APM Conceptual Design and Cost Estimate Update

Life Cycle Cost Estimate for

Used Fuel Transportation System

APM-REP-00440-0006 **August 2011**

SNC-:Lavalin Nuclear Inc.

SLN Report No. 020606-4100-REPT-0001

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NUCLEAR WASTE MANAGEMENT ORGANIZATION
SOCIÉTÉ DE GESTION DES DÉCHETS NUCLÉAIRES

NWMO
APM Conceptual Design and Cost Estimate Update

020606-4100-REPT-0001

LIFE CYCLE COST ESTIMATE FOR USED FUEL TRANSPORTATION SYSTEM

Base and Alternate Case

Submission to

Nuclear Waste Management Organization

August 2011

SNL 020606 / GAL 0911170032

nwmo NUCLEAR WASTE MANAGEMENT ORGANIZATION SOCIÉTÉ DE GESTION DES DÉCHETS NUCLÉAIRES

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Title

Report
Life Cycle Cost Estimate for Used Fuel Transportation System

Project

APM Conceptual Design and Cost Estimate Update

CLIENT: NUCLEAR WASTE MANAGEMENT ORGANIZATION

PROJECT: APM Conceptual Design and Cost Estimate Update

Prepared By: Pete Craig, M.Sc., P.Chem. _____ **Date** August 8, 2011

Reviewed By: George Schneider, P.Geo. _____ **Date** August 8, 2011

Reviewed By: Jonathan Read, P.Eng. _____ **Date** _____

Approved By: Derek Wilson _____ **Date** _____

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Issue Codes: RC = Released for Construction, RD = Released for Design, RF = Released for Fabrication, RI = Released for Information, RP = Released for Purchase, RQ = Released for Quotation, RR = Released for Review and Comments.

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EXECUTIVE SUMMARY

This report, the *Life Cycle Cost Estimate for the Used Fuel Transportation System*, presents life cycle cost and schedule estimates for the transportation of used nuclear fuel to a central repository as part of the Adaptive Phased Management (APM) approach selected for the management of Canadian used nuclear fuel.

The Nuclear Waste Management Organization (NWMO) has been entrusted by the Government of Canada with implementation of APM. In 2009/2010, the NWMO undertook an update of previous conceptual design work related to the APM program, including that related to fuel transport to a central management facility, *i.e.,* the Used Fuel Transportation System (UFTS).

The transportation system conceptual design uses specialized tractor/trailers and certified irradiated fuel transport casks (IFTCs) to ship used fuel from reactor sites to a central deep geological repository (DGR). DGR concepts are described in two companion reports:

- "Deep Geological Repository Design Report – Crystalline Rock Environment" submitted to NWMO by SNC Lavalin Nuclear (SLN 020606-6100-REPT-0001); and
- "Deep Geological Repository Design Report - Sedimentary Rock Environment" submitted to NWMO by SNC Lavalin Nuclear (SLN 020606-6200-REPT-0001).

The transportation system concept was developed for all-road transportation to a DGR in either sedimentary or crystalline rock (receiving facilities are equivalent, and the all-road design described herein can service either DGR concept).

The current transportation system conceptual design is described in the *Transportation Design Report* submitted to NWMO by SNC-Lavalin Nuclear (SLN 020606-4200-REPT-0001). As described in that document, the transportation system includes an assumed bundle distribution between reactor sites, a fleet of specialized tractor/trailers, emergency response equipment, real-time tracking equipment and additional features resulting in an overall system that meets current regulatory requirements and is capable of safely and securely transferring used nuclear fuel inventories to the DGR. This report, the Life Cycle Cost Estimate for the Used Fuel Transportation System, describes estimated costs and schedules for this system.

Two used fuel scenarios are considered in the Transportation Design Report and in this Life Cycle Cost Estimate: 3.6 million used fuel bundles (Base Case) and 7.2 million used fuel bundles (Alternate Case). The bundle distribution is described below.

Owner	Base Case	Alternate Case
Ontario Power Generation	3,272,140	6,567,228
AECL	30,715	30,715
Hydro-Québec	132,838	272,000
New Brunswick Power	121,758	285,000
TOTAL (rounded)	**3,600,000**	**7,200,000**

For both the Base and Alternate Cases, a fixed transportation/delivery rate of 120,000 bundles per year has been specified, matching the intended design capacity of the DGR.

Bundle inventories are assumed to occur at existing reactor sites (Base Case) or at existing sites and two new (location unspecified) reactors (Alternate Case). For conceptual cost and schedule development, the DGR has been assumed to be located somewhere in the Province of Ontario. Nominal transportation distances and transport cycle times have been assumed in order to develop logistics. These assumptions are summarized below:

Site	Base Case Bundle Count	Alternate Case Bundle Count	Assumed Haul Distance (km)	Haul Effort (person-hr)[1]
Pickering	856,113	1,235,943	1,000	89
Darlington	891,482	1,332,037	1,000	89
Bruce	1,524,545	2,340,197	1,000	89
Douglas Point	22,256	22,256	1,000	89
Chalk River	4,886	4,886	1,000	89
Whiteshell	360	360	1,000	89
Gentilly 1	3,213	3,213	1,500	112
Gentilly 2	132,838	272,000	1,500	112
Point Lepreau	121,758	285,000	2,500	162
New Build A		807,738	1,000	89
New Build B		851,313	1,000	89
TOTAL (rounded)	**3,600,000**	**7,200,000**		

[1] Crew of four persons operating in accordance with applicable regulations for non-stop truck transport.

The operational phase of the transportation system is determined by the fuel inventory and the transportation rate. The Base Case system will be operational for 30 years while the Alternate Case will be operational for 60 years.

For most reactor sites, the lifecycle cost and schedule estimate includes construction of a Hot Cell, a shipping area and a transport loading facility. The Hot Cell is used for the transfer of used fuel, in modules, to an IFTC. Such facilities will be required at the Pickering, Bruce, Darlington, Gentilly and Point Lepreau reactors. It is assumed that the two Gentilly operations will share a Hot Cell, as will Douglas Point and the Bruce site.

Given the small quantity of fuel stored at AECL's Chalk River and Whiteshell facilities, a cost-effective means of IFTC loading requires further study. Budgetary assignments based on a hypothetical cask-to-cask transfer approach have been included in the current estimate.

The UFTS system does not include costs associated with the retrieval of used fuel modules at the reactor sites. It is assumed that the reactor site owner retrieves the used fuel and has filled fuel modules ready to load into an IFTC.

Annual and Cumulative Costs for Base and Alternate Cases

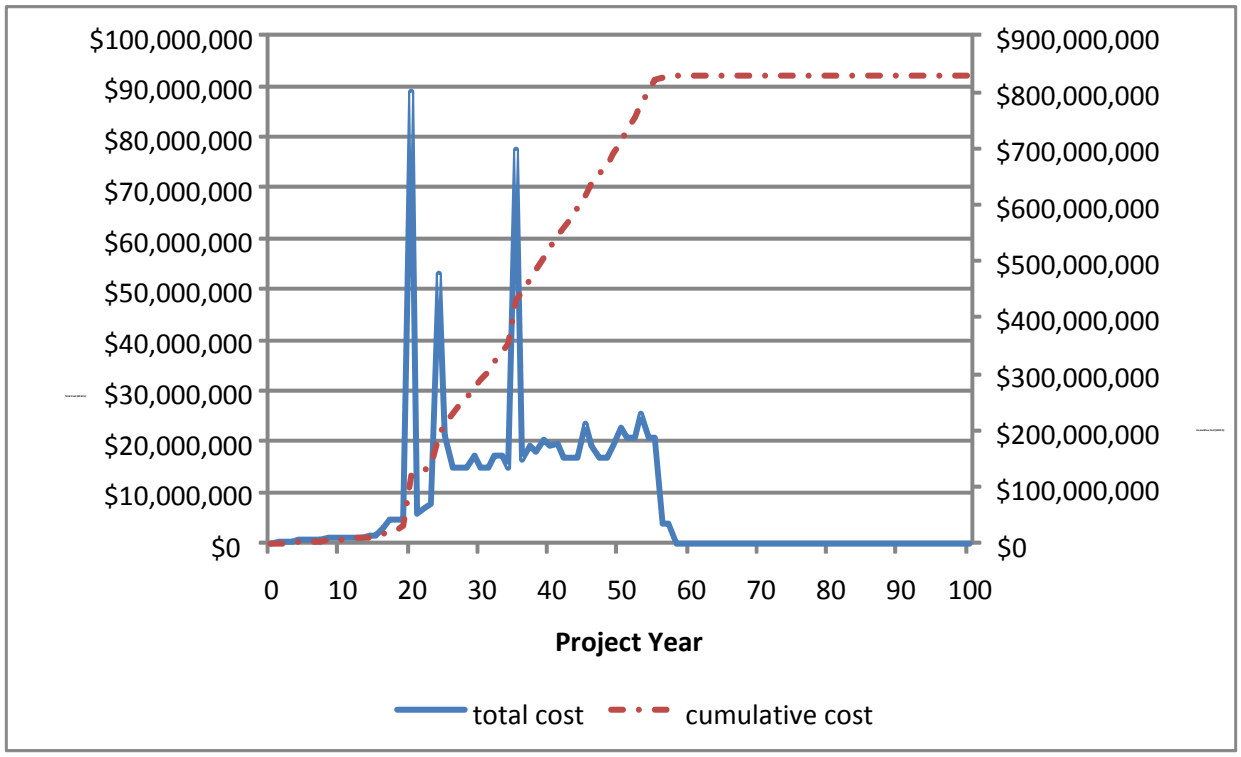
The Base Case and Alternate Case conceptual designs have been divided into individual work breakdown structures (WBSs). Estimates have been prepared for Labour, (permanent) Materials & Equipment, Other costs and an Allowance (a percentage-based sum to cover the cost of known but presently undefined requirements for each work element).

Contingency, an amount added to allow for uncertain events and project risk has been included as a lump sum. Contingency has been added to the estimate at the direction of the NWMO to reflect NWMOs understanding of risk and uncertainty.

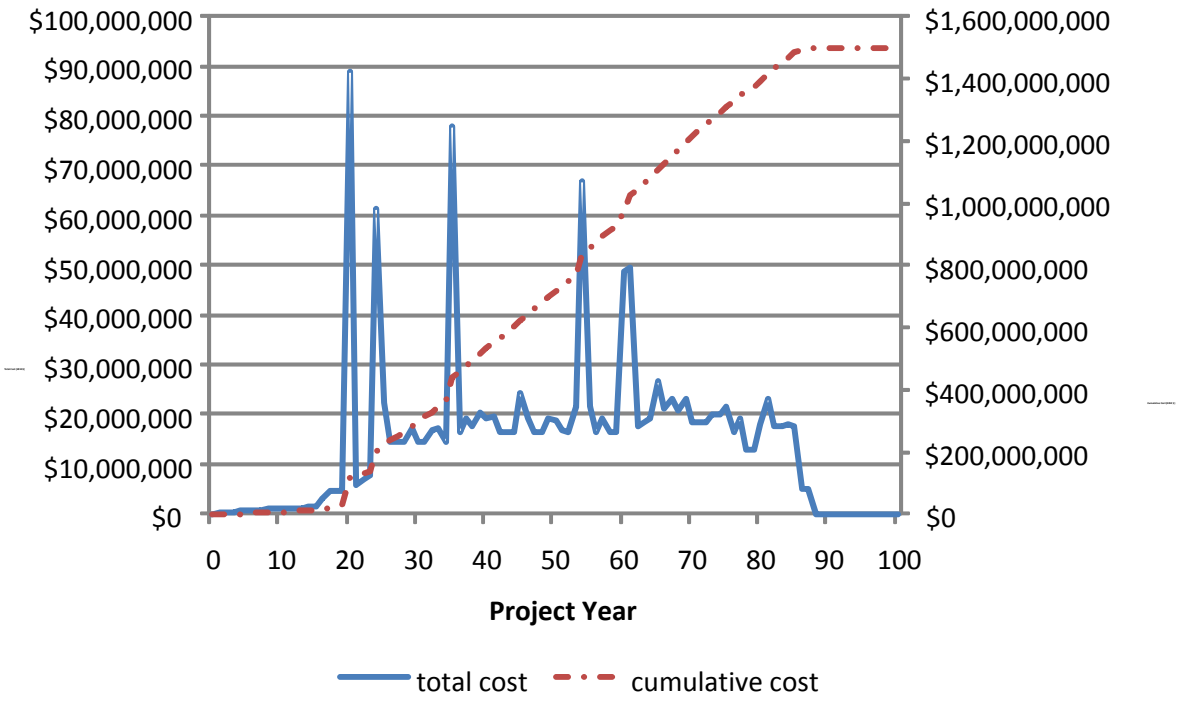
In total, and based on the methodology, scope and assumptions detailed in this report, the total 2010 constant Canadian dollar costs are as follows:

- Base Case (exclusive of contingency): $828 million; and
- Alternate Case (exclusive of contingency): $1,496 million.

Given the input years for each cost item, and the overall start and finish years for each work element, total annual costs are presented below for the Base Case in conjunction with the cumulative cost incurred over time.

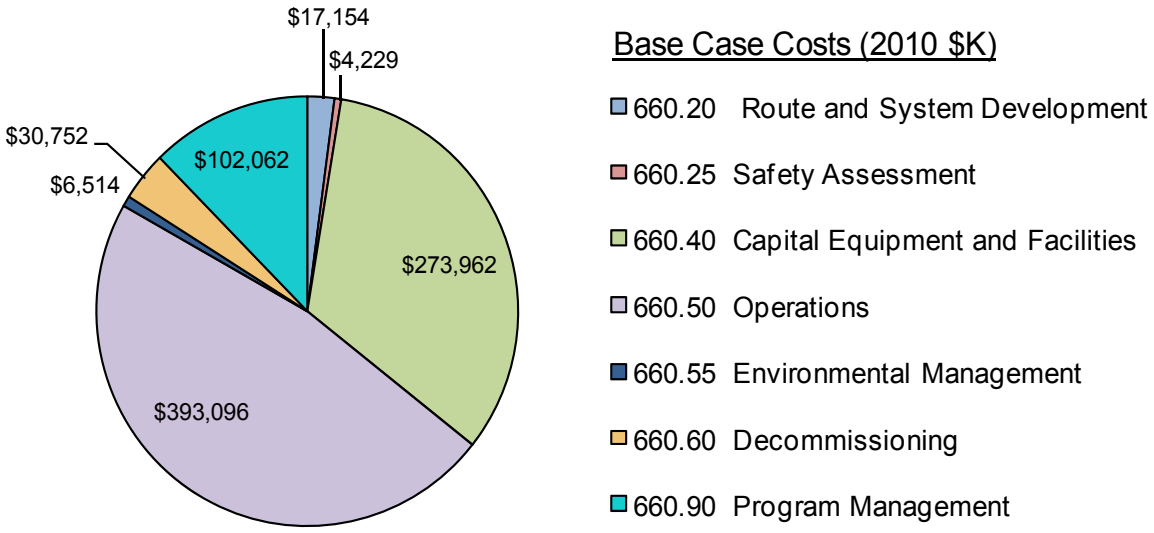


The total annual and cumulative costs for the Alternate Case are illustrated below:



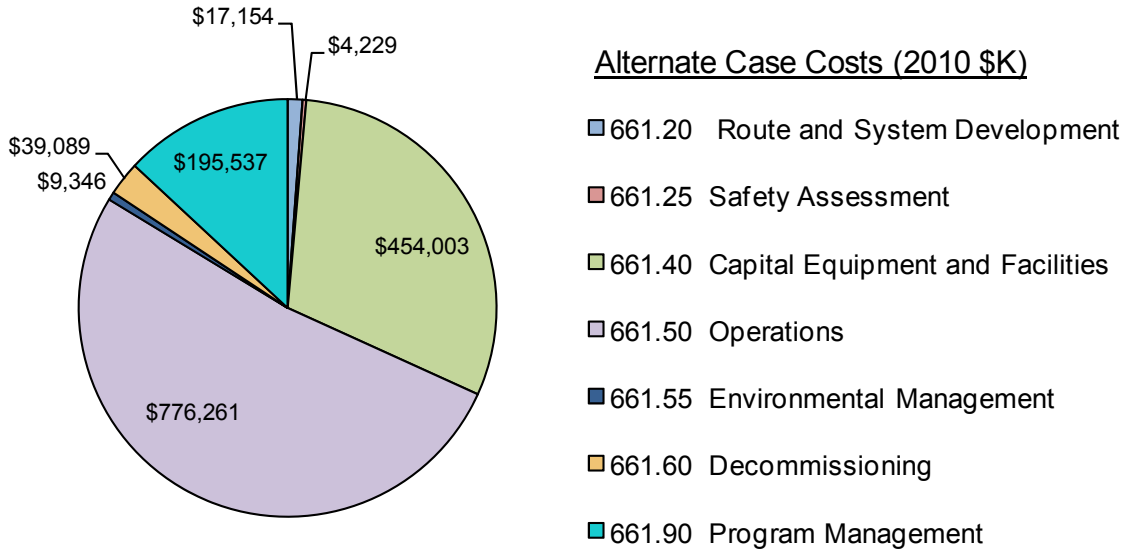
Based on calculations for each of the work elements in the work breakdown structure, estimated costs for the Base Case (660) are as follows:

WBS	Title	Total Cost Estimate ($k)
660.20	Route and System Development	$17,154
660.25	Safety Assessment	$4,229
660.40	Capital Equipment and Facilities	$273,962
660.50	Operations	$393,096
660.55	Environmental Management	$6,514
660.60	Decommissioning	$30,752
660.90	Program Management	$102,062
660 Subtotal		**$827,770**
Contingency		$95,516
660 Total		**$923,286**



Estimated costs for the Alternate Case (661) are as follows:

WBS	Title	Total Cost Estimate ($k)
661.20	Route and System Development	$17,154
661.25	Safety Assessment	$4,229
661.40	Capital Equipment and Facilities	$454,003
661.50	Operations	$776,261
661.55	Environmental Management	$9,346
661.60	Decommissioning	$39,089
661.90	Program Management	$195,537
661 Subtotal		**$1,495,620**
Contingency		$173,501
661 Total		**$1,669,121**



Summing the reactor-site-specific and common costs results in the following distribution of costs for nuclear power plants in the Base Case.

Base Case (2010 $K: 3.6M Bundles)					
Nuclear Power Plant	**Labour**	**Material & Equipment**	**Other**	**Allowance**	**Total**
Bruce	$97,266	$55,669	$12,462	$23,215	$188,611
Chalk River	$600	$747	$113	$214	$1,675
Darlington	$59,229	$42,795	$7,787	$15,539	$125,350
Douglas Point	$1,519	$869	$195	$362	$2,945
Gentilly 1	$380	$680	$68	$166	$1,294
Gentilly 2	$14,732	$26,335	$2,636	$6,416	$50,119
Pickering	$57,114	$42,060	$7,526	$15,109	$121,809
Point Lepreau	$16,568	$26,698	$3,441	$6,878	$53,585
Whiteshell	$305	$647	$78	$154	$1,184
Common Costs[1]	$205,268	$6,689	$48,153	$21,087	$281,197
660 Total	**$452,980**	**$203,191**	**$82,458**	**$89,140**	**$827,770**

[1] "Common Costs" are those costs incurred through development and operation of the UFTS that cannot be directly attributed to a specific reactor site.

Alternate Case costs per power plant are estimated as follows:

Alternate Case (2010 $K: 7.2M Bundles)					
Nuclear Power Plant	**Labour**	**Material & Equipment**	**Other**	**Allowance**	**Total**
Bruce	$146,410	$78,491	$18,514	$33,783	$277,198
Chalk River	$600	$760	$113	$215	$1,689
Darlington	$85,757	$55,216	$11,052	$21,250	$173,276
Douglas Point	$1,489	$798	$188	$344	$2,819
Gentilly 1	$310	$383	$53	$108	$855
Gentilly 2	$24,433	$30,186	$4,188	$8,504	$67,311
New Build A	$54,189	$42,987	$7,166	$14,709	$119,051
New Build B	$56,813	$44,004	$7,489	$15,253	$123,559
Pickering	$79,989	$52,982	$10,342	$20,055	$163,368
Point Lepreau	$31,296	$30,798	$6,465	$9,951	$78,510
Whiteshell	$305	$648	$78	$154	$1,185
Common Costs[1]	$363,952	$11,084	$75,765	$35,997	$486,798
661 Total	**$845,544**	**$348,338**	**$141,415**	**$160,323**	**$1,495,620**

[1] "Common Costs" are those costs incurred through development and operation of the UFTS that cannot be directly attributed to a specific reactor site.

Using input-estimated activity durations yields the following high-level schedule estimates, where "Year 1" is the first year of the project (currently taken as 2010).

Base Case (3.6M Bundles)			
WBS Number	**Title**	**Start Year**	**Finish Year**
660.20	Route and System Development	1	25
660.25	Safety Assessment	1	15
660.40	Capital Equipment and Facilities	20	55
660.40.10	IFTC Transportation Vehicles	22	55
660.40.20	IFTC Transport Casks	22	25
660.40.30	Equipment for IFTC Transport Cask Loading	20	51
660.40.40	Equipment for IFTC Transportation Logistics at DGR	24	55
660.50	Operations	16	55
660.50.10	Project Management	16	25
660.50.20	IFTC Transport Cask Loading	24	55
660.50.30	IFTC Transportation Logistics	26	55
660.50.40	IFTC Transportation Logistics at DGR	26	55
660.50.50	IFTC Transportation Vehicles Maintenance	25	55
660.55	Environmental Management	16	57
660.60	Decommissioning	50	57
660.90	Program Management	4	55

Alternate Case (7.2M Bundles)			
WBS Number	**Title**	**Start Year**	**Finish Year**
661.20	Route and System Development	1	25
661.25	Safety Assessment	1	85
661.40	Capital Equipment and Facilities	20	85
661.40.10	IFTC Transportation Vehicles	22	85
661.40.20	IFTC Transport Casks	22	54
661.40.30	Equipment for IFTC Transport Cask Loading	20	66
661.40.40	Equipment for IFTC Transportation Logistics at DGR	24	85
661.50	Operations	16	87
661.50.10	Project Management	16	25
661.50.20	IFTC Transport Cask Loading	24	85
661.50.30	IFTC Transportation Logistics	26	85
661.50.40	IFTC Transportation Logistics at DGR	26	85
661.50.50	IFTC Transportation Vehicles Maintenance	25	85
661.55	Environmental Management	16	87
661.6	Decommissioning	80	87
661.90	Program Management	4	85

Gantt charts of schedule are included in the main report.

Comparing the two estimates demonstrates that preparatory and decommissioning works are substantially similar between the two cases, as both scenarios are sized for the same annual throughput (120,000 bundles). The primary cost differences stem from varying the operational schedule, which incurs additional Labour, maintenance and project support costs as well as equipment replacement events.

Estimate Accuracy

The characteristics of the Base and Alternate Case estimates have been examined with regard to contemporary practice in cost engineering, including the following:

- Association for the Advancement of Cost Engineering International (AACE International). 2003. *Cost Estimate Classification System*. AACE International Recommended Practice No. 17R-97; and

- Association for the Advancement of Cost Engineering International (AACE International). 2005. *Cost Estimate Classification System - As Applied in Engineering, Procurement and Construction for the Process Industries*. AACE International Recommended Practice No. 18R-97.

If major design assumptions such as the hypothetical location of the DGR and the postulated used fuel inventories are valid, the conceptual design can be considered a “Study” estimate. Estimation methods included semi-detailed unit costs with assembly-level line items. Furthermore, item costs are based on existing, available applications. Assuming the scope of work described (including travel distances and bundle inventories) is the actual project scope, Base and Alternate Case estimates can be considered as AACE “Class 4” estimates.

In deference to project complexity and the relatively long period before commissioning, the anticipated accuracy of the Base and Alternate Case estimates after contingency assignment is expected to be on the low side of Class 4 norms, potentially on the order of -30% to +50%.

