cask or the basket transportation cask. No storage casks (DSCs) are received at this facility.

Four fuel modules are loaded into a module canister within the module transfer cell in the processing building. The loaded module canisters are then transferred and welded in the welding area, before being discharged into the module canister transfer flask, on module cell bogie. The module canister transfer flask is then transferred to the load/unload port below surface modular vault charge machine.

3.5 CVST FACILITY ALTERNATIVE

The Casks and Vaults in Shallow Trenches (CVST) alternative comprises the storage of fuel modules confined in self shielded casks, or fuel baskets confined in concrete vaults. The casks and vaults are housed in a series of parallel, modular chambers with concrete floors, walls and roofs constructed in a shallow trench and mounded over with earth cover (Figure 5). The chambers are interconnected at both ends with corridors to form a complex accessible by a ramp from ground level. The earth covers provides weather protection for the concrete chambers and added physical protection. The earth cover also lessens the visual impact of the

storage complex. The earthen cover applied over the roof is designed to protect the chamber structures against freeze/thaw and wetting and drying cycles, divert surface water, limit water infiltration, resist weathering, erosion and burrowing animals.

Packages of fuel bundles are transferred from individual reactor sites to the CES via either the storage cask transportation mode, module transportation cask mode and basket transportation cask mode. Storage casks arriving at the CES facility are inspected on arrival, then directed to the dedicated storage chamber. Fuel bundles arriving in modules are transferred into storage casks in the shielded cell and after cask processing the storage casks are then transferred to the storage chamber, where they are stacked 2 high. The cask transporter positions the casks on the lower tier within the appropriate storage chamber. The chamber crane facilitates the final movement of the cask, from the transfer position to the cask storage position, on the upper tier.

Fuel arriving in baskets is transferred from the transportation cask to a transfer flask at the shielded cell. A 30 tonne gantry crane is used to pick up the transfer flask and place it on top of the vault for transfer of the baskets to the storage tubes in the vault

3.6 CRC FACILITY ALTERNATIVE

The Casks in Rock Cavern (CRC) alternative comprises the storage of fuel bundles confined in self shielded storage casks. The casks are stored in underground caverns excavated from competent bedrock. There are two storage cask designs, a module cask and a basket cask. The storage casks are arranged within a series of separate storage caverns that are accessed from the processing building on the surface by an access ramp (Figure 6).

The storage caverns are constructed in competent bedrock at a nominal depth of 50 meters. This depth of store construction provides a high degree of physical protection and stability. The fuel is transferred from reactor sites to the CES facility via either the storage cask transportation mode, the module transportation cask mode or the basket transportation cask mode. Following receipt at the CES facility, existing storage casks are checked on arrival, and are then transferred to the appropriate dedicated storage cavern using the cask transporter. Fuel modules or baskets are received and placed into the relevant storage casks in the shielded cell within the Processing Building. The casks are sealed, checked and are then transferred, using the cask transporter, to the pre-determined underground storage cavern, where they are stacked 2 high.

The cask transporter positions the casks on the lower tier within the appropriate storage cavern. The cavern crane facilitates the final movement of the cask, from the transfer position to the cask storage position, on the upper tier.

3.7 AUXILIARY SURFACE FACILITIES

The CES design report (Ref. 1) provides a detailed description of the surface facilities, which are required, irrespective of the CES alternative under consideration.

These include the following:

- Administration and Visitors Building
- Operations Support, Health Physics and Test Facility Building
- Equipment Storage and Maintenance Building
- Storage Cask/Module Canister Store*

- Active-Solid Waste Handling Building
- Active-Solid Waste Storage Building
- Active-Liquid Waste Treatment Building
- Active-Liquid Waste Storage Building
- General Warehouse
- Guardhouse and Perimeter Security System
- Truck Inspection/Wash Facility
- Utility Building

*building description tailored to alternative under consideration.

In addition, a number of systems, features and areas are provided to support site activities.

- Fire Protection Systems
- Security and Communication Systems
- Electrical and Emergency Power
- Sanitary Sewer System
- Potable Water System
- Retention/Sedimentation Pond
- Storm Water Pond
- Batch Plant and Construction Materials Storage Area
- Site Materials Storage Area
- Access Roads and Vehicle Compounds

The costs for the establishment and maintenance of these facilities have been included in the detailed cost estimates.

Figure 3: Site Plan CVSB Facility

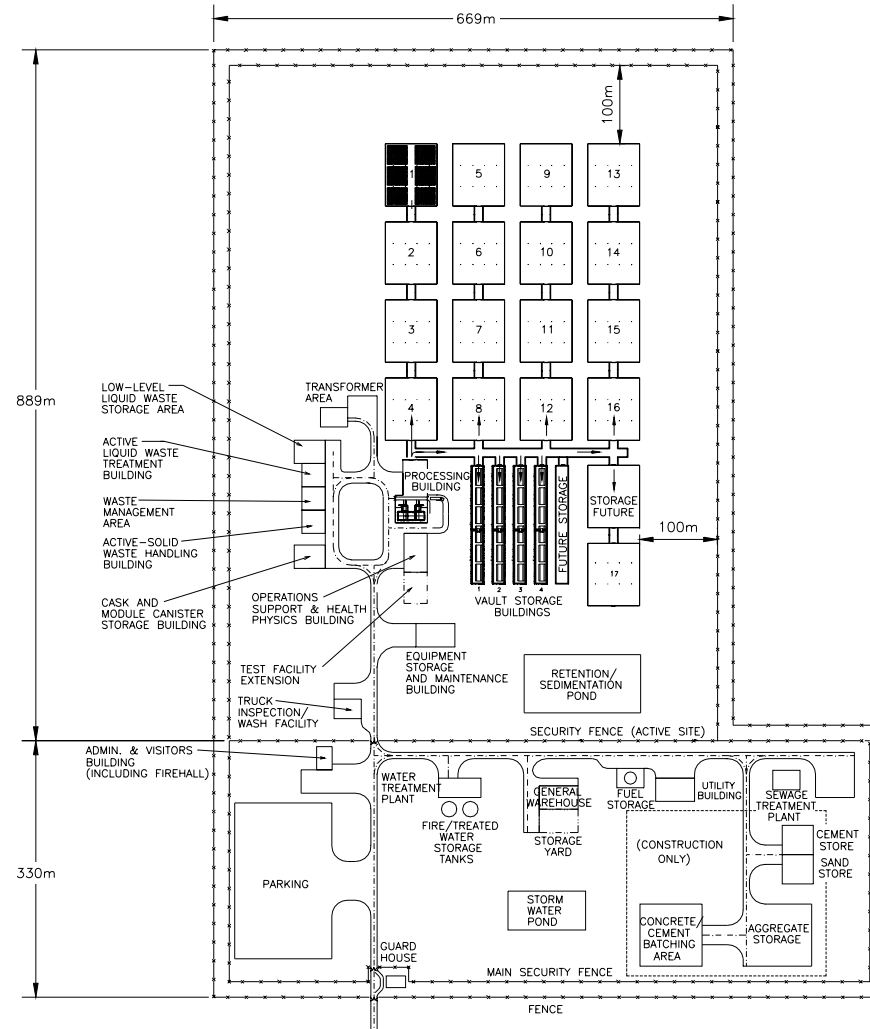


Figure 4: Site Plan SMV Facility

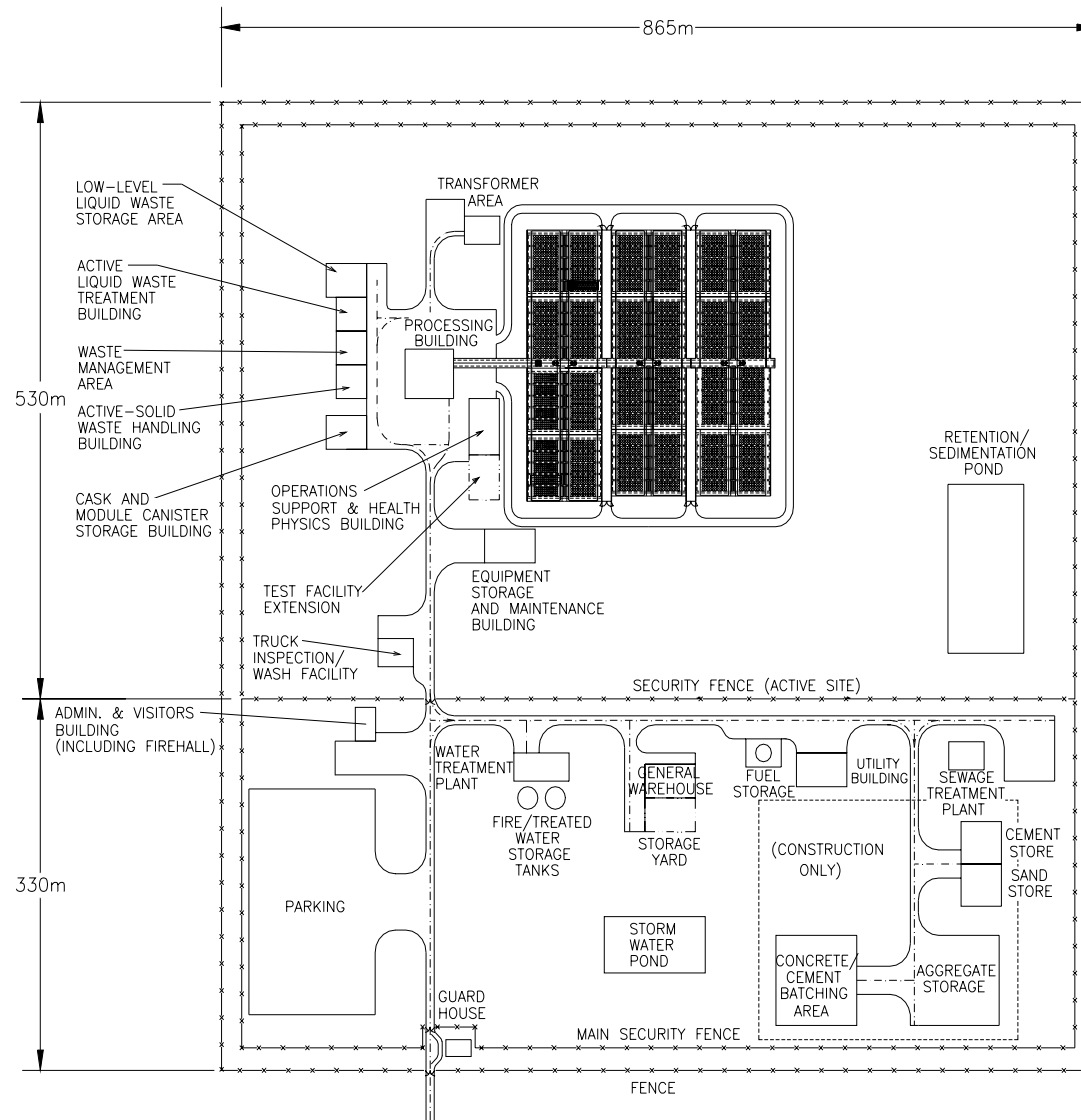


Figure 5: Site Plan CVST Facility

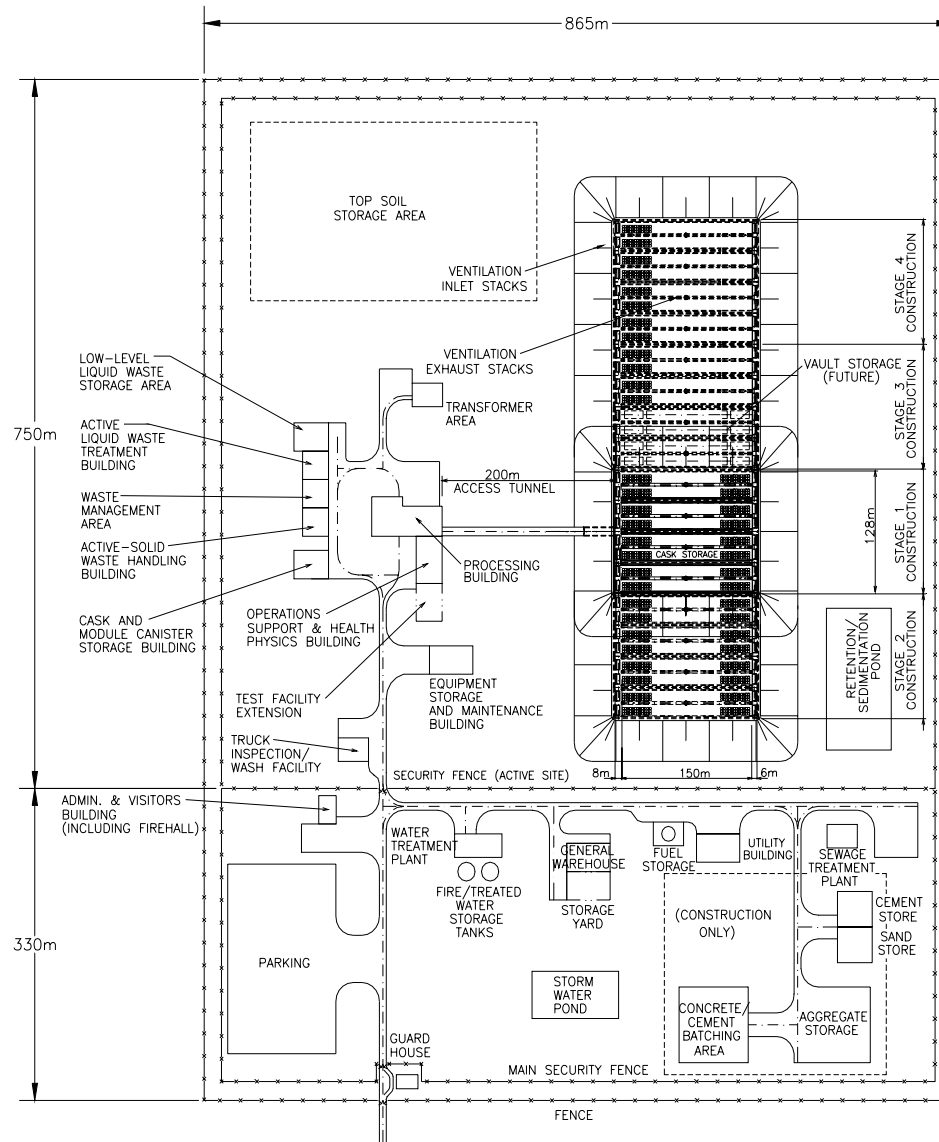
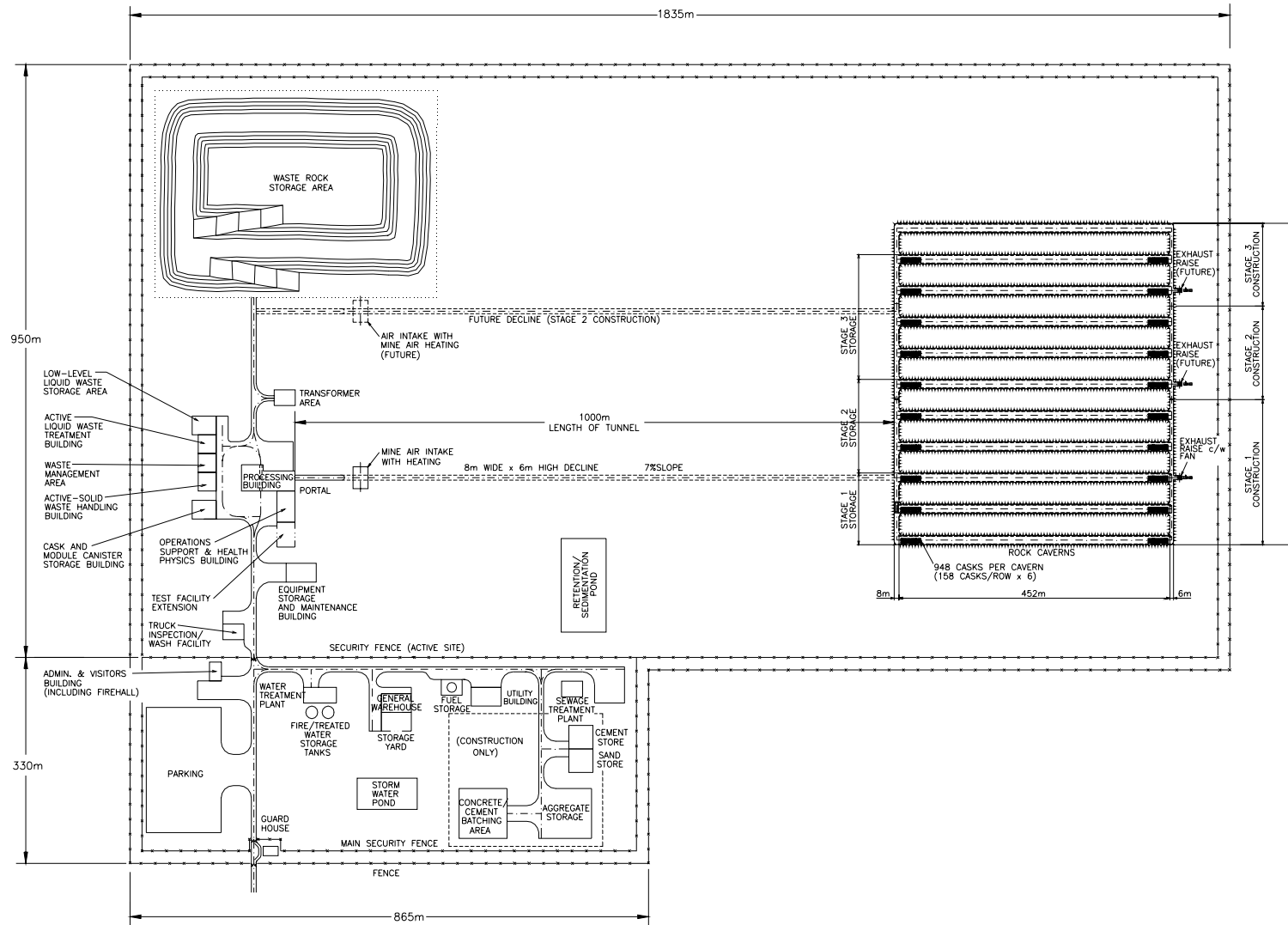


Figure 6: Site Plan CRC Facility



4 Schedule Estimates

4.1 OVERVIEW

The cost estimates for the four CES facility alternatives have been phased in accordance with schedules developed for each facility alternative. For the purposes of comparison, each schedule is developed over 347 years. This represents the cumulative time for the establishment of the site, the receipt of fuel and the timeframe for the extended storage and monitoring of the longest lived fuel containers employed by the alternative. Given the lesser service lives of some fuel container types, the schedule identifies time periods when repackaging events (for storage casks) have been scheduled, within the extended monitoring timeframe. Future lifecycles for the CES facility will not require inclusion of the siting (17 years) and initial fuel receipt (30 years) durations, and will therefore progress over a 300 year cycle duration.

4.1.1 CVSB

The CVSB schedule (Figure 7) includes intermediate facility repeat and repackaging events, when storage casks will be removed from time served storage buildings. Fuel in module format will be transferred to new storage casks. These new storage casks will be transferred to new storage buildings. Similarly, baskets will be removed from existing storage buildings and transferred to new storage buildings, at the end of the vault service lives. Periodically, as modules and baskets reach the end of the service lives, fuel will be transferred into replacement modules and baskets, before being returned to replacement storage buildings and vault structures.

4.1.2 SMV

The SMV schedule (Figure 8) includes intermediate facility repeat and repackaging events, when module canisters will be removed from time served modular vault building. Module canisters will be transferred to a new modular vault building. Similarly, baskets will be removed from an existing modular vault building will be transferred to a new modular vault building, at the end of the modular vault service life. Periodically, as modules and baskets reach the end of the service lives, fuel will be transferred into replacement modules and baskets, before being returned to replacement modular vault buildings within the complex.

4.1.3 CVST

The CVST schedule (Figure 9) includes intermediate facility repeat and repackaging events, when time served storage casks will be removed from storage trenches. Fuel in module format will be transferred to new storage casks. These new storage casks will be transferred to new storage trenches. Similarly, baskets will be removed from vault structures within existing storage trenches and transferred to new vault structures within storage trenches, at the end of the vault service lives. Periodically, as modules and baskets reach the end of the service lives, fuel will be transferred into replacement modules and baskets, before being returned to replacement storage trenches and vault structures.

4.1.4 CRC

The CRC schedule (Figure 10) includes intermediate facility repeat and repackaging events, when time served storage casks will be removed from storage caverns. Fuel in module format will be transferred to new storage casks. These new storage casks will be returned to existing storage caverns. Similarly, baskets casks will be removed from existing storage caverns, the baskets transferred to replacement basket casks and returned to existing storage caverns. Periodically, as modules and baskets reach the end of the service lives, fuel will be transferred into replacement modules and baskets, encapsulated into replacement storage casks, before being returned to refurbished storage caverns.

4.2 SITING PHASE

The Siting Phase covers the time period in which a suitable location for a CES facility is being sought. The Siting Phase begins after a formal decision is made to begin the process of finding a suitable site and would end when regulatory approval is received to construct the facility (i.e. assumed to be Y1 to Y13). Activities carried out in the Siting Phase include development of a siting process and site screening criteria, site screening, site evaluations (surface-based and underground-based), preparation of safety assessment and environmental impact assessment documents, participation in public hearings and preparation of licence applications.

The approach involves the use of “desk-top” technical feasibility studies during the early stages of siting Y4 to Y5. Then surface-based characterisation work, including subsurface exploration by borehole drilling, is carried out on two candidate sites in volunteer host communities Y9 to Y10 and a preferred candidate site is selected Y10. It is assumed that the preferred candidate site will be acceptable for extended storage and there are no significant delays.

The construction licensing and Environmental Assessment (EA) approvals process is assumed to proceed without any significant delays from Y11 to Y13 and that a construction licence will be granted at the start of Y14.

4.3 CONSTRUCTION PHASE

The Construction Phase is the period (Y14 to Y17) in the life cycle of the Extended Storage facility when the functional surface and underground facilities (if required by the alternative under consideration), and infrastructure are created for the purpose of used fuel storage. This phase begins with the receipt of regulatory (CNSC) approval to begin construction and ends when the “cold” and “hot” commissioning of the facilities are completed prior to receiving the first formal shipment of waste for storage operations. Note that construction, as an activity, will continue during the subsequent Operations Phase of the facility. Construction includes clearing of land, surface and/or underground excavation, construction of Processing Building and ancillary facilities, and construction of the first stage of the storage complex.

4.4 OPERATION PHASE

The Operation Phase is when the fuel is placed into the storage facility and the facility is monitored in perpetuity. Initial fuel receipts are assumed to occur over the 30-year period, Y18 to Y47. Following fuel receipts the facility enters into an indefinite period of extended

monitoring. Activities during this period include routine monitoring of fuel, and intermittent periods of increased activity, when fuel storage facilities will be replaced or refurbished, and fuel storage containers are periodically repackaged.

4.4.1 Operations - Initial Fuel Receipt

The initial fuel receipt is the period (Y18 to Y47) in the life cycle of the CES facility when fuel is received onto the CES site, and conveyed to the storage complex. Fuel will arrive in existing storage casks, or be conveyed in transportation casks containing modules or baskets. Depending on the CES alternative under consideration, some fuel will require conversion in a processing building into a format appropriate for long term storage. During the initial fuel receipt phase, additional fuel storage capacity will be constructed, expanding the storage complex capacity in a staged manner.

4.4.2 Operations – Extended Monitoring

Extended monitoring is the period in the life cycle of the CES facility when fuel and storage structures are monitored on a regular basis. The extended monitoring period effectively commences at the end of initial fuel receipts and continues indefinitely. During this period there periodic facility repeats and repackaging events.

4.4.3 Operations – Facility Repeats

The facility repeat events occur periodically given that the storage facilities and principal containment structures have a finite life span. Thus it will be necessary to move fuel baskets, module canisters and storage casks from an ageing storage complex to new facilities. Depending on the alternative under consideration, this may be achieved by the staged building of additional storage capacity on the site, permitting the transfer of fuel containers from one storage location to another. Once the used fuel has been transferred and the storage unit has been emptied, the redundant building will be demolished, and a replacement unit constructed. The facility repeat event for each alternative is assumed to comprise a 30 year duration.

4.4.4 Operations – Repackaging

Depending on the requirements of the alternative, the used fuel repackaging facility will perform functions relevant to the specific alternative under consideration. It is assumed that the repackaging facility will comprise a shielded cell complex, housed within a large building, configured to perform the activities required by the repackaging event.

There are two repackaging events which require consideration. One event, based on a 100 year service life of the storage casks (applicable to CVSB, CVST, and CRC alternatives), requires the removal of modules (or in the case of CRC) removal of baskets containing fuel from existing storage casks, and repackaging in fresh storage casks. The other repackaging event, occurring every 300 years based on the assumed service life of modules, module canisters and baskets requires the removal and transfer of fuel bundles to fresh modules, module canisters and baskets as required.

The shielded cell complex configured for the 300 year repackaging event is capable of allowing the opening of the storage casks, withdrawal of the modules and withdrawal of fuel bundles from the modules. The fuel bundles are transferred to 'fresh' modules, which are then be loaded into

a new storage cask. In the CRC alternative, a similar shielded cell is configured to accept the taller basket storage cask, and permit the removal of fuel baskets stored within.

The shielded cell complex permits the opening of seal welded baskets and the withdrawal of the fuel bundles within. The fuel bundles are inserted into 'fresh baskets', and the basket assembly seal welded.

For the SMV alternative, the shielded cell complex has the capability to open module canisters, withdraw the existing modules, transfer fuel to 'fresh' modules, and encase these modules in a new welded canister. The repackaging event for each alternative is assumed to comprise a 30 year duration.

Figure 7: Schedule for CVSB Facility

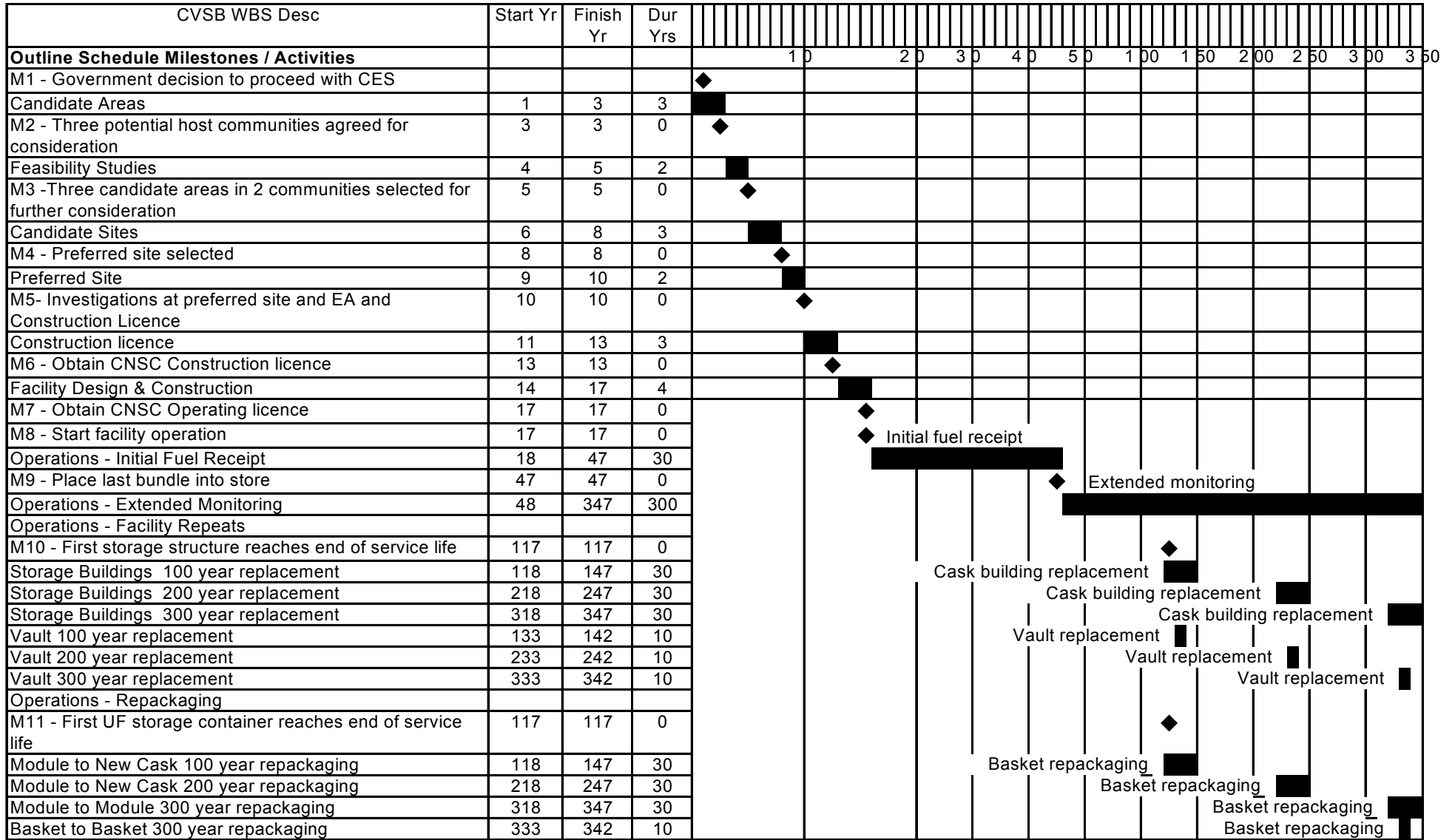


Figure 8: Schedule for SMV Facility

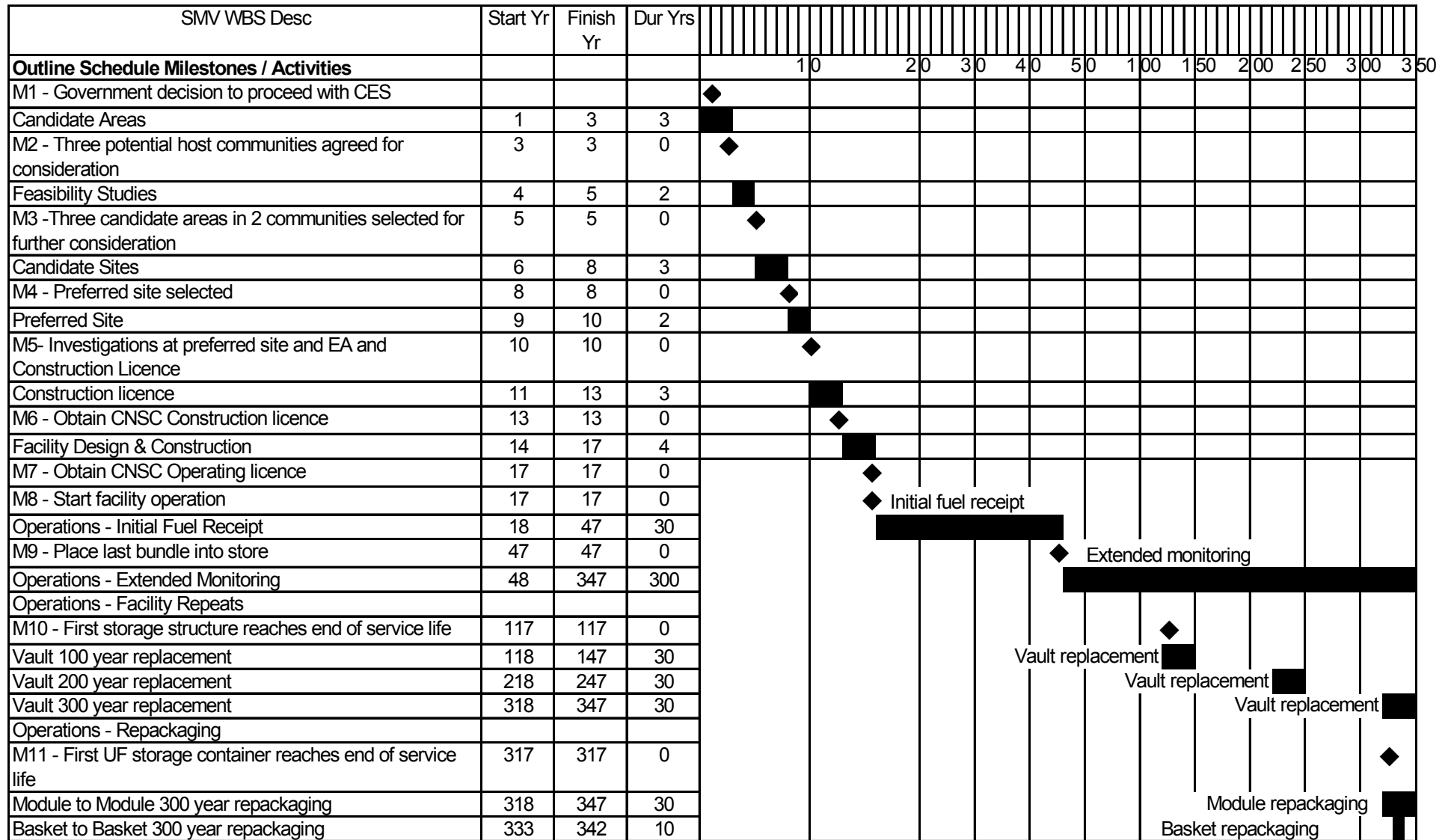


Figure 9: Schedule for CVST Facility

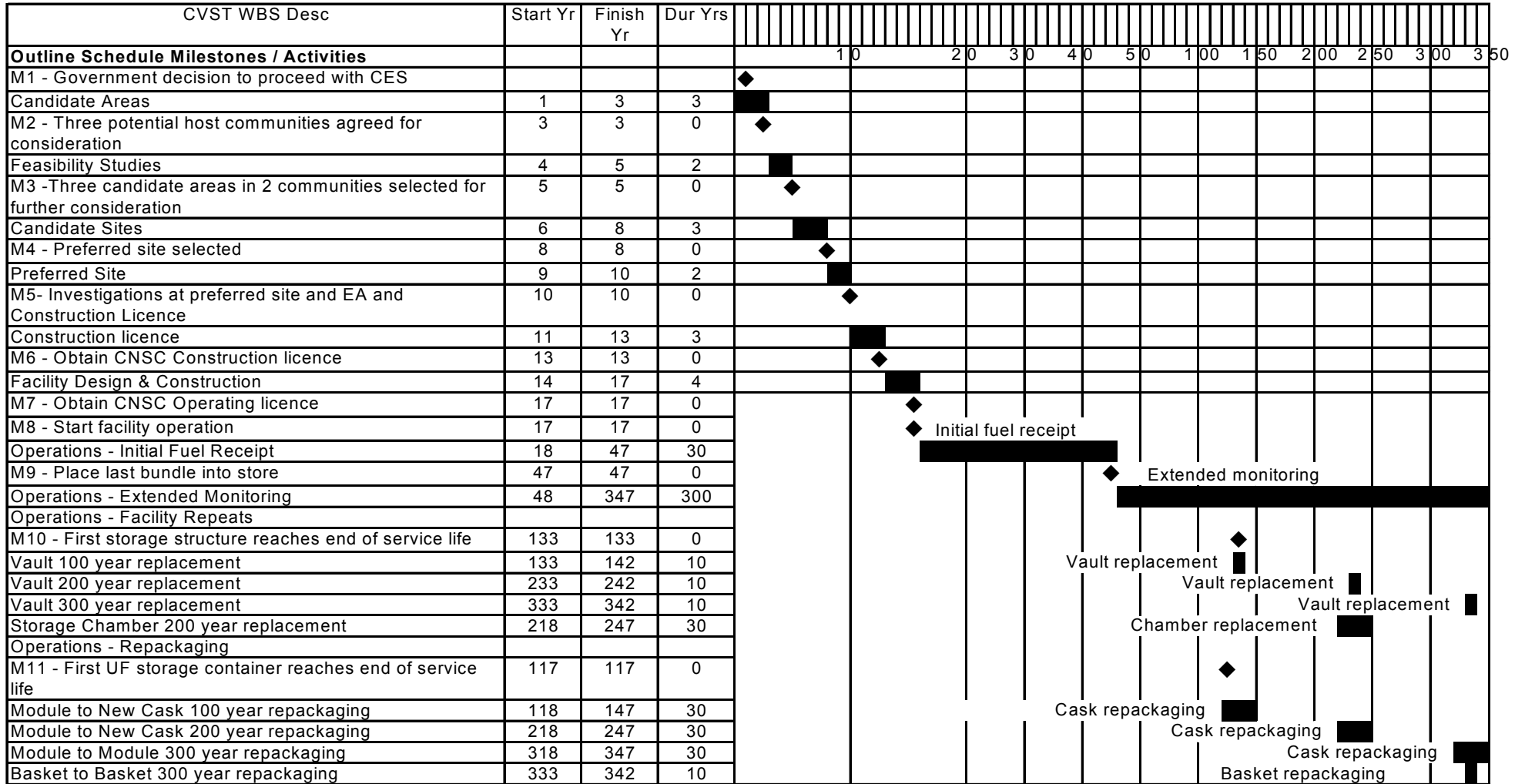
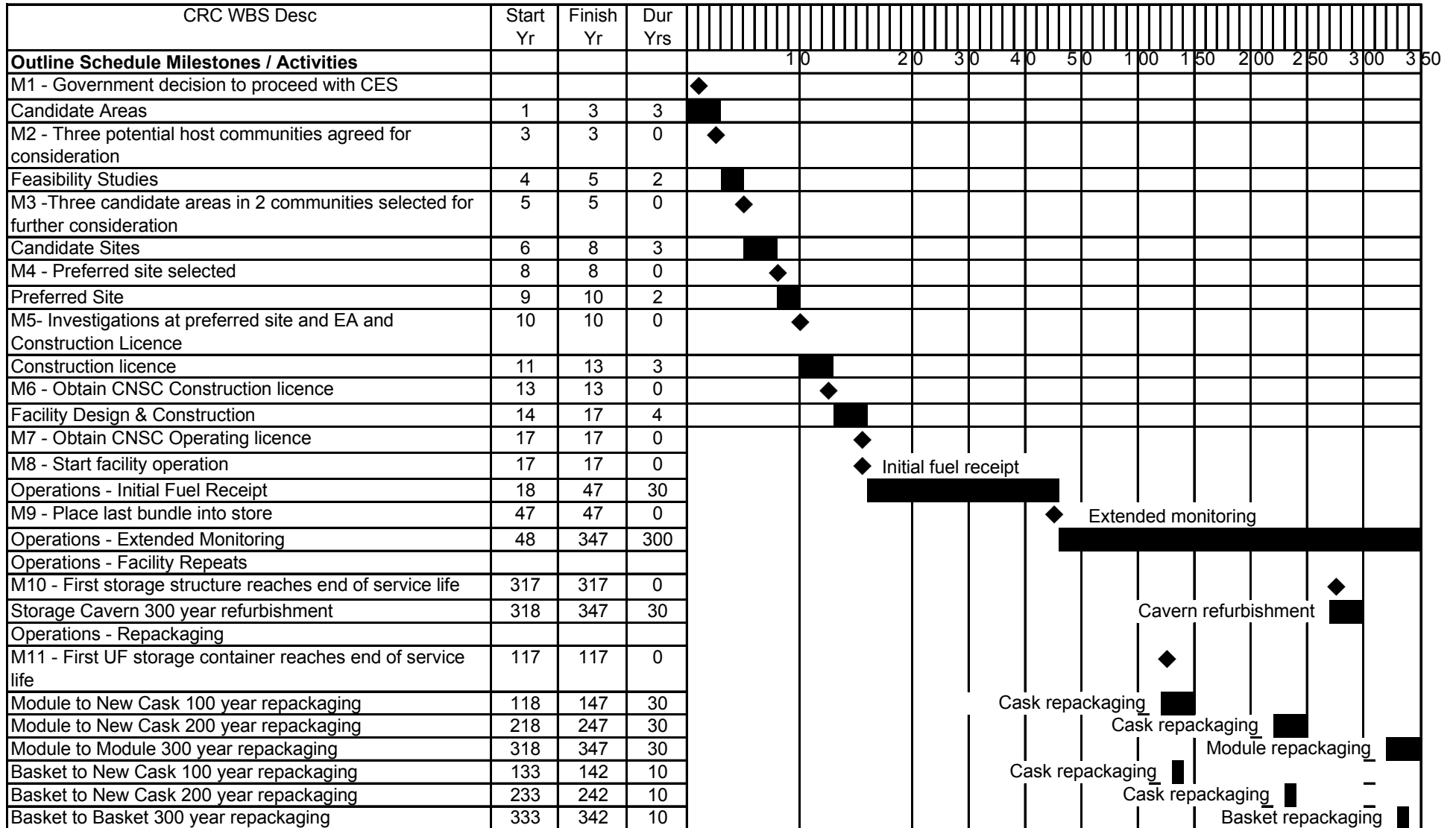


Figure 10: Schedule for CRC Facility



5 Cost Estimate

5.1 BASIS OF ESTIMATE

The cost estimates are based on the processes and activities considered necessary to establish and operate a centralized extended storage facility in Ontario.

Each of the four conceptual designs is required to store used fuel from all the fuel owners, and must be capable of accommodating and storing fuel delivered in different formats. A separate cost estimate has therefore been established for each CES alternative, (CVSB, SMV, CVST and CRC).

Each cost estimate assumes that the storage inventory of 3.6 million fuel bundles are accumulated over a 30 year period. Used fuel is to be stored at the CES facility indefinitely. To allow comparisons to be made between the facility alternatives, the estimates have been formulated over an extended period of time to capture costs associated with facility repeats and repackaging events. Beyond the initial fuel receipt period (30 years), each estimate covers the activities considered necessary to maintain the facility over a 300-year cycle, including a number of facility repeats and repackaging events as necessary. This 300 year cycle is defined by the service life of the fuel containers, such as casks, baskets and module canisters. This 300-year cycle of operational activities would be repeated indefinitely for each alternative.

Recognising that continued operation and periodic renewal will be required to maintain the integrity of the CES facility, a source of funding needs to be established. It is assumed that a fund will be established by the fuel owners, which through annual growth, will generate sufficient funds to bankroll all activities necessary to manage the facility. It should be noted that yearly expenditure at the CES facility is unlikely to be uniform, being strongly influenced by the site activities in progress. Periods of extended monitoring, for example, will require a smaller workforce than that required during initial fuel receipt, and periodic increases in the workforce will also be required during facility repeats and repackaging events. Such events will also require expenditure on replacement fuel containers and storage structures. Nevertheless, through the establishment of a fund, it will be possible to fund the activities during later years within the 300 year cycle, and prime the fund to cover expenditure throughout subsequent estimate cycles.

5.2 METHODOLOGY

The structure for the cost estimates has been prepared by the development of the Work Breakdown Structures (WBS) for each alternative cost estimate (refer Figure 2, for typical WBS). Each element on the WBS has been broken down to the most appropriate level, to describe activities with sufficient accuracy for cost estimating purposes. The developed WBS is included in the Appendix pertinent to each alternative. The developed cost estimate work elements have also been phased to years, to represent the timing within the cost estimate cycle, when these activities are scheduled.

The scope of work is described in a series of Work Element Definition (WED) sheets which include scope and cost information. The WED sheet is the output from a bespoke Microsoft

Access database, which stores text and numerical details which comprise all the elements of the cost estimate. This includes information on the estimated costs, the calculated contingency, cost categorisation, and the phasing to years for that cost element. The database extracts information from both forms, for presentation in the WED format. The WEDs for each alternative are presented in Appendices B to E respectively, and are available on the CD presented in Appendix F. In addition, the Detailed Entry Transfer Sheets (DETS), (which contain much of the estimate detail) are included on the CD, for information.

It should be noted that the Access database rounds all figures to integers on entry, to ensure that the processing of cost information is carried out efficiently. This means that there is a slight difference in overall figures obtained by summarising the DETS information, compared with the output from the Access database. The figures generated by the Access database should be considered as the definitive costs.

Much of the cost estimating information for the processing of storage casks, construction of surface storage buildings and the management of casks and vaults have been provided by the fuel owners. The construction of concrete chambers and rock caverns are considered conventional from a civils and mining engineering perspective.

5.3 COST CATEGORIES

This section describes the four major cost categories that have been used in the cost estimate for each work element – namely labour, equipment and material, other and contingency.

Labour cost is generally considered as salary costs plus labour burden and employee benefit. The labour cost may also include overheads, depending on the organisations involved in the project.

The labour resources used within the CES conceptual estimates have been rationalised and a selection of composite resources have been identified for each of the organisations involved. A composite resource rate is a term used to describe a rate that accommodates a range of grades and job descriptions and takes account of the likely percentage composition of the range to reflect the hierarchy within the range. For example a composite administration rate may account for, say; 1 administration manager, 10 senior clerical grades and 10 junior clerical grades, the gross hourly rate is then divided by 21 persons to obtain an average composite rate.

Labour rates categories for four organisations have been employed throughout the CES estimates. These are summarised as:

- Nuclear Waste Management Organisation (NWMO)
- Purchased Service
- Architect Engineer
- Design and Build Contractor

NWMO Labour Rates

The composite labour rates used when estimating the work performed by the Nuclear Waste Management Organisation (NWMO) staff are based on established OPG estimating rates and include the base pay, payroll burdens, SAVH and an allowance for training. No overhead costs are included in these rates. Overhead costs are estimated separately. No allowances for overtime-premium costs are incorporated.