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DEFINITIONS AND ACRONYMS

The major terms used in this document and its attachments are described below:

AECL	Atomic Energy of Canada Limited
ALARA	As Low As Reasonably Achievable
APM	Adaptive Phased Management, a management system based on phased and adaptive decision-making supported by public engagement and continuous learning
CANDU	Canadian Deuterium and Uranium (a type of fission power reactor)
Cask or Flask	A mobile durable container for enclosing and handling used fuel for storage or transport
CNSC	Canadian Nuclear Safety Commission
COTS	Commercial, Off-The-Shelf
DGR	Deep Geological Repository, the physical system intended for the long term management of used CANDU nuclear fuel
EPC	Engineer - Procure - Construct
EPSCA	Ontario Electrical Power Systems Construction Association
ERT	Emergency Response Team
FTE	Full Time Equivalent
GPS	Global Positioning System
Hot Cell	Isolated shielded room that provides a controlled environment for containing highly radioactive and contaminated material and equipment
HQ	Hydro Québec
IAEA	International Atomic Energy Agency
IFTC	Irradiated Fuel Transport Cask used to transport used fuel from the reactor storage facilities to the DGR
Module	A rack system for holding used fuel bundles. One module contains 96 bundles within horizontal tubes in a rectangular framework
NBP	New Brunswick Power
NWMO	Nuclear Waste Management Organization
OPG	Ontario Power Generation
Owners	Current parties responsible for the used fuel inventories; Ontario Power Generation, AECL, Hydro-Québec and New Brunswick Power
PFD	Process Flow Diagram
P&ID	Piping & Instrument Diagram

PPE	Personnel Protective Equipment
QA/QC	Quality Assurance / Quality Control
RCMP	Royal Canadian Mounted Police
RP	Recommended Practice
Tractor	Motive vehicle of the IFTC transportation vehicle system
TRUE	Transportation Risk and Uncertainty Evaluation
SAVH	Sickness, Accident, Vacation and Holiday Benefit. May include training
UFPP	Used Fuel Packaging Plant
UFTS	Used Fuel Transportation System; the loading equipment, vehicles, routes, logistics, monitoring, labour and on-route support to package and move used fuel by road from existing reactor storage sites to the DGR
USACE	United States Army Corp of Engineers
Used Fuel	(Also referred to as Used Nuclear Fuel) CANDU irradiated fuel bundles removed from a CANDU nuclear fission reactor
VBA	Visual Basic for Applications
WBS	Work Breakdown Structure
WEDS	Work Element Definition Sheet(s)

1. INTRODUCTION

The Nuclear Waste Management Organization (NWMO) is implementing Adaptive Phased Management (APM), Canada's plan for the safe, long-term management of its used nuclear fuel. The APM approach encompasses centralized containment and isolation of the used fuel in a Deep Geological Repository (DGR). The DGR will be constructed in a suitable rock formation, such as crystalline or sedimentary rock, at an as-yet undetermined location.

In 2009/2010, the NWMO undertook an update of previous conceptual design work related to the APM program, including transportation of the used fuel to the DGR. Under the APM initiative, the used nuclear fuel is to be retrieved from interim storage facilities at reactor locations and transferred into certified irradiated fuel transport casks (IFTCs). The casks, loaded onto specialised transport trailers, are to be transported by road to the DGR.

The scope of the update and fundamental design assumptions were set out in "*Used Fuel Deep Geological Repository and Transportation System - System Requirements for APM Update*" (NWMO Document No.: APM-PR-01110-0001-R00, the '*System Requirements*'). Specific guidance for the DGR cost estimation was summarized in the '*Estimate Requirements*' (*Cost Estimate Requirements for the Preparation of a Life Cycle Cost Estimate for a Used Fuel Transportation System (UFTS) within Adaptive Phased Management (APM)*, NWMO Document No.: APM-PR-00400-0002-R000).

This report, the *Life Cycle Cost Estimate for the Used Fuel Transportation System*, presents life cycle cost and schedule estimates for the transportation of used nuclear fuel to the DGR. It addresses the estimated costs and scheduling for the current transportation system concept, including used fuel packaging systems, loading systems and associated transportation procedures.

The current transportation system conceptual design is described in the *Transportation Design Report* submitted to NWMO by SNC-Lavalin Nuclear (SLN 020606-4200-REPT-0001). The transportation system concept was developed for all-road transportation to a DGR in either sedimentary or crystalline rock (receiving facilities are equivalent, and the all-road design described herein can service either DGR concept).

Two used fuel scenarios are considered in this Life Cycle Cost Estimate; 3.6 million used fuel bundles (Base Case) and 7.2 million used fuel bundles (Alternate Case). The estimates for the two fuel inventory scenarios have also been used to develop an approach to scale cost and schedule estimates for other used fuel inventories (a "Scaling Package").

For all cases, a fixed transportation/delivery rate of 120,000 bundles per year has been specified, matching the current design capacity of the DGR.

Report contents include the following:

- An executive summary, presenting an overview of methodology and findings;
- Section 1, which identifies the purpose of the study, objectives and key companion documents;

- Section 2, which sets out important considerations related to the on-going revision of cost elements, as well as descriptions of major scope components;
- Section 3, which describes the methodology, key assumptions, inclusions and exclusions for the cost and schedule estimate process;
- Section 3, which presents the current results for the cost model;
- Section 4, which includes the Base and Alternate Case schedules in Gantt chart form;
- Section 5; which discusses the formulation, use and limitations of the scalable estimate tool;
- Section 6, which reviews results and considerations such as the estimate class;
- Section 7, which documents the contributors to the estimate;
- Section 8, which summarizes important restrictions on this study and its use; and
- Section 9, which lays out the contents of the accompanying electronic deliverable.

1.1 Purpose of Estimate

The purpose of this report is to document a realistic cost estimate to design, license, construct, acquire, route, operate, and decommission a transportation system for the APM approach.

1.2 Objectives

The objectives of this report are to document the transportation system cost and schedule estimates in a transparent and concise fashion, enabling decision making, consultation and/or third party validation. The report also addresses:

- Estimate class;
- Estimated accuracy;
- Standards used in the development of the estimate;
- Deviations from the standards;
- Documentation in support of the estimate;
- Explanation of how documentation is interrelated (the “document trail”); and
- The structure and methodology of the estimate.

To the extent feasible using the methodologies and resources employed, the cost estimate is intended to function as a stand-alone guide to the current work, sufficient to allow review by a third party with access to supporting documentation, such as companion reports.

1.3 Companion Reports

A Microsoft Access database and sets of Microsoft Excel workbooks accompany this cost and schedule report and are intended to provide additional supporting information.

The current transportation system conceptual design is described in the companion *Transportation Design Report* submitted to NWMO by SNC Lavalin Nuclear (SLN 020606-4200-REPT-0001).

This cost and schedule report is also related to a number of companion studies, including those documented in the following reports and the related lifecycle cost and schedule estimates:

- "Deep Geological Repository Design Report – Crystalline Rock Environment" submitted to NWMO by SNC Lavalin Nuclear (SLN 020606-6100-REPT-0001); and
- "Deep Geological Repository Design Report - Sedimentary Rock Environment" submitted to NWMO by SNC Lavalin Nuclear (SLN 020606-6200-REPT-0001).

2. DESIGN BASIS

The following sections review the design basis for the lifecycle cost and schedule estimates. The estimates have been constructed by dividing the overall scope into a Work Breakdown Structure (WBS) for the Base and Alternate Cases. Aspects of the WBS were then subdivided into tasks of sufficient detail that costs and schedules could be assessed.

The following sections describe the structure of the WBS, project phasing, special considerations with regard to the current estimate compilation and the design used fuel inventory. This is followed by a discussion of scope, deliverables and assumptions for each of the major divisions of the WBS.

2.1 Scope Breakdown

For each case ("660", the Base Case, and "661", the Alternate Case), the scope of the transportation system has been divided into separate areas of effort. Many of these areas were subsequently broken down into sub-tasks of increasing detail to allow formulation of cost and schedule estimates. The full structure of the 660 and 661 WBSs is presented in Appendix A. The major WBS divisions are as follows:

- Route and System Development;
- Safety Assessment;
- Capital Equipment and Facilities;
  - Irradiated Fuel Transport Cask (IFTC) Transportation Vehicles;
  - IFTCs;
  - Equipment for IFTC Loading;
  - Equipment for IFTC Transportation Logistics at DGR;
- Operations;
  - Project Management;
  - IFTC Loading;
  - IFTC Transportation Logistics;
  - IFTC Transportation Logistics at DGR;
  - IFTC Transportation Vehicles Maintenance;
- Environmental Management;
- Decommissioning; and
- Program Management.

For the purposes of schedule development, activities are also identified as belonging to one of four project phases, as follows:

- **Siting & Licensing** - the time period in which a suitable DGR location is being sought. The Siting & Licensing Phase will end when regulatory approval is received to construct the facility. Activities carried out during this phase will include development of a siting process and site screening criteria, site screening, site evaluations, preparation of safety assessment and environmental impact assessment documents, participation in public hearings and preparation of license applications;

- **Construction** - the period of time beginning with the receipt of regulatory approval to begin construction and ending when the first used fuel is shipped;

- **Operations** - the time period during which used fuel is shipped for placement in the DGR; and

- **Closure and Decommissioning** - the period of time after the Operations Phase has ended and after regulatory approval has been received to decommission the transportation system through the completion of decommissioning.

Each of the major divisions of the WBS is described in more detail below. In aggregate, the described work elements comprise the scope of the transportation system and the design basis for the estimate. Appendix B includes summary descriptions (Work Element Description Sheets, or "WEDS") for each of the populated nodes of the WBS.

Each of these work elements have been assessed in terms of required Labour, Materials and Equipment, Other and Allowance. Summary Excel-format workbooks showing detailed assignments are provided in conjunction with the electronic deliverable for this report.

WBS components are scheduled in project years, with Year 1 currently held to be 2010. All costs are stated in constant 2010 Canadian dollars.

2.2 Used Fuel Inventory

Used fuel for the transportation system will originate from CANDU commercial power reactors in Canada. The main reactors in Ontario, owned by Ontario Power Generation (OPG), are located on the Pickering, Bruce and Darlington sites. A reactor near Bécancour, Québec (Gentilly 2), is owned by Hydro-Québec and the Point Lepreau reactor in New Brunswick is owned by New Brunswick Power.

In addition to these commercial power reactors, there are also four partially decommissioned demonstration/research reactors identified as Chalk River (Ontario), Douglas Point (Ontario), Gentilly 1 (Québec) and Whiteshell (Manitoba). These operations are under the jurisdiction of Atomic Energy of Canada Limited (AECL).

For most reactor sites, the lifecycle cost and schedule estimate for transportation includes construction of a Hot Cell for the transfer of fuel (in modules) into IFTCs, as well as construction of a shipping area and a transport trailer loading facility. Hot Cells and associated capacity will be required at the Pickering, Bruce, Darlington, Gentilly and Point Lepreau reactor sites. Because of close proximity and relatively small on-site inventories, the Douglas Point used fuel inventory will be loaded and shipped through the Bruce facility. Similarly, the Gentilly 1 used fuel inventory is expected to be managed through the Gentilly 2 Hot Cell.

Given the small quantity of fuel at AECL' s Chalk River and Whiteshell facilities, a cost-effective means of IFTC loading requires further study. Budgetary allowances based on a hypothetical cask-to-cask transfer approach have been included herein.

Two used fuel inventory scenarios are under consideration: 3.6 million used fuel bundles (Base Case); and, 7.2 million used fuel bundles (Alternate Case), as detailed below.

Table 1: Used Fuel Quantities (as Bundles) by Owner

Owner	Base Case	Alternate Case
Ontario Power Generation	3,272,140	6,567,228
AECL	30,715	30,715
Hydro-Québec	132,838	272,000
New Brunswick Power	121,758	285,000
TOTAL (rounded)	**3,600,000**	**7,200,000**

[1] OPG Alternate Case Total Includes New Builds

The relative distribution of this fuel between sites is itemized on Table 2. As indicated, fuel inventories are assumed to occur at existing reactor sites (Base Case) or at existing sites and two new (location unspecified) reactor operations (Alternate Case).

Table 2: Relative Distribution of Used Fuel by Site

Site	Base Case Fuel Bundles		Alternate Case Fuel Bundles	
	Number	%	Number	%
Pickering	856,113	24%	1,235,943	17%
Darlington	891,482	25%	1,332,037	19%
Bruce	1,524,545	43%	2,340,197	33%
Douglas Point	22,256	0.63%	22,256	0.31%
Chalk River	4,886	0.14%	4,886	0.07%
Whiteshell	360	0.010%	360	0.005%
Gentilly 1	3,213	0.090%	3,213	0.045%
Gentilly 2	132,838	3.7%	272,000	3.8%
Point Lepreau	121,758	3.4%	285,000	4.0%
New Build A		0%	807,738	11%
New Build B		0%	851,313	12%
TOTAL		**100%**		**100%**

The Base and Alternate Case estimates have been used to develop an approach to scale costs for other inventories (the Scaling Case). For all cases, a fixed transportation/delivery rate of 120,000 bundles per year has been specified, matching the DGR's design receiving capacity.

For conceptual cost and schedule development, the DGR and potential new reactor sites have been assumed to be located somewhere in the Province of Ontario. Nominal transportation distances and transport cycle times have been assumed in order to develop logistics as presented in Table 3.

Table 3: Inventory, Haul Distance and Transport Crew per Shipment

Site	Base Case Bundle Count	Alternate Case Bundle Count	Assumed Haul Distance (km)	Transportation Effort (person-hr)[1]
Pickering	856,113	1,235,943	1,000	89
Darlington	891,482	1,332,037	1,000	89
Bruce	1,524,545	2,340,197	1,000	89
Douglas Point	22,256	22,256	1,000	89
Chalk River	4,886	4,886	1,000	89
Whiteshell	360	360	1,000	89
Gentilly 1	3,213	3,213	1,500	112
Gentilly 2	132,838	272,000	1,500	112
Point Lepreau	121,758	285,000	2,500	162
New Build A		807,738	1,000	89
New Build B		851,313	1,000	89
TOTAL (rounded)	**3,600,000**	**7,200,000**		

[1] Crew of four persons operating in accordance with applicable regulations for non-stop transit by truck.

As mentioned, bundles are to be transported to the DGR in storage modules (a rack system holding 96 fuel bundles). The modules will be shipped two at a time in the IFTCs. A system transport rate of 120,000 bundles per year equates to approximately 625 loaded IFTC shipments per annum.

2.3 Design Components

The project scope is summarized in the following sections for each of the major divisions of the WBS. To eliminate redundancy and simplify this presentation, elements that apply to both the Base (660) and Alternate (661) Cases are denoted with the generic prefix "66X" (*e.g.*, code "66X.50" refers to both 660.50 and 661.50).

2.3.1 WBS 66X.20 – Route and System Development

"Route and System Development" comprises the detailed design and route selection process (which will depend on, for example, the actual inventories and storage locations at the time of commissioning). Specifically, Route Development includes mode and route development work, such as studies to assess the feasibility of transporting used fuel from the actual future storage facilities to the DGR and identifying preferred shipping routes. System Development encompasses the preliminary design and engineering of the transportation packages, tie-downs, trailers, tractors and weather covers.

"Route and System Development" spans the period from Year 1 to Year 25 of the project, and includes a comprehensive schedule of development studies, prototyping and commissioning such as:

- **Route Development** - High level transportation analyses to support feasibility studies in 10 communities and for studies on transport routes for two candidate sites.

- **Conceptual / Preliminary System Development** - A transport package options study as well as conceptual design reports for the final IFTC, transportation equipment, loading facilities, logistical infrastructure, security and emergency response measures.

- **Preliminary / Detailed Engineering** - Design requirements and technical specifications for the final IFTC transportation equipment, loading facilities, logistical infrastructure, security and emergency response measures.

- **Implementation / Test / Oversight** - Prototype used fuel transportation package, engineering support for the manufacturing, testing and commissioning of all components of the transportation system, and commissioning of security, emergency response and transportation logistics programs.

To complete this scope, $10 million has been budgeted for Labour (distributed on a specific year-by-year schedule of personnel), as well as $6.8 million in itemized Other costs, such as travel and consultant/purchased studies. No Material and Equipment or Allowance has been included.

2.3.2 WBS 66X.25 - Safety Assessment

"Safety Assessment" provides for an examination of occupational and public radiological safety during the transport of used fuel for transportation system optimization. It includes monitoring changes to radiological and environmental protection regulations and assessing impacts on the transportation system. Results will be used during route and site selection, site licensing, reactor site auxiliary facility improvements or construction and environmental assessments.

This WBS spans the Year 1 to Year 15 project period, and includes:

- Transportation safety assessments;
- Information packages for, and meetings with, local communities; and
- Contributions to Environmental Assessment and Preliminary Safety Report submissions.

It is intended that safety assessment activities after approval of the construction license will be accounted for in activities associated with the DGR. The scope of 66X.25 also specifically excludes used fuel package design, licensing and security system development, which are specifically costed in other work elements.

To complete the 66X.25 scope, $1.3 million has been budgeted for Labour, as well as $2.9 million in Other costs, such as travel and consultant/contractor purchased technical analyses. No Materials and Equipment or Allowance has been included.

2.3.3 WBS 66X.40 - Capital Equipment and Facilities

"Capital Equipment and Facilities" covers the design, procurement, construction, and testing and commissioning of all equipment or facilities to implement the transportation system. It includes the transporters, the transport packages, auxiliary equipment such as package loading facilities, as well as maintenance and transfer infrastructures.

For the purposes of the project, this WBS section has been subdivided to focus on categories of equipment and their relationship with specific waste owners and nuclear reactor sites. The major sub-divisions of WBS 66X.40 include the following:

- 66X.40.10 - IFTC Transportation Vehicles;
- 66X.40.20 - IFTCs;
- 66X.40.30 - Equipment for IFTC Loading; and
- 66X.40.40 - Equipment for IFTC Transportation Logistics at DGR.

Each of these subdivisions is discussed in more detail below. Related project management needs are covered in 660X.10 (Project Management) and 66X.90 (Program Management).

2.3.3.1 WBS 66X.40.10 - IFTC Transportation Vehicles

This WBS entry includes the detailed design, procurement and commissioning of the trailers and tractors for the transportation system. It is further subdivided into work elements for each reactor site and for "non-site specific" (also referred to as 'common') components.

As described in the *Transportation Design Report*, the transportation system will use an integrated overall (and specialized) vehicle fleet to service multiple reactor sites. Required fleet sizes (tractors, trailers and escort vehicles) were determined with respect to factors such as:

- Driving cycle times by reactor storage site;
- Site-specific peak yearly shipments to the DGR (based on manual adjustment of schedule by the design team);
- 80% availability for the transportation system (to reflect the potential impacts of external factors to fleet functions); and
- Availability of alternate vehicles and IFTCs at the reactor storage sites and DGR (to allow for parallel tasking and to cover maintenance downtime).

Calculations for fleet sizing, pricing and allocation to specific reactor sites on the basis of bundle count are summarized in the database accompanying this report and in the attached back-up files "RC DETS Base Case Final Sept 9, 10.xls" (Base Case) and "RC DETS Alternate Case Final Sept 9, 10.xls" (Alternate Case). A summary of the calculated equipment quantities is provided on Table 4.

Table 4: Transportation Equipment Quantities

Vehicle	Minimum Quantity to operate UFTS		Alternates for Rapid Dispatch and Receiving		Spares for Maintenance		Totals	
	Base Case	Alternate Case	Base Case	Alternate Case	Base Case	Alternate Case	Base Case	Alternate Case
Tractor	6	7	5	5	2	2	*13*	*14*
Trailer	6	7	12	14	0	0	*18*	*21*
Escort Vehicle	6	7	5	5	2	2	*13*	*14*

As discussed in the *Transportation Design Report*, identified equipment numbers have not been optimized. Detailed consideration of shipping schedules and logistics may be able to reduce the required number of vehicles.

Each of the fleet components has a design replacement interval, as follows:

Table 5: Transportation Equipment Replacement

UFTS Equipment Description	Cost of Purchase or Replacement (2010)	Replacement Interval in Years	Estimated Mileage at Replacement
IFTC Vehicle Tractor	$162,000	7 years	~700,000km
IFTC Vehicle Trailer	$181,000	10 years	~750,000km
IFTC Security Escort Vehicle	$175,000	4 years	~400,000km

Costs for transport vehicles have been based on current Ontario pricing for commercially available equipment with modifications to account for project-specific features. Global Positioning System (GPS) tracking components and satellite phones are accounted for in a separate work element (66X.40.40.10 - Equipment for IFTC Transportation Logistics for Real Time Tracking).

Transport tractors are assumed to have the following features:

- Extended cab with integrated sleeper berth for 2 persons;
- Speed limiters to meet provincial regulations;
- Radar based collision mitigation system to assist driver with avoiding collisions;
- Anti-theft electronic immobilizer system (*e.g.*, biometric or handprint scanner);
- Passenger mounted touch screen computer with GPS interface for communications with DGR central logistics;
- Load protection barrier behind cab to help protect occupants in a sudden stop; and
- Heavy duty alternator to accommodate the tractor's enhanced electrical peripherals.

Transport trailers are currently available in the commercial trucking industry to handle loads similar to a filled IFTC. In addition to meeting Provincial requirements, the trailers are assumed to have the following features:

- Modified double-drop 14.6 m long, 4 axle flatbed to minimize load height and center of gravity;
- Air ride suspension;
- Custom mounting frame to spread the load of the IFTC evenly across the axles;
- Custom integrated IFTC tie-down system;
- Custom weather cover for the IFTC; and
- Marking and labelling, including hazardous material placards.

A security escort vehicle may accompany the used fuel shipments. It is understood that escort vehicles may not be necessary, however for the purpose of costing, escort vehicles have been included. Should the final transportation system not include escort vehicles the cost will be commensurately lower. Escort vehicles are assumed to have the following features:

- Radar-based collision mitigation system to assist driver with avoiding collisions;
- Anti-theft electronic immobilizer system (*e.g.,* biometric or handprint scanner);
- Passenger mounted touch screen computer with GPS interface for communications with DGR central logistics; and
- Security and vehicle handling customization as typically performed on Royal Canadian Mounted Police and provincial police vehicles.

Following vehicle system set-up in Years 22 to 24, vehicle purchases are expected to begin in Year 25 and continue on a replacement-interval basis for the duration of transportation system operations. Costs are registered as Materials and Equipment, with an additional 10% Allowance.

Design and testing of transport equipment for the purposes of licensing, certification and commissioning of the transportation system has been assigned to work element 66X.40.10.10 - IFTC Transportation Vehicles for non-Site-Specific. This element includes 3,280 hours of contract engineering Labour, a purchased set of equipment and an Allowance (to account for expected but not yet itemized costs) of 10%. Licensing and certification are handled under 66X.90 – Program Management.

Fleet costs are assigned to individual site-specific work elements in the years of equipment purchase or replacement according to a site-specific share of the total transported bundle count, as follows:

Table 6: Allocation of Fleet Costs

Site	Base Case		Alternate Case	
	Bundles	% of Total Bundles & Total Fleet Cost	Bundles	% of Total Bundles & Total Fleet Cost
Pickering	856,113	24.1	1,235,943	17.3
Darlington	891,482	25.1	1,332,037	18.6
Bruce	1,524,545	42.9	2,340,197	32.7
Douglas Point	22,256	0.6	22,256	0.3
Chalk River	4,886	0.1	4,886	<0.1
Whiteshell	360	<0.1	360	<0.1
Gentilly 1	3,213	0.1	3,213	<0.1
Gentilly 2	132,838	3.7	272,000	3.8
Point Lepreau	121,758	3.4	285,000	4
New Build A			807,738	11.3
New Build B			851,313	11.9
TOTAL (rounded)	**3,600,000**	**100**	**7,200,000**	**100**

2.3.3.2 WBS 66X.40.20 - IFTC Transport Casks

The IFTC WBS entry encompasses the detailed design, documentation for licensing, procurement and manufacturing, testing and commissioning of the IFTCs, the associated tie-down system and weather cover. This WBS component has been further subdivided into work elements for each reactor site and for 'non-site specific' components. The tie-down system and weather cover are accounted for under trailer design (see 66X.40.10 - IFTC Transportation Vehicles).