Purchased Service Labour Rates

The Purchased Service labour rates used when estimating the work performed by purchased service staff. The rates include the base pay, payroll burdens, SAVH and an allowance for professional development. The rates also cover overhead costs and profit. Overhead costs relate to general business operation and maintenance, including the cost of office accommodation, furnishings and equipment, and various sundry costs.

Architect Engineer Labour Rates

The rate for the office based Architect Engineer has been taken as being similar to the Purchased services labour rate, the overheads ratio will be similar based on durations of contracts. The rate for the site based Architect Engineer assumes personal accommodation, office facilities and messing are provided by the site, therefore a significant element of normal overheads has been deducted.

The rates include for wages, reduced company overheads, profit, and allowances for travel expenses, transport costs, travel time, and enhancement for working away from home. The rates are also applicable for Architect Engineers when undertaking non-site based activities.

Design and Build Contractor Labour Rates

Composite rates for Office based design and engineering/project management duties, (similar to the Purchased Services labour rate), The overhead costs for Home office D&B Contractors are included in the established rates. Composite rates for site engineering, project management and trades assume site provision of personal accommodation, office facilities and messing, therefore a significant element of normal overheads have been deducted. The rates include for wages, reduced company overheads, profit, and allowances for travel expenses, transport costs, travel time, and enhancement for working away from home.

Material and Equipment cost is the cost of acquiring materials for building construction and permanent equipment. The latter could include equipment used during operations, flasks, transporters, overhead cranes and similar. Material and equipment costs exclude the cost of installation.

Other costs include items such as consumables (fuel, utilities and non-permanent materials), permits and fees, taxes, communications costs, furniture, temporary monitoring equipment, and travel and accommodation expenses.

Contingency cost is included to improve the accuracy of a cost estimates to compensate for the inherent inaccuracies due to uncertainties in the CES program. The contingency should be large enough to compensate for the maximum range of inaccuracy associated with each estimate. The CES cost estimates are equal to the sum of all work element estimates and their associated contingencies.

The CES conceptual cost estimates have been based on incomplete design information, information about technology that is in the early stages of development, and many assumptions about the program and how it will be executed. As a result there will be uncertainty associated with various elements of the CES cost estimates. However, as the CES program develops, so the uncertainty in future estimates will be reduced and the accuracy of the estimates increased.

Contingency has been assigned to the estimate by work element at the lowest level of the Work Breakdown Structure (WBS). This approach highlights any activities in the estimate subject to significant risk or estimating error, and enables future work to be more focused.

The CES estimate has been compiled by a number of estimators and therefore guidance was required to ensure that levels of contingency are applied in a consistent manner.

For a project at the conceptual stage of design and development, the reference materials indicate a minimum level of contingency in the 30% to 40% range. However, because contingency has been applied to individually estimated activities, which have varying degrees of design status, on occasion manufacturers substantiated prices have been available, in certain instances, the chosen lower range of 15% has been applied. Additionally assumptions have been assigned to activities and used to mitigate specific risks and uncertainties.

The levels of contingency for the activity being costed are identified below:

- | | | |
|---------------|------|-----------------------------------|
| • LOW | 15% | (Minimum for conceptual estimate) |
| • MEDIUM LOW | 20% | |
| • MEDIUM | 25% | |
| • MEDIUM HIGH | 30% | |
| • HIGH | 40% | |
| • EXTRA HIGH | 50%+ | |

To ensure that the application of the contingency level was consistently applied, a common set of subjective criteria have been used by the estimators. The level of contingency chosen was deemed sufficient to mitigate against uncertainties due to one or more of the following factors:

- Level and quality of design or activity definition
- Accuracy of quantities and specifications
- Definition of scope and deliverables
- Quality and reliability of the cost data
- Previous experience through benchmarking
- Mitigation of risk and uncertainty through generic / specific project assumptions
- Complexity of activity, conventional >>>State of the Art (SOTA)
- Probability of schedule overrun (Particularly effect on activity labour element)
- Traditional accuracy/uncertainty of type of activity
- Estimating method
- Others to be specified by the estimator

The above criteria have not been applicable to all CES work elements, but have been used as an aid in deciding on and justifying the level of contingency suitable for a particular element. Reasons for the level of contingency have been applied in the WEDS form under "Contingency Basis", citing which criteria and other factors that were applicable.

Additionally allowances have been included within the estimates to accommodate unquantifiable items, special risks and uncertainties.

In these instances, the estimates have identified the reasons for the allowances. For consistency, contingency has normally been added to allowances.

5.4 ASSUMPTIONS

The major high level assumptions are listed in Section 1.3. More detailed assumptions regarding each facility alternative are presented on the Work Element Definition sheets (WEDS) in Appendices B to E respectively.

5.5 SUMMARY OF COST ESTIMATES

The detailed cost estimates for the siting, construction, and extended operation of the four CES facility alternatives are presented in Appendices B to E respectively.

The total cost of each facility alternative than can accept 3.6 million fuel bundles is approximately \$12.69 B for CVSB, \$16.58 B for SMV, \$15.62 B for CVST and \$14.08 B for CRC respectively.

Tables 2 and 3 presents the cost estimate for each CES facility alternative by major work element and development phase, respectively. Table 4 summarises the cost estimates by category (Labour, Material and Equipment, Other and Contingency). More detailed cost data is presented in the appendices.

Table 2: Costs for Centralized Extended Storage Facilities by Level 2 Work Element

WBS	Description	Cost (2002K\$)			
		CVSB	SMV	CVST	CRC
560.15	Siting	44,362	44,362	45,748	47,789
560.20	System Development	63,715	94,253	79,198	89,338
560.25	Safety Assessment	37,271	37,271	37,271	37,271
560.30	Licensing and Approvals	156,905	159,101	159,101	205,824
560.35	Public Affairs (Y1-Y17)	64,281	64,281	64,281	64,281
560.40	Facility Design and Construction	353,688	529,443	582,312	536,468
560.45	Facility Operation	11,311,400	14,971,436	13,983,341	12,431,365
560.55	Environmental Assessment and Monitoring	530,341	530,341	530,341	530,341
560.90	Program Management (Y1-Y17)	128,153	147,390	143,121	135,048
Total Cost		12,690,116	16,577,878	15,624,714	14,077,906

Table 3: Costs for Centralized Extended Storage Facilities by Phase of Development

Development Phase	Cost (2002K\$)			
	CVSB	SMV	CVST	CRC
Siting	262,487	293,944	280,275	334,760
Construction	430,921	627,190	675,790	583,754
Operations				
Initial Fuel Receipt	1,417,981	2,413,863	1,999,539	1,664,791
Extended Monitoring	3,748,148	4,520,197	4,830,088	4,230,941
Facility Repeats/Repackaging	6,830,579	8,722,684	7,839,022	7,263,479
Total Cost	12,690,116	16,577,878	15,624,714	14,077,906

NB.

Initial Fuel Receipt spans Y18-47.

Extended Monitoring spans Y48-347.

Facility repeats and repackaging events occur periodically (typically 30 year durations), within the extended monitoring duration.

Table 4: Costs for Centralized Extended Storage Facilities as Cost by Category

Alternative	Labour	Material & Equipment	Other	Contingency	Total Cost
CVSB	4,156,819	3,696,928	2,814,238	2,022,131	12,690,116
SMV	3,754,429	3,406,742	6,233,143	3,183,564	16,577,878
CVST	4,401,250	4,153,042	4,534,928	2,535,494	15,624,714
CRC	4,291,702	3,910,906	3,598,485	2,276,632	14,077,906

Figures 11 to 14 present the cumulative annual cash flow for the program to site develop, construct and operate each facility alternative over the first cost estimating cycle of 347 years.

Figure 11: Annual Cash flow projection and cumulative costs for CVSB Facility

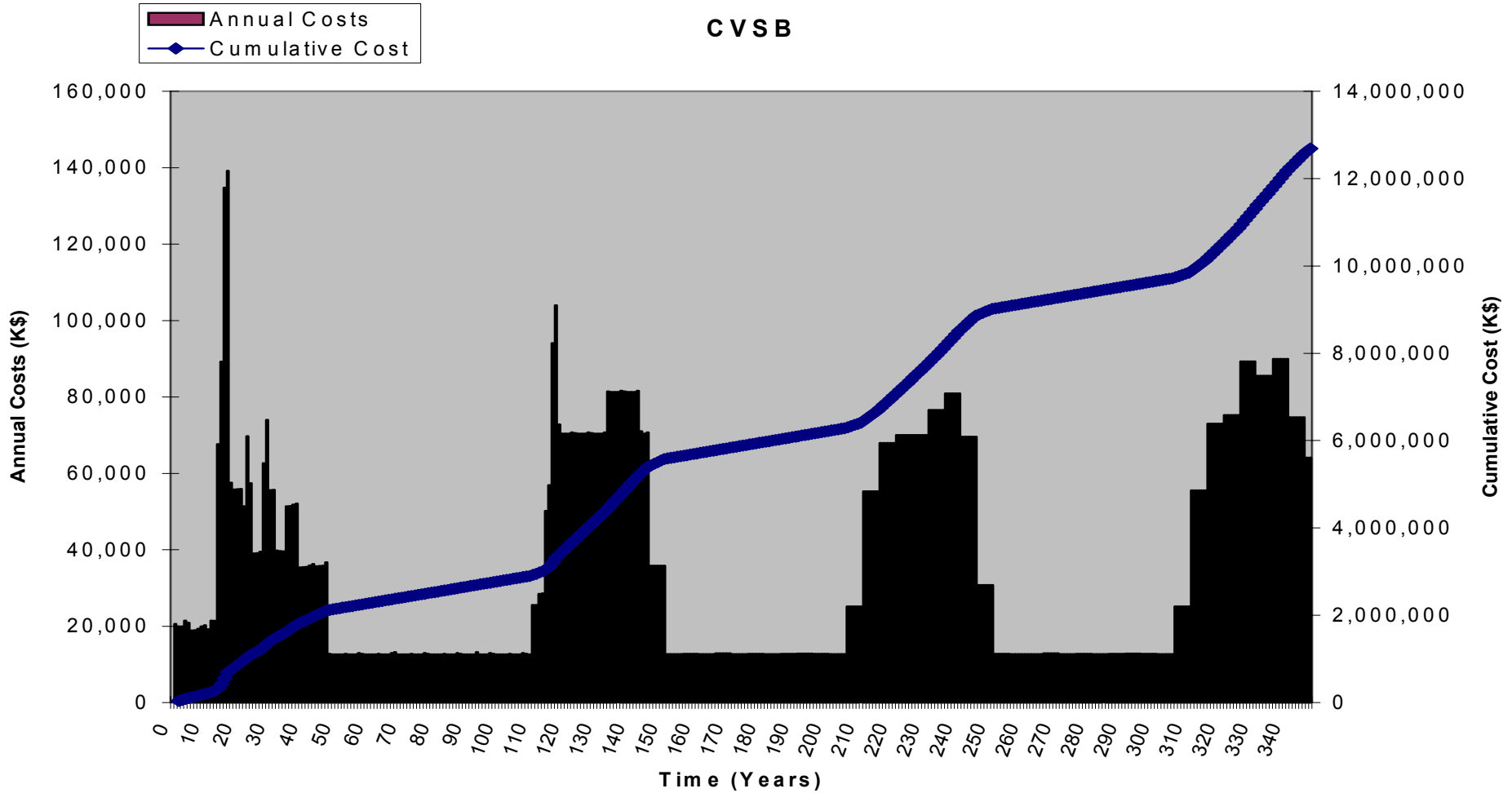


Figure 12: Annual Cash flow projection and cumulative costs for SMV Facility

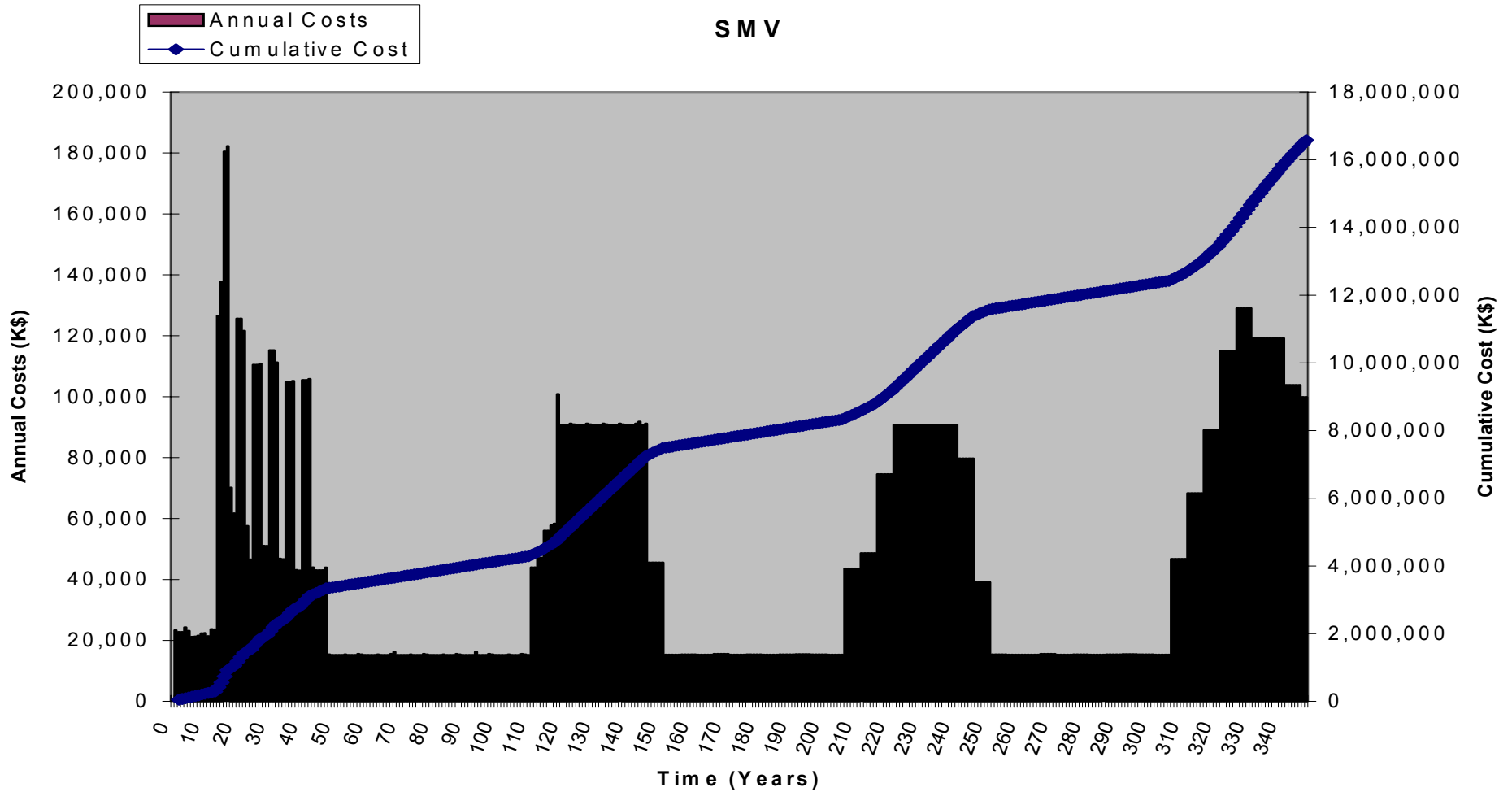


Figure 13: Annual Cash flow projection and cumulative costs for CVST Facility

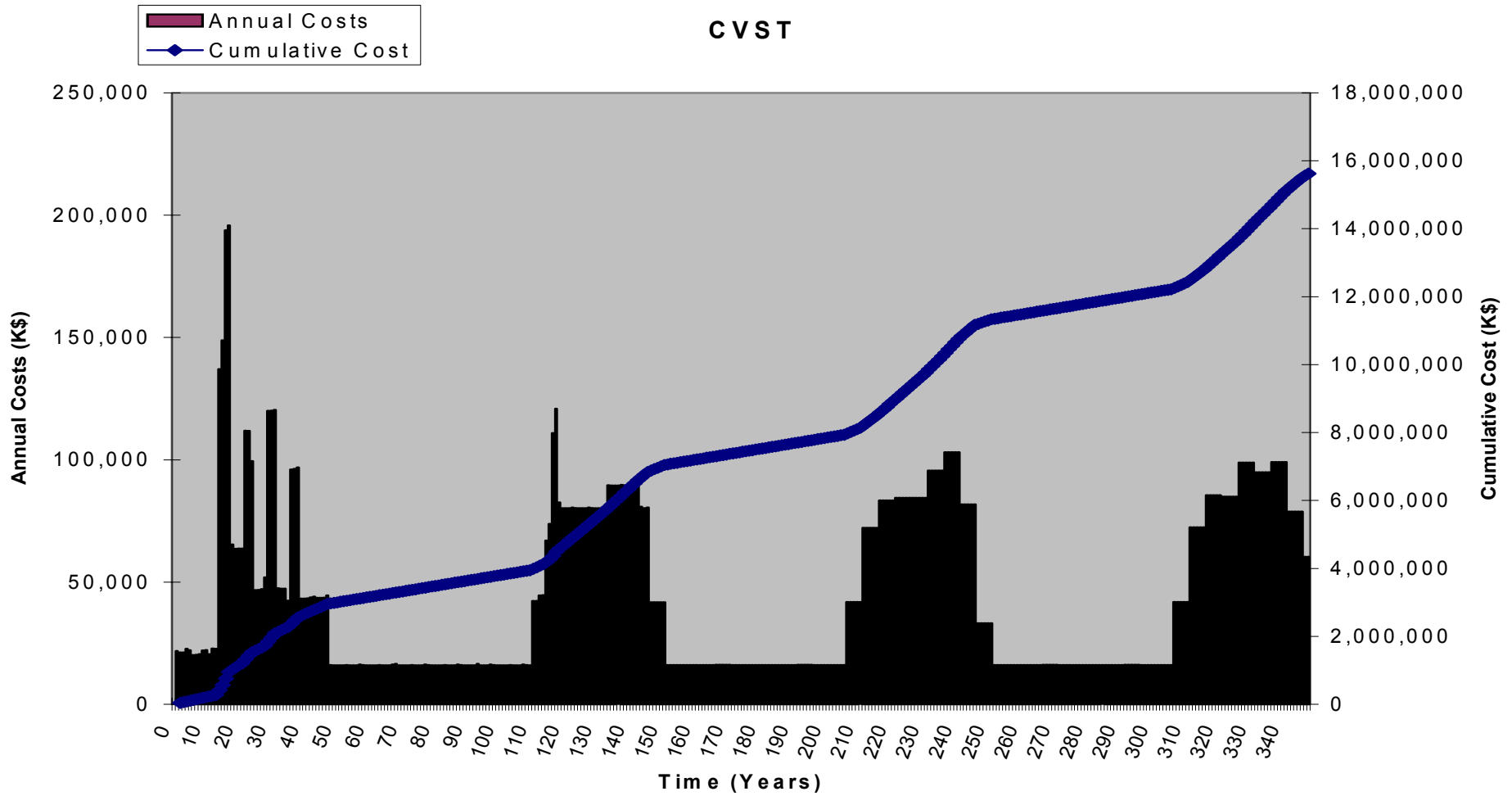
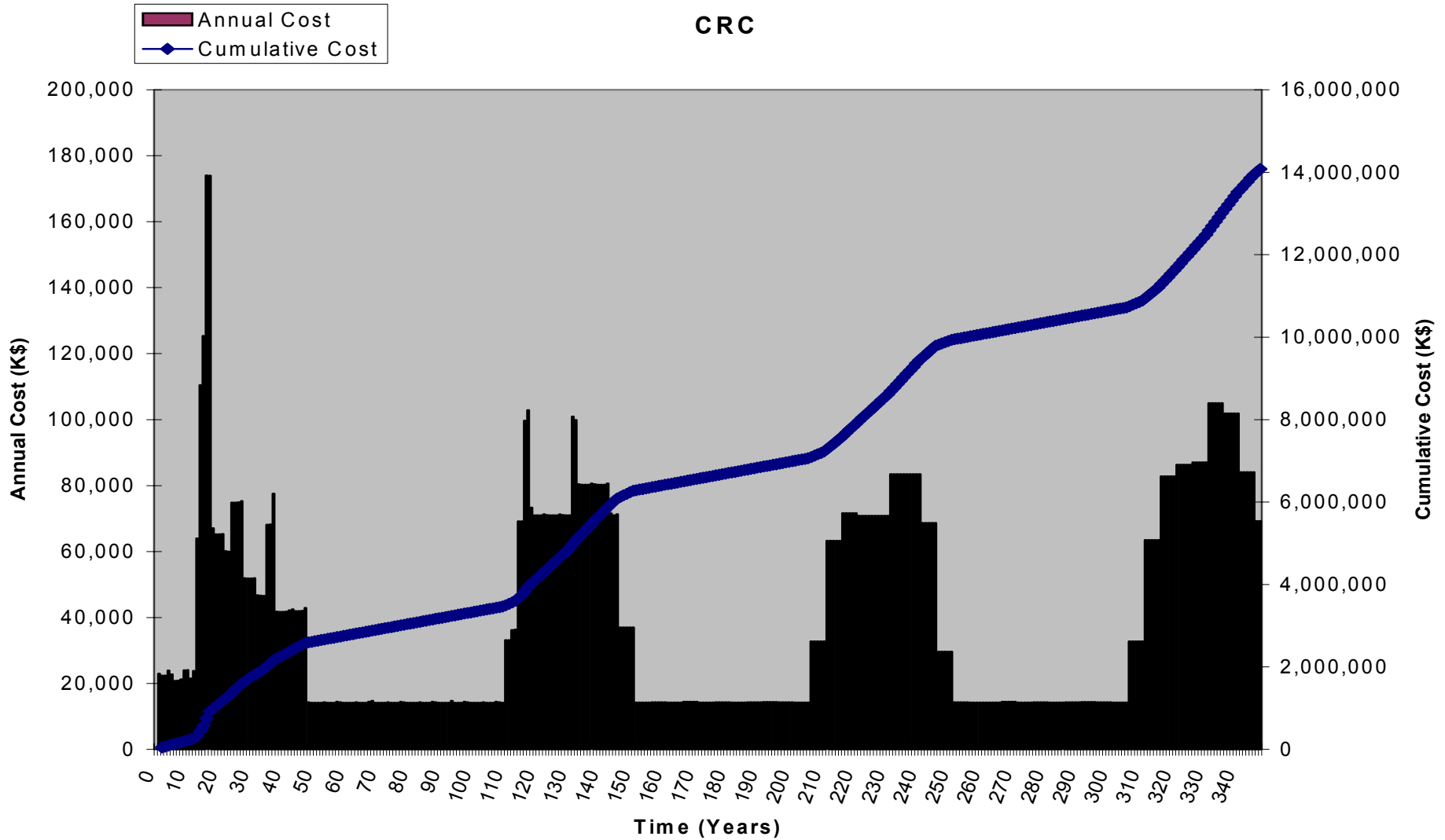


Figure 14: Annual Cash flow projection and cumulative costs for CRC Facility



5.6 FUEL CONTAINER COSTS

5.6.1 Overview

A significant cost component within each of the alternatives will be the cost of fuel containers. Costs are incurred at initial fuel receipt, and further costs will be incurred during repackaging events, which occur significantly later in the estimate cycle. Each fuel storage alternative is required to store fuel in module format (either within storage casks or within module canisters), and each storage alternative utilizes storage within baskets. The summated costs for each container type presented below are exclusive of contingency.

5.6.2 Storage Casks

Storage casks are required at initial fuel receipt, for three alternatives, (CVSB, CVST and CRC). For CVSB and CVST, over half of the total complement of storage casks (4,426) are received from the reactor sites. The balance (4,102 of 8,528) are filled at the CES facility. These storage casks are fabricated off site, by a specialist manufacturer and shipped to the site. The cost (including transportation) of each storage cask has been assessed at \$92,500. For CRC, the fuel baskets are confined within a basket storage cask. The required population of basket storage casks is 674. Although no historical costs are available for the basket cask, based on the conceptual design information, it has been assessed as similar to the module storage cask. This includes the cost of the basket restraint frame, within the storage cask body.

Given the service life of a storage cask is assumed to be 100 years, three repackaging events will occur during the estimate cycle. Fuel (in modules) will be transferred from one storage cask to a replacement. At each repackaging event, the total complement of storage casks will require replacement. For CVSB and CVST alternatives, the total storage cask population that is required for each repackaging event is (8,528). For the CRC alternative, the total population of module and basket storage casks is (9,202).

In summary, the summated cost for new storage casks for each alternative is:

	Initial fuel receipt (new)	1 st repackaging event (100yr)	2 nd repackaging event (200yr)	3 rd repackaging event (300yr)	Total storage casks	Total cost (\$k)
CVSB	4,102	8,528	8,528	8,528	29,686	2,745,955
CVST	4,102	8,528	8,528	8,528	29,686	2,745,955
CRC	4,776	9,202	9,202	9,202	32,382	2,995,335

5.6.3 Modules

For CVSB, CVST and CRC, a significant proportion (92%) of the fuel arrives at the CES facility either in existing storage casks from the reactor sites, or as the payload within transportation casks. During the initial fuel receipt phase, no additional modules will be required.

Given the service life of a module is assumed to be 300 years, one repackaging event will occur during the estimate cycle. For CVSB, CVST and CRC, the intermediate repackaging events will not require transfer of fuel from one module to another.

The SMV alternative also requires that replacement modules are provided at the 300 year repackaging event.

Modules will be fabricated off site, by a specialist manufacturer and shipped to the site. The cost (including transportation) of each module has been assessed at \$,3000.

In summary, the summated cost for new modules for each alternative is:

	Initial fuel receipt (new)	1 st repackaging event (100yr)	2 nd repackaging event (200yr)	3 rd repackaging event (300yr)	Total modules	Total cost (\$k)
CVSB	n/a	n/a	n/a	n/a	34,112	102,336
SMV	n/a	n/a	n/a	n/a	34,112	102,336
CVST	n/a	n/a	n/a	n/a	34,112	102,336
CRC	n/a	n/a	n/a	n/a	34,112	102,336

5.6.4 Baskets

For all alternatives, a proportion (8%) of the fuel arrives at the CES facility from the reactor sites in baskets, as the payload within transportation casks. During the initial fuel receipt phase, no additional baskets will be required.

Given the service life of a basket is assumed to be 300 years, one repackaging event will occur during the estimate cycle. For all alternatives, intermediate repackaging events will not require transfer of fuel from one basket to another.

Baskets will be fabricated off site, by a specialist manufacturer and shipped to the site. The cost (including transportation) of each basket has been assessed at \$5,000.

In summary, the summated cost for new baskets for each alternative is:

	Initial fuel receipt (new)	1 st repackaging event (100yr)	2 nd repackaging event (200yr)	3 rd repackaging event (300yr)	Total baskets	Total cost (\$k)
CVSB	n/a	n/a	n/a	n/a	4,717	23,585
SMV	n/a	n/a	n/a	n/a	4,717	23,585
CVST	n/a	n/a	n/a	n/a	4,717	23,585
CRC	n/a	n/a	n/a	n/a	4,717	23,585

5.6.5 Module Canisters

For the SMV alternative, a large proportion (92%) of the fuel arrives at the CES facility from the reactor sites in modules, as the payload within transportation casks. No storage casks are

received at the CES facility. During the initial fuel receipt phase, modules will be contained in module canisters. Four modules will form the payload of each module canister.

Given the service life of a module canister is assumed to be 300 years, one repackaging event will occur during the estimate cycle. All intermediate repackaging events will not require the transfer of fuel from one module canister to another.

Module canisters will be fabricated off site, by a specialist manufacturer and shipped to the site. The cost (including transportation) of each module canister has been assessed at \$30,000.

In summary, the summated cost for new module canisters is:

	Initial fuel receipt (new)	1 st repackaging event (100yr)	2 nd repackaging event (200yr)	3 rd repackaging event (300yr)	Total module canisters	Total cost (\$k)
SMV	8,528	n/a	n/a	8,528	17,056	511,168

5.7 STAFFING REQUIREMENTS

5.7.1 Overview

The staffing requirements for the CES facility alternatives are summarised in the following sections. During periods of the initial fuel receipt period, and the facility repeat and repackaging events (typically of duration 30 years), additional resources will be required, above those required for periods of extended monitoring. The numbers presented below identify permanent full time employees, including security and administrative staff, operations and maintenance personnel. Construction workers, required for relatively short durations to construct replacement and repackaging facilities are not included.

Detailed staff resource listings are available for each alternative. They are described at appendix F and the information is contained on the attached CD.

5.7.2 CVSB

The CVSB staffing requirements for fuel receipt and extended monitoring operations are displayed in Figure 15 below. The initial peak represents approximately 159 employees employed on site during the fuel receipt event. The staff numbers reduce during the extended monitoring phase to 51 employees. During facility repeats (every 100 years – cask replacement and transfer to new storage buildings, and transfer of baskets to new vaults) the site staff increases to 166 employees. In addition, every 300 years when module and basket repackaging is effected in a combination with a facility replacement event, the site complement increases to between 172 and 191 employees, over this 30 year duration.

5.7.3 SMV

The SMV staffing requirements for fuel receipt and extended monitoring operations are displayed in Figure 16 below. The initial peak represents approximately 161 employees employed on site during the fuel receipt event. The staff numbers reduce during the extended

monitoring phase to 51 employees. During facility repeats (every 100 years – module canisters and fuel baskets are transferred to replacement modular vault storage buildings), the site staff increases to 129 employees. In addition, every 300 years when module and basket repackaging is effected in a combination with a facility replacement event, the site complement increases to between 135 to 154 employees, over this 30 year duration.

5.7.4 CVST

The CVST staffing requirements for fuel receipt and extended monitoring operations are displayed in Figure 17 below. The initial peak represents approximately 160 employees employed on the site during the fuel receipt event, the staff numbers reduce during the extended monitoring phase to 51 employees. During facility repeats (every 100 years – cask replacement and transfer to new storage chambers, and transfer of baskets to new vaults) the site staff increases to 168 employees. In addition, every 300 years when module and basket repackaging is effected in a combination with a facility replacement event, the site complement increases to between 174 and 193 employees, over this 30 year duration.

5.7.5 CRC

The CRC staffing requirements for fuel receipt and extended monitoring operations are displayed in Figure 18 below. The initial peak represents approximately 160 employees employed on the site during the fuel receipt event, the staff numbers reduce during the extended monitoring phase to 51 employees. During facility repeats (every 100 years – module and basket cask replacement) the site staff increases to 170 employees. In addition, every 300 years when module and basket repackaging is effected in a combination with a facility replacement event, the site complement increases to between 137 and 191 employees over this 30 year duration.

Figure 15: CVSB Staffing Requirements

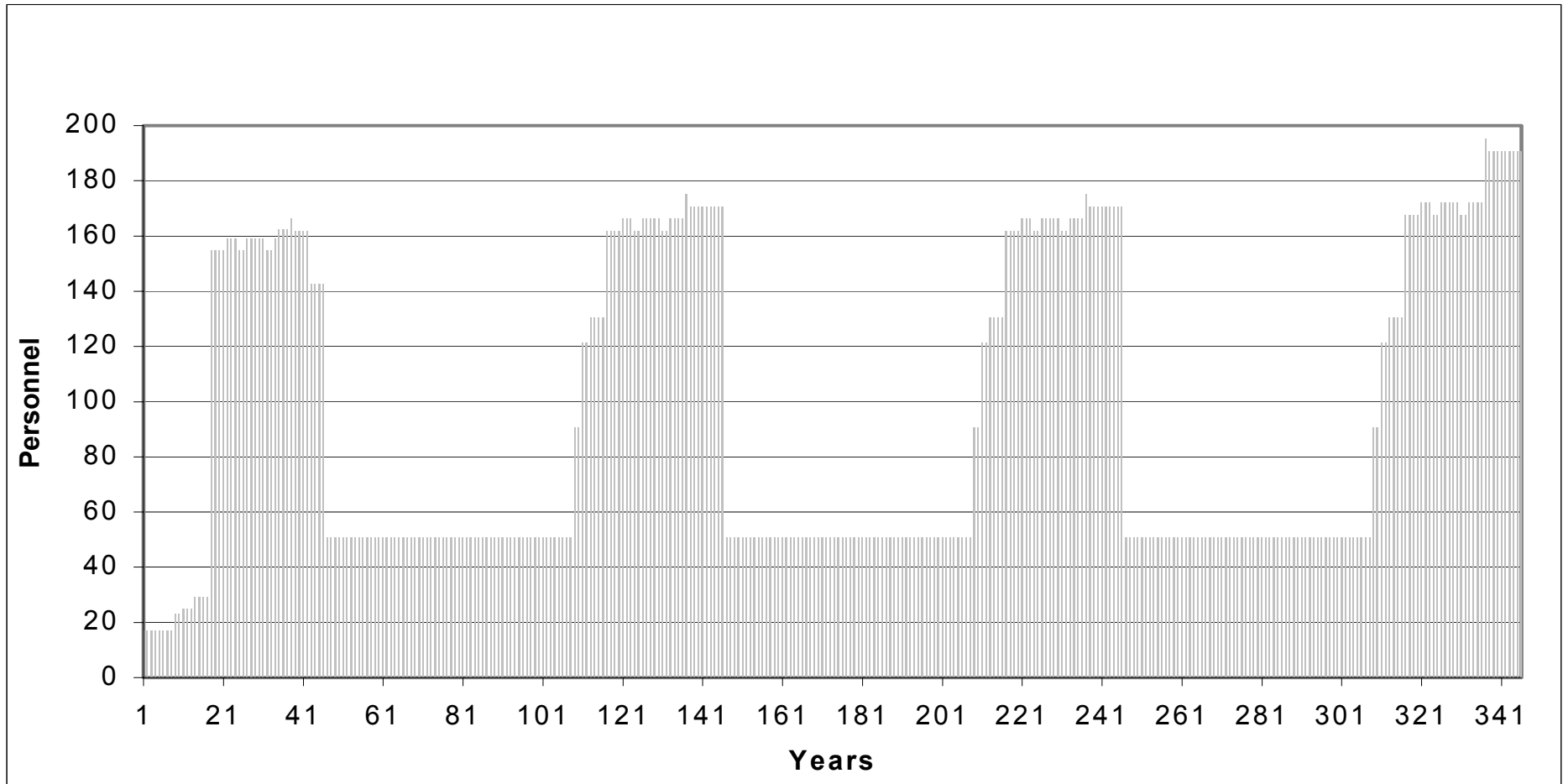


Figure 16: SMV Staffing Requirements

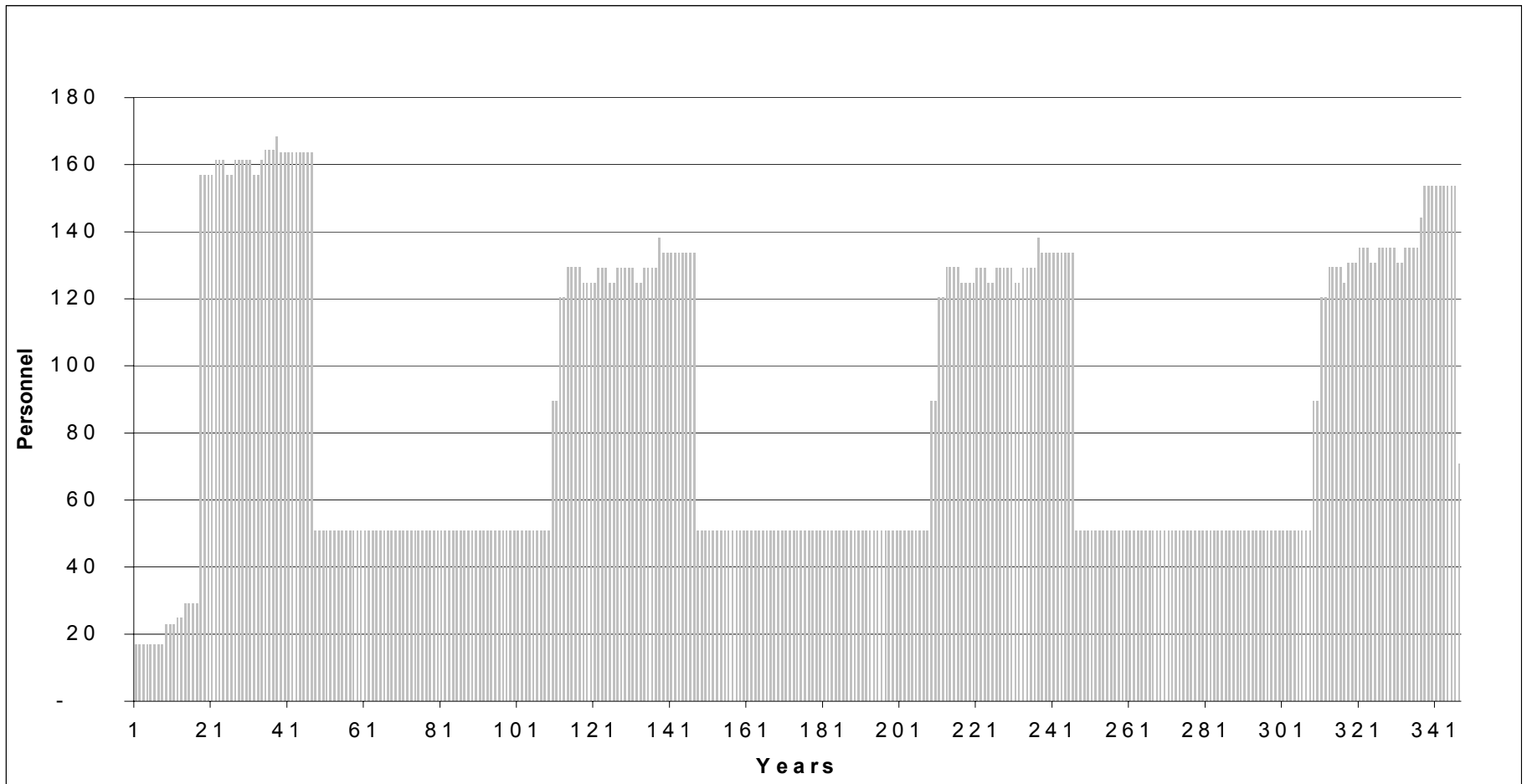


Figure 17: CVST Staffing requirements

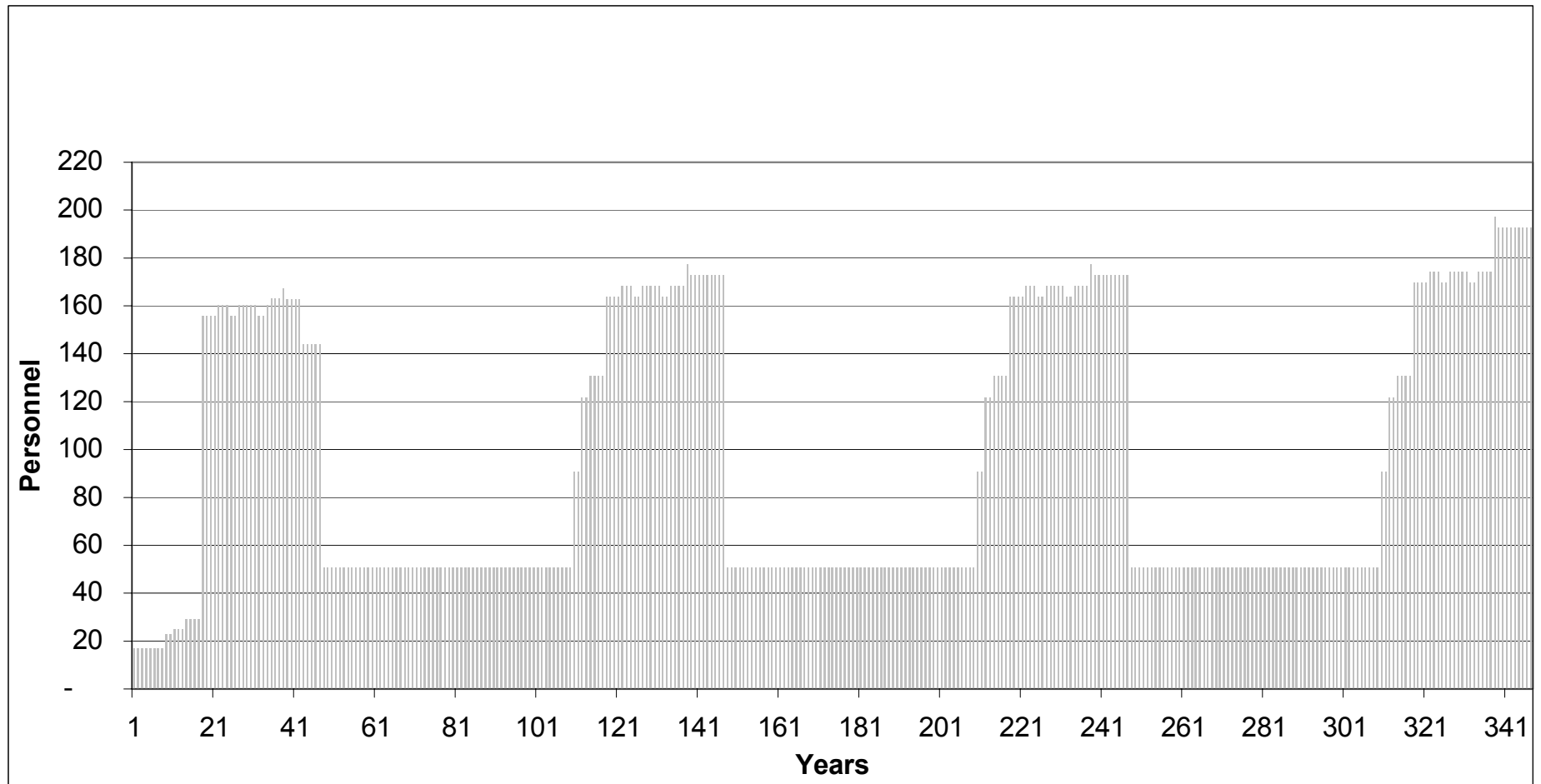
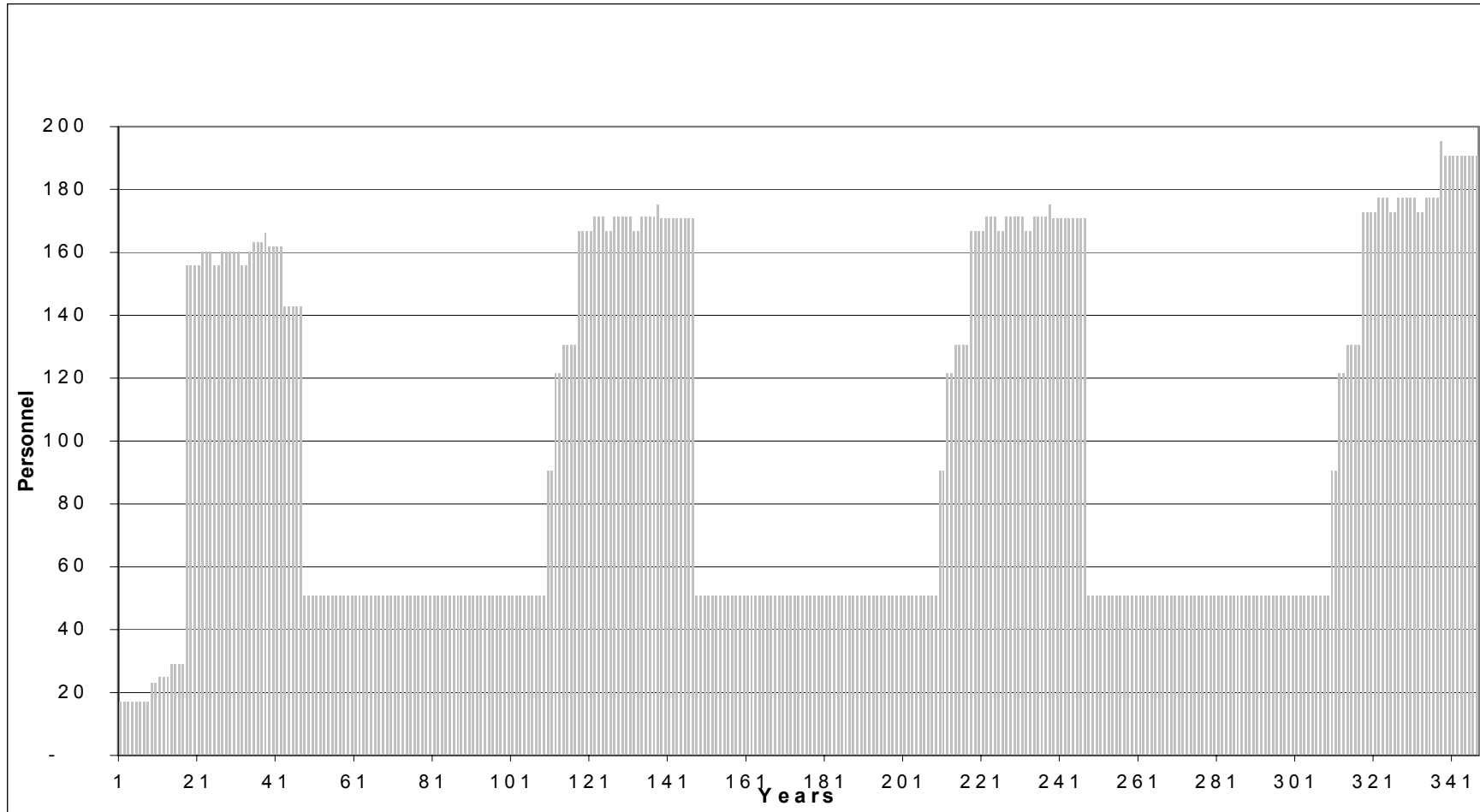


Figure 18: CRC Staffing Requirements



5.8 WASTE ARISING

Each of the CES alternatives will generate waste streams, particularly following the repackaging of fuel containers, and the dismantling of processing and storage facilities which have reached the end of their service lives. The waste facilities on the CES site provide simple waste sorting/segregation and interim storage, until sufficient waste volumes have been generated, which merit transport off-site. From experience gained in the operation of existing dry storage facilities, little to no intermediate level waste (ILW) is expected to be generated at a CES facility.