As described in the *Transportation Design Report*, the transportation system will use a fleet of IFTCs to service multiple reactor sites. IFTC quantities with allowance for availability considerations included are presented on Table 7.

Table 7: Estimated Quantity of IFTCs Required

System	IFTC Quantity	
	Base Case	Alternate Case
Transportation	18	21
Loading	4	6
Unavailability (Maintenance)	2	2
TOTAL	**24**	**29**

Production/fleet IFTCs are valued at a cost of $1,250,000 for the cask and $250,000 for the impact limiter, for a total of $1,500,000 per purchase. A 30 year replacement interval is anticipated. Costs are estimated as Materials and Equipment, with an additional 10%. GPS tracking system components are accounted for in a separate work element (66X.40.40.10 - Equipment for IFTC Transportation Logistics for Real Time Tracking).

Following set-up of the IFTC system in Years 22 to 24, IFTC purchases will take place in Years 24 and 25. IFTCs are replaced if transport periods exceed the replacement interval of 30 years, equating to no IFTC cask replacement in the Base Case and a single round of replacements in the Alternate Case. IFTC fleet costs are assigned to individual site-specific work elements in the years of equipment purchase or replacement according to each site's share of the total transported bundle count, as previously discussed for transportation vehicles.

Design and testing for the purposes of licensing, certification and commissioning of transport equipment has been assigned to work element 66X.40.20.10.30 - IFTC Transport Cask non-Site-Specific. This element includes 2,460 hours of contract engineering Labour, a purchased set of equipment and an Allowance (to account for expected but not included costs) of 10%. Licensing and certification are handled under 66X.90 – Program Management.

Additional WBS elements record reactor-site-specific IFTC acquisition costs.

Please note that the pre-update transportation conceptual design anticipated maintenance for both vehicles and IFTCs at a transportation system maintenance facility. Subsequent analysis has removed both vehicle and IFTC cask maintenance facilities from the UFTS estimate.

With respect to vehicle maintenance, design review demonstrated that the vehicle fleet could be better serviced by a specialist vendor at commercial premises. The current estimate therefore does not include for vehicle maintenance facilities: contractor maintenance costs at unspecified off-site locations are included as an operational charge.

With respect to IFTCs, maintenance equipment and maintenance has been shifted to the repository and the repository estimate. Used Fuel Packaging Plant (UFPP) costs are understood to allow for light maintenance incorporated in the IFTC off-load/store/load cycle at the UFPP.

2.3.3.3 WBS 66X.40.30 - Equipment for IFTC Transport Cask Loading

Owners will provide fuel in modules to the point of transfer to the IFTC. WBS division 66X.40.30, Equipment for IFTC Transport Cask Loading, covers the procurement of the related IFTC loading equipment.

WBS 66X.40.30.10 - Equipment for IFTC Transport Cask Loading non-Site-Specific accounts for a design basis for the equipment integration at the different sites, including: conceptual design; documentation for licensing; and, detailed design files and related procurement specifications.

This effort is estimated to require 1,640 hours of engineering Labour per year for six years. A 15% Allowance is specified to account for expected additional costs and incidentals. Equipment procurement, inspection, site-specific supervision, facility development, testing and commissioning is accounted for in the individual facility costs; additional design is accommodated in program management.

Additional cost elements record facility-specific costs.

As described in the *Transportation Design Report*, hot cells will be constructed for fuel packaging at each of the reactor sites with the following exceptions:

- Douglas Pont, which will use a Hot Cell at the Bruce facility, the costs of which are allocated based on the relative bundle distributions between the two sites;
- Gentilly 1, which will use a Hot Cell shared with Gentilly 2, the costs of which are allocated based on the relative bundle distributions between the two sites;
- Chalk River, which has a relatively minor bundle inventory; and
- Whiteshell, which also has a relatively minor bundle inventory.

The final transfer approach to be used at Chalk River and Whiteshell requires further investigation. For the time being, a cask-to-cask “Transfer Plate” approach is retained for cost and schedule development.

With consideration for clearance allowances, shielding wall thicknesses, etc. the overall dimensions of a Hot Cell will be 15 m x 6 m x 7 m (length x depth x height). The length and height should be sufficient to fit within a conventional industrial building at the reactor storage sites assuming that the building height is at least 8.5 m. It is anticipated, however, that new buildings will need to be constructed at the storage sites for this purpose.

Hot Cell facilities will include a complement of features, including the following:

- Dedicated building with equipped Hot Cell;
- Hoists with grippers to remove transfer clamps, open or close the Owners' cask lids, unload modules from the Owners' casks and load the IFTCs (and open or close the IFTC lid);
- Lifting beams to support the above;
- Master-slave telemanipulators and remote camera system;
- Shielded windows, lining, shielded equipment door;
- Hot cell shuttles;
- Hot cell pit shielding covers;
- Owner's cask lift, lift lock, docking port and gate;
- IFTC cask lift, lift lock, docking port and gate;
- Leakage and purging equipment;
- Air pressure decay test equipment, smear testing equipment and radiometers;
- IFTC lid transfer clamp and bolt driver;
- Decontamination area/booth;
- Vacuum cleaning unit; and
- Shipping Area, including two gantry cranes.

Hot Cell costs total approximately $35 million per installation, including over $23 million in Materials and Equipment, as well as a 15% Allowance. The installation budget for an individual Hot Cell also includes approximately 34,600 hours of design engineering Labour and 14,700 hours of construction/installation Labour, as well as approximately 1.2 million in 'Other' costs related to installation, (consumables, temporary construction, etc.). Where Hot Cells are shared, costs have been allocated between WBS elements according to the relative fuel inventories of the sharing sites.

Given the small amount of used fuel stored at Whiteshell and Chalk River, the cost of Hot Cell construction and maintenance for the used fuel transfer is not included. Instead, a Transfer Plate approach is currently carried forward as the method of transfer for the used fuel modules. Under this approach, the following equipment complement will be required at each location:

- IFTC transfer plate and three lifting beams;
- Remote camera system;
- Owner's flask docking system and lock equipment;
- Leakage and purging equipment;
- Air pressure decay test equipment, smear test equipment sets and radiameters;
- IFTC bolt driver;
- Decontamination area/booth; and
- Shipment/transfer area with (leased) portable crane.

A Transfer Plate - based site is estimated to require $639,000 in Materials and Equipment, $75,000 in Other costs related to crane lease (incurred in the year of use according to the shipping schedule) and approximately 2,500 hours of Labour, as well as an overall Allowance of 15%. While Whiteshell and Chalk River may share equipment (leakage and purging equipment, tooling, lifting beams, smear testing equipment and radiameters), the current estimate carries unique equipment sets for each site. Each site is assumed to supply the Owner's transfer flask and supportive gantry/overhead cranes at no cost to the transportation system.

Both Hot Cell and Transfer Plate installations share common assumptions, including the following:

- Host facility provides all working, transfer and laydown staff support and holding areas at no cost to the transportation system;
- Host facility provides all effort and equipment to retrieve fuel and place it, in modules, into the Hot Cell or onto the IFTC transfer plate at no cost to the transportation system;
- Host facility provides all effort and equipment related to reactor site security, management of conventional and radiological waste material, etc., at no cost to the transportation system;
- Minor and incidental costs up to and including aspects such as a crisis room for tracking and emergency response are included in the Allowance percentage; and
- Cask decontamination is assumed to be a manual operation with minimal equipment needs.

Common DGR-based equipment (emergency response and real time tracking) are handled elsewhere, under 66X.40.40 - Equipment for IFTC Transportation Logistics at DGR.

2.3.3.4 WBS 66X.40.40 - Equipment for IFTC Transportation Logistics at DGR

This WBS element accounts for equipment and facilities associated with the DGR receiving facility. It includes two main subdivisions, as follows:

- 66X.40.40.10 Equipment for IFTC Transportation Logistics for Real Time Tracking; and
- 66X.40.40.20 Equipment for IFTC Transportation Logistics for Emergency Response.

As discussed previously, transportation vehicle maintenance will be out-sourced and there will be no related maintenance facilities acquisition (vehicle maintenance during operations is covered under 56X.50.50 IFTC Transportation Vehicles Maintenance). Cask maintenance equipment and facilities are accounted for in DGR estimates as a necessary component of IFTC handling at the UFPP.

66X.40.40.10 Equipment for IFTC Transportation Logistics for Real Time Tracking accounts for the development, procurement, testing and commissioning of a real time tracking system. This includes a number of components, such as:

- Tracking system software customization for central and vehicle mounted systems;
- Surge protection and uninterruptible power supply backups;
- GPS tracking units (for tractor, trailer, support vehicle and IFTC); and
- Satellite phones.

Material and equipment costs have been included for each piece of equipment. Software and system access fees are accounted for as Other costs. Material and equipment items, such as the GPS tracking units, are replaced on 10 year intervals while the transport fleet is in use. 1,640 Labour hours are budgeted for design and procurement. A 15% Allowance has been applied to account for additional expected costs not included in the detailed breakdowns.

It is noted that tracking of the GPS units will also occur inside covered environments (*e.g.,* reactor storage site warehouses) to allow continuous monitoring of the used fuel casks while they are in storage and provide a clear high level view of work in process. Trade-off analysis between boosting the GPS signals while indoors and alternatives, such as angle-of-arrival or WiFi sub-systems, will be conducted during detailed design based on the technology available at the time of the comparison (note that multiple existing, available systems have been demonstrated to achieve sub-metre accuracy; current costing is therefore anticipated to cover indoor as well as outdoor tracking).

66X.40.40.20 Equipment for IFTC Transportation Logistics for Emergency Response covers the development, procurement, testing and commissioning of the emergency response system.

The first response to any emergency will rely on equipment from local responders and authorities (police, RCMP, local fire departments). Consistent with the stipulated requirements for Category II nuclear material transport, these agencies will be aware of any shipments through their territory.

To deal with more extreme emergency scenarios (including the recovery of an IFTC), an all-terrain portable emergency crane would be available for dispatch from the DGR within 48 hours. It will be capable of travelling at 85 km/hr to minimize arrival times to the emergency site. In addition, a spare tractor and trailer will be available at the DGR to transport retrieved IFTCs. Ready-to-employ lifting beams for the IFTC and impact limiters will also be located at the DGR and at the Bruce, Darlington and Gentilly reactor storage sites.

In total, this WBS element includes an array of emergency response equipment, including:

- A crisis center located at the DGR;
- Emergency response equipment located at the DGR; and
- Emergency response equipment (not counted as part of any one facility) staged for deployment at Bruce, Darlington and Gentilly, such as lifting beams.

It is assumed that the physical Crisis Centre for Emergency Response will be incorporated into (and is accounted for in) the Communication Centre for Real Time Tracking (see 66X.40.40.20, Equipment for IFTC Transportation Logistics for Emergency Response) forming a single communications centre at the DGR.

Material and equipment costs have been included for each piece of equipment. 1,640 Labour hours are budgeted for design and procurement. A 15% Allowance has been applied to the total to account for additional expected costs not included in the detailed breakdowns.

2.3.4 WBS 66X.50 - Operations

“Operations” includes all activities to operate the transportation system from used fuel module reception in the loading facilities to the delivery of the loaded IFTCs at the DGR. This WBS element is subdivided into several components to account for each step, as follows:

- 66X.50.10 Project Management;
- 66X.50.20 IFTC Transport Cask Loading;
- 66X.50.30 IFTC Transportation Logistics;
- 66X.50.40 IFTC Transportation Logistics at DGR; and
- 66X.50.50 IFTC Transportation Vehicles Maintenance.

These components are further broken down to identify where activities are common or are specific to reactor sites.

Overall, the operational phase of the transportation system is determined by the fuel inventory and the transportation rate. The Base Case transportation system will be operational for 30 years, while the Alternate Case will be operational for 60 years. The projected annual numbers of used fuel shipments are presented in *Transportation Design Report* with the estimated maximum values as shown below.

Table 8: Maximum Shipments per Year by Site

Sites	Base Case Shipments	Alternate Case Shipments
Pickering	166	160
Darlington	165	160
Bruce	295	305
Douglas Point	13	15
Chalk River	7	7
Whiteshell	2	2
Gentilly 1	5	5
Gentilly 2	52	47
Point Lepreau	47	46
New Build A		244
New Build B		384

The receiving and dispatch areas of the DGR's UFPP will be designed to accommodate the projected weekly processing rates. Fleet sizing, discussed previously in relation to equipment procurement, has allowed for spares to accommodate availability issues such as maintenance, inspection, loading, unloading, etc.

2.3.4.1 WBS 66X.50.10 - Project Management

This WBS element encompasses project-level management of the transportation system, including reporting to program management (66X.90). Project management activities include the following:

- Management of UFTS components and reporting on the project's progress;
- Project management documentation (Project Charters, execution plans, business case summaries, release quality estimates, change control forms, etc.);
- Project schedule and cost updates;
- Regular meetings to discuss schedule, project status, cash flows, etc.; and
- Reporting to program management on the project's progress.

This WBS element's activity has been estimated as requiring 17,640 Labour hours per year plus a 15% Allowance to account for consumables and other expected costs. Related activities are anticipated to begin in Year 16 and end in Year 25. From Year 26 onwards, related costs are incorporated in program management.

2.3.4.2 WBS 66X.50.20 - IFTC Transport Cask Loading

The conceptual design assumes that 30 years out-of-reactor fuel is provided in modules to the point of transfer to the IFTC by the Owner at no cost to the transportation system. WBS element 66X.50.20 IFTC Transport Cask Loading takes into account the activities required to load used fuel into an IFTC, fit the IFTC impact limiter, carry out testing and complete security and safeguard seals. The scope has been subdivided into elements that address common activities and those specific to reactor sites.

66X.50.20.10 IFTC Transport Cask Non-Site Specific allows for minor centralized efforts related to the completion and assessment of loading mock-ups at each reactor site in Years 24 and 25 of the project. Effort has been estimated as 1,640 hours of contract engineering Labour for each year for two years (3,280 hours total), plus a 15% Allowance for incidentals.

Effort for each reactor site has been estimated based on site-specific labour requirements per shipment. This effort, along with loading cycle times, is itemized in the *Transportation Design Report*. Loading activities encompass the following:

- Preparation of IFTC;
- Transfer of used fuel to IFTC and transfer of loaded IFTC to shipment area;
- Placement of IFTC impact limiter on filled IFTC; and
- Pre-shipment tests and seals.

Removal of the Owner's cask from the hot cell and or handling of the owner's flask are not included in the estimate.

For hot cell-based loading operations, a crew of three will take approximately 13 hours to load an IFTC and prepare it for shipment (total of 39 person-hours per shipment). At Whiteshell and Chalk River, a crew of three will require about 14 hours to prepare an IFTC for shipment (total of 42 person-hours). Reactor site costs are based on expended Labour plus a 15% Allowance for incidentals and consumables. Based on the manually levelled (smoothed) shipping schedule in the *Transportation Design Report*, approximate annual costs for the Base and Alternate Case estimates were calculated by dividing total site Labour over the active period of shipping.

With consideration for the estimated time durations for all tasks expected in the loading and transfer operations, the anticipated used fuel shipments for the Base Case and Alternate Case are shown on Table 9.

Table 9: Used Fuel Shipments

Owner	Sites	Base Case		Alternate Case	
		Period (year) of Shipments	Total Shipments	Period (year) of Shipments	Total Shipments
OPG	Pickering	26 - 55	4,461	26 - 66	6,440
	Darlington	26 - 55	4,644	26 - 69	6,939
	Bruce	26 - 55	7,942	26 - 77	12,191
AECL	Douglas Point	41 - 51	124	41 - 51	124
	Chalk River	52 - 55	27	51 - 55	27
	Whiteshell	51	2	51	2
	Gentilly 1	52 - 55	18	51 - 55	18
HQ	Gentilly 2	41 - 55	697	41 - 72	1,417
NBP	Point Lepreau	41 - 55	636	41 - 74	1,486
OPG	New Build A	NA	NA	67 - 85	4,208
	New Build B	NA	NA	66 - 85	4,435
			18,551		**37,287**

2.3.4.3 WBS 66X.50.30 - IFTC Transportation Logistics

Transportation system operation as defined in the *Estimate Requirements* included loading of the IFTCs onto the trailers and transport to the DGR. This scope of work has been incorporated under 66X.50.30 IFTC Transportation Logistics, which has been subdivided to focus on site-specific costs. This WBS element addresses the full cycle of trailer loading/unloading and active driving time.

As presented in the *Transportation Design Report*, driving time and crew sizes reflect Commercial Vehicle Drivers Hours of Service Regulations (SOR/2005-313), provincial speed limits and associated considerations. Driving cycle times were calculated for each of the reactor storage sites. Estimates assumed the following:

- Cycles are based on a 7 day - 70 hour cycle;
- Rapid dispatch and receiving will be practised at the DGR and the reactor storage sites (accomplished in part by using spare vehicles pre-loaded with filled IFTCs);
- Average vehicle speeds of 60 km/hr will be achieved in Ontario and Manitoba; and
- Average vehicle speeds of 80 km/hr will be achieved for areas east of Ontario for routes to and from the Gentilly and Point Lepreau storage sites.

For each of the driving cycles a team of 4 individuals will be required. At any given time there will be two people on-duty and two off-duty. For all facilities except Gentilly 1, Gentilly 2 and Point Lepreau, a 38 hour return trip cycle time is anticipated, resulting in an average of 89 chargeable person-hours of effort per trip. For Gentilly 1 and 2 and Point Lepreau, the return trip driving times are assumed to be 54 and 80 hours, respectively, resulting in average trip efforts of 112 and 162 person-hours, respectively.

The operational sequence covering vehicle preparation and IFTC loading/unloading is expected to be common amongst the various reactor storage sites. Specific steps include:

- Preparation of transport vehicle (including pre-loading inspection of transport vehicle; and positioning the transport trailer for loading of an IFTC);
- Transfer of IFTC, with impact limiter, onto transport vehicle (and attach tie-downs);
- Post-loading inspection (contamination swipes, radiological survey) and closing of weather cover on trailer, and
- Removal of IFTC from transport vehicle (open weather cover, inspect vehicle, perform contamination swipe including radiological survey, remove tie-downs and unload IFTC).

Based on cycle times presented in the *Transportation Design Report*, the preparation, loading and unloading activities will consume an additional average 18.3 hours per shipment. Using the manually levelled (smoothed) shipping schedule in the *Transportation Design Report*, approximate annual costs are calculated by dividing this total Labour over the active period of shipping for each site.

An average per kilometre cost ($0.71) for fuel and insurance was developed based on fleet size, assumed vehicle mileage and annual insurance costs. 'Other' costs for each site have been calculated by dividing total site mileage (number of shipments x nominal return-trip shipment distance) over the active shipping period for each site, taking into account this $0.71 per kilometre operating cost. In addition, a 15% Allowance has been made to account for incidentals and additional consumables.

2.3.4.4 WBS 66X.50.40 - IFTC Transportation Logistics at DGR

System operation as defined in the *Estimate Requirements* included the real time tracking system, emergency response plan and secure areas, the cask maintenance facility and the tractor/trailer maintenance facility. As discussed previously, the current design includes non-stop driving cycles, eliminating the need for secure way stations or stop-overs. In addition, vehicle maintenance will be conducted by a contractor (as described for 66X.50.50 IFTC Transportation Vehicles Maintenance), and the UFPP component of the DGR will accommodate IFTC turn-around.

WBS element 66X.50.40 IFTC Transportation Logistics at DGR, has been subdivided to address the remaining operational system activities as follows:

- 66X.50.40.10.10 IFTC Transportation Logistics DGR Emergency Response; and
- 66X.50.40.10.20 IFTC Transportation Logistics DGR Real Time Tracking.

66X.50.40.10.10 encompasses the operation of the emergency response system during the shipping period which includes:

- Completed emergency response plans with all necessary documentation; and
- Staffed emergency system ready to activate needed resources and deploy a recovery system for the transportation package.

The availability of four types of emergency response teams is anticipated. A Command and Decision Team will provide logistic and technical assistance to authorities and decide on the proper technical means to be implemented. A Technical Analysis Team will assess the state of the packaging and associated impacts and solutions. A Mobile Command Team will implement command, information and expertise near the incident. Lastly, a Communications Team will manage crisis communications. To maintain a high level of competence in procedures, annual emergency response exercises will be performed.

1,200 hours of Labour have been assigned for emergency response exercises per year. Additionally, 3,280 hours of annual technician labour have been assigned to maintain and operate the recovery equipment and update the necessary documentation. Minor incidentals, including working area services, consumables, conventional and radiological waste handling, etc., are accommodated in a 15% Allowance.

66X.50.40.10.20 covers the operations of the real time tracking system during the shipping period. Such system operations will include:

- Real time information on IFTC and related vehicle locations;
- Provision of progress information for transport operations; and
- Maintaining the security of transmitted information.

The tracking system will operate 24 hours per day, 7 days a week (8,760 hrs/year) using three shifts of two controllers, as well as a supervisor and administrative assistant on a conventional work week. This is estimated to comprise 20,800 hours of Labour per year. Consumables and incidentals are accommodated for in a 15% Allowance.

2.3.4.5 WBS 66X.50.50 - IFTC Transportation Vehicles Maintenance

This WBS element encompasses transportation system vehicle maintenance (periodic vehicle replacement is accounted for under 66X.40.10 - IFTC Transportation Vehicles).

Vehicle maintenance requirements are expected to be substantially similar to those associated with commercially available equipment currently in use in the trucking industry. As the tractors and trailers are not expected to experience any direct radiological contamination, third party trucking industry maintenance providers will be contracted to manage the required maintenance and care.

The location of the vehicle maintenance shops could either be near the DGR or a major metropolitan centre where existing third party facilities are located. As previously noted, an allowance of 80% availability has been assumed for the transportation system to account for, among other things, maintenance downtime. To account for this out-sourcing of maintenance, Other costs have been estimated as follows:

- Annual maintenance costs equivalent to 5% of the one-time fleet procurement cost; and
- Annual tire replacement costs equivalent to 2% the one-time fleet procurement cost.

Additional costs, including the incidental maintenance of low-mileage non-fleet vehicles (mock-ups, emergency response fleet, etc.) are accounted for within a 15% Allowance.

2.3.5 WBS 66X.55 - Environmental Management

Environmental management work, as defined under this WBS element, encompasses the following, beginning in Year 16 (the time engineering work starts on the transportation system) and continuing throughout system operations:

- The set-up and monitoring of transportation aspects within an Environmental Management System (EMS) in accordance with ISO 14001;
- Auditing of comparable supplier management systems;
- Liaison with regulators regarding associated requirements;
- Assistance with transportation aspects of Environmental Assessment work; and
- Planning of environmental monitoring activities as needed.

This scope of work has been estimated to require approximately 3,280 hours Labour per year from Year 16 to the start of operations (Year 24), and thereafter 820 hours per year during transport operations. Expenses and incidentals are included in a 30% Allowance. Note that preparation of material for IFTC approval certificate(s) and other approvals for transport equipment are included in 66X.40.20. Administrative support is covered by Program Management - 66X.50.10.

2.3.6 WBS 66X.60 - Decommissioning

The 66X.60 - Decommissioning WBS element includes the development and approval of plans to decommission the transportation systems and associated loading facilities (and undertaking those plans), the decontamination of used fuel auxiliary equipment, and the management / storage of the decommissioning wastes. It is assumed that the UFTS and associated loading facilities will have been well maintained and will not have any major contamination or have experienced a major irradiation incident or accident.

Contractor-provided, non-permanent equipment and material, and disposal costs of decommissioning is estimated at 10% of the initial cost for the IFTCs, impact limiters, transport vehicles and equipment for IFTC loading, subdivided into Labour (approximately 30% of total) and Other (approximately 70% of total; this includes contracted demolition/decommissioning services and waste disposal). No credit is made for any remaining useful life or salvage value at the time of decommissioning.