All waste, which arises on the CES site, will be monitored and decontaminated, if necessary, prior to shipment off-site. The two principal waste streams are assumed to be free release waste and low level waste (LLW).

Free release waste comprises waste in which the concentration or quantity of radionuclides is below clearance levels established by the regulatory body (CNSC). Most of the free release wastes will be generated during decommissioning of the CES facilities. The waste will largely comprise bulk materials (concrete, rubble soil etc) and ordinary industrial wastes, such as plastics and scrap metal, including structural frameworks, ventilation ducts, piping) produced by facility dismantling activities.

LLW waste comprises radioactive waste, in which the concentration or quantity of radionuclides is above clearance levels established by the regulatory body (CNSC). This waste does not necessarily require management in a deep geological repository. It contains primarily short-lived radionuclides (half-lives shorter than or equal to the half-life of Cs-137, 30.2 years). It is expected that a relatively small volume of LLW will be generated during operations and during the decommissioning of the 100-year "facility repeats" of the CES facility (starting around Y117, Y217 and 317). For example less than 200 m³ of LLW would likely be generated when the CVSB Processing Building and the storage buildings are replaced every 100 years.

Each CES alternative generates waste streams comprising fuel containers, which have reached the end of their service lives.

Empty fuel modules are assumed to be classified as LLW. The modules will be decontaminated to remove loose contaminants and to allow safe handling. The empty modules will be placed in a reusable ISO freight container for shipment off-site .

Empty fuel baskets are assumed to be classified as LLW. The baskets will be decontaminated to remove loose contaminants and to allow safe handling. The empty baskets will be placed in a reusable ISO freight container for shipment to an off-site processing facility.

Empty storage casks (DSCs) are assumed to be classified as free release waste. Following decontamination of the interior of the casks and their lids, the containers will be shipped off-site whole; i.e. no volume reduction will be undertaken.

Module canisters will be decontaminated at the CES facility and will be size-reduced (by approximately 50%) before being packed into reusable ISO freight containers to be shipped off-site.

Waste materials from facility dismantling activities that are certified to be free of contamination by radioactive or hazardous materials (i.e. free release) will be released for conventional disposal. However it is possible that some of the waste materials could be recycled which would reduce disposal costs, although no credit is taken for recycled waste materials in the cost estimates.

The following unit costs have been supplied by OPG and have been used to calculate allowances for off-site disposal:

LLW -	\$1,400/m ³
Free Release Cask –	\$13,000/cask
Free Release Canister	\$800/canister
Free Release Waste -	\$200/Mg for steel or concrete, (equivalent to \$500/m ³ for concrete rubble).

5.9 COMMUNITY PAYMENTS

Community payments in the form of community offsets and benefits are addressed in 560-35-120 and various Program Management work elements (560-45-10-05; 560-45-20-05; 560-45-40-05).

Taxation is addressed in the Program Management work elements (560-90; 560-45-10-05; 560-45-20-05; 560-45-40-05) of the CES facility estimates.

Provincial Sales Tax (PST) is levied at 8% on such items as office supplies, computers, telecommunication services, labour on services to repair equipment, clean offices, remove snow and travel services. The total cost of these equipment, supplies and services were estimated and multiplied by 8% to obtain an estimate for PST. It has been assumed that PST on materials that would be purchased by a contractor to build real property (e.g. buildings, rock caverns, roads and fences) or to install fixtures (e.g. cranes, pumps and processing equipment) is part of the estimated cost and is not shown separately. All machinery, equipment and processing materials used directly in processing and storage of used fuel have been assumed to be exempt from PST.

The potential cost of Goods and Services Tax (GST) has not been included in the cost estimates. Land transfer tax has been captured under 560-40-10 and is included in the site acquisition costs.

Property Tax is levied at two separate rates, depending on the assumed designation of the buildings, which comprise the CES facility. The processing buildings are considered as large industrial manufacturing facilities and rated at 4% of their assessed value. The storage complexes are considered as commercial industrial buildings, and rated at 3% of their assessed value. These property tax rates were supplied by OPG and are based on tax rates applied to their used fuel dry storage facilities. To estimate the property tax it was assumed that the assessed value of structures is 50% of the estimated construction cost.

Allowances for community offsets and benefits have been included in the cost estimate. It is recognised that the actual amount of offsets and benefits would ultimately be determined through negotiations between the implementing organisation and the local community. However for the purposes of this cost estimate it has been assumed that during Y14 to Y17 payments is

provided at a rate of \$518,000/a. During Y18 and beyond the payments are assumed to be \$68,500/a. These payments would cover the cost of various items including a liaison committee, workforce accommodation and infrastructure improvements, road maintenance and upgrades, emergency service equipment and training, and municipal services and infrastructure improvements.

5.10 INSURANCE

Allowances for Insurance are considered in the various Program Management elements (560-90, 560-45-10-5, 560-45-20-5, and 560-45-40-5) of the estimates. The following specific Insurance issues have been addressed during Initial fuel receipt, extended monitoring and repackaging events:

- Conventional Insurance - \$175,000/a
- Vehicular Insurance - \$600/vehicle
- Nuclear Liability Insurance - \$65,000/a

These rates are based on OPG experience and are assumed to be applicable for periods when the fuel is being received and handled at the CES facility. Lower rates were assumed during periods of extended monitoring.

5.11 ESTIMATION OF LONG-TERM COSTS

The CES study has been assumed that the facilities would need to operate indefinitely. In order to do so the CES facilities would be refurbished on a regular basis and the fuel would need to be periodically repackaged when fuel containers reach the end of their service life. These refurbishment and repackaging activities would be carried out indefinitely.

This estimate report presents costs in the first 347 years of the CES facility operations. The last 300 years of this time period represents a complete cycle of facility refurbishment and repackaging for all CES facility alternatives. Should it be necessary to define the costs beyond Y347 then the costs for this 300-year period can simple be repeated as required to generate costs, say, for 647, 947 years and so on.

6 References

- 1 Conceptual Designs for Four Centralized Extended Storage Facility Alternatives for Used Nuclear Fuel. CTECH Report No: 1105/MD18084/REP/08 September 2002.

APPENDIX A

Glossary of Terms

Assumption – a statement or hypothesis made concerning unknown factors and data that are required to accomplish the cost analysis. Assumptions should be clearly identified in all cost estimating documents.

Activity – a basic element of work or task that must be performed in order to complete a project. An activity occurs over a given period of time.

Allowances – additional resources included in estimates to cover the cost of known but undefined requirements for an individual activity or work item.

Cash Flow – the net flow of dollars into and out of a project. The algebraic sum, in any time period, of all cash receipts, expenses, and investments.

Conceptual design cost estimate – an estimate made with conceptual engineering data. This type of estimate should be accurate within +50% or -30% of the most probable final cost.

Constant dollars – current, and future costs that reflect the level of prices of a base year. Constant dollars have the effects of inflation removed.

Contingency – a separately planned amount used to allow for future situations which may be planned for only in part (sometimes referred to as “known unknowns”). Contingencies are intended to reduce the impact of missing cost or schedule objectives. Contingencies are normally included in the project’s cost and schedule baselines. Contingencies usually exclude changes in scope, quality or unforeseeable major events such as strikes, earthquakes, etc.

Cost – the amount measured in money, cash expended, or liability incurred, in consideration of goods and/or services received.

Cost Estimating – the determination of quantity and the prediction or forecasting, within a defined scope, of the costs required to provide services, construct and equip a facility, to manufacture goods, or to furnish a space. Costs are determined utilising experience and calculating and forecasting the future cost of required resources, methods, and management within a scheduled time frame. Included in these costs are an assessment and evaluation of risks and uncertainties.

Deliverable – a report or product of one or more tasks that satisfy one or more objectives and must be delivered to satisfy contractual requirements.

Estimator – an engineer whose judgement and experience are utilised in the application of scientific principles and techniques to cost estimation, cost control, business planning and management science, profitability analysis, and project management, planning and scheduling.

Equipment cost – is the cost of acquiring permanent equipment such as heavy equipment (trucks, forklifts, cranes) to be used during operations, container fabrication equipment, and laboratory and office equipment. Equipment cost does not include the labour cost for installing the equipment.

Fixed cost – is a cost that is not sensitive to total quantity of waste being shipped or stored, or to facility or system throughput capacity. For example, most development costs, all siting costs, safety assessment, licensing and approval costs, environmental monitoring costs, many infrastructure costs (roads, surface facilities, utilities), program costs (program management, public affairs, administration) are not sensitive to total quantity of waste or the facility or system throughput capacity. Fixed costs are generally unavoidable costs and must be paid irrespective of total waste quantity or throughput capacity.

Indirect costs – (1) in construction, all costs which do not become a final part of the installation, but which are required for the orderly completion of the installation and may include, but are not limited to, field administration, direct supervision, capital tools, start-up costs, contractor's fees, insurance, taxes, etc.; (2) in operations, costs not directly assignable to the end product or process, such as overhead and general purpose labour, or costs of outside operations. Indirect operating cost may include insurance, property taxes or grants in lieu of taxes, maintenance, depreciation, warehousing and loading.

Labour cost – the salary plus labour burden. Labour cost may not include overhead costs, which are estimated separately.

Labour (or payroll) burden – payroll taxes and payroll insurances the employer is required to pay by law based on labour payroll, on behalf of or for the benefit of labour (i.e. federal old age benefits, federal unemployment insurance and Workers' Compensation). Labour burden would also include the following employee benefits: statutory holidays, vacation, sick time, hospitalisation and medical insurance, group life insurance, pension plan, plus living and transportation allowances.

Life cycle costs – the inclusion of all costs incurred during the total life (from project initiation through to decommissioning) of a facility and/or system, or aggregation of facilities and/or systems. Life cycle cost estimates would include, where applicable, costs for development, siting, licensing, construction, operation, extended monitoring and decommissioning.

Material cost – refers to the cost of permanent materials only, consumables are listed under "other costs". When the purchase cost includes installation (e.g. of building materials) the estimator will be requested to provide a cost breakdown indicating separately the material cost and the installation labour cost.

Milestone – an important or critical event and/or activity that must occur when scheduled in the project cycle in order to achieve the project objective(s).

Other costs – includes items such as consumables (fuel, utilities and non-permanent materials), permits and fees, taxes, duties, licences, royalties, communication costs, furniture, temporary monitoring equipment, and travel and accommodation expenses.

Overhead – a cost or expense inherent in the performing of an operation (i.e., engineering, construction, operation or decommissioning) which cannot be charged to or identified with a part of the work, product, or asset, and therefore must be allocated on some arbitrary base believed to be equitable or handled as separate business expense.

Present value dollars – means dollars that have had their annual cash flow occurring over time converted to equivalent amounts at a common point in time in order to account for both inflation and the time value of money. The computation begins with constant dollars.

Program management – includes all activities in the implementing organization that cannot be identified with work, products or assets within the organization. Program management activities within the implementing organization would include senior management support and direction, administrative and clerical services, financial and business services, quality engineering services, safety program, human resources and payroll services, records management, and procurement services. Program management would include overheads such as the following: taxes or grants in lieu of taxes, insurance, communication services, office space, office furniture, office supplies and general expenses.

Project management – labour comprising the implementing agency staff who are directly involved in the administration or execution of scientific and engineering work.

Step-Fixed Cost - is a type of fixed cost that is sensitive to changes in total quantity of waste shipped or stored, or to the waste throughput capacity of the facility or system. If the total quantity of waste changes or the waste throughput capacity changes, then the size or number and the associated cost of some infrastructure or capital-cost items will change. Examples of step-fixed costs are the following:

- Waste processing, conditioning and packaging facilities
- Waste package handling equipment
- Storage buildings.

Work breakdown structure (WBS) – a hierarchical grouping of work elements, which organises and defines the total scope of the facility or system. Each descending level represents an increasing detailed definition of the work.

Work Element Definition Sheet (WEDS) – describes a work element in the WBS and includes the following information: WBS number, WBS title, WBS description of work, WBS deliverables, WBS assumptions, WBS schedule, WBS resource and cost estimate and recommended contingency level and its basis. The WEDS includes information on whether the work element is a fixed, step-fixed or variable cost.

Variable Cost – is a cost that is directly proportional to quantity of waste shipped or stored. If the quantity of waste changes, then the operating cost will change in direct proportion to the change in quantity of used fuel being shipped or stored. Variable operating costs are not sensitive to changes in waste throughput rate and these costs are only incurred during the Operations Phase. Examples of variable costs are the following:

- Labour directly involved in handling the waste, conditioning and packaging waste, constructing storage facilities, employing waste in storage structures, and inspection and monitoring.
- Materials – e.g. materials for fuel containers and some storage structures.
- Maintenance of equipment and facilities.

- Utilities
- Consumables – energy and materials consumed during operations but not appearing as a product.
- Any indirect costs associated with the above activities

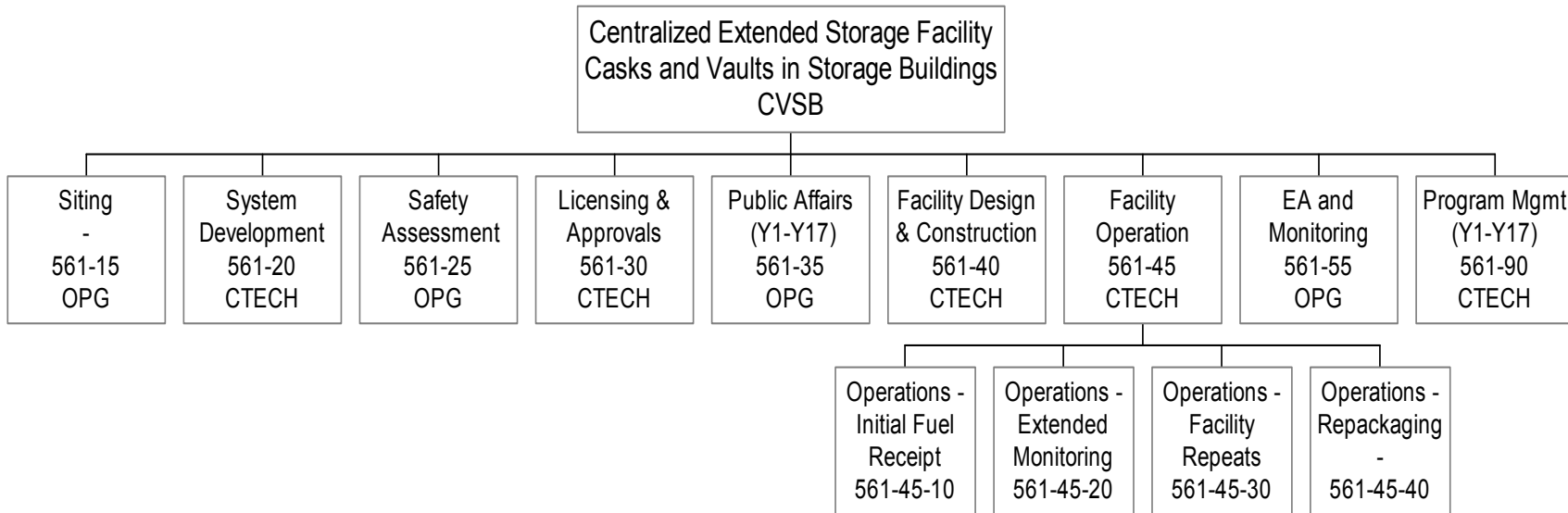
APPENDIX B

Cost Estimate for CVSB Facility (561)

B1 Work Breakdown Structure for CVSB Facility

Centralized Extended Storage Facility Cost Estimate

Work Breakdown Structure, Coding and Estimating Responsibilities



B2 Work Element Definition Sheets for CVSB Facility

CVSB WEDs presented under separate cover

B3 CVSB Facility Cost Estimate Schedule

CVSB Work Breakdown schedule to lowest WBS level is presented on the attached CD.

B4 CVSB Facility Cost by Category Report

WBS	WBS Title	Total	Labour	Material & Equipment	Other	Cont'y
561 15	SITING	44,362	23,826	0	5,750	14,786
561 15 10	SITING MANAGEMENT	9,295	4,897	0	1,300	3,098
561 15 20	CANDIDATE AREAS	15,478	6,709	0	3,610	5,159
	SELECTION OF FEASIBILITY STUDY COMMUNITIES	5,955	3,610	0	360	1,985
	DATABASE & INFORMATION SYSTEM	6,585	1,290	0	3,100	2,195
	CANDIDATE AREAS - CHARACTERIZATION	2,938	1,809	0	150	979
561 15 50	FEASIBILITY STUDIES (3 SITES)	8,155	5,097	0	340	2,718
	FEASIBILITY STUDIES - SUPPORT & REPORTING	4,332	2,648	0	240	1,444
	FEASIBILITY STUDIES - CHARACTERISATION	3,823	2,449	0	100	1,274
561 15 60	CANDIDATE SITES (2 SITES)	7,846	5,051	0	180	2,615
	CANDIDATE SITES - SUPPORT & REPORTING	4,056	2,524	0	180	1,352
	CANDIDATE SITES - CHARACTERISATION	3,790	2,527	0	0	1,263
561 15 70	PREFERRED SITE	3,588	2,072	0	320	1,196
	PREFERRED SITE - SUPPORT AND REPORTING	1,062	588	0	120	354
	PREFERRED SITE - CHARACTERISATION	2,526	1,484	0	200	842
561 20	SYSTEM DEVELOPMENT	63,715	40,333	4,300	1,575	17,507
561 20 02	SYSTEM DEVELOPMENT MANAGEMENT	8,065	6,690	0	300	1,075
561 20 05	SYSTEM OPTIMIZATION	4,414	3,303	0	120	991
561 20 20	PROCESS SYSTEM ENG'NG (PACK'G, REPACK'G & DEC'NT'M)	38,917	20,750	4,300	895	12,972
561 20 30	STORAGE SYSTEM ENG'NG	10,378	8,143	0	200	2,035
561 20 40	SECURITY & SAFEGUARD ENG'NG	1,941	1,447	0	60	434
561 25	SAFETY ASSESSMENT	37,271	21,098	0	5,525	10,648
561 25 10	SAFETY ASSESSMENT MANAGEMENT	8,495	5,218	0	850	2,427
561 25 30	SA - SITING	8,592	2,287	0	3,850	2,455
561 25 40	SA - OPERATING LICENSE	2,576	1,540	0	300	736
561 25 50	SA - FACILITY OPERATIONS	13,760	9,604	0	225	3,931
561 25 70	SA - DECOMMISSIONING (Processing Facilities)	3,848	2,449	0	300	1,099
561 30	LICENSING & APPROVALS	156,905	37,188	0	83,526	36,191
561 30 30	LIAISON WITH CNSC	773	555	0	40	178

WBS	WBS Title	Total	Labour	Material & Equipment	Other	Cont'y
561 30 50	CNSC CONSTRUCTION LICENCE	11,563	2,631	0	6,264	2,668
561 30 60	OTHER GOVN'MT APPROVALS	1,089	736	0	0	353
	APPROVAL REQUIREMENTS	505	337	0	0	168
	FEDERAL APPROVALS	199	133	0	0	66
	PROVINCIAL APPROVALS	186	133	0	0	53
	MUNICIPAL APPROVALS	199	133	0	0	66
561 30 65	CNSC OPERATING LICENCE (Initial Application)	1,685	513	0	902	270
561 30 70	CNSC OPERATING LICENCE (Maintenance & Renewal)	141,795	32,753	0	76,320	32,722
561 35	PUBLIC AFFAIRS (Y1-Y17)	64,281	33,763	0	9,092	21,426
561 35 10	PUBLIC AFFAIRS - CANDIDATE AREAS	12,820	7,047	0	1,500	4,273
561 35 30	PUBLIC AFFAIRS - FEASIBILITY STUDIES	9,325	5,217	0	1,000	3,108
561 35 40	PUBLIC AFFAIRS - CANDIDATE SITES	13,989	7,826	0	1,500	4,663
561 35 45	PUBLIC AFFAIRS - PREFERRED SITE	5,469	3,046	0	600	1,823
561 35 50	PUBLIC AFFAIRS - PUBLIC REVIEW & EA APPROVAL	9,028	4,569	0	1,450	3,009
561 35 70	PUBLIC AFFAIRS - DESIGN & CONSTRUCTION	4,992	2,528	0	800	1,664
561 35 110	PUBLIC AFFAIRS - PROGRAM MANAGEMENT	5,550	3,530	0	170	1,850
561 35 120	COMMUNITY OFFSETS AND BENEFITS	3,108	0	0	2,072	1,036
561 40	FACILITY DESIGN AND CONSTRUCTION	353,688	114,756	133,347	11,544	94,041
561 40 10	SITE & IMPROVEMENTS	161,482	45,930	58,350	3,375	53,827
561 40 20	PROCESSING BUILDING (PB)	87,029	25,851	36,358	5,424	19,396
	RECEIPT & TRANSFER (EQUIP)	8,208	286	5,728	300	1,894
	MODULE TRANSFER CELLS (EQUIP)	11,585	1,107	7,381	424	2,673
	BASKET TRANSFER CELLS (EQUIP)	10,952	1,046	6,978	401	2,527
	COMMON CRANE MAINTENANCE AREA (EQUIP)	3,543	338	2,258	129	818
	CASK PROCESS AREA (EQUIP)	4,077	294	2,943	161	679
	PROCESSING BUILDING DESIGN & CONST'N	14,716	5,312	4,946	1,062	3,396
	PB BUILDING SERVICES DESIGN AND INSTALL'N	19,005	6,692	6,124	2,388	3,801
	COMMISSIONING (PB)	1,557	865	0	173	519
	CONST'N INDIRECTS (PB)	13,386	9,911	0	386	3,089
561 40 30	COMMON ANCILLARY FACILITIES	63,754	22,956	29,502	0	11,296
	ADMIN AND VISITOR RECEPTION BLDG	1,524	486	784	0	254
	OPS SUPPT & HEALTH PHYSICS BLDG	3,487	1,294	1,612	0	581