A 15% Allowance has been assigned to capture the cost of consumables and incidentals.

2.3.7 WBS 66X.90 - Program Management

Program management and administration is meant to cover senior-level staff direction to the program as well as financial, scheduling, Quality Assurance and business support (company overheads). Activities are staged according to time period.

During siting activities (Year 1 to Year 9), the licensing process (Year 10 to Year 15), and procurement and manufacturing (Year 16 to Year 25) deliverables will include the following:

- Project scheduling;
- Project business plan inputs on a yearly basis;
- Program definition and resourcing plan; and
- Regulatory work.

During the licensing process, support will additionally be required for the Environmental Assessment activities. During the procurement and manufacturing time period, certification (Year 19) and recertification (Year 24) of the Transport Package Design will need to be addressed. A licence to Transport Category II Nuclear Material must also be obtained.

For the balance of operations, the 66X.90 WBS element will encompass a similar list of activities, in addition to the management of resources, facilities and infrastructures required for the UFTS as well as the maintenance of its organizational structure.

At present, Program Management is estimated as follows:

- Regulatory work including recertification of active transport certificates (transfer of IFTC ownership from OPG is anticipated by Year 3, certificate renewal is required in Year 4), keeping abreast of current regulatory issues and changes;

- During transportation-oriented manufacturing, a program management team comprised of one project director and one program administrator;

- During operations, the program management team will include one transport manager, one maintenance supervisor, three engineers, four transportation officers, one scheduler, one secretary, two forwarding technicians and one quality assurance and inspection technician;

- Trips to interface with regulators will be made every 2 years (from Year 4 to Year 14). During manufacturing, 10 trips/year are made to the site and manufacturing facilities. During operations, 10 trips/year are made between the DGR and shipping sites. All trips are costed at $1,500 per event;

- There will be a Production Package Certificate application costing $24,000 in Year 19 and a Design Certificate recertification in Year 24 at $1,000; and

- Licence to Transport is required in Year 24. Certificate re-certifications (7) are required every 4 years at $1,000 per re-certification.

No Materials and Equipment cost or Allowance is included.

Incidental public affairs costs are anticipated to be within the Allowance assigned to project and program management. Overall APM public affairs costs have been estimated separately by NWMO (encompassing both the UFTS and DGR) and are not included herein.

2.4 Assumptions

Project estimates are based on the assumptions included above, in the *Transportation Design Report* and in the work element definition sheets attached to this estimate report. Several key assumptions affect multiple parts of the estimate, including:

- Experimental fuel storage or transfer is not included in the scope of the project;
- No costs are allowed for major accidents or loss of fuel bundle integrity;
- Shipping distances are as presented [1,000 km to all sites but Gentilly (set at 1,500 km), and Point Lepreau (set at 2,500 km)]. For the Alternate Case, two new build reactors are assumed to be located 1,000 km from the DGR;
- Owner provides hot cell footprint, staging area, reactor site security, hot cell utilities and hot cell waste disposal at own cost (not included in this estimate);
- Owner assumes all costs for providing fuel in modules ready for transfer at point of transfer (not included in this estimate);
- Douglas Point and Bruce will share loading and shipping facilities as will Gentilly 1 & 2;
- IFTCs have a service life of 30 years and equipment for IFTC loading has a service life of at least 60 years;
- The UFPP at the DGR will receive nominally 120,000 used fuel bundles per year in IFTCs, dispatch an equivalent number of empty IFTCs, and perform maintenance and decontamination on IFTCs as required;
- The battery limit interface for the transportation system at the DGR will be the UFPP. Equipment and facilities for extracting the used fuel modules from the IFTCs are not included in the transportation system costs;
- The UFPP will not reject any incoming used fuel or modules. Modules will not be returned to original Owners' sites after delivery to the DGR;
- No mode transfer facilities or enroute stop-over areas are required. Further, no road or transportation infrastructure upgrades are required. Highways and provincial roads are available for use from existing reactor storage facilities to the DGR site;
- Vehicle maintenance can be outsourced to commercial service providers, eliminating the need for vehicle maintenance facilities;
- Total cost of trailer and tractor fleet as well as the IFTCs are apportioned to each Owner's site according to share of use. One mock-up transportation package is required for system qualification; and
- The transportation system and DGR will operate 365 days/year at 80% capacity to account for weather/traffic delays, maintenance downtime, crew rotations, etc.

3. BASIS OF ESTIMATE

3.1 Estimating Methodology

The cost and lifecycle estimate was derived from the conceptual design update. The scope of the update and fundamental design assumptions were set out in "*Used Fuel Deep Geological Repository and Transportation System - System Requirements for APM Update*" (NWMO Document No.: APM-PR-01110-0001-R00, the "*System Requirements*"). Specific guidance for the UFTS cost estimation was summarized in "*Cost Estimate Requirements for the Preparation of a Life Cycle Cost Estimate for a Used Fuel Transportation System (UFTS) within Adaptive Phased Management (APM)",* (NWMO Document No.: APM-PR-00400-0002-R000, the "*Estimate Requirements*").

Based on consideration of the system components, guidance in the *Estimate Requirements*, and review of earlier estimate work (*e.g.,* the 2003 Cogema Logistics Report), a work breakdown structure was developed to divide overall systems into discrete activities that could be assigned costs and completion schedules. The work breakdown structure (WBS) was used to construct a Microsoft Access format database for recording work element data, such as:

- Primary estimator ("Prepared By");
- WBS code and description;
- Deliverables;
- Assumptions;
- Basis for the assignment of Allowance;
- Task start and end year;
- Type of cost (fixed, step-fixed or variable);
- Valid range (in millions of fuel bundles);
- Critical predecessors;
- Critical successors;
- Labour (labour ID, start year, finish year and hours per year);
- Material and Equipment (by item);
- Other costs (by item); and
- Allowance (as a percent of the value of Labour, Materials and Equipment and Other).

A consistent database has been constructed for the companion DGR lifecycle cost and schedule estimates. The databases allow the attachment of back-up calculations and quotes, including Microsoft Excel-format worksheets.

Based on the conceptual design, the database for the UFTS was populated for each terminal node of the relevant WBS (costs were not assigned to branching points in the WBS). Costs were estimated for Labour, Materials and Equipment, Other and Allowance as defined below:

- Labour – Labour has been input as hours and classifications. Each labour classification is associated with a specific rate ($/hr) and available hours per year per Full Time Equivalent (FTE). Classifications are provided for a variety of labour types, including NWMO employees (categories NWMO1 though NWMO10) and design-build contractors (DB01 to DB08).

- Materials and Equipment – Materials and Equipment have been input on an item-by-item basis and refer to the cost of permanent materials and equipment, *i.e.*, those materials used to construct the project (consumables are not included) and incorporated equipment installations. This includes heavy equipment (trucks, forklifts, cranes) to be used during operations, UFC assembly equipment, and laboratory and office equipment.

- Other – Other has been input on an item-by-item basis. This includes items such as consumables (fuel, utilities and non-permanent materials), permits and fees, taxes, communication costs, furniture, temporary monitoring equipment, and travel and accommodation expenses.

- Allowance – Allowance has been input as a percentage of the total of Labour, Materials & Equipment and Other. Allowance refers to an additional amount added to the cost for an individual work element to cover expected requirements that are not fully defined at the time of the estimate. Allowance is a budget element that is expected to be expended (Allowance is not a 'reserve' that an owner seeks to retain).

Typically, element costs were developed as semi-detailed unit costs with assembly-level line items (with allowances). Because a common fleet services multiple sites, spreadsheets attached to work elements were used to develop common costs and apportion them to individual reactor used fuel storage sites (with individual work elements) by share of use.

NWMO has developed and supplied data for the following work elements:

- 66X.20 – Route and System Development; and
- 66X.25 - Safety Assessment.

Input costs other than Labour were predominately collected by verbal quotes and searches of publicly available media over the November 2009 to April 2010 period. Costs were modified using professional judgement of the design team and in reference to recent project experience related to nuclear materials transport. Input costs are expected to be valid for most of Ontario circa January 2010.

The database was used to generate Microsoft Word format "Work Element Definition Sheets" (WEDS) as well as Microsoft Excel workbooks summarizing a variety of estimate data. Excel sheets were then manually manipulated, including use of Visual Basic for Applications (VBA) programming, to produce a scalable version of the estimate (as discussed later). The database and workbooks package accompany the electronic version of this report.

3.2 Guidance and Standards

Formulation of the estimate and this cost and schedule report was guided by the *System Requirements* and the *Estimate Requirements* discussed previously. In addition, the design and estimation team referred to common terminology and practice as conveyed, for example, in the following:

- Association for the Advancement of Cost Engineering International (AACE International). 2009. *Cost Engineering Terminology*. Recommended Practice No. 10S-90;

- AACE International. 2008. *Contingency Estimating – General Principles*. Recommended Practice No. 40R-08;

- AACE International. 2007. *Basis of Estimate*. Recommended Practice No. 34R-05;

- AACE International. 2005. *Cost Estimate Classification System – As Applied in Engineering, Procurement and Construction for the Process Industries*. Recommended Practice No. 18R-97; and

- AACE International. 2003. *Cost Estimate Classification System*. Recommended Practice No. 17R-97.

Additionally, various regulations, codes and standards were referenced in the completion of the supporting project work and the *Transportation Design Report*. These references included the following:

- *Packaging and Transport of Nuclear Substances Regulations*, SOR/2000 208 plus amendments SOR/2003-405;
- *Nuclear Security Regulations*, SOR/2000-209 plus amendments SOR/2006-191;
- CNSC Regulatory Guide G-208, *Transportation Security Plans for Category I, II or III Nuclear Material*;
- *Transportation of Dangerous Goods Regulations*, including Amendment 6, SOR/2008-34;
- *Commercial Vehicle Drivers Hours of Service Regulations*, SOR/2005-313;
- *IAEA Safety Standards Series, Regulations for the Safe Transport of Radioactive Material*, 1996 Edition (Revised), No. TS-R-1 (ST-1, Revised); and
- *Radiation Protection Regulations*, SOR/2000-203.

3.3 Scheduling

Based on the *System Requirements*, an overall schedule was determined, with identified phases. The *Transportation Design Report* describes the scheduling of shipments to meet the system requirements. From these requirements, activities required to construct and deconstruct the transportation system were assigned dates. The derived schedule is not resource-constrained or resource-driven, it reflects project scheduling objectives.

Because costs are assigned on an annual basis and work element descriptions include items like start and finish years, an annual cost flow is directly exportable from the estimate database. This basic expenditure schedule was used in conjunction with activity logic, work element assumptions and project objectives to construct project timelines (Gantt charts).

3.4 Base Year, Currency and Escalation

The entire cost estimate has been developed in January 2010 Canadian dollars. While the use of a construction cost index to estimate 2010 values from historic data was allowed for, the current estimate reflects recent pricing, and index-based escalation of historic pricing was not required.

3.5 Inflation, Escalation, Discount Rate and Cost of Capital

As discussed above, the estimate is in constant dollar estimates. No inflation, escalation, discount rate assignment, cost of capital calculation or internal rate of return analysis is provided herein.

3.6 Planning Basis and Resource Strategy

The primary planning basis, including logistics and resource assumptions for the estimate is the conceptual design summarized herein and more completely presented in the *Transportation Design Report*. Within this context, a phase-based resourcing approach has been applied, as follows:

Table 10: Resource Strategy

Phase	Who Performs Work
Site Exploration & Approval	NWMO Staff
Construction (Design Build)	Consultant (architecture/engineering) and Design Build staff with NWMO managing contracts and obtaining licenses/performing safety assessments, etc.
Construction Phase (Commissioning)	Primarily NWMO staff
Operation Phase	NWMO staff/ NWMO-contracted operational staff
Decommissioning Phase	Contracted (with NWMO component)

Related labour categories, rates, annual availability and associated considerations are presented in later sections.

3.7 Identification of System-Wide and Facility-Specific Costs

Each work element is identified with respect to the related facility or, if applicable to multiple facilities, as 'common'. In addition, the naming convention used for work elements typically contains a reference to the related site. Sites are assigned to Owners, and Owner-specific costs can be summed on the basis of this assignment.

3.8 Labour Categories, Labour Rates, Included Costs and Productivity

The estimate database uses a central list of labour categories (resource codes). Individual estimates are input on the basis of hours required.

To calculate the cost of Labour, the database calls on the current input rate for each labour code. Updates to codes are immediately and consistently propagated throughout the estimate. Labour codes for the current estimate were last updated on September 10, 2010, as identified on Table 11.

Table 11: Labour Codes and Categories

Labour Code	Organization	Type	Hourly Rate	Yearly Available Hours	Notes
AE01	Architect Engineer	Executive/ Management/ Senior Engineer	$220.00	1860	See Purchased Service 01 (PS01)
AE02	Architect Engineer	Administration	$80.00	1860	Jan 2010$ Golder estimate based on Ontario Consultant Charge-out Rates
AE03	Architect Engineer	Engineering/ Technical/ Specialist	$110.00	1860	See Purchased Service 03 (PS03)
DB01	Design Build Contractor	Executive/ management/ Senior Engineer	$220.00	1860	Jan2010$, Golder Estimate based on Current Contracting Division (GAIA) Rates
DB02	Design Build Contractor	Administration	$80.00	1860	Jan2010$, Golder Estimate based on Current Contracting Division (GAIA) Rates
DB03	Design Build Contractor	Engineering/ Technical/ Specialist/ Design	$110.00	1860	See Purchased Service 03 (PS03)
DB04	Design Build Contractor	Site Administration	$80.00	1860	Jan2010$, Golder Estimate based on Current Contracting Division (GAIA) Rates
DB05	Design Build Contractor	Site management/ Senior Engineers	$160.00	1860	See Purchased Service 02 (PS02)
DB06	Design Build Contractor	Site Engineering/ Technical/ Specialist	$110.00	1860	See Purchased Service 03 (PS03)
DB07	Design Build Contractor	Site Construction workers (Surface)	$118.00	1860	NWMO supplied site worker rate including construction indirects
DB08	Design Build Contractor	Site Construction workers (Underground)	$118.00	1860	NWMO supplied site worker rate including construction indirects
NWMO1	NWMO	Management/ Executive	$150.58	1470	Jan 2010$ - NWMO Labour Rates (Rates are a weighted average based on 2009 NWMO Staff Profile Distribution and include burden and AIP (cat 1-3))
NWMO10	NWMO	FLM Trades	$98.88	1680	Jan 2010$ - OPG Labour Rate as proxy (Rates are based on 2010 OPG NWMD Staff Profile Distribution and include burden and AIP (cat 4 - 10))
NWMO2	NWMO	Administration	$57.01	1470	Jan 2010$ - NWMO Labour Rates (Rates are a weighted average based on 2009 NWMO Staff Profile Distribution and include burden and AIP (cat 1-3))
NWMO3	NWMO	Engineering/ Technical/ Specialists	$88.56	1470	Jan 2010$ - NWMO Labour Rates (Rates are a weighted average based on 2009 NWMO Staff Profile Distribution and include burden and AIP (cat 1-3))
NWMO4	NWMO	Cost & Schedule Technician	$92.49	1680	Jan 2010$ - OPG Labour Rate as proxy (Rates are based on 2010 OPG NWMD Staff Profile Distribution and include burden and AIP (cat 4 - 10))
NWMO5	NWMO	Operator	$79.01	1680	Jan 2010$ - OPG Labour Rate as proxy (Rates are based on 2010 OPG NWMD Staff Profile Distribution and include burden and AIP (cat 4 - 10))
NWMO6	NWMO	Civil	$61.87	1680	Jan 2010$ - OPG Labour Rate as proxy (Rates are based on 2010 OPG NWMD Staff Profile Distribution and include burden and AIP (cat 4 - 10))
NWMO7	NWMO	Maintainer Control	$77.71	1680	Jan 2010$ - OPG Labour Rate as proxy (Rates are based on 2010 OPG NWMD Staff Profile Distribution and include burden and AIP (cat 4 - 10))
NWMO8	NWMO	Maintainer Mechanical	$77.74	1680	Jan 2010$ - OPG Labour Rate as proxy (Rates are based on 2010 OPG NWMD Staff Profile Distribution and include burden and AIP (cat 4 - 10))
NWMO9	NWMO	Rad Technician	$67.84	1680	Jan 2010$ - OPG Labour Rate as proxy (Rates are based on 2010 OPG NWMD Staff Profile Distribution and include burden and AIP (cat 4 - 10))
PS01	Purchased Service	Manager or Project Manager	$220.00	1860	Jan 2010$ Golder estimate based on Ontario Consultant Charge-out Rates
PS02	Purchased Service	Senior Technical Specialist	$160.00	1860	Jan 2010$ Golder estimate based on Ontario Consultant Charge-out Rates
PS03	Purchased Service	Intermediate Technical Specialist	$110.00	1860	Jan 2010$ Golder estimate based on Ontario Consultant Charge-out Rates
PS04	Purchased Service	Junior Technical Specialist or Senior Technician	$100.00	1860	Jan 2010$ Golder estimate based on Ontario Consultant Charge-out Rates

Labour rate derivation is as follows:

- NWMO rates are derived from existing OPG rates, and include conventional labour burden. This burden is comprised of involuntary labour surcharges such as payroll taxes, unemployment insurance, and employee benefits including SAVH (Sickness, Accident, Vacation and Holiday Benefit, including training);

- Architect/Engineer and purchased service costs are based on burdened labour with subcontractor overhead and profit, *i.e.*, they represent 'charge out rates'. Supervision, small tools, job-site overheads and indirects are not included; and

- Design Build costs represent inclusive labour costs and incorporate a range of typical project indirects, including training, tools, supervision, job-site housekeeping, etc. Rates are based on an average 2010 Ontario Electrical Power Systems Construction Association base hourly rate, supplemented with allowances for indirects as follows:

Table 12: Design-Build Labour Rate Inclusions

Base Labour Rate ($/hr)		$43.94
Canada Pension Plan	4.95%	$2.18
Employment Insurance	2%	$0.88
Workplace Safety and Insurance Board	6%	$2.64
Travel Allowance	7.87%	$3.46
Site Supervision	12%	$5.27
Site Overhead and Profit	18%	$7.91
Mark Up	15%	$6.59
Construction Equipment	22%	$9.67
On-going Safety	8%	$3.52
Safety Orientation	4%	$1.76
Small Tools	10%	$4.39
Spot Premium Overtime	10%	$4.39
Janitorial Clean Up	1.8%	$0.79
Warehousing	1.1%	$0.48
Surveying	2.8%	$1.23
Pickup Trucks and Fuel	18%	$7.91
Office Trailers	2.8%	$1.23
Propane and Temporary Facilities	1.4%	$0.62
Telephone	5.5%	$2.42
Computer/Printer	5%	$2.20
Sewage for Temporary Facilities	1%	$0.44
Power for Temporary Facilities	2.8%	$1.23
Sewage Pumps Outs	1%	$0.44
Special Rigging	5.5%	$2.42
		$74.05
		$117.99

Input Labour hours are as envisaged to complete the described deliverables, which includes assumptions as to productivity under the working conditions and schedules specified in the *Transportation Design Report*.

3.9 Assemblies, Unit Cost Data and Standard Crews

As discussed previously, rolled-up crew/equipment/material assemblies were not used to formulate the cost estimate.

3.10 Location and Location Factors

Cost data collected applies to Ontario purchases in 2010. Consolidated, central purchasing of equipment and services is envisaged. A common fleet will service various sites; location factors were not used to adjust costs for individual sites.

3.11 Indirects

Differing indirect costs are accounted for in differing components of the estimate:

- Program and Project Management have dedicated WBS entries;
- Sales tax, freight and duty are incorporated in the installed/delivered cost of equipment;
- Design labour has been entered for work elements with a design component;
- Fuel, system access fees and fleet maintenance have been included in 'Other' costs;
- Travel and contracted design services have been included as line items in 'Other' costs;
- Consumables and miscellaneous indirect costs have been explicitly included in 'Other' costs or are intended to be accounted for in the assigned Allowances;
- Architect/engineering labour contains contractor overhead and profit as previously discussed; and
- Design Build labour codes include overhead, profit and construction labour indirects as previously described.

Allowances for taxes, payments in lieu of taxes and community payments are not included. It is noted that related DGR estimates carry related sums. Furthermore, NWMO (the assumed transportation system owner and operator) has developed additional estimates for program-level APM costs which are not included herein.

3.12 Insurance

Commercial vehicle insurance is included in operating costs. Additional insurance costs are not included herein. The nature, extent and mechanisms of NWMO's approach to risk management issues will be decided by NWMO.

3.13 Freight, Tax, Sales Tax, Duties and Community Payments

Materials and equipment and other costs are on an installed basis, inclusive of freight and duty unless otherwise noted. The cost of taxes on materials or services that would be purchased by

a contractor to build real property (*e.g.*, buildings) or to install fixtures (*e.g.*, cranes) are also included in the Materials and Equipment and Other costs for the relevant work elements.

Based on the *Estimate Requirements*, offsets, benefits, compensation, tax or payments in lieu of tax, provision for harmonized sales tax, etc. to host communities are the domain of NWMO and are not included herein.

3.14 Management Reserve, Allowance and Contingency

No management reserve is incorporated into the current estimate. Two different sums, 'Allowance' and 'Contingency' are considered in order to account for incomplete design and project risk, respectively. The definition of 'Allowance' from the *Estimate Requirements* is as follows:

> "*Additional resources included in estimates to cover the cost of known but undefined requirements for an individual activity or work item. Allowances are included within individual work element estimates*."

NWMO reserved the assignment of 'Contingency', and the use of the term, to itself, noting:

> "*The application of contingency is decided by the owner* [*i.e.*, NWMO] *based on their assessment of risk within the estimate including* allowance."

'Allowance' is reported at the lowest level of the WBS, at the level of the terminal nodes on the WBS tree. 'Contingency' is calculated as a single value applied to the overall estimate and is independent of any specific work element or estimated annual expenditure. Contingency has been calculated as directed by the NWMO.

As applied herein, 'Allowance' accounts for the expected additional costs not captured in individual estimate line items. Given the conceptual state of the design, detail as to consumables, fittings, small parts, miscellaneous costs, etc., are not available. To create a realistic total price, judgement is used to assign a factor (the 'Allowance') that accounts for these additional costs. These costs are expected expenditures, budgeted for completion of the work according to plan.

The amount of Allowance is based on previous experience with similar work, similar projects and an assessment of both design completeness and the novelty of the undertaking. Overall, the general guidance as identified in Table 13 was provided for the estimate.

Table 13: Allowance Guidelines

Amount of Allowance	Characteristics of Work Element
≤15%	• Commercial Off-the-Shelf (COTS) item with known price (no further work necessary); • Cost data from recent, similar identical or very similar work used; • High degree of confidence in design status and procurement specification; • Accurate measurement of quantities; • Firm contractor quotations on detailed specification(s); and • Risk areas identified and mitigated by assumptions.
20%	• Commercial Off-the-Shelf item with limited, identifiable modifications required; • Data used from previous similar contract or recent benchmarking; • Reasonable confidence in methods of measurement & quantities; • High degree of confidence in design status and procurement specification; • Contractor firm or "budget" quotations; and • Risk areas identified and mitigated by assumptions.
25%	• Design has been reviewed and assessed; • Suppliers provide budget quotations in response to a conceptual/provisional specification; • Previous similar contract or benchmarking data available; • Involves only conventional methods of construction / manufacture; and • Methods of measurement and quantities are reasonably reliable.
30%	• Design has been reviewed and assessed; • Estimating data from similar contracts have been used for reference; • Methods of measurement and/or quantities are unreliable or inexact; • Involves unconventional methods/materials of construction / manufacture; and • Labour-intensive (this includes many aspects of operations phases).
40%	• Design is an initial revision; • Labour intensive activity; • Activity or item likely to overrun (high cost variance in current practice); • Suppliers provide budget pricing based on design outline; • Little previous experience; and • Requires development for methods/materials of construction/manufacture.
50%	• State of the Art; • Requires significant development; • Never been done before commercially; • Innovative design; • Complex features; and • Labour intensive activity liable to overrun (specifically includes commissioning phase).
>50%	• High cost risk, extremely speculative design or only a general concept.

Actual Allowances were assigned on a work-element basis by the relevant initial estimator.

3.15 Exclusions

A number of factors and related costs have been excluded from the current estimate, including:

- Scope other than described or contract delivery other than that assumed;
- Major design or operational changes over the lifecycle of the project;
- Financing costs or lack of adequate and timely funding;
- Road infrastructure maintenance or upgrade;
- Traffic conditions/congestion and construction delays;
- Impacts from floods, earthquakes or major climate change;
- Prolonged labour strikes and major work stoppages;
- Major protest or civil unrest, acts of crime, terrorism or war;
- Lawsuits or injunctions;
- Changes in regulatory requirements;
- Changes in science or technology or in health & safety requirements;
- New used fuel types;
- Extreme economic conditions (such as deflation/depression with excess labour/ equipment availability or runaway inflation and extremely low labour/equipment availability); and
- Foreign procurement, foreign currency costs and related risk.

Also, other than routine fees already embedded in current cost data (for example, software fees allowed for in office costs), or as specifically mentioned in individual work element descriptions, no allowance for intellectual property fees (patents, royalties and licensing fees) related to future technology are included.

4. ESTIMATED COST

Based on the foregoing, detailed year-by-year costs were developed for each work element. These detailed costs are presented in associated Excel format workbooks which enable, for example, summaries of costs by year at sub-levels of the WBS.

The following sections present the overall cost estimate results in terms of the major elements of the WBS, project year, cost category, labour type, reactor site and waste owner. In total, and based on the methodology, scope and assumptions detailed in this report, the 2010 constant Canadian dollar costs for the Base and Alternate Cases are as follows:

- Base Case (exclusive of contingency): $828 million; and
- Alternate Case (exclusive of contingency): $1,496 million.

4.1 Summary of Costs at Level 2 of WBS

At the second level of the WBS, current Base and Alternate Case estimates are as presented below on Table 14 / Figures 1 & 2 and, Table 15 / Figures 3 & 4, respectively.

Table 14: Base Case Estimate by Level 2 of the WBS

WBS	Title	Total Cost Estimate (2010 $K)
660.20	Route and System Development	$17,154
660.25	Safety Assessment	$4,229
660.40	Capital Equipment and Facilities	$273,962
660.50	Operations	$393,096
660.55	Environmental Management	$6,514
660.60	Decommissioning	$30,752
660.90	Program Management	$102,062
	660 Subtotal	$827,770
	Contingency	$95,517
	660 Total	$923,287

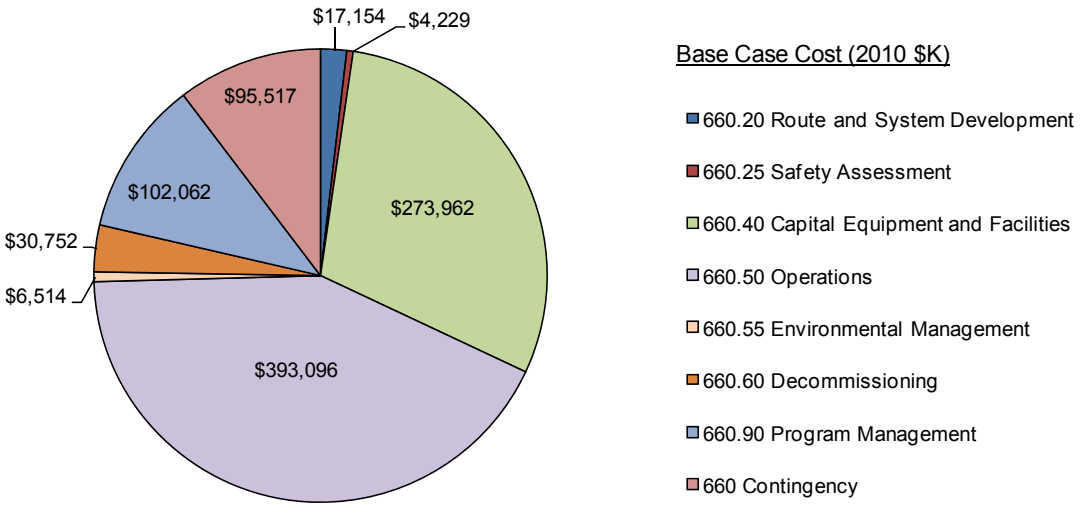


Figure 1: Base Case Estimate by Level 2 of the WBS (2010 $K)

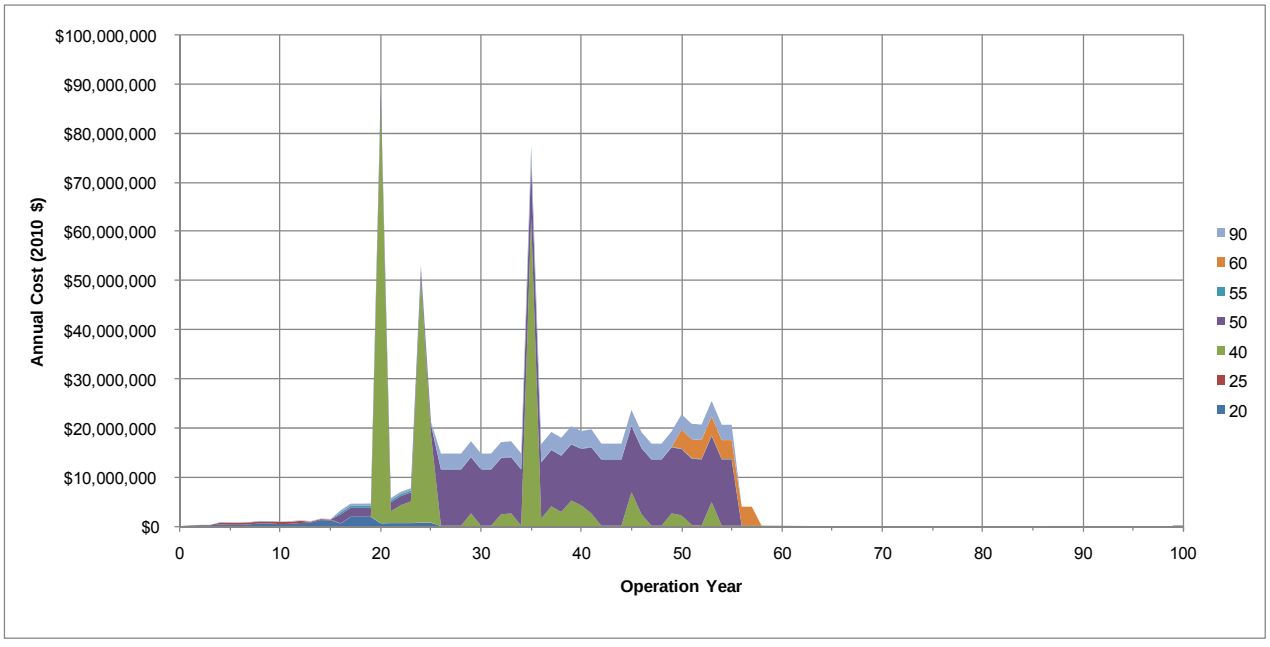


Figure 2: Annual Base Case Estimate by Level 2 of the WBS (2010 $K)

Table 15: Alternate Case Estimate by Level 2 of the WBS (2010 $K)

WBS	Title	Total Cost Estimate (2010 $K)
661.20	Route and System Development	$17,154
661.25	Safety Assessment	$4,229
661.40	Capital Equipment and Facilities	$454,003
660.50	Operations	$776,261
661.55	Environmental Management	$9,346
661.60	Decommissioning	$39,089
661.90	Program Management	$195,537
661 Subtotal		$1,495,620
Contingency		$173,501
661 Total		$1,669,121

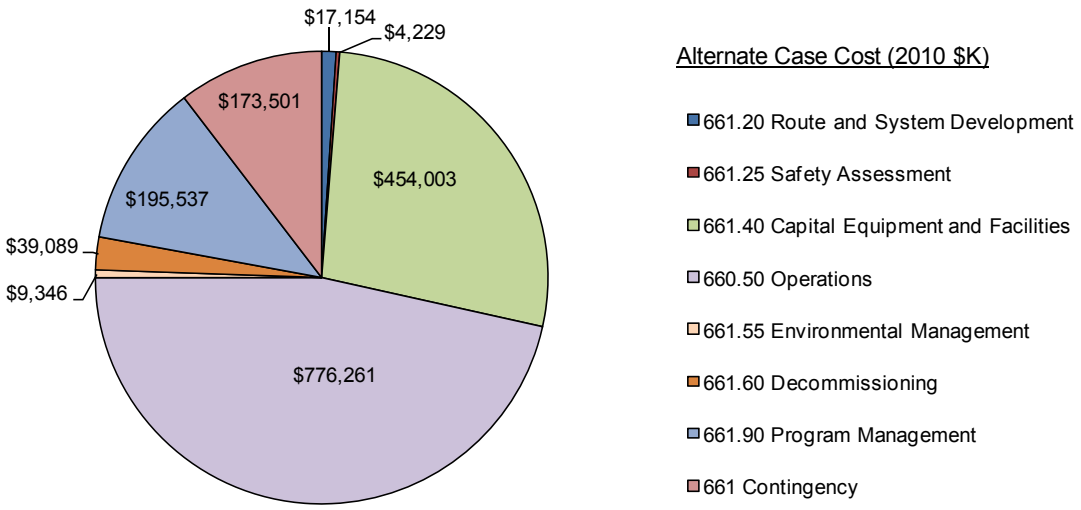


Figure 3: Alternate Case Estimate by Level 2 of the WBS (2010 $K)

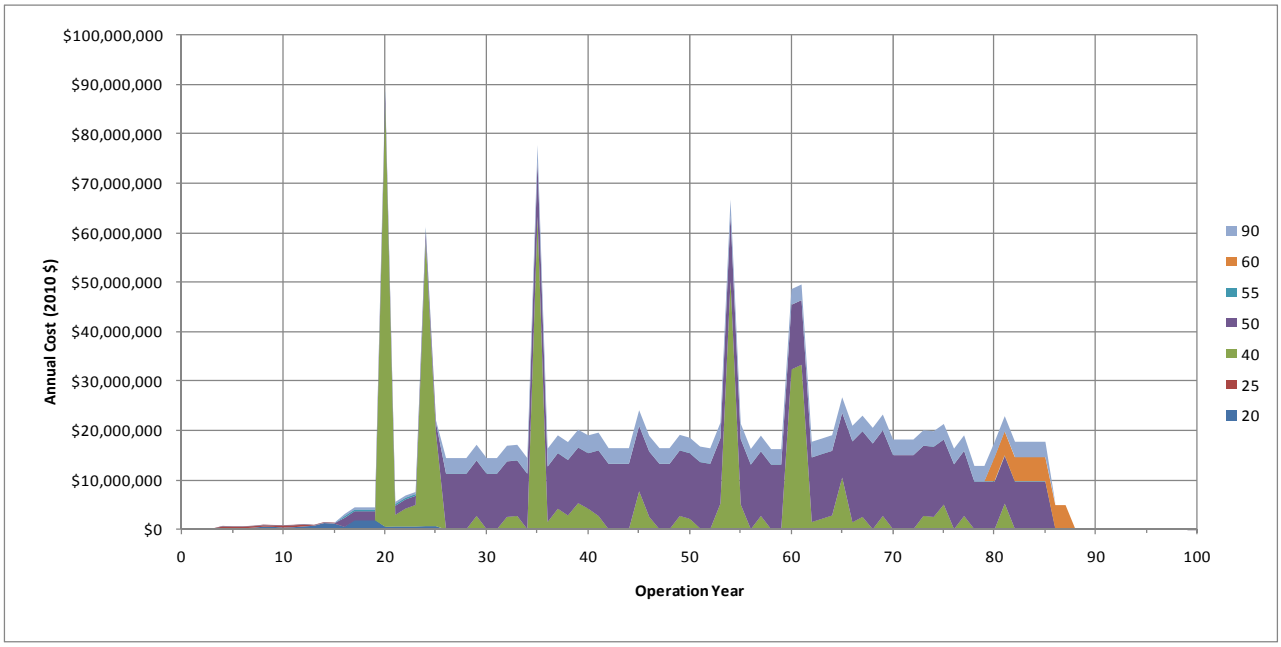


Figure 4: Annual Alternate Case Estimate by Level 2 of the WBS (2010 $K)

4.2 Detailed Cost Breakdown

Costs per work element are presented in Appendix A. Workbooks accompanying this report include annual costs per work element, per cost category, on an annual basis.

4.3 Annual and Cumulative Cost

Given the input years for each cost item, and the overall start and finish years for each work element, total annual costs in the Base and Alternate Case estimates are presented below in conjunction with the cumulative cost incurred over time (see Figures 5 and 6, respectively).

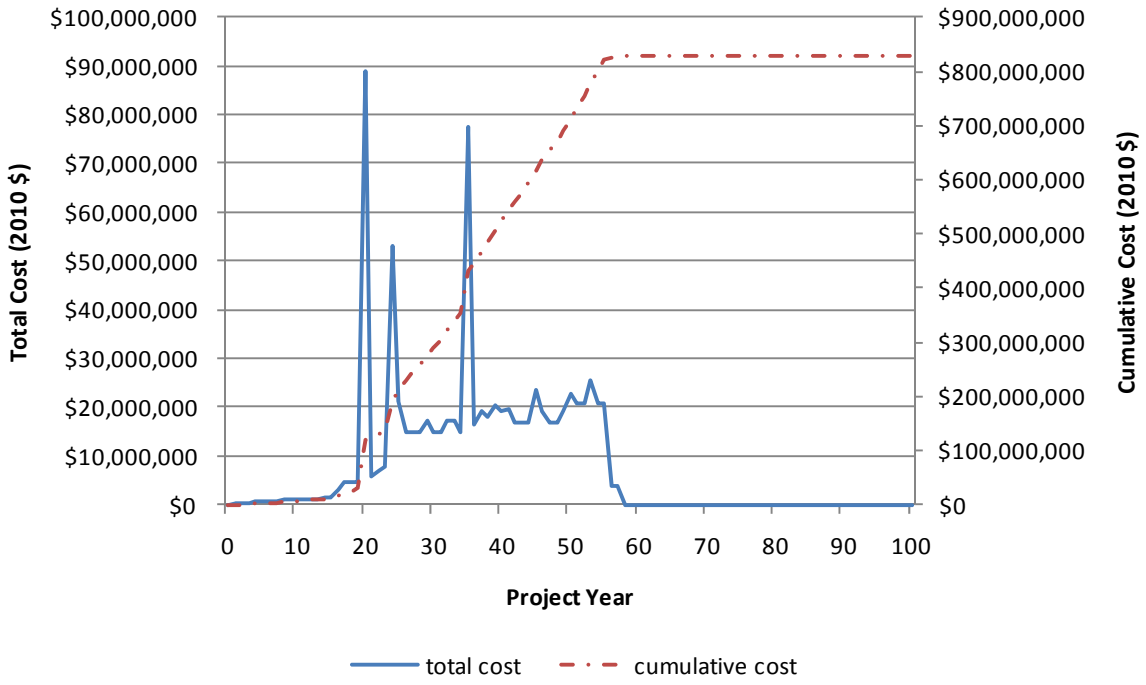


Figure 5: Base Case Estimate – Annual and Cumulative Cost (2010 $K)

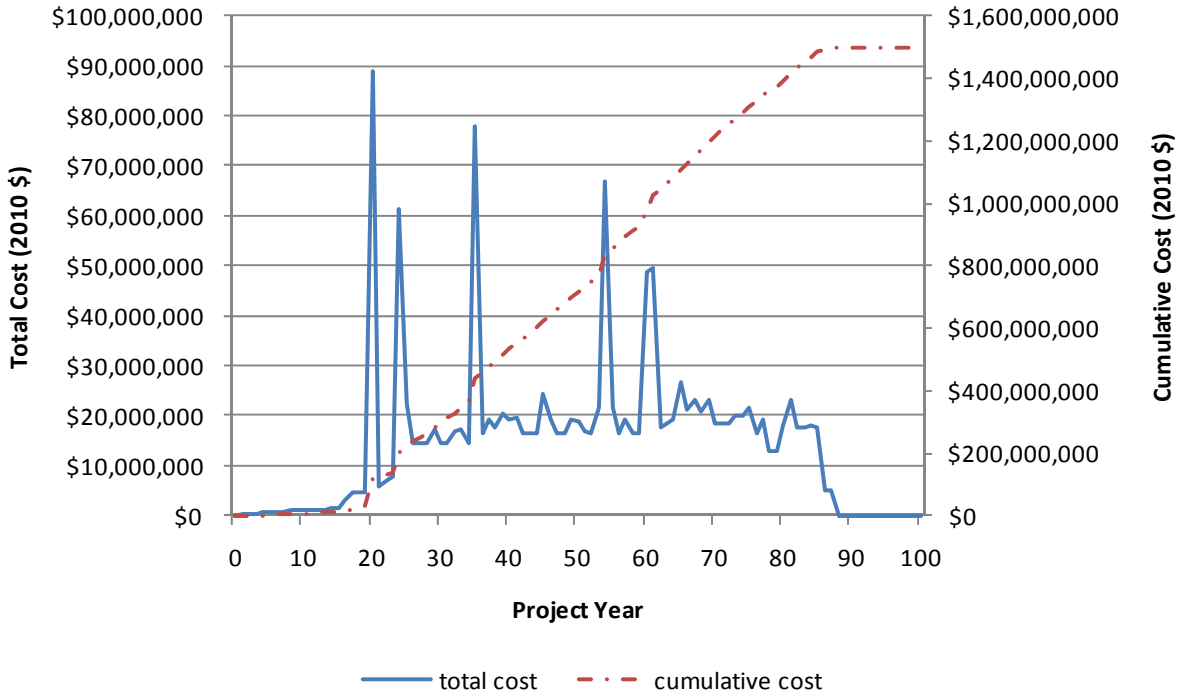


Figure 6: Alternate Case Estimate – Annual and Cumulative Cost (2010 $K)

4.4 Summary of Cost by Phase

Assigning each work element to one of the four project phases results in the estimated division of costs as provided on Table 16. Figures 7 and 8 illustrate the same information graphically for the Base and Alternate Cases, respectively.

Table 16: Costs by Project Phase

Project Phase	Base Case (2010 $K)	Alternate Case (2010 $K)
Siting & Licensing	$21,383	$21,383
Construction	$273,962	$454,003
Operation	$501,673	$981,144
Closure and Decommissioning	$30,752	$39,089
Subtotal	**$827,770**	**$1,495,620**
Contingency	$95,517	$173,501
Total	**$923,287**	**$1,669,121**

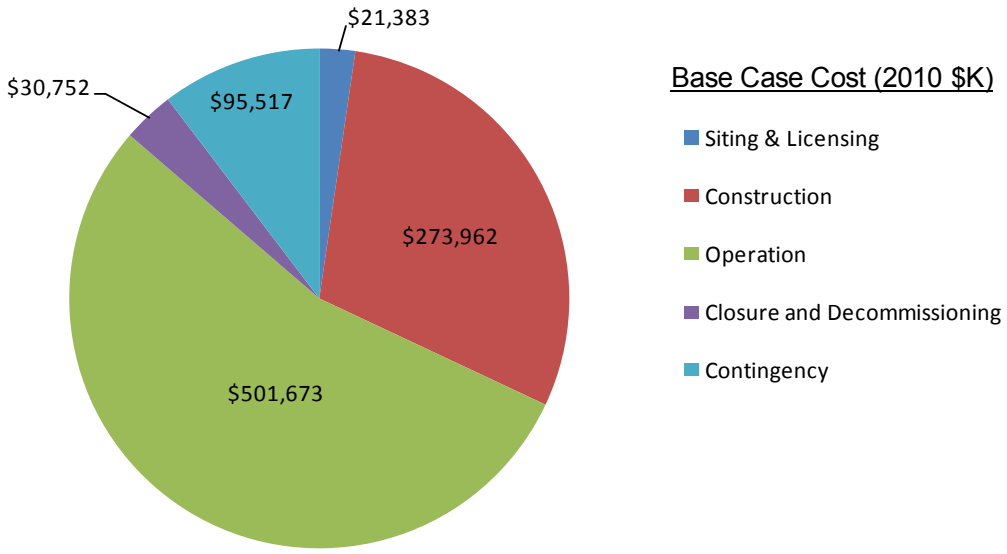


Figure 7: Base Case Estimate by Project Phase (2010 $K)

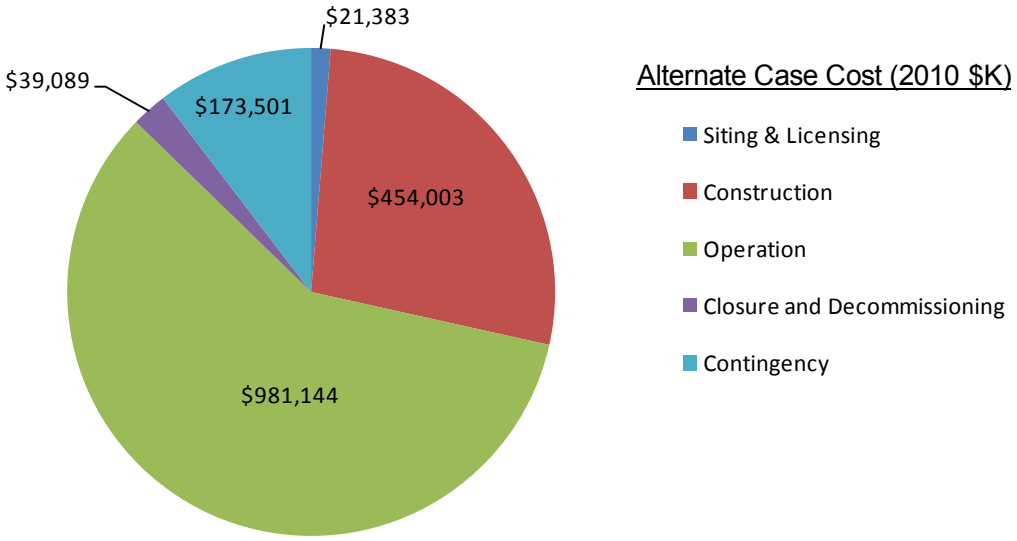


Figure 8: Alternate Case Estimate by Project Phase (2010 $K)

4.5 Summary of Cost by Cost Category

Estimated cost by specific category (Labour, Material & Equipment, Other and, Allowance) are presented below on Table 17 / Figure 9 and Table 18 / Figure 10, for the Base and Alternate Cases, respectively.