WBS	WBS Title	Total	Labour	Material & Equipment	Other	Cont'y
	EQUIP STORAGE AND MAINT'CE BLDG	3,524	1,262	1,675	0	587
	STORAGE CASK/MODULE CANISTER STORE	3,507	1,031	1,892	0	584
	ACTIVE SOLID WASTE HDLG BLDG	2,072	459	1,135	0	478
	SOLID WASTE STORAGE AREA	1,163	458	437	0	268
	ACTIVE LIQ/W TRT'MT BLDG	2,711	359	1,727	0	625
	LOW LVL LIQ/W STRG BLDG	2,338	373	1,426	0	539
	WAREHOUSE BLDG	1,224	470	550	0	204
	GUARDHOUSE AND SECURITY FENCE	1,420	631	553	0	236
	TRUCK INSP'N / WASH STATION	2,336	872	1,075	0	389
	UTILITY BLDG	2,964	1,023	1,257	0	684
	TEST FACILITY CONSTRUCTION	2,929	766	1,675	0	488
	FIRE PROTECTION SYSTEMS	2,122	1,022	676	0	424
	SECURITY AND COMMUNICATION SYSTEM	1,471	607	600	0	264
	ELECTRICAL AND EMERGENCY POWER	4,838	1,939	1,932	0	967
	SANITARY SEWER SYSTEM	811	339	310	0	162
	POTABLE WATER SYSTEM	648	371	148	0	129
	RETENTION/SEDIMENTATION POND	1,382	874	189	0	319
	STORM WATER DETENTION POND	624	387	93	0	144
	CONST'N MAT'L STOCKPILE AREA	1,913	1,039	625	0	249
	SITE MATERIALS STORAGE AREA	2,097	1,169	655	0	273
	ACCESS ROADS AND VEHICLE COMPOUNDS	3,981	1,319	1,866	0	796
	CONST'N INDIRECTS ANCILLARY FACILITIES	12,668	4,406	6,610	0	1,652
561 40 40	STORAGE CONSTRUCTION (STAGE 1)	40,455	19,866	8,885	2,349	9,355
	STORAGE BUILDINGS DESIGN & CONST'N	24,525	10,080	6,770	2,016	5,659
	STORAGE BUILDINGS SERVICES DESIGN AND INSTALL'N	2,495	835	764	320	576
	CONST'N INDIRECTS STORAGE BUILDINGS	7,149	4,148	1,351	0	1,650
561 40 500	COMMISSIONING MANAGEMENT	275	153	0	30	92
561 40 600	EQUIPMENT, SPARES AND CONSUMABLES	327	0	252	0	75
561 40 650	ENERGY CONSUMPTION	366	0	0	366	0
561 45	FACILITY OPERATION	11,311,400	3,439,450	3,531,727	2,636,748	1,703,475
561 45 10	OPERATIONS INITIAL FUEL RECEIPT	1,340,442	463,023	453,530	226,390	197,499
	PROGRAM MANAGEMENT	300,177	110,251	0	138,547	51,379
	PROCESSING BUILDING OPERATIONS	489,048	85,255	379,435	0	24,358
	COMMON ANCILLARY FACILITIES OPERATIONS (INITIAL FUEL RECEIPTS)	40,845	32,676	0	0	8,169
	MONITORING AND SURVEILLANCE (INITIAL FUEL RECEIPTS)	29,261	19,455	52	0	9,754
	OPERATION INDIRECTS (INITIAL FUEL RECEIPTS)	279,418	140,137	1,968	74,072	63,241
	STORAGE OPERATIONS	27,422	20,794	300	0	6,328
	STORAGE CONSTRUCTION STAGE 2	36,880	10,400	14,819	3,520	8,141
	STORAGE CONSTRUCTION STAGE 3 (CASK)	36,880	10,400	14,819	3,520	8,141
	STORAGE CONSTRUCTION STAGE 3 (VAULTS)	34,074	11,095	12,897	2,219	7,863

WBS	WBS Title	Total	Labour	Material & Equipment	Other	Cont'y
	STORAGE CONSTRUCTION STAGE 4	66,437	22,560	29,240	4,512	10,125
561 45 20	OPERATIONS - EXTENDED MONITORING	3,252,427	1,490,888	89,690	975,937	695,912
	PROGRAM MANAGEMENT	1,067,639	312,354	0	575,558	179,727
	MONITORING AND SURVEILLANCE -EXTENDED MONITORING	226,267	150,328	517	0	75,422
	OPERATION INDIRECTS (EXTENDED MONITORING)	1,761,947	875,047	86,282	399,720	400,898
	COMMON ANCILLARY FACILITIES OPERATIONS (EXTENDED MONITORING)	185,660	148,528	0	0	37,132
	FUEL INTEGRITY MONITORING (25 YEARLY)	10,914	4,631	2,891	659	2,733
561 45 30	OPERATIONS - FACILITY REPEATS	980,712	392,682	200,223	194,184	193,623
	STORAGE BUILDINGS 100 YEAR REPLACEMENT	217,925	89,823	41,803	43,879	42,420
	STORAGE BUILDINGS 200 YEAR REPLACEMENT	217,925	89,823	41,803	43,879	42,420
	STORAGE BUILDINGS 300 YEAR REPLACEMENT	217,925	89,823	41,803	43,879	42,420
	BASKET VAULTS 100 YEAR REPLACEMENT	108,979	41,071	24,938	20,849	22,121
	BASKET VAULTS 200 YEAR REPLACEMENT	108,979	41,071	24,938	20,849	22,121
	BASKET VAULTS 300 YEAR REPLACEMENT	108,979	41,071	24,938	20,849	22,121
561 45 40	OPERATIONS - REPACKAGING	5,737,819	1,092,857	2,788,284	1,240,237	616,441
	PROGRAM MANAGEMENT (FACILITY REPEATS & REPACKAGING)	1,400,705	389,170	0	775,519	236,016
	DECOMMISSIONING OF EXISTING FACILITIES	7,128	2,357	0	3,207	1,564
	CONSTRUCTION FACILITIES - REPACK'NG PLANT Module (RPM)	1,375	476	354	228	317
	RECEIPT & TRANSFER (EQUIP)	7,914	276	5,523	289	1,826
	CASK TO CASK FUEL TRANSFER (EQUIP)	18,709	2,284	11,423	685	4,317
	CASK DECONTAMINATION (EQUIP)	21,021	2,743	13,716	822	3,740
	DECONTAMINATED CASK BUFFER STORAGE AREA (EQUIP)	6,571	0	5,055	0	1,516
	CASK PROCESS AREA (RP EQUIP)	3,232	233	2,332	128	539
	RPM BUILDING DESIGN & CONST'N	24,141	8,435	8,584	1,624	5,498
	BUILDING SERVICES (RPM)	29,612	11,374	9,117	3,486	5,635
	COMMISSIONING (RPM)	2,180	1,252	0	232	696
	CONST'N INDIRECTS (RPM)	19,325	14,668	0	518	4,139
	COMMON ANCILLARY FACILITIES (REPLACEMENT)	66,930	24,230	30,900	0	11,800
	COMMISSIONING MANAGEMENT (RPM)	409	273	0	0	136
	REPACKAGING OPERATIONS (RPM)	1,087,433	118,823	788,840	110,864	68,906
	ANCILLARY FACILITIES OPERATIONS (FACILITY REPEATS AND REPACKAGING)	14,852	11,882	0	0	2,970
	OPERATION INDIRECTS (RPM)	37,471	16,070	380	16,200	4,821
	STORAGE OPERATIONS (RPM)	2,721	2,093	0	0	628
	MODULE TO CASK 200 YEAR REPACKAGING	1,358,173	219,831	876,226	141,495	120,621
	MODULE TO CASK 300 YEAR REPACKAGING	1,358,173	219,831	876,226	141,495	120,621
	MM EQUIP. DESIGN, SUPPLY & INSTALL	8,412	0	6,471	0	1,941
	BUILDING DESIGN & CONST'N (Module to Module)	1,063	372	372	74	245
	BUILDING SERVICES (MM)	974	383	310	97	184
	COMMISSIONING(MM)	820	334	0	53	433
	CONST'N INDIRECTS (MM)	1,238	723	0	25	490
	REPACKAGING OPERATIONS (Module to Module)	155,976	17,823	102,336	35,817	0

WBS	WBS Title	Total	Labour	Material & Equipment	Other	Cont'y
	CONSTRUCTION FACILITIES - REPACK'NG PLANT Basket (RPB)	1,375	476	354	228	317
	RECEIPT & TRANSFER (EQUIP)	2,027	70	1,415	74	468
	BASKET TO BASKET FUEL TRANSFER	18,993	2,319	11,596	695	4,383
	BASKET DECONTAMINATION	7,374	854	4,562	256	1,702
	RPBB BUILDING DESIGN AND CONSTRUCTION	12,052	4,160	4,279	832	2,781
	BUILDING SERVICES (RPB)	12,376	4,447	4,153	1,309	2,467
	COMMISSIONING (RPB)	1,173	668	0	126	379
	CONST'N INDIRECTS (RPB)	8,484	6,299	0	241	1,944
	REPACKAGING OPERATIONS (RPB)	29,224	3,960	23,585	378	1,301
	OPERATION INDIRECTS (RPB)	6,896	2,678	175	3,240	803
	STORAGE OPERATIONS (RPB)	1,287	990	0	0	297
561 55	EA & MONITORING	530,341	390,100	27,554	9,989	102,698
561 55 10	EA & MONITORING PROGRAM MANAGEMENT	95,908	70,306	0	3,470	22,132
561 55 20	CNSC CONSTRUCTION LICENCE - ENVIRONMENTAL ASSESSMENT	12,234	6,006	0	2,150	4,078
561 55 40	GROUNDWATER MONITORING	59,599	37,158	5,058	3,630	13,753
561 55 50	RADIOLOGICAL BIOSPHERE MONITORING	282,187	217,280	17,876	0	47,031
561 55 60	NON-RAD BIOSPHERE MONITORING	72,762	53,590	4,620	0	14,552
561 55 80	HUMAN HEALTH MONITORING	7,651	5,760	0	739	1,152
561 90	PROGRAM MANAGEMENT (Y1-Y17)	128,153	56,305	0	50,489	21,359
561 90 00	PROGRAM MANAGEMENT (Y1-Y17)	128,153	56,305	0	50,489	21,359
	TOTAL	12,690,116	4,156,819	3,696,928	2,814,238	2,022,131

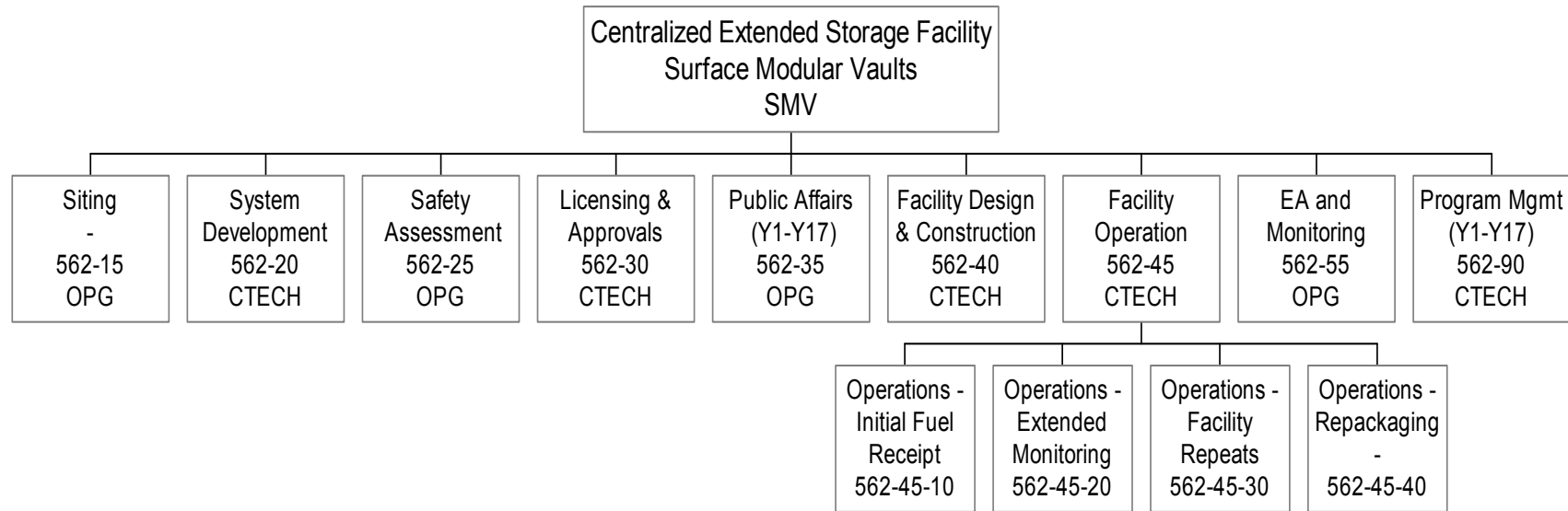
APPENDIX C

Cost Estimate for SMV Facility (562)

C1 Work Breakdown Structure for SMV Facility

Centralized Extended Storage Facility Cost Estimate

Work Breakdown Structure, Coding and Estimating Responsibilities



C2 Work Element Definition Sheets for SMV Facility

SMV WEDs presented under separate cover

C3 SMV Facility Cost Estimate Details

SMV Work Breakdown schedule to lowest WBS level is presented on the attached CD.

C4 SMV Facility Cost by Category Report

WBS	WBS Title	Total	Labour	Material & Equipment	Other	Cont'y
562 15	SITING	44,362	23,826	0	5,750	14,786
562 15 10	TECHNICAL SITING MANAGEMENT	9,295	4,897	0	1,300	3,098
562 15 20	CANDIDATE AREAS	15,478	6,709	0	3,610	5,159
	SELECTION OF FEASIBILITY STUDY COMMUNITIES	5,955	3,610	0	360	1,985
	DATABASE & INFO SYSTEM	6,585	1,290	0	3,100	2,195
	CANDIDATE AREAS - CHARACTERIZATION	2,938	1,809	0	150	979
562 15 50	FEASIBILITY STUDIES (3 SITES)	8,155	5,097	0	340	2,718
	FEASIBILITY STUDIES - SUPPORT & REPORTING	4,332	2,648	0	240	1,444
	FEASIBILITY STUDIES - CHARACTERIZATION	3,823	2,449	0	100	1,274
562 15 60	CANDIDATE SITES (2 SITES)	7,846	5,051	0	180	2,615
	CANDIDATE SITES - SUPPORT & REPORTING	4,056	2,524	0	180	1,352
	CANDIDATE SITES - CHARA CTERIZATION	3,790	2,527	0	0	1,263
562 15 70	PREFERRED SITE	3,588	2,072	0	320	1,196
	PREFERRED SITE - SUPPORT AND REPORTING	1,062	588	0	120	354
	PREFERRED SITE - CHARACTERIZATION	2,526	1,484	0	200	842
562 20	SYSTEM DEVELOPMENT	94,253	59,375	4,300	3,575	27,003
562 20 02	SYSTEM DEVELOPMENT MANAGEMENT	9,355	7,980	0	300	1,075
562 20 05	SYSTEM OPTIMIZATION	6,634	5,011	0	120	1,503
562 20 20	PROCESS SYSTEM ENG'NG (PACK'G, REPACK'G & DEC'NT'M)	53,755	30,642	4,300	895	17,918
562 20 30	STORAGE SYSTEM ENG'NG	22,568	14,295	0	2,200	6,073
562 20 40	SECURITY & SAFEGUARD ENG'NG	1,941	1,447	0	60	434
562 25	SAFETY ASSESSMENT	37,271	21,098	0	5,525	10,648
562 25 10	SAFETY ASSESSMENT MANAGEMENT	8,495	5,218	0	850	2,427
562 25 30	SA - SITING	8,592	2,287	0	3,850	2,455
562 25 40	SA - OPERATING LICENSE	2,576	1,540	0	300	736
562 25 50	SA - FACILITY OPERATIONS	13,760	9,604	0	225	3,931
562 25 70	SA - DECOMMISSIONING (Processing Facilities)	3,848	2,449	0	300	1,099
562 30	LICENSING & APPROVALS	159,101	37,883	0	84,555	36,663
562 30 30	LIAISON WITH CNSC	773	555	0	40	178

WBS	WBS Title	Total	Labour	Material & Equipment	Other	Cont'y
562 30 50	CNSC CONSTRUCTION LICENCE	13,037	3,177	0	6,852	3,008
562 30 60	OTHER GOVN'MT APPROVALS	1,089	736	0	0	353
	APPROVAL REQUIREMENTS	505	337	0	0	168
	FEDERAL APPROVALS	199	133	0	0	66
	PROVINCIAL APPROVALS	186	133	0	0	53
	MUNICIPAL APPROVALS	199	133	0	0	66
562 30 65	CNSC OPERATING LICENCE (Initial Application)	2,407	662	0	1,343	402
562 30 70	CNSC OPERATING LICENCE (Maintenance & Renewal)	141,795	32,753	0	76,320	32,722
562 35	PUBLIC AFFAIRS (Y1-Y17)	64,281	33,763	0	9,092	21,426
562 35 10	PUBLIC AFFAIRS - CANDIDATE AREAS	12,820	7,047	0	1,500	4,273
562 35 30	PUBLIC AFFAIRS - FEASIBILITY STUDIES	9,325	5,217	0	1,000	3,108
562 35 40	PUBLIC AFFAIRS - CANDIDATE SITES	13,989	7,826	0	1,500	4,663
562 35 45	PUBLIC AFFAIRS - PREFERRED SITE	5,469	3,046	0	600	1,823
562 35 50	PUBLIC AFFAIRS - PUBLIC REVIEW & EA APPROVAL	9,028	4,569	0	1,450	3,009
562 35 70	PUBLIC AFFAIRS - DESIGN & CONSTRUCTION	4,992	2,528	0	800	1,664
562 35 110	PUBLIC AFFAIRS - PROGRAM MANAGEMENT	5,550	3,530	0	170	1,850
562 35 120	COMMUNITY OFFSETS AND BENEFITS	3,108	0	0	2,072	1,036
562 40	FACILITY DESIGN AND CONSTRUCTION	529,443	132,197	221,599	55,652	119,995
562 40 10	SITE & IMPROVEMENTS	161,482	45,930	58,350	3,375	53,827
562 40 20	PROCESSING BUILDING (PB)	78,472	24,598	31,509	4,644	17,721
	RECEIPT & TRANSFER (EQUIP)	3,447	120	2,406	126	795
	MODULE TRANSFER CELLS (EQUIP)	15,323	1,464	9,762	561	3,536
	BASKET TRANSFER CELLS (EQUIP)	10,952	1,046	6,978	401	2,527
	COMMON CRANE MAINTENANCE AREA (EQUIP)	3,543	338	2,258	129	818
	PROCESSING BUILDING DESIGN & CONST'N	13,466	4,800	4,599	960	3,107
	PB BUILDING SERVICES DESIGN AND INSTALL'N	17,585	6,630	5,506	1,932	3,517
	COMMISSIONING (PB)	1,503	835	0	167	501
	CONST'N INDIRECTS (PB)	12,653	9,365	0	368	2,920
562 40 30	COMMON ANCILLARY FACILITIES	64,242	23,208	29,688	0	11,346
	ADMIN AND VISITOR RECEP'T'N BLDG	1,524	486	784	0	254
	OPS SUPPT & HEALTH PHYSICS BDLG	3,487	1,294	1,612	0	581
	EQUIP STORAGE AND MAINT'CE BLDG	3,524	1,262	1,675	0	587

WBS	WBS Title	Total	Labour	Material & Equipment	Other	Cont'y
	STORAGE CASK/MODULE CANISTER STORE	3,507	1,031	1,892	0	584
	ACTIVE SOLID WASTE HDLG BLDG	2,072	459	1,135	0	478
	SOLID WASTE STORAGE AREA	1,163	458	437	0	268
	ACTIVE LIQ/W TRT'MT BLDG	2,711	359	1,727	0	625
	LOW LVL LIQ/W STRG BLDG	2,428	463	1,426	0	539
	WAREHOUSE BLDG	1,224	470	550	0	204
	GUARDHOUSE AND SECURITY FENCE	1,353	631	497	0	225
	TRUCK INSP'N / WASH STATION	2,336	872	1,075	0	389
	UTILITY BLDG	2,964	1,023	1,257	0	684
	TEST FACILITY CONTRUCTION	2,929	766	1,675	0	488
	FIRE PROTECTION SYSTEMS	2,122	1,022	676	0	424
	SECURITY AND COMUNICATION SYSTEM	1,471	607	600	0	264
	ELECTRICAL AND EMERGENCY POWER	4,838	1,939	1,932	0	967
	SANITARY SEWER SYSTEM	811	339	310	0	162
	POTABLE WATER SYSTEM	648	371	148	0	129
	RETENTION/SEDIMENTATION POND	1,382	874	189	0	319
	STORM WATER DETENTION POND	624	387	93	0	144
	CONST'N MAT'L STOCKPILE AREA	1,913	1,039	625	0	249
	SITE MATERIALS STORAGE AREA	2,097	1,169	655	0	273
	ACCESS ROADS AND VEHICLE COMPOUNDS	3,981	1,319	1,866	0	796
	CONST'N INDIRECTS ANCILLARY FACILITIES	13,133	4,568	6,852	0	1,713
562 40 40	STORAGE CONSTRUCTION (STAGE 1)	224,345	38,317	101,838	47,239	36,951
	CONSTRUCTION FACILITIES	1,163	469	312	114	268
	STORES ENGINEERING	8,893	6,841	0	0	2,052
	STORES EQUIP. DESIGN, SUPPLY & INSTALL	19,661	5,476	12,131	0	2,054
	SURFACE MODULAR VAULT DESIGN AND CONST'N	165,059	2,940	89,285	47,112	25,722
	COMMISSIONING	229	164	0	0	65
	CONST'N INDIRECTS	23,054	17,624	110	0	5,320
562 40 500	COMMISSIONING MANAGEMENT	258	144	0	28	86
562 40 600	EQUIPMENT, SPARES AND CONSUMABLES	278	0	214	0	64
562 40 650	ENERGY CONSUMPTION	366	0	0	366	0
562 45	FACILITY OPERATION	14,971,436	2,999,882	3,153,289	5,992,485	2,825,780
562 45 10	OPERATIONS INITIAL FUEL RECEIPT	2,329,421	489,286	719,234	658,550	462,351
	PROGRAM MANAGEMENT	572,191	118,334	0	357,142	96,715
	PROCESSING BUILDING OPERATIONS	435,080	78,324	255,840	0	100,916
	COMMON ANCILLARY FACILITIES OPERATIONS (INITIAL FUEL RECEIPTS)	40,845	32,676	0	0	8,169
	MONITORING AND SURVEILLANCE (INITIAL FUEL RECEIPTS)	6,007	3,899	106	0	2,002
	OPERATION INDIRECTS (INITIAL FUEL RECEIPTS)	284,090	146,955	1,284	74,072	61,779
	STORAGE OPERATIONS	40,163	30,695	200	0	9,268
	STORAGE CONSTRUCTION STAGE 2	191,646	14,792	91,538	46,846	38,470