Table 17: Base Case Cost Estimate by Cost Category

Base Case (2010 $K: 3.6M Bundles)					
Project Phase	**Labour**	**Material & Equipment**	**Other**	**Allowance**	**Total**
Siting & Licensing	$11,651	$0	$9,732	$0	$21,383
Construction	$30,559	$203,191	$7,859	$32,352	$273,962
Operation	$403,906	$0	$44,990	$52,777	$501,673
Closure & Decommissioning	$6,864	$0	$19,877	$4,011	$30,752
660 subtotal	**$452,980**	**$203,191**	**$82,458**	**$89,140**	**$827,770**
Contingency	-	-	-	-	$95,517
660 Total	**$452,980**	**$203,191**	**$82,458**	**$89,140**	**$923,287**

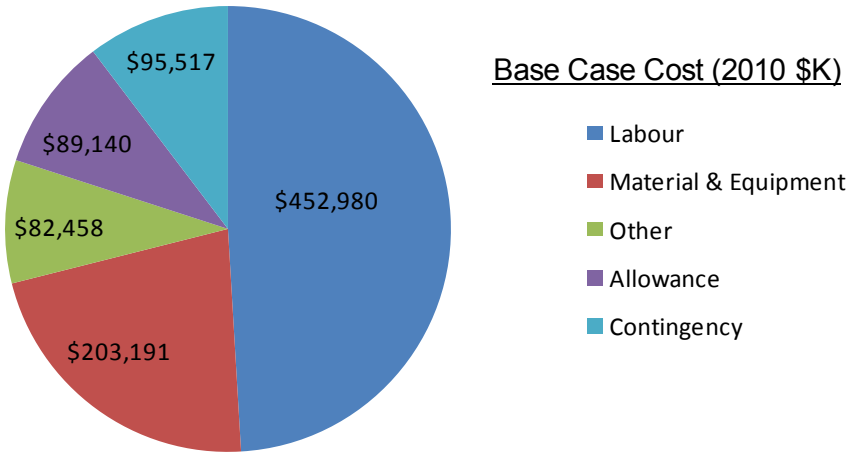


Figure 9: Base Case Estimate by Cost Category (2010 $K)

Table 18: Alternate Case Cost Estimate by Cost Category

Alternate Case (2010 $K: 7.2M Bundles)					
Project Phase	**Labour**	**Material & Equipment**	**Other**	**Allowance**	**Total**
Siting & Licensing	$11,651	$0	$9,732	$0	$21,383
Construction	$41,656	$348,338	$12,194	$51,816	$454,003
Operation	$783,513	$0	$94,222	$103,408	$981,144
Closure & Decommissioning	$8,724	$0	$25,266	$5,099	$39,089
661 subtotal	**$845,544**	**$348,338**	**$141,415**	**$160,323**	**$1,495,620**
Contingency	-	-	-	-	$173,501
661 Total	**$845,544**	**$348,338**	**$141,415**	**$160,323**	**$1,669,121**

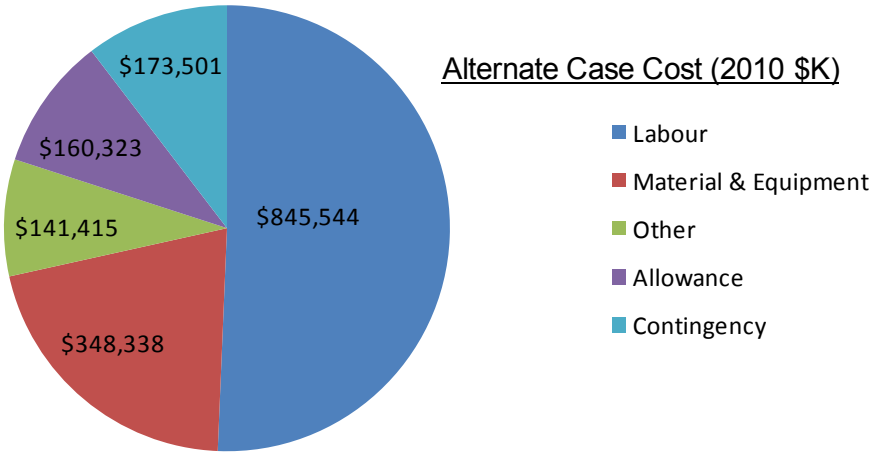


Figure 10: Alternate Case Estimate by Cost Category (2010 $K)

4.6 Labour Utilization

The estimated use of differing labour categories is summarized below on Tables 19 and 20, for the Base and Alternate Cases, respectively. Subsequent sub-sections present the use of labour categories on an annual basis and with respect to project phase.

Table 19: Base Case Labour Category Use (Total)

Base Case (2010 $K: 3.6 M Bundles)				
Labour Code	**Labour Category**	**Hourly Rate**	**Total Hours**	**Labour Cost**
AE03	Engineering/ Technical/ Specialist	$110.00	196,990	$21,669
DB03	Engineering/ Technical/ Specialist/ Design	$110.00	5,122	$563
DB07	Site Construction workers (Surface)	$118.00	73,625	$8,688
NWMO1	Management/ Executive	$150.58	737,160	$111,002
NWMO2	Administration	$57.01	63,900	$3,643
NWMO3	Engineering/ Technical/ Specialists	$88.56	335,145	$29,680
NWMO5	Operator	$79.01	2,911,371	$230,027
NWMO7	Maintainer Control	$77.71	525,600	$40,844
NWMO9	Rad Technician	$67.84	101,174	$6,864
		660 Total	**4,950,087**	**$452,980**
	Weighted Average Hourly Rate	**$91.51**		

Table 20: Alternate Case Labour Category Use (Total)

Alternate Case (2010 $K: 7.2 M Bundles)				
Labour Code	**Labour Category**	**Hourly Rate**	**Total Hours**	**Labour Cost**
AE03	Engineering/ Technical/ Specialist	$110.00	266,274	$29,290
DB03	Engineering/ Technical/ Specialist/ Design	$110.00	5,122	$563
DB07	Site Construction workers (Surface)	$118.00	103,074	$12,163
NWMO1	Management/ Executive	$150.58	1,403,760	$211,378
NWMO2	Administration	$57.01	113,100	$6,448
NWMO3	Engineering/ Technical/ Specialists	$88.56	359,745	$31,859
NWMO5	Operator	$79.01	5,865,458	$463,430
NWMO7	Maintainer Control	$77.71	1,051,200	$81,689
NWMO9	Rad Technician	$67.84	128,604	$8,724
		661 Total	**9,296,337**	**$845,544**
	Weighted Average Hourly Rate	**$90.95**		

4.6.1 Utilization by Year

Labour hours by project year by labour category for the Base and Alternate Cases are illustrated on the following Figures 11 and 12, respectively.

Figure 11: Base Case Labour Category Use by Year

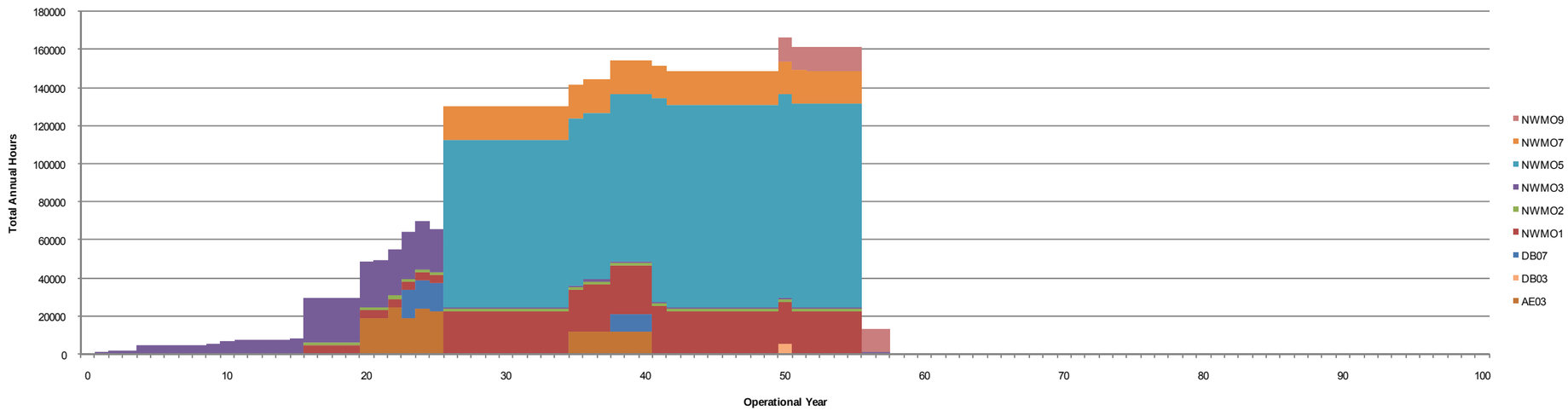
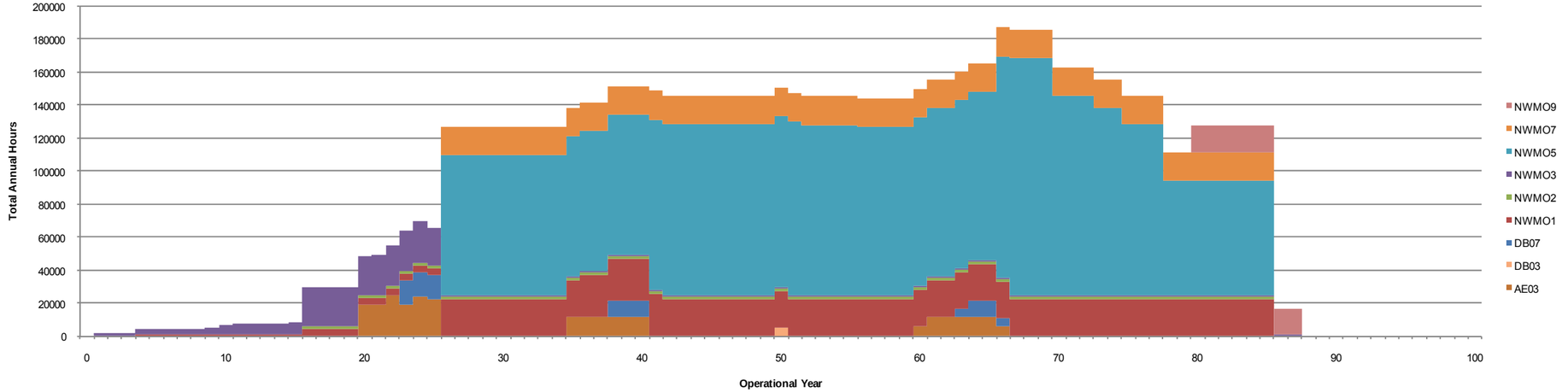


Figure 12: Alternate Case Labour Category Use by Year



4.6.2 Utilization by Phase

Based on the classification of work elements, the estimated use of labour categories per phase is as presented below on Tables 21 and 22 for the Base and Alternate Cases, respectively.

Table 21: Base Case Labour Use by Phase

Base Case (2010 $K: 3.6 M Bundles)					
Project Phase	**Labour Code**	**Labour Category**	**Hourly Rate**	**Total Hours**	**Labour Cost**
Siting & Licensing	NWMO3	Engineering/ Technical/Specialists	$88.56	131,565	$11,651
Construction	AE03	Engineering/ Technical/Specialist	$110.00	193,710	$21,308
	DB03	Engineering/ Technical/Specialist/ Design	$110.00	5,122	$563
	DB07	Site Construction workers (Surface)	$118.00	73,625	$8,688
Operation	AE03	Engineering/ Technical/Specialist	$110.00	3,280	$361
	NWMO1	Management/ Executive	$150.58	737,160	$111,002
	NWMO2	Administration	$57.01	63,900	$3,643
	NWMO3	Engineering/ Technical/Specialists	$88.56	203,580	$18,029
	NWMO5	Operator	$79.01	2,911,371	$230,027
	NWMO7	Maintainer Control	$77.71	525,600	$40,844
Closure and Decommissioning	NWMO9	Rad Technician	$67.84	101,174	$6,864
			660 Total	**4,950,087**	**$452,980**

Table 22: Alternate Case Labour Use by Phase

Alternate Case (2010 $K: 7.2 M Bundles)					
Project Phase	**Labour Code**	**Labour Category**	**Hourly Rate**	**Total Hours**	**Labour Cost**
Siting & Licensing	NWMO3	Engineering/ Technical/Specialists	$88.56	131,565	$11,651
Construction	AE03	Engineering/ Technical/Specialist	$110.00	262,994	$28,929
	DB03	Engineering/ Technical/Specialist/ Design	$110.00	5,122	$563
	DB07	Site Construction workers (Surface)	$118.00	103,074	$12,163
Operation	AE03	Engineering/ Technical/Specialist	$110.00	3,280	$361
	NWMO1	Management/ Executive	$150.58	1,403,760	$211,378
	NWMO2	Administration	$57.01	113,100	$6,448
	NWMO3	Engineering/ Technical/Specialists	$88.56	228,180	$20,208
	NWMO5	Operator	$79.01	5,865,458	$463,430
	NWMO7	Maintainer Control	$77.71	1,051,200	$81,689
Closure and Decommissioning	NWMO9	Rad Technician	$67.84	128,604	$8,724
			661 Total	**9,296,337**	**$845,544**

4.7 Costs per Reactor Site

Considering reactor site-specific and common costs results in the following distribution of costs for each nuclear facility as provided on Tables 23 and 24 for the Base and Alternate Cases, respectively.

Table 23: Base Case Site-Specific and Common Costs

Base Case (2010 $K: 3.6 M Bundles)					
Nuclear Power Plant	**Labour**	**Material & Equipment**	**Other**	**Allowance**	**Total**
Bruce	$97,266	$55,669	$12,462	$23,215	$188,611
Chalk River	$600	$747	$113	$214	$1,675
Darlington	$59,229	$42,795	$7,787	$15,539	$125,350
Douglas Point	$1,519	$869	$195	$362	$2,945
Gentilly 1	$380	$680	$68	$166	$1,294
Gentilly 2	$14,732	$26,335	$2,636	$6,416	$50,119
Pickering	$57,114	$42,060	$7,526	$15,109	$121,809
Point Lepreau	$16,568	$26,698	$3,441	$6,878	$53,585
Whiteshell	$305	$647	$78	$154	$1,184
Common Costs[1]	$205,268	$6,689	$48,153	$21,087	$281,197
660 Subtotal	**$452,980**	**$203,191**	**$82,458**	**$89,140**	**$827,770**
Contingency	-	-	-	-	$95,517
660 Total	**$452,980**	**$203,191**	**$82,458**	**$89,140**	**$923,287**

[1] "Common Costs" are those costs incurred through development and operation of the UFTS that cannot be directly attributed to a specific reactor site.

Table 24: Alternate Case Site-Specific and Common Costs

Alternate Case (2010 $K: 7.2 M Bundles)					
Nuclear Power Plant	**Labour**	**Material & Equipment**	**Other**	**Allowance**	**Total**
Bruce	$146,410	$78,491	$18,514	$33,783	$277,198
Chalk River	$600	$760	$113	$215	$1,689
Darlington	$85,757	$55,216	$11,052	$21,250	$173,276
Douglas Point	$1,489	$798	$188	$344	$2,819
Gentilly 1	$310	$383	$53	$108	$855
Gentilly 2	$24,433	$30,186	$4,188	$8,504	$67,311
New Build A	$54,189	$42,987	$7,166	$14,709	$119,051
New Build B	$56,813	$44,004	$7,489	$15,253	$123,559
Pickering	$79,989	$52,982	$10,342	$20,055	$163,368
Point Lepreau	$31,296	$30,798	$6,465	$9,951	$78,510
Whiteshell	$305	$648	$78	$154	$1,185
Common Costs[1]	$363,952	$11,084	$75,765	$35,997	$486,798
661 subtotal	**$845,544**	**$348,338**	**$141,415**	**$160,323**	**$1,495,620**
Contingency	-	-	-	-	$173,501
661 Total	**$845,544**	**$348,338**	**$141,415**	**$160,323**	**$1,669,121**

[1] "Common Costs" are those costs incurred through development and operation of the UFTS that cannot be directly attributed to a specific reactor site.

4.7.1 Costs per Waste Owner

Considering reactor site-specific and common costs results in the following distribution of costs for each waste Owner (see Tables 25 and 26 for the Base and Alternate Cases, respectively).

Table 25: Base Case Owner-Specific and Common Costs

Base Case (2010 $K: 3.6M Bundles)					
Fuel Owner	**Labour**	**Material & Equipment**	**Other**	**Allowance**	**Total Cost Estimate**
AECL	$2,805	$2,944	$454	$896	$7,098
Hydro-Québec	$14,732	$26,335	$2,636	$6,416	$50,119
New Brunswick Power	$16,568	$26,698	$3,441	$6,878	$53,585
OPG	$213,608	$140,525	$27,774	$53,863	$435,770
Common Costs[1]	$205,268	$6,689	$48,153	$21,087	$281,197
660 Subtotal	**$452,980**	**$203,191**	**$82,458**	**$89,140**	**$827,770**
Contingency	-	-	-	-	$95,517
660 Total	**$452,980**	**$203,191**	**$82,458**	**$89,140**	**$923,287**

[1] "Common Costs" are those costs incurred through development and operation of the UFTS that cannot be directly attributed to a specific reactor site.

Table 26: Alternate Case Owner-Specific and Common Costs

Alternate Case (2010 $K: 7.2M Bundles)					
Fuel Owner	**Labour**	**Material & Equipment**	**Other**	**Allowance**	**Total Cost Estimate**
AECL	$2,705	$2,590	$433	$821	$6,548
Hydro-Québec	$24,433	$30,186	$4,188	$8,504	$67,311
New Brunswick Power	$31,296	$30,798	$6,465	$9,951	$78,510
New Build A	$54,189	$42,987	$7,166	$14,709	$119,051
New Build B	$56,813	$44,004	$7,489	$15,253	$123,559
OPG	$312,156	$186,689	$39,909	$75,088	$613,843
Subtotal (OPG, New Build)	*$423,159*	*$273,680*	*$54,564*	*$105,050*	*$856,453*
Common Costs[1]	*$363,952*	*$11,084*	*$75,765*	*$35,997*	*$486,798*
661 Subtotal	**$845,544**	**$348,338**	**$141,415**	**$160,323**	**$1,495,620**
Contingency	-	-	-	-	$173,501
661 Total	**$845,544**	**$622,018**	**$195,979**	**$265,373**	**$2,525,574**

[1] "Common Costs" are those costs incurred through development and operation of the UFTS that cannot be directly attributed to a specific reactor site.

5. SCHEDULE

Each work element is also described in terms of its start and end years. Moreover, there is a necessary sequence to operations. Based on work element data, the current project schedules for the Base and Alternate Cases are depicted below (see Figures 13 and 14, respectively), where Year 1 is assumed to be 2010.

Figure 13: Base Case Schedule

WBS Number	Title	Start Year	Finish Year
660.20	Route and System Development	1	25
660.25	Safety Assessment	1	15
660.40	Capital Equipment and Facilities	20	55
660.40.10	IFTC Transportation Vehicles	22	55
660.40.10.10	IFTC Transportation Vehicle for non-Site-Specific	22	24
660.40.10.20	IFTC Transportation Vehicles for Whiteshell	25	55
660.40.10.30	IFTC Transportation Vehicles for Bruce	25	55
660.40.10.40	IFTC Transportation Vehicles for Pickering	25	55
660.40.10.50	IFTC Transportation Vehicles for Darlington	25	55
660.40.10.60	IFTC Transportation Vehicles for Point Lepreau	25	55
660.40.10.70	IFTC Transportation Vehicles for Chalk River	25	55
660.40.10.80	IFTC Transportation Vehicles for Gentilly 1	25	55
660.40.10.90	IFTC Transportation Vehicles for Gentilly 2	25	55
660.40.10.100	IFTC Transportation Vehicles for Douglas Point	25	55
660.40.20	IFTC Transport Casks	22	25
660.40.20.10	IFTC Transport Casks at DGR	22	24
660.40.20.10.30	IFTC Transport Cask non-Site-Specific	22	24
660.40.20.20	IFTC Transport Casks for Whiteshell	24	25
660.40.20.30	IFTC Transport Casks for Bruce	24	25
660.40.20.40	IFTC Transport Casks for Pickering	24	25
660.40.20.50	IFTC Transport Casks for Darlington	24	25
660.40.20.60	IFTC Transport Casks for Point Lepreau	24	25
660.40.20.70	IFTC Transport Casks for Chalk River	24	25
660.40.20.80	IFTC Transport Casks for Gentilly 1	24	25
660.40.20.90	IFTC Transport Casks for Gentilly 2	24	25
660.40.20.100	IFTC Transport Casks for Douglas Point	24	25
660.40.30	Equipment for IFTC Transport Cask Loading	20	51
660.40.30.10	Equipment for IFTC Transport Cask Loading non-Site-Specific	20	25
660.40.30.20	Equipment for IFTC Transport Cask Loading at Whiteshell	50	51
660.40.30.30	Equipment for IFTC Transport Cask Loading at Bruce	20	25
660.40.30.40	Equipment for IFTC Transport Cask Loading at Pickering	20	25
660.40.30.50	Equipment for IFTC Transport Cask Loading at Darlington	20	25
660.40.30.60	Equipment for IFTC Transport Cask Loading at Point Lepreau	35	40
660.40.30.70	Equipment for IFTC Transport Cask Loading at Chalk River	50	51
660.40.30.80	Equipment for IFTC Transport Cask Loading at Gentilly 1	35	40
660.40.30.90	Equipment for IFTC Transport Cask Loading at Gentilly 2	35	40
660.40.30.100	Equipment for IFTC Transport Cask Loading at Douglas Point	20	25
660.40.40	Equipment for IFTC Transportation Logistics at DGR	24	55
660.40.40.10	Equipment for IFTC Transportation Logistics for Real Time Tracking	24	55
660.40.40.20	Equipment for IFTC Transportation Logistics for Emergency Response	24	25
660.50	Operations	16	55
660.50.10	Project Management	16	25
660.50.20	IFTC Transport Cask Loading	24	55
660.50.20.10	IFTC Transport Cask Loading non-Site-Specific	24	25
660.50.20.20	IFTC Transport Cask Loading Whiteshell	51	51
660.50.20.30	IFTC Transport Cask Loading at Bruce	26	55
660.50.20.40	IFTC Transport Cask Loading at Pickering	26	55
660.50.20.50	IFTC Transport Cask Loading at Darlington	26	55
660.50.20.60	IFTC Transport Cask Loading at Point Lepreau	41	55
660.50.20.70	IFTC Transport Cask Loading at Chalk River	52	55
660.50.20.80	IFTC Transport Cask Loading at Gentilly 1	52	55
660.50.20.90	IFTC Transport Cask Loading at Gentilly 2	41	55
660.50.20.100	IFTC Transport Cask Loading Douglas Point	41	51
660.50.30	IFTC Transportation Logistics	26	55
660.50.30.10	IFTC Transportation Logistics from Whiteshell to DGR	51	51
660.50.30.20	IFTC Transportation Logistics from Bruce to DGR	26	55
660.50.30.30	IFTC Transportation Logistics from Pickering to DGR	26	55
660.50.30.40	IFTC Transportation Logistics from Darlington to DGR	26	55
660.50.30.50	IFTC Transportation Logistics from Point LePreau to DGR	41	55
660.50.30.60	IFTC Transportation Logistics from Chalk River to DGR	52	55
660.50.30.70	IFTC Transportation Logistics from Gentilly 1 to DGR	52	55
660.50.30.80	IFTC Transportation Logistics from Gentilly 2 to DGR	41	55
660.50.30.90	IFTC Transportation Logistics from Douglas Point to DGR	41	51
660.50.40	IFTC Transportation Logistics at DGR	26	55
660.50.40.10	IFTC Transportation Logistics DGR Emergency Response	26	55
660.50.40.20	IFTC Transportation Logistics DGR Real Time Tracking	26	55
660.50.50	IFTC Transportation Vehicles Maintenance	25	55
660.55	Environmental Management	16	57
660.60	Decommissioning	50	57
660.90	Program Management	4	55

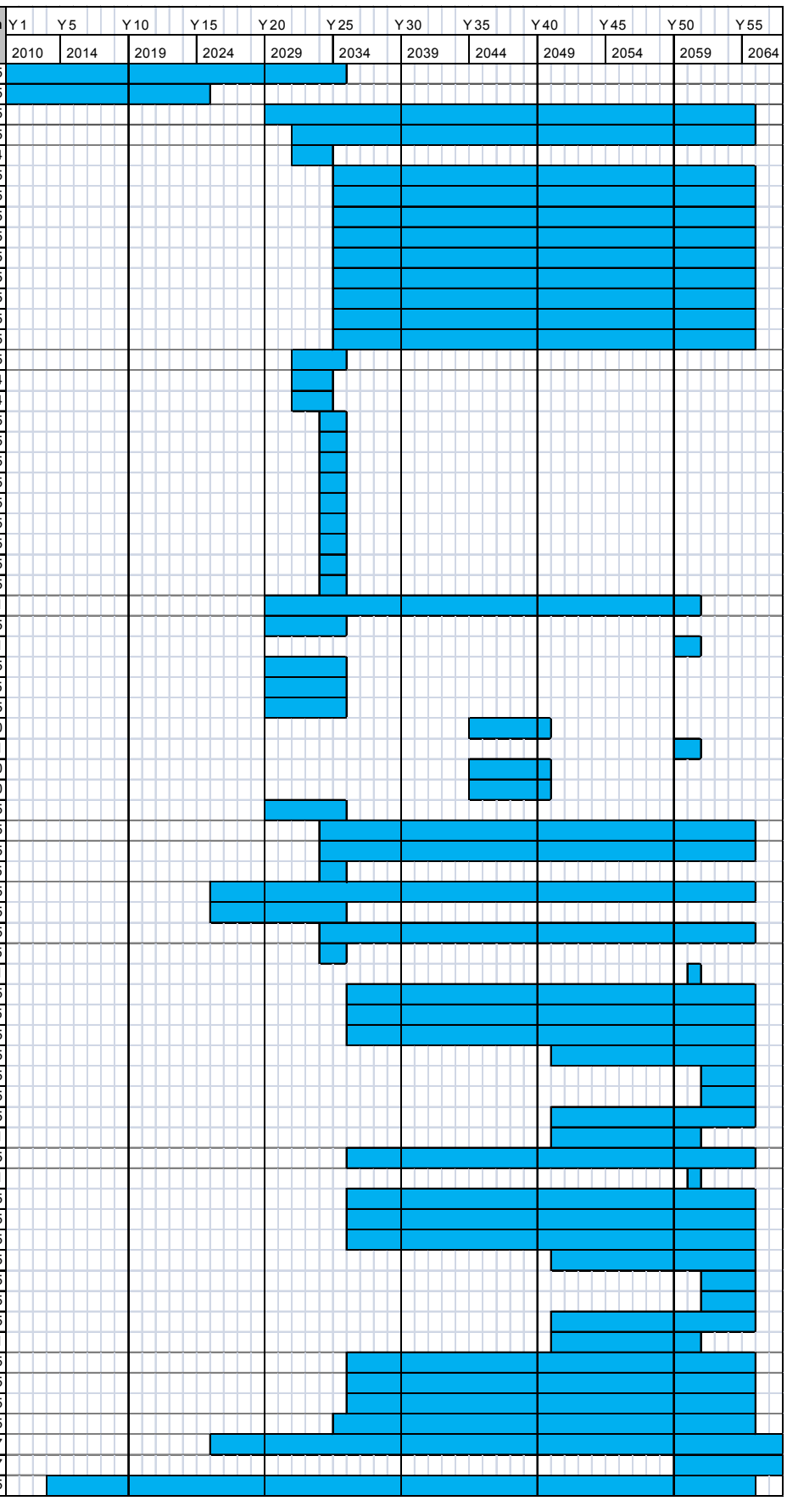
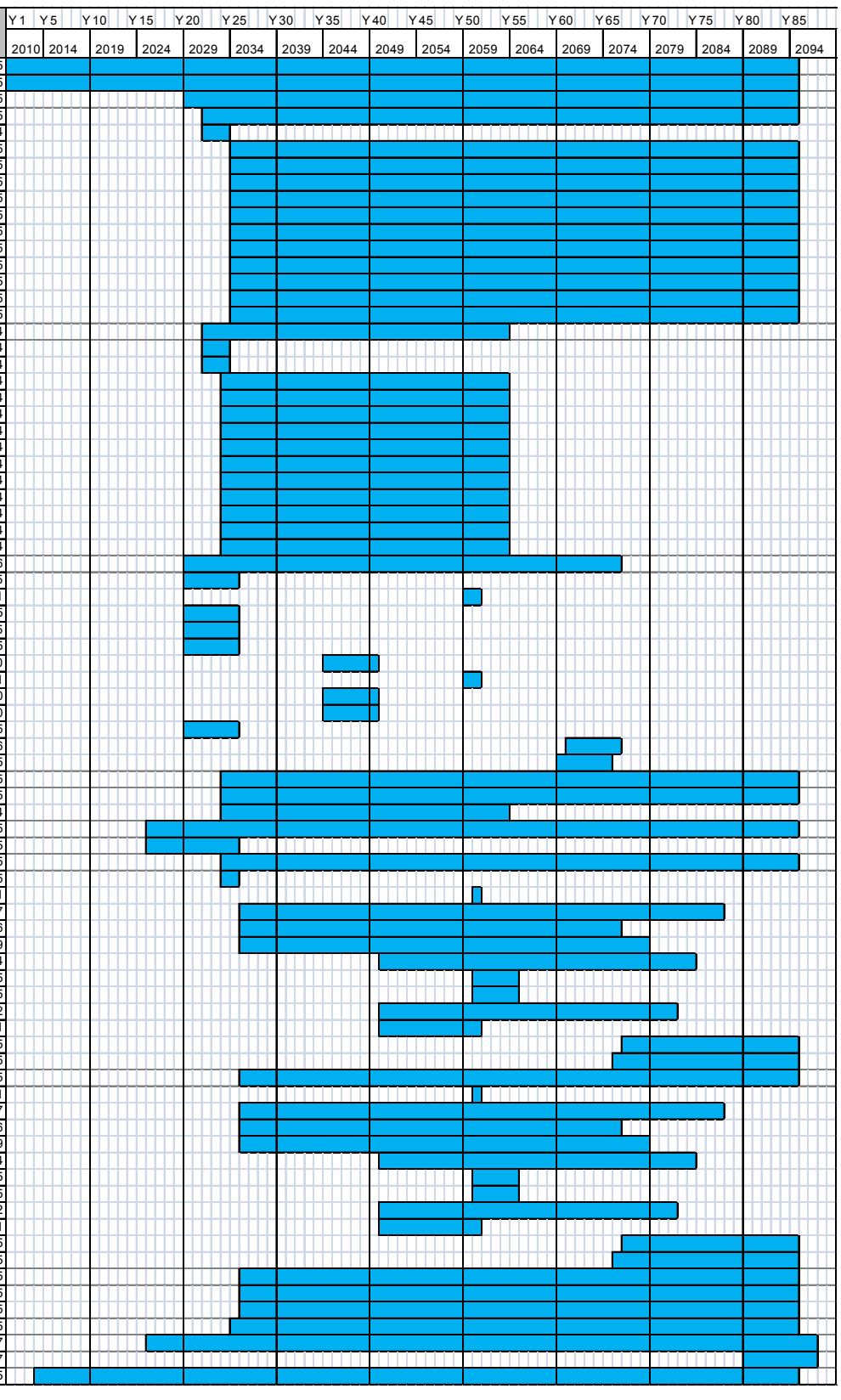


Figure 14: Alternate Case Schedule

WBS Number	Title	Start Year	Finish Year
661.20	Route and System Development	1	85
661.25	Safety Assessment	1	85
661.40	Capital Equipment and Facilities	20	85
661.40.10	IFTC Transportation Vehicles	22	85
661.40.10.10	IFTC Transportation Vehicles for non-Site-Specific	22	24
661.40.10.20	IFTC Transportation Vehicles for Whiteshell	25	85
661.40.10.30	IFTC Transportation Vehicles for Bruce	25	85
661.40.10.40	IFTC Transportation Vehicles for Pickering	25	85
661.40.10.50	IFTC Transportation Vehicles for Darlington	25	85
661.40.10.60	IFTC Transportation Vehicles for Point Lepreau	25	85
661.40.10.70	IFTC Transportation Vehicles for Chalk River	25	85
661.40.10.80	IFTC Transportation Vehicles for Gentilly 1	25	85
661.40.10.90	IFTC Transportation Vehicles for Gentilly 2	25	85
661.40.10.100	IFTC Transportation Vehicles for Douglas Point	25	85
661.40.10.110	IFTC Transportation Vehicles for New Build A	25	85
661.40.10.120	IFTC Transportation Vehicles for New Build B	25	85
661.40.20	IFTC Transport Casks	22	54
661.40.20.10	IFTC Transport Casks at DGR	22	24
661.40.20.10.30	IFTC Transport Cask non-Site-Specific	22	24
661.40.20.20	IFTC Transport Casks for Whiteshell	24	54
661.40.20.30	IFTC Transport Casks for Bruce	24	54
661.40.20.40	IFTC Transport Casks for Pickering	24	54
661.40.20.50	IFTC Transport Casks for Darlington	24	54
661.40.20.60	IFTC Transport Casks for Point Lepreau	24	54
661.40.20.70	IFTC Transport Casks for Chalk River	24	54
661.40.20.80	IFTC Transport Casks for Gentilly 1	24	54
661.40.20.90	IFTC Transport Casks for Gentilly 2	24	54
661.40.20.100	IFTC Transport Casks for Douglas Point	24	54
661.40.20.110	IFTC Transportation Cask for New Build A	24	54
661.40.20.120	IFTC Transportation Cask for New Build B	24	54
661.40.30	Equipment for IFTC Transport Cask Loading	20	66
661.40.30.10	Equipment for IFTC Transport Cask Loading non-Site-Specific	20	25
661.40.30.20	Equipment for IFTC Transport Cask Loading at Whiteshell	50	51
661.40.30.30	Equipment for IFTC Transport Cask Loading at Bruce	20	25
661.40.30.40	Equipment for IFTC Transport Cask Loading at Pickering	20	25
661.40.30.50	Equipment for IFTC Transport Cask Loading at Darlington	20	25
661.40.30.60	Equipment for IFTC Transport Cask Loading at Point Lepreau	35	40
661.40.30.70	Equipment for IFTC Transport Cask Loading at Chalk River	50	51
661.40.30.80	Equipment for IFTC Transport Cask Loading at Gentilly 1	35	40
661.40.30.90	Equipment for IFTC Transport Cask Loading at Gentilly 2	35	40
661.40.30.100	Equipment for IFTC Transport Cask Loading Douglas Point	20	25
661.40.30.110	Equipment for IFTC Transportation Cask for New Build A	61	66
661.40.30.120	Equipment for IFTC Transportation Cask for New Build B	60	65
661.40.40	Equipment for IFTC Transportation Logistics at DGR	24	85
661.40.40.10	Equipment for IFTC Transportation Logistics for Real Time Tracking	24	85
661.40.40.20	Equipment for IFTC Transportation Logistics for Emergency Response	24	54
661.50	Operations	16	85
661.50.10	Project Management	16	25
661.50.20	IFTC Transport Cask Loading	24	85
661.50.20.10	IFTC Transport Cask Loading non-Site-Specific	24	25
661.50.20.20	IFTC Transport Cask Loading at Whiteshell	51	51
661.50.20.30	IFTC Transport Cask Loading at Bruce	26	77
661.50.20.40	IFTC Transport Cask Loading at Pickering	26	66
661.50.20.50	IFTC Transport Cask Loading at Darlington	26	69
661.50.20.60	IFTC Transport Cask Loading at Point Lepreau	41	74
661.50.20.70	IFTC Transport Cask Loading at Chalk River	51	55
661.50.20.80	IFTC Transport Cask Loading at Gentilly 1	51	55
661.50.20.90	IFTC Transport Cask Loading at Gentilly 2	41	72
661.50.20.100	IFTC Transport Cask Loading at Douglas Point	41	51
661.50.20.110	IFTC Transportation Cask for New Build A	67	85
661.50.20.120	IFTC Transportation Cask for New Build B	66	85
661.50.30	IFTC Transportation Logistics	26	85
661.50.30.10	IFTC Transportation Logistics from Whiteshell to DGR	51	51
661.50.30.20	IFTC Transportation Logistics from Bruce to DGR	26	77
661.50.30.30	IFTC Transportation Logistics from Pickering to DGR	26	66
661.50.30.40	IFTC Transportation Logistics from Darlington to DGR	26	69
661.50.30.50	IFTC Transportation Logistics from Point LePreau to DGR	41	74
661.50.30.60	IFTC Transportation Logistics from Chalk River to DGR	51	55
661.50.30.70	IFTC Transportation Logistics from Gentilly 1 to DGR	51	55
661.50.30.80	IFTC Transportation Logistics from Gentilly 2 to DGR	41	72
661.50.30.90	IFTC Transportation Logistics from Douglas Point to DGR	41	51
661.50.30.100	IFTC Transportation Logistics from New Build A	67	85
661.50.30.110	IFTC Transportation Logistics from New Build B	66	85
661.50.40	IFTC Transportation Logistics at DGR	26	85
661.50.40.10	IFTC Transportation Logistics DGR Emergency Response	26	85
661.50.40.20	IFTC Transportation Logistics DGR Real Time Tracking	26	85
661.50.50	IFTC Transportation Vehicles Maintenance	25	85
661.55	Environmental Management	16	87
661.6	Decommissioning	80	87
661.90	Program Management	4	85



6. DISCUSSION

This report presents the current lifecycle cost estimate and schedule for a UFTS tasked with safely and reliably transporting a range of used fuel inventories to a central DGR as part of Canada's APM approach to the management of used nuclear fuel. Together with companion files, such as the attached Work Element Definition Sheets and Excel workbooks, the estimate constitutes a transparent, reproducible assessment of related costs and timelines.

The estimated total cost of the UFTS (in constant 2010 Canadian dollars) for the subject cases is as follows.

- Base Case (3.6 million used fuel bundles): $828 million; and
- Alternate Case (7.2 million used fuel bundles): $1,496 million.

As demonstrated by the scaling package associated with this report, the Base and Alternate Case estimates can be extended to represent a range of alternate fuel inventories.

As the project progresses, project definition will advance and progressively more detailed and accurate cost estimates will be possible. Items such as the following will be resolved as the design progresses:

- The confirmation or modification of estimate assumptions (the design basis);
- Identification of the actual DGR location;
- Final shipping inventories and source sites, actual routes and timelines;
- Final IFTC safeguard and security requirements; and
- Potential used fuel shipment rejections at loading or unloading points.

6.1 Estimate Classification and Accuracy

To avoid misapplication or misrepresentation, the following sections discuss the estimate classification, expected accuracy and related considerations. The estimate characteristics have been examined with regard to contemporary practice in cost engineering, including the following:

- Association for the Advancement of Cost Engineering International (AACE International). 2003. *Cost Estimate Classification System*. Recommended Practice No. 17R-97. ("AACE RP 17R-97"); and

- AACE International. 2005. *Cost Estimate Classification System – As Applied in Engineering, Procurement and Construction for the Process Industries*. Recommended Practice No. 18R-97. ("AACE RP 18R-97").

All else being equal, estimate accuracy is generally correlated with estimate class. It is noted, however, that the accuracy range is affected by many factors, and should be evaluated on an estimate-by-estimate basis.

6.1.1 Estimate Class and Level of Project Definition

'Project Definition' is a primary determinant of estimate class, commonly taken to correspond to the percent completion of engineering. As engineering is advanced, quantities, characteristics and schedules are finalized, allowing progressively more complete/accurate estimate entries.

While industry-wide guidance for assessing project definition for nuclear waste management is not available, it is informative to look to the process engineering community for indications of design state. For example, AACE RP 18R-97 maps the extent and maturity of estimate input information (deliverables) against five estimate classification levels, as shown on Table 27 where "S" denotes "Started", "P" denotes "Preliminary" and "C" denotes "Complete":

Overall, the current state of the UFTS corresponds to a Class 4 estimate, *i.e.*, to a project defined to up to 15% of full definition. As presented in the *Transportation Design Report*, material flow and cycle times have been plotted out for both the Base and Alternate Cases. Reasonably detailed equipment and labour requirements, including consideration of availability, have been produced, and the general characteristics of major equipment have been determined. Schematics of major processes have been developed, and crew size and support requirements have been determined in light of applicable regulations.

However, it is also noted that the Base and Alternate Case estimates developed herein rely on specific bundle inventories and travel distances that will not exactly match real conditions. For example, it is not possible for a DGR to be simultaneously 1,000 km from all Ontario reactor sites and Whiteshell, 1,500 km from Gentilly and 2,500 km from Point Lepreau.

Table 27: Available Design Data vs. Estimate Class

General Project Data	Estimate Class				
	Class 5	Class 4	Class 3	Class 2	Class 1
Project Scope Description	General	Preliminary	Defined	Defined	Defined
Plant Production/Facility Capacity	Assumed	Preliminary	Defined	Defined	Defined
Plant Location	General	Approximate	Specific	Specific	Specific
Soils & Hydrology	None	Preliminary	Defined	Defined	Defined
Integrated Project Plan	None	Preliminary	Defined	Defined	Defined
Project Master Schedule	None	Preliminary	Defined	Defined	Defined
Escalation Strategy	None	Preliminary	Defined	Defined	Defined
Work Breakdown Structure	None	Preliminary	Defined	Defined	Defined
Project Code of Accounts	None	Preliminary	Defined	Defined	Defined
Contracting Strategy	Assumed	Assumed	Preliminary	Defined	Defined
Engineering Deliverables					
Block Flow Diagrams	S/P	P/C	C	C	C
Plot Plans		S	P/C	C	C
Process Flow Diagrams (PFDs)		S/P	P/C	C	C
Utility Flow Diagrams (UFDs)		S/P	P/C	C	C
Piping & Instrument Diagrams (P&IDs)		S	P/C	C	C
Heat & Material Balances		S	P/C	C	C
Process Equipment List		S/P	P/C	C	C
Utility Equipment List		S/P	P/C	C	C
Electrical One-Line Drawings		S/P	P/C	C	C
Specifications & Datasheets		S	P/C	C	C
General Equipment Arrangement Drawings		S	P/C	C	C
Spare Parts Listings			S/P	P	C
Mechanical Discipline Drawings			S	P	P/C
Electrical Discipline Drawings			S	P	P/C
Instrumentation/Control Discipline Drawings			S	P	P/C
Civil/Structural/Site Discipline Drawings			S	P	P/C

Notes:
S – “Started”. Work on deliverable begun. Development typically limited to sketches, rough outlines, or similar.
P – “Preliminary”. Work on deliverable advanced. Interim, cross-functional reviews have usually been conducted.
C – “Complete”. The deliverable has been reviewed and approved as appropriate.

6.1.2 Classification of Estimates for Individual Work Elements

Individual cost estimates are predominantly build-ups based on specific deliverables, *i.e.*, similar to Class 3 or Class 4 estimates. Notable exceptions include decommissioning costs and vehicle maintenance costs, both of which are calculated as percentages (factors) of purchased equipment cost, implying Class 4 or Class 5 status.

6.1.3 Classification of Aggregate Estimate

Accepting the hypothetical location of the DGR and the postulated used fuel inventories, the conceptual design can be considered a "Study" level estimate. Estimation methods used include semi-detailed unit costs with assembly level line items. Item costs are based on existing, available applications. Overall, the estimate can be considered as AACE "Class 4". However, because it is unlikely that all assumptions will be borne out, the accuracy with respect to actual costs is likely to be lower than typically assumed for Class 4 estimates.

6.1.4 State of Technology

As discussed in AACE RP 17R-97, estimate accuracy is a function of the state of technology, as follows:

> "*For a "first-of-a-kind" project there is a lower level of confidence that the execution of the project will be successful (all else being equal). There is generally a higher confidence for projects that repeat past practices. Projects for which research and development are still under way at the time that the estimate is prepared are particularly subject to low accuracy expectations. The state of technology may have an order of magnitude (10 to 1) effect on the accuracy range.*"

In some sense, the UFTS will be a 'first-of-a-kind' project for Canada. However, it must be recognized that road shipment of used nuclear fuel (for research purposes), high and intermediate level waste, medical radioisotopes and similar payloads has been safely and practically conducted for over 40 years. Several studies have examined the feasibility of existing technologies for used fuel transportation, including the following:

- Wardrop Engineering. 2003. NWMO Background Paper 6-6. *Status of Transportation Systems for High-level Radioactive Waste Management*;
- Kinectrics. 2003. NWMO Background Paper 6-7. *Status of Storage, Disposal and Transportation Containers for the Management of Used Nuclear Fuel*; and
- Butterfield Carter and Associates. 2004. NWMO Background Paper 6-8. *Review of the Fundamental Issues and Key Considerations Related to the Transportation of Spent Nuclear Fuel*.

The equipment and technology for transporting Category II nuclear material is not new. The core of the assumed transport package, the certified IFTC design, was originally developed in the 1980s and the balance of the transportation fleet is comprised of slightly modified, readily available commercial equipment.

With regard to the state of technology, therefore, the UFTS extends presently existing equipment and techniques to a new scale and level of coordination. No fundamentally new technology development risk is required for safe and effective system operation (with the exception of a relatively small amount of cask-to-cask fuel transfer at Whiteshell and Chalk River). As a result, cost estimate accuracy is expected to be relatively good.

6.1.5 Quality of Reference Data

As it is a unique project, full-scale costs for a road-based transportation system similar to the UFTS concept are not available. As later discussed, the estimate has been compared with a previous independent estimate of a similar concept, with reasonable agreement.

The pricing of individual components was primarily ascertained by the design and estimating team through market queries. IFTC pricing for large volume production, and/or fleet equipment pricing under long-term contracts could conceivably be lower than estimated as economies of scale and institutional learning come to bear.

Overall, the quality of reference data is moderate at best – in the absence of similar fleet procurement exercises, limited truly comparable reference data is available.

6.1.6 Uncertainty and Risk

Formal design optimization, value engineering and/or risk analysis have not been performed on the conceptual design. However, on the basis of the design, three relatively significant sources of cost and schedule risk (defined here as actual results varying more than expected from predictions, either negatively or positively) have been identified, as follows:

1. Assumptions: The estimate is based on a number of design basis assumptions, identified in the description of scope and the cost estimating process. Violations of these assumptions will likely cause unforeseen changes to cost and schedule. For example, specific transport distances and average speed drive a number of labour costs.

2. Complexity: Estimated costs and schedules are for activities conducted according to plan. The project, however, involves thousands of shipments over several decades. Events that are relatively improbable for a single shipment may occur over the course of many shipments. Because of complexity, it is unreasonable to expect that every part of the program will take place exactly as planned. While transport packages and associated equipment will be built to rigorous standards to safeguard human health and the environment, improbable combinations of events may still have cost and schedule impacts. Moreover, a wide range of unexpected events with no practical impact on safety (*e.g.*, procurement difficulties) may nevertheless affect cost and schedule.

3. Exclusions: A potentially very significant source of risk stems from items specifically excluded from the estimate (itemized earlier in this report). As an example, changes in the regulatory environment cannot be reliably predicted, yet could have a dramatic impact on cost and schedule.

Both positive and negative risks are possible; unpredicted events may increase or decrease costs. Overall, however, the aggregate impact of multiple risks typically results in costs greater than initially predicted. Studies which have demonstrated that under-estimation is epidemic at the conceptual design or project approvals stage for large capital projects include:

- Merrow (1988) studied 52 civilian megaprojects ranging from $500 million to over $10 billion in 1984 US dollars. The average cost growth from the beginning of detailed engineering to completion was 88%.

- Pohl and Mihalek (1991) examined 1,015 World Bank Projects and concluded that actual costs were, on average, 22% higher than projected despite ample contingencies built into the cost estimates.

- The British Consultancy Mott McDonald (2002) examined 50 major (over 40 million GBP in 2001) public projects in the UK and concluded that results clearly showed that historically there has been a tendency for project estimates to be highly optimistic.

- Based on 258 public sector transportation infrastructure projects worth $90 billion US, Bent Flyvbjerg (2002) found that on average, project costs were 28% higher than early-stage estimates (standard deviation of 38.7%).

- As reported in Bertisen and Davis, previous studies by Bennett (1997), Thomas (2001) and Gypton (2002) found that as-built costs for 16 large capital projects exceeded the feasibility study estimate by an average of 27%.

Accurate contingency assignment is an important tool in preventing underestimation. For example, studies by the University of Bath in 1998 and 1999 (cited in Mott McDonald, 2002) that included a number of projects having risk contingency allotments found a median capital cost underestimate of 6% at the approvals stage and 1% at the pre-tender stage. This should be compared to the 38% average underestimation for a similar Mott McDonald study which excluded risk contingencies.