WBS	WBS Title	Total	Labour	Material & Equipment	Other	Cont'y
	STORAGE CONSTRUCTION STAGE 3	191,646	14,792	91,538	46,846	38,470
	STORAGE CONSTRUCTION STAGE 4	192,773	19,425	97,604	44,548	31,196
	STORAGE CONSTRUCTION STAGE 5	187,489	14,696	90,562	44,548	37,683
	STORAGE CONSTRUCTION STAGE 6	187,491	14,698	90,562	44,548	37,683
562 45 20	OPERATIONS - EXTENDED MONITORING	4,067,270	1,447,268	192,069	1,607,346	820,587
	PROGRAM MANAGEMENT	1,854,973	312,651	0	1,231,373	310,949
	MONITORING AND SURVEILLANCE (EXTENDED)	81,054	53,849	187	0	27,018
	OPERATION INDIRECTS (EXTENDED MONITORING)	1,909,336	907,516	186,204	375,000	440,616
	COMMON ANCILLARY FACILITIES OPERATIONS (EXTENDED MONITORING)	185,660	148,528	0	0	37,132
	FUEL INTEGRITY MONITORING (25 YEARLY)	36,247	24,724	5,678	973	4,872
562 45 30	OPERATIONS - FACILITY REPEATS	4,259,805	464,688	1,690,935	1,343,295	760,887
	VAULT 100 YEAR REPLACEMENT	1,419,935	154,896	563,645	447,765	253,629
	VAULT 200 YEAR REPLACEMENT	1,419,935	154,896	563,645	447,765	253,629
	VAULT 300 YEAR REPLACEMENT	1,419,935	154,896	563,645	447,765	253,629
562 45 40	OPERATIONS - REPACKAGING	4,314,940	598,640	551,051	2,383,294	781,955
	PROGRAM MANAGEMENT	3,198,457	360,064	0	2,302,752	535,641
	DECOMMISSIONING OF EXISTING FACILITIES	7,458	2,357	0	3,462	1,639
	CONSTRUCTION FACILITIES - REPACK'NG PLANT M TO M	1,375	476	354	228	317
	RECEIPT & TRANSFER (EQUIP)	3,054	106	2,132	111	705
	CANISTER TO CANISTER FUEL TRANSFER (EQUIP)	30,474	3,721	18,605	1,116	7,032
	CANISTER DECONTAMINATION (EQUIP)	7,870	961	4,805	288	1,816
	MODULE DECONTAMINATION(EQUIP)	6,236	761	3,808	228	1,439
	CANISTER DISMANTLING / BREAKDOWN(EQUIP)	8,732	1,066	5,332	319	2,015
	RPMM BUILDING DESIGN & CONST'N	22,578	8,000	7,768	1,600	5,210
	BUILDING SERVICES (RPMM)	23,445	9,120	7,199	2,527	4,599
	COMMISSIONING (RPMM)	2,042	1,169	0	218	655
	CONST'N INDIRECTS (RPMM)	16,993	12,695	0	481	3,817
	COMMON ANCILLARY FACILITIES (REPLACEMENT)	152,330	24,230	92,700	0	35,400
	COMMISSIONING MANAGEMENT (RPMM)	328	219	0	0	109
	REPACKAGING OPERATIONS (RPMM)	676,771	118,823	358,176	43,594	156,178
	ANCILLARY FACILITIES OPERATIONS (FACILITY REPEATS AND REPACKAGING)	14,852	11,882	0	0	2,970
	OPERATION INDIRECTS (RPMM)	34,714	13,976	346	16,200	4,192
	STORAGE OPERATIONS (RPMM)	2,721	2,093	0	0	628
	CONSTRUCTION FACILITIES - REPACK'NG PLANT B TO B	1,375	476	354	228	317
	RECEIPT & TRANSFER (EQUIP)	2,027	70	1,415	74	468
	BASKET TO BASKET FUEL TRANSFER (EQUIP)	18,993	2,319	11,596	695	4,383
	BASKET DECONTAMINATION (EQUIP)	6,997	854	4,272	256	1,615
	RPBB BUILDING DESIGN AND CONSTRUCTION	12,052	4,160	4,279	832	2,781
	BUILDING SERVICES (RPBB)	12,376	4,447	4,153	1,309	2,467
	COMMISSIONING (RPBB)	1,173	668	0	126	379
	CONST'N INDIRECTS (RPBB)	8,484	6,299	0	241	1,944
	REPACKAGING OPERATIONS (RPBB)	32,853	3,960	23,585	3,169	2,139
	OPERATION INDIRECTS (RPBB)	6,893	2,678	172	3,240	803

WBS	WBS Title	Total	Labour	Material & Equipment	Other	Cont'y
	STORAGE OPERATIONS (RPBB)	1,287	990	0	0	297
562 55	EA & MONITORING	530,341	390,100	27,554	9,989	102,698
562 55 10	EA & MONITORING PROGRAM MANAGEMENT	95,908	70,306	0	3,470	22,132
562 55 20	CNSC CONSTRUCTION LICENCE - ENVIRONMENTAL ASSESSMENT	12,234	6,006	0	2,150	4,078
562 55 40	GROUNDWATER MONITORING	59,599	37,158	5,058	3,630	13,753
562 55 50	RADIOLOGICAL BIOSPHERE MONITORING	282,187	217,280	17,876	0	47,031
562 55 60	NON-RAD BIOSPHERE MONITORING	72,762	53,590	4,620	0	14,552
562 55 80	HUMAN HEALTH MONITORING	7,651	5,760	0	739	1,152
562 90	PROGRAM MANAGEMENT (Y1-Y17)	147,390	56,305	0	66,520	24,565
562 90 00	PROGRAM MANAGEMENT (Y1-Y17)	147,390	56,305	0	66,520	24,565
TOTAL		16,577,878	3,754,429	3,406,742	6,233,143	3,183,564

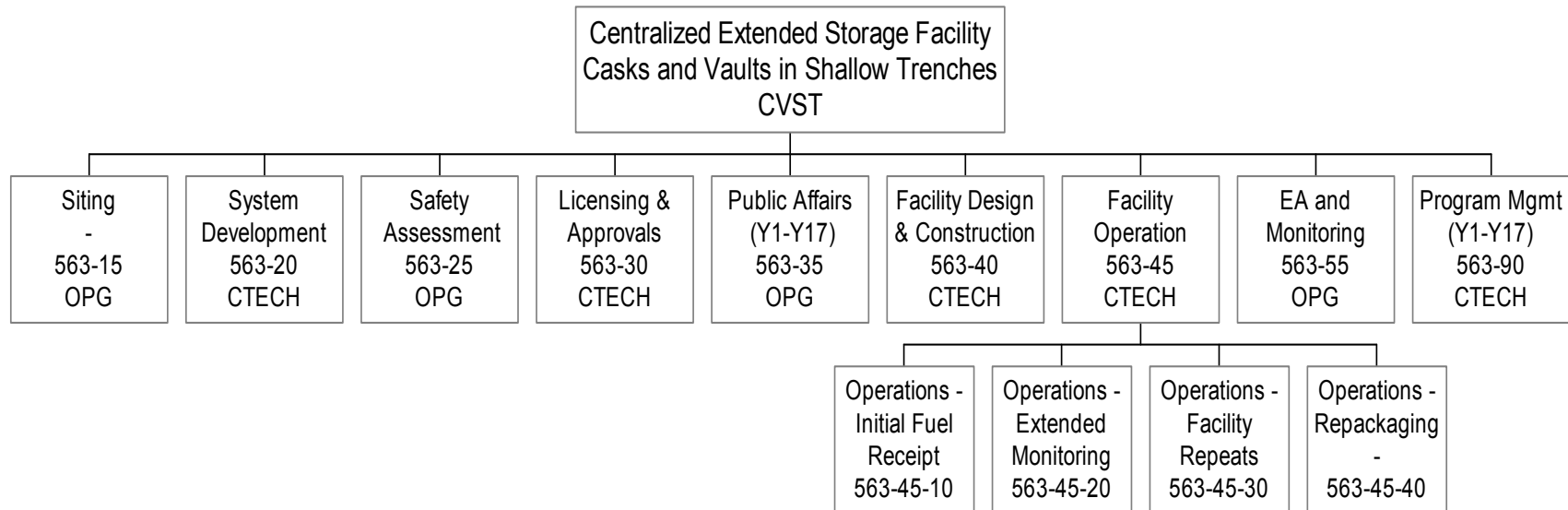
APPENDIX D

Cost Estimate for CVST Facility (563)

D1 Work Breakdown Structure for CVST Facility

Centralized Extended Storage Facility Cost Estimate

Work Breakdown Structure, Coding and Estimating Responsibilities



D2 Work Element Definition Sheets for CVST Facility

CVST WEDs presented under separate cover

D3 CVST Facility Cost Estimate Details

CVST Work Breakdown schedule to lowest WBS level is presented on the attached CD.

D4 CVST Facility Cost by Category Report

WBS	WBS Title	Total	Labour	Material & Equipment	Other	Cont'y
563 15	SITING	45,748	24,550	0	5,950	15,248
563 15 10	TECHNICAL SITING MANAGEMENT	9,295	4,897	0	1,300	3,098
563 15 20	CANDIDATE AREAS	15,478	6,709	0	3,610	5,159
	SELECTION OF FEASIBILITY STUDY COMMUNITIES	5,955	3,610	0	360	1,985
	DATABASE & INFO SYSTEM	6,585	1,290	0	3,100	2,195
	CANDIDATE AREAS - CHARACTERIZATION	2,938	1,809	0	150	979
563 15 50	FEASIBILITY STUDIES (3 SITES)	8,155	5,097	0	340	2,718
	FEASIBILITY STUDIES - SUPPORT & REPORTING	4,332	2,648	0	240	1,444
	FEASIBILITY STUDIES - CHARACTERIZATION	3,823	2,449	0	100	1,274
563 15 60	CANDIDATE SITES (2 SITES)	7,846	5,051	0	180	2,615
	CANDIDATE SITES - SUPPORT & REPORTING	4,056	2,524	0	180	1,352
	CANDIDATE SITES - CHARA CTERIZATION	3,790	2,527	0	0	1,263
563 15 70	PREFERRED SITE	4,974	2,796	0	520	1,658
	PREFERRED SITE - SUPPORT AND REPORTING	1,062	588	0	120	354
	PREFERRED SITE - CHARACTERIZATION	3,912	2,208	0	400	1,304
563 20	SYSTEM DEVELOPMENT	79,198	51,203	4,300	1,575	22,120
563 20 02	SYSTEM DEVELOPMENT MANAGEMENT	8,065	6,690	0	300	1,075
563 20 05	SYSTEM OPTIMIZATION	4,414	3,303	0	120	991
563 20 20	PROCESS SYSTEM ENG'NG (PACK'G, REPACK'G & DEC'NT'M)	50,283	28,327	4,300	895	16,761
563 20 30	STORAGE SYSTEM ENG'NG	14,495	11,436	0	200	2,859
563 20 40	SECURITY & SAFEGUARD ENG'NG	1,941	1,447	0	60	434
563 25	SAFETY ASSESSMENT	37,271	21,098	0	5,525	10,648
563 25 10	SAFETY ASSESSMENT MANAGEMENT	8,495	5,218	0	850	2,427
563 25 30	SA - SITING	8,592	2,287	0	3,850	2,455
563 25 40	SA - OPERATING LICENSE	2,576	1,540	0	300	736
563 25 50	SA - FACILITY OPERATIONS	13,760	9,604	0	225	3,931
563 25 70	SA - DECOMMISSIONING (Processing Facilities)	3,848	2,449	0	300	1,099
563 30	LICENSING & APPROVALS	159,101	37,883	0	84,555	36,663
563 30 30	LIAISON WITH CNSC	773	555	0	40	178

WBS	WBS Title	Total	Labour	Material & Equipment	Other	Cont'y
563 30 50	CNSC CONSTRUCTION LICENCE	13,037	3,177	0	6,852	3,008
563 30 60	OTHER GOVN'MT APPROVALS	1,089	736	0	0	353
	APPROVAL REQUIREMENTS	505	337	0	0	168
	FEDERAL APPROVALS	199	133	0	0	66
	PROVINCIAL APPROVALS	186	133	0	0	53
	MUNICIPAL APPROVALS	199	133	0	0	66
563 30 65	CNSC OPERATING LICENCE	2,407	662	0	1,343	402
563 30 70	CNSC OPERATING LICENCE (Maintenance & Renewal)	141,795	32,753	0	76,320	32,722
563 35	PUBLIC AFFAIRS (Y1-Y17)	64,281	33,763	0	9,092	21,426
563 35 10	PUBLIC AFFAIRS - CANDIDATE AREAS	12,820	7,047	0	1,500	4,273
563 35 30	PUBLIC AFFAIRS - FEASIBILITY STUDIES	9,325	5,217	0	1,000	3,108
563 35 40	PUBLIC AFFAIRS - CANDIDATE SITES	13,989	7,826	0	1,500	4,663
563 35 45	PUBLIC AFFAIRS - PREFERRED SITE	5,469	3,046	0	600	1,823
563 35 50	PUBLIC AFFAIRS - PUBLIC REVIEW & EA APPROVAL	9,028	4,569	0	1,450	3,009
563 35 70	PUBLIC AFFAIRS - DESIGN & CONSTRUCTION	4,992	2,528	0	800	1,664
563 35 110	PUBLIC AFFAIRS - PROGRAM MANAGEMENT	5,550	3,530	0	170	1,850
563 35 120	COMMUNITY OFFSETS AND BENEFITS	3,108	0	0	2,072	1,036
563 40	FACILITY DESIGN AND CONSTRUCTION	582,312	242,601	184,534	16,499	138,678
563 40 10	SITE & IMPROVEMENTS	161,482	45,930	58,350	3,375	53,827
563 40 20	PROCESSING BUILDING (PB)	87,034	25,851	36,361	5,425	19,397
	RECEIPT & TRANSFER (EQUIP)	8,208	286	5,728	300	1,894
	MODULE TRANSFER CELLS (EQUIP)	11,585	1,107	7,381	424	2,673
	BASKET TRANSFER CELLS (EQUIP)	10,952	1,046	6,978	401	2,527
	COMMON CRANE MAINTENANCE AREA (EQUIP)	3,543	338	2,258	129	818
	CASK PROCESS AREA (EQUIP)	4,082	294	2,946	162	680
	PROCESSING BUILDING DESIGN & CONST'N	14,716	5,312	4,946	1,062	3,396
	PB BUILDING SERVICES DESIGN AND INSTALL'N	19,005	6,692	6,124	2,388	3,801
	COMMISSIONING (PB)	1,557	865	0	173	519
	CONST'N INDIRECTS (PB)	13,386	9,911	0	386	3,089
563 40 30	COMMON ANCILLARY FACILITIES	64,266	23,265	29,639	0	11,362
	ADMIN AND VISITOR RECEPT'N BLDG	1,524	486	784	0	254
	OPS SUPPT & HEALTH PHYSICS BLDG	3,487	1,294	1,612	0	581

WBS	WBS Title	Total	Labour	Material & Equipment	Other	Cont'y
	EQUIP STORAGE AND MAINT'CE BLDG	3,524	1,262	1,675	0	587
	STORAGE CASK/MODULE CANISTER STORE	3,507	1,031	1,892	0	584
	ACTIVE SOLID WASTE HDLG BLDG	2,072	459	1,135	0	478
	SOLID WASTE STORAGE AREA	1,163	458	437	0	268
	ACTIVE LIQ/W TRT'MT BLDG	2,711	359	1,727	0	625
	LOW LVL LIQ/W STRG BLDG	2,338	373	1,426	0	539
	WAREHOUSE BLDG	1,224	470	550	0	204
	GUARDHOUSE AND SECURITY FENCE	1,388	620	537	0	231
	TRUCK INSP'N / WASH STATION	2,336	872	1,075	0	389
	UTILITY BLDG	2,964	1,023	1,257	0	684
	TEST FACILITY CONSTRUCTION	2,929	766	1,675	0	488
	FIRE PROTECTION SYSTEMS	2,122	1,022	676	0	424
	SECURITY AND COMMUNICATION SYSTEM	1,471	607	600	0	264
	ELECTRICAL AND EMERGENCY POWER	4,838	1,939	1,932	0	967
	SANITARY SEWER SYSTEM	811	339	310	0	162
	POTABLE WATER SYSTEM	648	371	148	0	129
	RETENTION/SEDIMENTATION POND	1,382	874	189	0	319
	STORM WATER DETENTION POND	624	387	93	0	144
	CONST'N MAT'L STOCKPILE AREA	1,913	1,039	625	0	249
	SITE MATERIALS STORAGE AREA	2,641	1,489	808	0	344
	ACCESS ROADS AND VEHICLE COMPOUNDS	3,981	1,319	1,866	0	796
	CONST'N INDIRECTS ANCILLARY FACILITIES	12,668	4,406	6,610	0	1,652
563 40 40	STORAGE DESIGN & CONSTRUCTION (STAGE 1)	268,562	147,402	59,932	7,303	53,925
563 40 500	COMMISSIONING MANAGEMENT	275	153	0	30	92
563 40 600	EQUIPMENT, SPARES AND CONSUMABLES	327	0	252	0	75
563 40 650	ENERGY CONSUMPTION	366	0	0	366	0
563 45	FACILITY OPERATION	13,983,341	3,543,747	3,936,654	4,338,780	2,164,160
563 45 10	OPERATIONS INITIAL FUEL RECEIPT	1,922,000	588,601	620,155	412,244	301,000
	PROGRAM MANAGEMENT	504,280	110,251	0	308,633	85,396
	PROCESSING BUILDING OPERATIONS	493,355	91,493	379,435	0	22,427
	COMMON ANCILLARY FACILITIES OPERATIONS (INITIAL FUEL RECEIPTS)	40,845	32,676	0	0	8,169
	MONITORING AND SURVEILLANCE (INITIAL FUEL RECEIPTS)	29,261	19,455	52	0	9,754
	OPERATION INDIRECTS (INITIAL FUEL RECEIPTS)	291,590	152,040	1,968	74,072	63,510
	STORAGE OPERATIONS	39,006	29,705	300	0	9,001
	STORAGE DESIGN & CONSTRUCTION STAGE 2	158,384	37,467	81,361	9,868	29,688
	STORAGE DESIGN & CONSTRUCTION STAGE 3	204,632	66,321	87,582	9,803	40,926
	STORAGE DESIGN & CONSTRUCTION STAGE 4	160,647	49,193	69,457	9,868	32,129
563 45 20	OPERATIONS - EXTENDED MONITORING	4,250,478	1,490,888	409,778	1,456,764	893,048
	PROGRAM MANAGEMENT	1,674,295	312,354	0	1,081,105	280,836

WBS	WBS Title	Total	Labour	Material & Equipment	Other	Cont'y
	MONITORING AND SURVEILLANCE - EXTENDED MONITORING	226,267	150,328	517	0	75,422
	OPERATION INDIRECTS (MONITORING)	2,153,342	875,047	406,370	375,000	496,925
	COMMON ANCILLARY FACILITIES OPERATIONS (EXTENDED MONITORING)	185,660	148,528	0	0	37,132
	FUEL INTEGRITY MONITORING (25 YEARLY)	10,914	4,631	2,891	659	2,733
563 45 30	OPERATIONS - FACILITY REPEATS	525,111	296,322	118,530	18,548	91,711
	BASKET VAULT 100 YEAR REPLACEMENT	92,547	43,775	38,620	5,500	4,652
	BASKET VAULTS 200 YEAR REPLACEMENT	187,549	98,845	50,865	412	37,427
	BASKET VAULTS 300 YEAR REPLACEMENT	104,455	43,302	29,045	10,588	21,520
	STORAGE CHAMBER 200 YEAR REPLACEMENT	140,560	110,400	0	2,048	28,112
563 45 40	OPERATIONS - REPACKAGING	7,285,752	1,167,936	2,788,191	2,451,224	878,401
	PROGRAM MANAGEMENT	2,924,839	440,777	0	1,991,459	492,603
	DECOMMISSIONING OF EXISTING FACILITIES	5,861	2,357	0	2,216	1,288
	CONSTRUCTION FACILITIES - REPACK'NG PLANT Module (RPM)	1,375	476	354	228	317
	RECEIPT & TRANSFER (EQUIP)	7,914	276	5,523	289	1,826
	CASK TO CASK FUEL TRANSFER	18,709	2,284	11,423	685	4,317
	CASK DECONTAMINATION (EQUIP)	21,021	2,743	13,716	822	3,740
	DECONTAMINATED CASK BUFFER STORAGE AREA (EQUIP)	6,571	0	5,055	0	1,516
	CASK PROCESS AREA (RP EQUIP)	3,232	233	2,332	128	539
	RPM BUILDING DESIGN & CONST'N	24,141	8,435	8,584	1,624	5,498
	BUILDING SERVICES (RPM)	29,612	11,374	9,117	3,486	5,635
	COMMISSIONING (RPM)	2,180	1,252	0	232	696
	CONST'N INDIRECTS (RPM)	19,325	14,668	0	518	4,139
	COMMON ANCILLARY FACILITIES (REPLACEMENT)	67,486	24,486	31,100	0	11,900
	COMMISSIONING MANAGEMENT (RPM)	409	273	0	0	136
	REPACKAGING OPERATIONS (RPM)	1,079,708	112,881	788,840	110,864	67,123
	ANCILLARY FACILITIES OPERATIONS (FACILITY REPEATS AND REPACKAGING)	14,852	11,882	0	0	2,970
	OPERATION INDIRECTS (RPM)	38,922	17,186	380	16,200	5,156
	STORAGE OPERATIONS (RPM)	19,054	14,657	0	0	4,397
	MODULE TO CASK 200 YEAR REPACKAGING	1,365,700	227,570	876,226	139,514	122,390
	MODULE TO CASK 300 YEAR REPACKAGING	1,365,700	227,570	876,226	139,514	122,390
	MM EQUIP. DESIGN, SUPPLY & INSTALL	8,412	0	6,471	0	1,941
	BUILDING DESIGN & CONST'N (Module to Module)	1,063	372	372	74	245
	BUILDING SERVICES (MM)	974	383	310	97	184
	COMMISSIONING (MM)	710	334	0	53	323
	CONST'N INDIRECTS (MM)	1,238	723	0	25	490
	REPACKAGING OPERATIONS (Module to Module)	155,976	17,823	102,336	35,817	0
	CONSTRUCTION FACILITIES - REPACK'NG PLANT Basket (RPB)	1,375	476	354	228	317
	RECEIPT & TRANSFER (EQUIP)	2,027	70	1,415	74	468
	BASKET TO BASKET FUEL TRANSFER	18,993	2,319	11,596	695	4,383
	BASKET DECONTAMINATION	6,997	854	4,272	256	1,615
	RPBB BUILDING DESIGN AND CONSTRUCTION	12,052	4,160	4,279	832	2,781

WBS	WBS Title	Total	Labour	Material & Equipment	Other	Cont'y
	BUILDING SERVICES (RPB)	12,376	4,447	4,153	1,309	2,467
	COMMISSIONING (RPB)	1,173	668	0	126	379
	CONST'N INDIRECTS (RPB)	8,484	6,299	0	241	1,944
	REPACKAGING OPERATIONS (RPB)	29,111	3,960	23,585	378	1,188
	OPERATION INDIRECTS (RPB)	6,893	2,678	172	3,240	803
	STORAGE OPERATIONS (RPB)	1,287	990	0	0	297
563 55	EA & MONITORING	530,341	390,100	27,554	9,989	102,698
563 55 10	EA & MONITORING PROGRAM MANAGEMENT	95,908	70,306	0	3,470	22,132
563 55 20	CNSC CONSTRUCTION LICENCE - ENVIRONMENTAL ASSESSMENT	12,234	6,006	0	2,150	4,078
563 55 40	GROUNDWATER MONITORING	59,599	37,158	5,058	3,630	13,753
563 55 50	RADIOLOGICAL BIOSPHERE MONITORING	282,187	217,280	17,876	0	47,031
563 55 60	NON-RAD BIOSPHERE MONITORING	72,762	53,590	4,620	0	14,552
563 55 80	HUMAN HEALTH MONITORING	7,651	5,760	0	739	1,152
563 90	PROGRAM MANAGEMENT (Y1-Y17)	143,121	56,305	0	62,963	23,853
563 90 00	PROGRAM MANAGEMENT (Y1-Y17)	143,121	56,305	0	62,963	23,853
	TOTAL	15,624,717	4,401,250	4,153,042	4,534,928	2,535,494

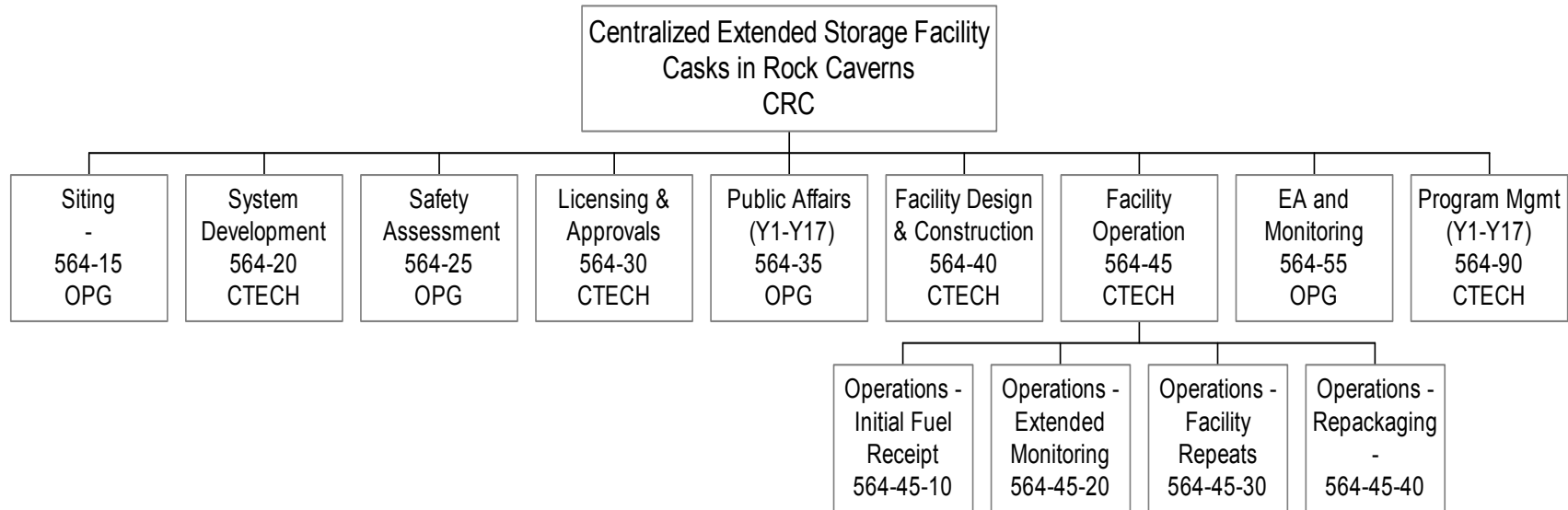
APPENDIX E

Cost Estimate for CRC Facility (564)

E1 Work Breakdown Structure for CRC Facility

Centralized Extended Storage Facility Cost Estimate

Work Breakdown Structure, Coding and Estimating Responsibilities



E2 Work Element Definition Sheets for CRC Facility

CRC WEDs presented under separate cover

E3 CRC Facility Cost Estimate Details

CRC Work Breakdown schedule to lowest WBS level is presented on the attached CD.

E4 CRC Facility Cost by Category Report

WBS	WBS Title	Total	Labour	Material & Equipment	Other	Cont'y
564 15	SITING	47,789	25,311	0	6,550	15,928
564 15 10	SITING MANAGEMENT	9,295	4,897	0	1,300	3,098
564 15 20	CANDIDATE AREAS	15,478	6,709	0	3,610	5,159
	SELECTION OF FEASIBILITY STUDY COMMUNITIES	5,955	3,610	0	360	1,985
	DATABASE & INFORMATION SYSTEM	6,585	1,290	0	3,100	2,195
	CANDIDATE AREAS - CHARACTERIZATION	2,938	1,809	0	150	979
564 15 50	FEASIBILITY STUDIES (3 SITES)	8,155	5,097	0	340	2,718
	FEASIBILITY STUDIES - SUPPORT & REPORTING	4,332	2,648	0	240	1,444
	FEASIBILITY STUDIES - CHARACTERISATION	3,823	2,449	0	100	1,274
564 15 60	CANDIDATE SITES (2 SITES)	7,846	5,051	0	180	2,615
	CANDIDATE SITES - SUPPORT & REPORTING	4,056	2,524	0	180	1,352
	CANDIDATE SITES - CHARACTERISATION	3,790	2,527	0	0	1,263
564 15 70	PREFERRED SITE	7,015	3,557	0	1,120	2,338
	PREFERRED SITE - SUPPORT AND REPORTING	1,062	588	0	120	354
	PREFERRED SITE - CHARACTERISATION	5,953	2,969	0	1,000	1,984
564 20	SYSTEM DEVELOPMENT	89,338	56,872	4,300	2,575	25,591
564 20 02	SYSTEM DEVELOPMENT MANAGEMENT	8,065	6,690	0	300	1,075
564 20 05	SYSTEM OPTIMIZATION	6,634	5,011	0	120	1,503
564 20 20	PROCESS SYSTEM ENG'NG (PACK'G, REPACK'G & DEC'NT'M)	55,245	31,635	4,300	895	18,415
564 20 30	STORAGE SYSTEM ENG'NG	17,453	12,089	0	1,200	4,164
564 20 40	SECURITY & SAFEGUARD ENG'NG	1,941	1,447	0	60	434
564 25	SAFETY ASSESSMENT	37,271	21,098	0	5,525	10,648
564 25 10	SAFETY ASSESSMENT MANAGEMENT	8,495	5,218	0	850	2,427
564 25 30	SA - SITING	8,592	2,287	0	3,850	2,455
564 25 40	SA - OPERATING LICENSE	2,576	1,540	0	300	736
564 25 50	SA - FACILITY OPERATIONS	13,760	9,604	0	225	3,931
564 25 70	SA - DECOMMISSIONING (Processing Facilities)	3,848	2,449	0	300	1,099
564 30	LICENSING & APPROVALS	205,824	37,883	0	120,495	47,446
564 30 30	LIAISON WITH CNSC	773	555	0	40	178

WBS	WBS Title	Total	Labour	Material & Equipment	Other	Cont'y
564 30 50	CNSC CONSTRUCTION LICENCE	16,286	3,177	0	9,351	3,758
564 30 60	OTHER GOVN'MT APPROVALS	1,089	736	0	0	353
	APPROVAL REQUIREMENTS	505	337	0	0	168
	FEDERAL APPROVALS	199	133	0	0	66
	PROVINCIAL APPROVALS	186	133	0	0	53
	MUNICIPAL APPROVALS	199	133	0	0	66
564 30 65	CNSC OPERATING LICENCE (Initial Application)	2,981	662	0	1,784	535
564 30 70	CNSC OPERATING LICENCE (Maintenance & Renewal)	184,695	32,753	0	109,320	42,622
564 35	PUBLIC AFFAIRS (Y1-Y17)	64,281	33,763	0	9,092	21,426
564 35 10	PUBLIC AFFAIRS - CANDIDATE AREAS	12,820	7,047	0	1,500	4,273
564 35 30	PUBLIC AFFAIRS - FEASIBILITY STUDIES	9,325	5,217	0	1,000	3,108
564 35 40	PUBLIC AFFAIRS - CANDIDATE SITES	13,989	7,826	0	1,500	4,663
564 35 45	PUBLIC AFFAIRS - PREFERRED SITE	5,469	3,046	0	600	1,823
564 35 50	PUBLIC AFFAIRS - PUBLIC REVIEW & EA APPROVAL	9,028	4,569	0	1,450	3,009
564 35 70	PUBLIC AFFAIRS - DESIGN & CONSTRUCTION	4,992	2,528	0	800	1,664
564 35 110	PUBLIC AFFAIRS - PROGRAM MANAGEMENT	5,550	3,530	0	170	1,850
564 35 120	COMMUNITY OFFSETS AND BENEFITS	3,108	0	0	2,072	1,036
564 40	FACILITY DESIGN AND CONSTRUCTION	536,468	220,073	154,324	32,144	129,927
564 40 10	SITE & IMPROVEMENTS	161,482	45,930	58,350	3,375	53,827
564 40 20	PROCESSING BUILDING (PB)	92,471	27,061	39,041	5,846	20,523
	RECEIPT & TRANSFER (EQUIP)	8,208	286	5,728	300	1,894
	MODULE TRANSFER CELLS (EQUIP)	11,585	1,107	7,381	424	2,673
	BASKET TRANSFER CELLS (EQUIP)	10,952	1,046	6,978	401	2,527
	COMMON CRANE MAINTENANCE AREA (EQUIP)	3,543	338	2,258	129	818
	CASK PROCESS AREA (EQUIP)	4,077	294	2,943	161	679
	PROCESSING BUILDING DESIGN & CONST'N	15,530	5,472	5,380	1,094	3,584
	PB BUILDING SERVICES DESIGN AND INSTALL'N	23,177	7,408	8,373	2,761	4,635
	COMMISSIONING (PB)	1,557	865	0	173	519
	CONST'N INDIRECTS (PB)	13,842	10,245	0	403	3,194
564 40 30	COMMON ANCILLARY FACILITIES	74,206	27,335	33,130	0	13,741
	ADMIN AND VISITOR RECEPT'N BLDG	1,524	486	784	0	254
	OPS SUPPT & HEALTH PHYSICS BLDG	3,487	1,294	1,612	0	581

WBS	WBS Title	Total	Labour	Material & Equipment	Other	Cont'y
	EQUIP STORAGE AND MAINT'CE BLDG	3,524	1,262	1,675	0	587
	STORAGE CASK/MODULE CANISTER STORE	3,507	1,031	1,892	0	584
	ACTIVE SOLID WASTE HDLG BLDG	2,072	459	1,135	0	478
	SOLID WASTE STORAGE AREA	1,163	458	437	0	268
	ACTIVE LIQ/W TRT'MT BLDG	2,711	359	1,727	0	625
	LOW LVL LIQ/W STRG BLDG	2,338	373	1,426	0	539
	WAREHOUSE BLDG	1,224	470	550	0	204
	GUARDHOUSE AND SECURITY FENCE	1,809	760	748	0	301
	TRUCK INSP'N / WASH STATION	2,336	872	1,075	0	389
	UTILITY BLDG	3,303	1,065	1,476	0	762
	TEST FACILITY CONSTRUCTION	2,929	766	1,675	0	488
	FIRE PROTECTION SYSTEMS	2,182	1,022	724	0	436
	SECURITY AND COMMUNICATION SYSTEM	1,471	607	600	0	264
	ELECTRICAL AND EMERGENCY POWER	4,451	1,939	1,932	0	580
	SANITARY SEWER SYSTEM	811	339	310	0	162
	POTABLE WATER SYSTEM	3,216	1,316	1,257	0	643
	RETENTION/SEDIMENTATION POND	1,382	874	189	0	319
	STORM WATER DETENTION POND	624	387	93	0	144
	CONST'N MAT'L STOCKPILE AREA	4,477	2,933	960	0	584
	SITE MATERIALS STORAGE AREA	2,628	1,486	800	0	342
	ACCESS ROADS AND VEHICLE COMPOUNDS	3,981	1,319	1,866	0	796
	CONST'N INDIRECTS ANCILLARY FACILITIES	17,056	5,458	8,187	0	3,411
564 40 40	STORAGE DESIGN & CONSTRUCTION (STAGE 1)	207,341	119,594	23,551	22,527	41,669
564 40 500	COMMISSIONING MANAGEMENT	275	153	0	30	92
564 40 600	EQUIPMENT, SPARES AND CONSUMABLES	327	0	252	0	75
564 40 650	ENERGY CONSUMPTION	366	0	0	366	0
564 45	FACILITY OPERATION	12,431,365	3,450,297	3,724,728	3,355,880	1,900,460
564 45 10	OPERATIONS INITIAL FUEL RECEIPT	1,583,350	574,963	455,242	325,543	227,602
	PROGRAM MANAGEMENT	401,925	116,097	0	217,491	68,337
	PROCESSING BUILDING OPERATIONS	551,542	86,542	441,780	0	23,220
	COMMON ANCILLARY FACILITIES OPERATIONS (INITIAL FUEL RECEIPTS)	40,845	32,676	0	0	8,169
	MONITORING AND SURVEILLANCE (INITIAL FUEL RECEIPTS)	19,840	13,185	42	0	6,613
	OPERATION INDIRECTS (INITIAL FUEL RECEIPTS)	331,556	182,783	1,968	74,072	72,733
	STORAGE OPERATIONS	32,570	24,754	300	0	7,516
	STORAGE CONSTRUCTION STAGE 2	114,827	65,963	6,619	19,280	22,965
	STORAGE CONSTRUCTION STAGE3	90,245	52,963	4,533	14,700	18,049
564 45 20	OPERATIONS - EXTENDED MONITORING	3,671,108	1,467,481	245,210	1,181,616	776,801
	PROGRAM MANAGEMENT	1,344,474	312,651	0	805,957	225,866
	MONITORING AND SURVEILLANCE -EXTENDED MONITORING	190,671	126,694	420	0	63,557

WBS	WBS Title	Total	Labour	Material & Equipment	Other	Cont'y
	OPERATION INDIRECTS (EXTENDED MONITORING)	1,939,374	875,047	241,779	375,000	447,548
	COMMON ANCILLARY FACILITIES OPERATIONS (EXTENDED MONITORING)	185,660	148,528	0	0	37,132
	FUEL INTEGRITY MONITORING (25 YEARLY)	10,929	4,561	3,011	659	2,698
564 45 30	OPERATIONS - FACILITY REPEATS	303,066	200,194	1,850	0	101,022
	STORAGE CAVERN 300 YEAR REFURBISHMENT	303,066	200,194	1,850	0	101,022
564 45 40	OPERATIONS - REPACKAGING	6,873,841	1,207,659	3,022,426	1,848,721	795,035
	PROGRAM MANAGEMENT (FACILITY REPEATS & REPACKAGING)	2,085,881	389,060	0	1,344,044	352,777
	DECOMMISSIONING OF EXISTING FACILITIES	7,500	2,357	0	3,495	1,648
	CONSTRUCTION FACILITIES - REPACK'NG PLANT Module (RPM)	1,375	476	354	228	317
	RECEIPT & TRANSFER (RPM & RPB - EQUIP)	7,914	276	5,523	289	1,826
	CASK TO CASK FUEL TRANSFER (RPM & RPB - EQUIP)	18,709	2,284	11,423	685	4,317
	CASK DECONTAMINATION (RPM & RPB - EQUIP)	21,021	2,743	13,716	822	3,740
	DECONTAMINATED CASK BUFFER STORAGE AREA (EQUIP)	6,571	0	5,055	0	1,516
	CASK PROCESS AREA (RPM & RPB - EQUIP)	3,232	233	2,332	128	539
	RPM BUILDING DESIGN & CONST'N	24,141	8,435	8,584	1,624	5,498
	BUILDING SERVICES (RPM)	29,612	11,374	9,117	3,486	5,635
	COMMISSIONING (RPM)	2,180	1,252	0	232	696
	CONST'N INDIRECTS (RPM)	19,325	14,668	0	518	4,139
	COMMON ANCILLARY FACILITIES (REPLACEMENT)	72,530	27,430	32,700	0	12,400
	COMMISSIONING MANAGEMENT (RPM)	409	273	0	0	136
	REPACKAGING OPERATIONS (RPM)	1,095,156	124,764	788,840	110,864	70,688
	ANCILLARY FACILITIES OPERATIONS (FACILITY REPEATS AND REPACKAGING)	14,852	11,882	0	0	2,970
	OPERATION INDIRECTS (RPM)	37,471	16,070	380	16,200	4,821
	STORAGE OPERATIONS (RPM)	2,721	2,093	0	0	628
	MODULE TO CASK 200 YEAR REPACKAGING	1,375,992	230,151	878,026	143,820	123,995
	MODULE TO CASK 300 YEAR REPACKAGING	1,375,992	230,151	878,026	143,820	123,995
	MM EQUIP. DESIGN, SUPPLY & INSTALL	8,412	0	6,471	0	1,941
	BUILDING DESIGN & CONST'N (Module to Module MM)	1,063	372	372	74	245
	BUILDING SERVICES (MM)	974	383	310	97	184
	COMMISSIONING(MM)	710	334	0	53	323
	CONST'N INDIRECTS (MM)	1,238	723	0	25	490
	REPACKAGING OPERATIONS (MM)	161,323	17,823	102,336	35,817	5,347
	CONSTRUCTION FACILITIES - REPACK'NG PLANT BASKET (RPB)	1,375	476	354	228	317
	RECEIPT AND TRANSFER (EQUIP - RPB)	1,808	63	1,262	66	417
	CASK TO CASK FUEL TRANSFER (EQUIP - RPB)	16,513	2,016	10,082	604	3,811
	BUILDING DESIGN & CONST'N (RPB)	9,870	3,520	3,369	704	2,277
	BUILDING SERVICES (RPB)	12,930	4,703	4,309	1,358	2,560
	COMMISSIONING (RPB)	1,192	668	0	131	393
	CONST'N INDIRECTS (RPB)	8,928	6,661	0	250	2,017
	REPACKAGING OPERATIONS (RPB)	86,607	9,901	62,345	8,762	5,599
	OPERATION INDIRECTS (RPB)	5,324	2,678	113	1,730	803

WBS	WBS Title	Total	Labour	Material & Equipment	Other	Cont'y
	STORAGE OPERATIONS (RPB)	1,287	990	0	0	297
	BASKET TO CASK 200 YEAR REPACKAGING	151,772	36,205	81,836	13,849	19,882
	BASKET TO CASK 300 YEAR REPACKAGING	151,772	36,205	81,836	13,849	19,882
	EQUIP. DESIGN, SUPPLY & INSTALL (BB)	14,641	1,787	8,939	536	3,379
	BUILDING DESIGN & CONST'N (BB)	1,761	616	616	123	406
	BUILDING SERVICES (BB)	645	235	215	67	128
	COMMISSIONING(BB)	1,105	417	0	108	580
	CONST'N INDIRECTS (BB)	1,274	951	0	35	288
	REPACKAGING OPERATIONS (BB)	28,733	3,960	23,585	0	1,188
564 55	EA & MONITORING	530,341	390,100	27,554	9,989	102,698
564 55 10	EA & MONITORING PROGRAM MANAGEMENT	95,908	70,306	0	3,470	22,132
564 55 20	CNSC CONSTRUCTION LICENCE - ENVIRONMENTAL ASSESSMENT	12,234	6,006	0	2,150	4,078
564 55 40	GROUNDWATER MONITORING	59,599	37,158	5,058	3,630	13,753
564 55 50	RADIOLOGICAL BIOSPHERE MONITORING	282,187	217,280	17,876	0	47,031
564 55 60	NON-RAD BIOSPHERE MONITORING	72,762	53,590	4,620	0	14,552
564 55 80	HUMAN HEALTH MONITORING	7,651	5,760	0	739	1,152
564 90	PROGRAM MANAGEMENT (Y1-Y17)	135,048	56,305	0	56,235	22,508
564 90 00	PROGRAM MANAGEMENT (Y1-Y17)	135,048	56,305	0	56,235	22,508
	TOTAL	14,077,725	4,291,702	3,910,906	3,598,485	2,276,632

APPENDIX F

Contents of CD

The contents of the attached CD comprise four folders. Each contains several folders, bullet point listed below:

561 CVSB

- Cost Estimate Database
- Detail Resources List
- Detailed Entry Transfer Sheets (DETS)
- DETS Summary Spreadsheet
- Detailed Work Breakdown Structure Schedule
- Work Element Definition Sheets (WEDS)

562 SMV

- Cost Estimate Database
- Detail Resources List
- Detailed Entry Transfer Sheets (DETS)
- DETS Summary Spreadsheet
- Detailed Work Breakdown Structure Schedule
- Work Element Definition Sheets (WEDS)

563 CVST

- Cost Estimate Database
- Detail Resources List
- Detailed Entry Transfer Sheets (DETS)
- DETS Summary Spreadsheet
- Detailed Work Breakdown Structure Schedule
- Work Element Definition Sheets (WEDS)

564 CRC

- Cost Estimate Database
- Detail Resources List
- Detailed Entry Transfer Sheets (DETS)
- DETS Summary Spreadsheet
- Detailed Work Breakdown Structure Schedule
- Work Element Definition Sheets (WEDS)