Current AACE guidance (*i.e.* RP 40R-08) does not provide a definite amount of contingency for a given level of design definition. However, AACE does state that research has consistently shown that the level of project scope definition is a predominant risk driver and a good starting point for most risk analyses.

The British Department of Transport for Transport Planning (Flyvbjerg, 2004) has advocated taking nominally “most likely” estimates for transportation projects and adding pre-determined percentage-based “optimism bias uplifts” based on project type and available data for similar, reference projects. Unfortunately, accurate reference class uplifts rely on valid statistics from a large group of similar projects, and assumes estimates are consistent in their optimism bias.

NATO (2007) produced the “*Optimism Bias Uplift Percentages*” for major weapons system procurement for use where the relevant items/issues have not been fully accounted for in the basic estimate. The objectives of the uplifts are to increase the total estimate value to one that roughly represents the 50th percentile (*i.e.* roughly a 50/50 chance that the actual price will be

either higher or lower than the total estimate). While the comparison of a transportation system to a weapons system is tenuous, it is useful to consider NATO's interpretation of the relative importance of risk factors (see Table 28).

Table 28: NATO Risk Factors and Uplift

Item (Issue)	% Uplift to Add to Estimate
Complexity of contract	7%
Late contractor involvement in design	7%
Poor contractor capabilities	4%
Information Management	5%
Design complexity	10%
Degree of innovation	17%
Inadequacy of business case	18%
Poor management team	5%
Poor project intelligence	4%
Legislation/regulations	5%
Technology	18%

Rothwell (2004) examined both traditional contingency rules-of-thumb and the expected standard deviation of a cost estimate implied by the accuracy range for the relevant estimate class. Essentially, Rothwell demonstrated that rule-of-thumb percentage-based guidance for contingency was approximately equal to the standard deviation of the distribution of a cost estimate assuming the rule-of-thumb accuracy range for the estimate class. Rothwell also presented a summary of recommended contingencies vs. estimate class and expected accuracy that specifically includes energy sector projects (Table 29).

Table 29: Historic Relationships between Estimated Accuracy and Contingency

Project Stage (AACE 1997, superseded)	Expected Accuracy Range (Low & High)	AACE Suggested Contingency (1997, superseded)	EPRI Project Stage (1993)	EPRI Suggested Contingency (1993)
Concept Screening	L: -20% to -50% H: +30% to +100%	50%	Not Applicable	Not Applicable
Feasibility Study	L: -15% to -30% H: +20% to +50%	30%	Simplified Estimate	30% to 50%
Authorisation or Control	L: -10% to -20% H: +10% to +30%	20%	Preliminary Estimate	15% to 30%
Control or Bid/Tender	L: -5% to -15% H: +5% to +20%	15%	Detailed Estimate	10% to 20%
Check Estimate or Bid/Tender	L: -3% to -10% H: +3% to +15%	5%	Finalised Estimate	5 to 10%

AACE – Association for the Advancement of Cost Engineering
EPRI – Electric Power Research Institute

NWMO has determined an amount of contingency to include in this specific estimate to reflect risk and uncertainty in the cost model. However, even with the inclusion of appropriate contingency, the scale and complexity and duration of the project should temper overly optimistic assessments of estimate accuracy.

6.1.7 Estimated Accuracy

In deference to project complexity and the relatively long period before commissioning, the anticipated accuracy of the Base and Alternate Case estimates is on the low side of Class 4 norms, potentially on the order of -30% to +50% per AACE RP18R-97, with the inclusion of appropriate contingency.

6.1.8 End Use

This estimate has been prepared for NWMO's use in planning and consultation. Given the class of estimate and the supporting information, this work can be considered a "conceptual", "feasibility", "authorization" or "screening" study, and may be appropriate for strategic planning, business development, alternative analysis, confirmation of feasibility and preliminary approvals to proceed.

Users must understand that the estimate is for a specific scope of work, subject to a number of important assumptions and exclusions. This estimate is not suitable for full funding requests or project controls. It should not be considered a "definitive", "detailed" or "control" estimate.

6.2 Document Trail

Excel workbook deliverables have been exported from the estimate database. These workbooks, submitted in conjunction with this report, were used to create the scaling package. The database was also used to export Work Element Definition Sheets and estimate back-ups such as calculation sheets and quotes. These materials are also submitted in conjunction with this report.

The estimate database, which includes the root data for the exports, is included in this submission. Effectively, data flows from the database (which includes back-up files attached to specific work elements) to the estimate deliverables. Revision to the estimate is made by updating the database and then regenerating exports.

6.3 Estimate Quality Assurance

Overall project management and project quality assurance has been implemented by SNC-Lavalin Nuclear. This quality assurance program has included coordination with NWMO's internal quality assurance resources.

Estimate guidance, including estimate requirements, was provided to primary estimators and embedded in the estimate database, along with a "Frequently Asked Questions" function. The database was designed to prevent common estimation error by constraining inputs, such as available labour resources. Database functionality and design was validated through design-

test-improve cycles which included the NWMO and resulted in a production database release in April 2009.

Data for individual work elements has been cross-checked against design documentation, estimate calculation sheets, quotes and associated backup. The compiled estimate was then considered as an integrated whole, with scope and assumption data cross-checked between elements. Each component of the estimate has been double-checked by a person other than the author.

6.4 Benchmarking

Due to the uniqueness of the project, benchmarking has not been conducted against analogous undertakings.

6.5 Risks and Opportunities

As described in previous sections, actual and predicted costs will vary from one another, for example because of factors including:

- Change in project scope;
- Project complexity and duration;
- Violation of design assumptions;
- Later stage design optimization or value engineering; and
- Risk factors excluded from the estimate.

As the siting process progresses and the design basis is finalized, the conceptual design can be updated. The updated design may be subject to scenario analysis or multivariate modelling to optimize system characteristics.

NWMO may also wish to undertake a structured assessment of risk in order to validate, and perhaps reduce, the assignment of contingency. Again, this may be deferred until basic design assumptions can be confirmed or improved, for example, as candidate DGR sites are identified.

Several well-documented processes exist, such as “TRUE” (Transportation Risk and Uncertainty Evaluation), the “Lichtenberg Successive Principle” and variants of Delphi analysis. One potentially appropriate process, modified from the Army Corp of Engineers procedure promulgated in 2008 (USACE, 2008) is as follows:

- An estimating team assembles and develops an estimate with Monte Carlo simulation using low, most likely and high values for individual components;
- Monte Carlo (probabilistic) modelling software is used to identify the specific line items and/or risks that are primarily responsible for overall estimate variance;
- The model outcomes, both in terms of overall estimate variance and the identified critical risk items are subject to structured expert panel review. The results should be in line with the level of design maturity, estimate quality, previous experience, etc.; and
- The model and check cycle is repeated until multiple lines of evidence (model results, experience on other projects, expert judgement, available guidance) converge.

Typically, initial runs result in large estimate variances and in unacceptably large suggested contingencies to achieve, for example, 80% confidence that the final cost will not exceed the estimate. The check step then results in the modification of assumptions and in the collection of additional data.

As noted by USACE (2008), the model and check cycle should include careful consideration of how risks embedded in the costs relate to one another. For example, in the case that IFTC design costs are higher than expected, is it likely that Hot Cell design costs will be high as well? It is imperative that reviewers worry out the implicit and explicit correlations in critical risks.

Once the modelled estimate distribution makes sense, both in comparison with other lines of evidence and when variance is traced back to individual inputs, the team generates a table that depicts the project cost with corresponding confidence levels. The total estimate to achieve a target level of confidence less the mean value (50% confidence – half of the time too high, half of the time too low) constitutes the total contingency for a given confidence level.

7. ESTIMATING TEAM

Palladium Product Development (PDD) under management of SNC-Lavalin Nuclear developed the conceptual design for the transportation system.

This cost and schedule estimate was undertaken by Golder Associates in conjunction with PDD, also under the management of SNC-Lavalin Nuclear. Initial work element data was contributed by PDD and NWMO as indicated on the Work Element Definition Sheets.

7.1 Study Limitations

This estimate reflects a specific conceptual design, which is subject to further development. Cost and schedule estimates reported in this document are therefore subject to change; readers are cautioned to confer with NWMO to verify that this version of the estimate is current.

This report was specifically developed for submission to NWMO. It should not be referenced in published reports or papers without the express consent of NWMO.

Any reference to a specific firm, commercial entity, consultant, commercial product, material, process or service by trade name, trademark, manufacturer or otherwise, does not constitute or imply its endorsement, recommendation, or preference.

8. CONTENTS OF THE ACCOMPANYING DVD

This report is accompanied by electronic files on DVD. These files have been organized as follows:

Table 30: DVD Contents

Folder Title	Sub-folder	Contents
Report		This report and Appendices.
Database		Single Microsoft Access database containing both 660 and 661 data, as well as attached back-up calculations and quotes.
Base Case	L2 Workbooks	Individual Microsoft Excel 2007 workbooks for costs associated with each 2nd level component of the Base Case (660) WBS.
Base Case	Master Workbook	One Microsoft Excel 2007 workbook containing all of the Base Case (660) WBS and related costs, as well as a pivot table enabling roll-up to any level within the WBS.
Alternate Case	L2 Workbooks	Individual Microsoft Excel 2007 workbooks for costs associated with each 2nd level component of the Alternate Case (661) WBS.
Alternate Case	Master Workbook	One Microsoft Excel 2007 workbook containing all of the Alternate Case (661) WBS and related costs, as well as a pivot table enabling roll-up to any level within the WBS.
Scaling Package		Scalable estimate tool as Microsoft Excel 2007 workbook.

9. TECHNICAL REFERENCES

Canadian federal acts, regulations and codes apply to all aspects of the UFTS. A list of applicable codes, standards and regulations is included in the document *Used Fuel Geologic Repository and Transportation System - System Requirements for the APM Update*, APM-PR-01110-0001-R01, July 29, 2009.

Key system references are documented in the *Transportation Design Report* submitted to NWMO by SNC Lavalin Nuclear (SLN 020606-4200-REPT-0001).

In addition, the lifecycle cost and schedule estimate was informed by the following:

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DOCUMENT END

APPENDIX A:

WORK BREAKDOWN STRUCTURE TO THE LOWEST LEVEL

Table A-1: 660 Costs

Base Case (2010 $K: 3.6M Bundles)										
WBS Number	Title	Start Year	Finish Year	Labour	Material	Other	Allowance	Total	Owner	Phase
660	All Road Transport System (based on 3.6M fuel bundles)	1	57	$452,980	$203,191	$82,458	$89,140	$827,770	-	-
660.20	Route and System Development	1	25	$10,317	$0	$6,837	$0	$17,154	COMMON	SITING
660.25	Safety Assessment	1	15	$1,334	$0	$2,895	$0	$4,229	COMMON	SITING
660.40	Capital Equipment and Facilities	20	55	$30,559	$203,191	$7,859	$32,352	$273,962	-	-
660.40.10	IFTC Transportation Vehicles	22	55	$361	$39,022	$0	$3,938	$43,321	-	-
660.40.10.10	IFTC Transportation Vehicle for non-Site-Specific	22	24	$361	$518	$0	$88	$967	COMMON	CONSTRUCTION
660.40.10.20	IFTC Transportation Vehicles for Whiteshell	25	55	$0	$4	$0	$0	$5	AECL	CONSTRUCTION
660.40.10.30	IFTC Transportation Vehicles for Bruce	25	55	$0	$16,484	$0	$1,648	$18,133	OPG	CONSTRUCTION
660.40.10.40	IFTC Transportation Vehicles for Pickering	25	55	$0	$9,259	$0	$926	$10,185	OPG	CONSTRUCTION
660.40.10.50	IFTC Transportation Vehicles for Darlington	25	55	$0	$9,639	$0	$964	$10,603	OPG	CONSTRUCTION
660.40.10.60	IFTC Transportation Vehicles for Point Lepreau	25	55	$0	$1,320	$0	$132	$1,452	NBP	CONSTRUCTION
660.40.10.70	IFTC Transportation Vehicles for Chalk River	25	55	$0	$56	$0	$6	$62	AECL	CONSTRUCTION
660.40.10.80	IFTC Transportation Vehicles for Gentilly 1	25	55	$0	$37	$0	$4	$41	AECL	CONSTRUCTION
660.40.10.90	IFTC Transportation Vehicles for Gentilly 2	25	55	$0	$1,447	$0	$145	$1,591	HQ	CONSTRUCTION
660.40.10.100	IFTC Transportation Vehicles for Douglas Point	25	55	$0	$257	$0	$26	$283	AECL	CONSTRUCTION
660.40.20	IFTC Transport Casks	22	25	$271	$38,125	$0	$3,840	$42,235	-	-
660.40.20.10	IFTC Transport Casks at DGR	22	24	$271	$2,125	$0	$240	$2,635	-	-
660.40.20.10.30	IFTC Transport Cask non-Site-Specific	22	24	$271	$2,125	$0	$240	$2,635	COMMON	CONSTRUCTION
660.40.20.20	IFTC Transport Casks for Whiteshell	24	25	$0	$4	$0	$0	$4	AECL	CONSTRUCTION
660.40.20.30	IFTC Transport Casks for Bruce	24	25	$0	$15,412	$0	$1,541	$16,953	OPG	CONSTRUCTION
660.40.20.40	IFTC Transport Casks for Pickering	24	25	$0	$8,657	$0	$866	$9,523	OPG	CONSTRUCTION
660.40.20.50	IFTC Transport Casks for Darlington	24	25	$0	$9,012	$0	$901	$9,913	OPG	CONSTRUCTION
660.40.20.60	IFTC Transport Casks for Point Lepreau	24	25	$0	$1,234	$0	$123	$1,358	NBP	CONSTRUCTION
660.40.20.70	IFTC Transport Casks for Chalk River	24	25	$0	$52	$0	$5	$58	AECL	CONSTRUCTION
660.40.20.80	IFTC Transport Casks for Gentilly 1	24	25	$0	$35	$0	$3	$38	AECL	CONSTRUCTION
660.40.20.90	IFTC Transport Casks for Gentilly 2	24	25	$0	$1,353	$0	$135	$1,488	HQ	CONSTRUCTION
660.40.20.100	IFTC Transport Casks for Douglas Point	24	25	$0	$241	$0	$24	$265	AECL	CONSTRUCTION
660.40.30	Equipment for IFTC Transport Cask Loading	20	51	$29,387	$121,998	$6,040	$23,614	$181,038	-	-
660.40.30.10	Equipment for IFTC Transport Cask Loading non-Site-Specific	20	25	$1,082	$0	$0	$162	$1,245	COMMON	CONSTRUCTION
660.40.30.20	Equipment for IFTC Transport Cask Loading at Whiteshell	50	51	$282	$639	$75	$149	$1,145	AECL	CONSTRUCTION
660.40.30.30	Equipment for IFTC Transport Cask Loading at Bruce	20	25	$5,463	$23,773	$1,160	$4,559	$34,955	OPG	CONSTRUCTION
660.40.30.40	Equipment for IFTC Transport Cask Loading at Pickering	20	25	$5,548	$24,144	$1,178	$4,631	$35,501	OPG	CONSTRUCTION
660.40.30.50	Equipment for IFTC Transport Cask Loading at Darlington	20	25	$5,548	$24,144	$1,178	$4,631	$35,501	OPG	CONSTRUCTION
660.40.30.60	Equipment for IFTC Transport Cask Loading at Point Lepreau	35	40	$5,548	$24,144	$1,178	$4,631	$35,501	NBP	CONSTRUCTION
660.40.30.70	Equipment for IFTC Transport Cask Loading at Chalk River	50	51	$282	$639	$75	$149	$1,145	AECL	CONSTRUCTION
660.40.30.80	Equipment for IFTC Transport Cask Loading at Gentilly 1	35	40	$140	$608	$30	$117	$894	AECL	CONSTRUCTION
660.40.30.90	Equipment for IFTC Transport Cask Loading at Gentilly 2	35	40	$5,408	$23,536	$1,148	$4,514	$34,607	HQ	CONSTRUCTION
660.40.30.100	Equipment for IFTC Transport Cask Loading at Douglas Point	20	25	$85	$371	$18	$71	$546	AECL	CONSTRUCTION
660.40.40	Equipment for IFTC Transportation Logistics at DGR	24	55	$541	$4,046	$1,819	$961	$7,367	-	-
660.40.40.10	Equipment for IFTC Transportation Logistics for Real Time Tracking	24	55	$180	$1,930	$1,819	$589	$4,519	COMMON	CONSTRUCTION
660.40.40.20	Equipment for IFTC Transportation Logistics for Emergency Response	24	25	$361	$2,116	$0	$372	$2,848	COMMON	CONSTRUCTION
660.50	Operations	16	55	$297,516	$0	$44,307	$51,273	$393,096	-	-
660.50.10	Project Management	16	25	$16,070	$0	$0	$2,410	$18,480	COMMON	OPERATION
660.50.20	IFTC Transport Cask Loading	24	55	$57,531	$0	$0	$8,630	$66,160	-	-

Table A-1: 660 Costs

Base Case (2010 $K: 3.6M Bundles)										
WBS Number	Title	Start Year	Finish Year	Labour	Material	Other	Allowance	Total	Owner	Phase
660.50.20.10	IFTC Transport Cask Loading non-Site-Specific	24	25	$361	$0	$0	$54	$415	COMMON	OPERATION
660.50.20.20	IFTC Transport Cask Loading Whiteshell	51	51	$7	$0	$0	$1	$8	AECL	OPERATION
660.50.20.30	IFTC Transport Cask Loading at Bruce	26	55	$24,472	$0	$0	$3,671	$28,143	OPG	OPERATION
660.50.20.40	IFTC Transport Cask Loading at Pickering	26	55	$13,746	$0	$0	$2,062	$15,808	OPG	OPERATION
660.50.20.50	IFTC Transport Cask Loading at Darlington	26	55	$14,310	$0	$0	$2,146	$16,456	OPG	OPERATION
660.50.20.60	IFTC Transport Cask Loading at Point Lepreau	41	55	$1,960	$0	$0	$294	$2,254	NBP	OPERATION
660.50.20.70	IFTC Transport Cask Loading at Chalk River	52	55	$90	$0	$0	$13	$103	AECL	OPERATION
660.50.20.80	IFTC Transport Cask Loading at Gentilly 1	52	55	$55	$0	$0	$8	$64	AECL	OPERATION
660.50.20.90	IFTC Transport Cask Loading at Gentilly 2	41	55	$2,148	$0	$0	$322	$2,470	HQ	OPERATION
660.50.20.100	IFTC Transport Cask Loading Douglas Point	41	51	$382	$0	$0	$57	$439	AECL	OPERATION
660.50.30	IFTC Transportation Logistics	26	55	$162,239	$0	$28,265	$28,576	$219,079	-	-
660.50.30.10	IFTC Transportation Logistics from Whiteshell to DGR	51	51	$17	$0	$3	$3	$23	AECL	OPERATION
660.50.30.20	IFTC Transportation Logistics from Bruce to DGR	26	55	$67,330	$0	$11,302	$11,795	$90,427	OPG	OPERATION
660.50.30.30	IFTC Transportation Logistics from Pickering to DGR	26	55	$37,819	$0	$6,348	$6,625	$50,793	OPG	OPERATION
660.50.30.40	IFTC Transportation Logistics from Darlington to DGR	26	55	$39,371	$0	$6,609	$6,897	$52,876	OPG	OPERATION
660.50.30.50	IFTC Transportation Logistics from Point LePreau to DGR	41	55	$9,060	$0	$2,263	$1,698	$13,021	NBP	OPERATION
660.50.30.60	IFTC Transportation Logistics from Chalk River to DGR	52	55	$229	$0	$38	$40	$307	AECL	OPERATION
660.50.30.70	IFTC Transportation Logistics from Gentilly 1 to DGR	52	55	$185	$0	$38	$34	$257	AECL	OPERATION
660.50.30.80	IFTC Transportation Logistics from Gentilly 2 to DGR	41	55	$7,176	$0	$1,488	$1,300	$9,963	HQ	OPERATION
660.50.30.90	IFTC Transportation Logistics from Douglas Point to DGR	41	51	$1,051	$0	$176	$184	$1,412	AECL	OPERATION
660.50.40	IFTC Transportation Logistics at DGR	26	55	$61,677	$0	$0	$9,252	$70,928	-	-
660.50.40.10	IFTC Transportation Logistics DGR Emergency Response	26	55	$10,619	$0	$0	$1,593	$12,212	COMMON	OPERATION
660.50.40.20	IFTC Transportation Logistics DGR Real Time Tracking	26	55	$51,058	$0	$0	$7,659	$58,716	COMMON	OPERATION
660.50.50	IFTC Transportation Vehicles Maintenance	25	55	$0	$0	$16,042	$2,406	$18,448	COMMON	OPERATION
660.55	Environmental Management	16	57	$5,011	$0	$0	$1,503	$6,514	COMMON	OPERATION
660.60	Decommissioning	50	57	$6,864	$0	$19,877	$4,011	$30,752	COMMON	CLOSURE AND DECOMMISSIONING
660.90	Program Management	4	55	$101,379	$0	$683	$0	$102,062	COMMON	OPERATION

Alternate Case (2010 $K: 7.2M Bundles)										
WBS Number	Title	Start Year	Finish Year	Labour	Material	Other	Allowance	Total	Owner	Phase
661	All Road Transport System (based on 7.2M fuel bundles)	1	85	$845,544	$348,338	$141,415	$160,323	$1,495,620	-	-
661.20	Route and System Development	1	25	$10,317	$0	$6,837	$0	$17,154	COMMON	SITING
661.25	Safety Assessment	1	15	$1,334	$0	$2,895	$0	$4,229	COMMON	SITING
661.40	Capital Equipment and Facilities	20	85	$41,656	$348,338	$12,194	$51,816	$454,003	-	-
661.40.10	IFTC Transportation Vehicles	22	85	$361	$80,486	$0	$8,085	$88,931	-	-
661.40.10.10	IFTC Transportation Vehicles for non-Site-Specific	22	24	$361	$518	$0	$88	$967	COMMON	CONSTRUCTION
661.40.10.20	IFTC Transportation Vehicles for Whiteshell	25	85	$0	$4	$0	$0	$5	AECL	CONSTRUCTION
661.40.10.30	IFTC Transportation Vehicles for Bruce	25	85	$0	$26,146	$0	$2,615	$28,760	OPG	CONSTRUCTION
661.40.10.40	IFTC Transportation Vehicles for Pickering	25	85	$0	$13,812	$0	$1,381	$15,193	OPG	CONSTRUCTION
661.40.10.50	IFTC Transportation Vehicles for Darlington	25	85	$0	$14,882	$0	$1,488	$16,370	OPG	CONSTRUCTION
661.40.10.60	IFTC Transportation Vehicles for Point Lepreau	25	85	$0	$3,187	$0	$319	$3,506	NBP	CONSTRUCTION
661.40.10.70	IFTC Transportation Vehicles for Chalk River	25	85	$0	$58	$0	$6	$64	AECL	CONSTRUCTION
661.40.10.80	IFTC Transportation Vehicles for Gentilly 1	25	85	$0	$39	$0	$4	$42	AECL	CONSTRUCTION
661.40.10.90	IFTC Transportation Vehicles for Gentilly 2	25	85	$0	$3,039	$0	$304	$3,343	HQ	CONSTRUCTION
661.40.10.100	IFTC Transportation Vehicles for Douglas Point	25	85	$0	$266	$0	$27	$293	AECL	CONSTRUCTION
661.40.10.110	IFTC Transportation Vehicles for New Build A	25	85	$0	$9,025	$0	$902	$9,927	NEW BUILD A	CONSTRUCTION
661.40.10.120	IFTC Transportation Vehicles for New Build B	25	85	$0	$9,512	$0	$951	$10,463	NEW BUILD B	CONSTRUCTION
661.40.20	IFTC Transport Casks	22	54	$271	$89,125	$0	$8,940	$98,335	-	-
661.40.20.10	IFTC Transport Casks at DGR	22	24	$271	$2,125	$0	$240	$2,635	-	-
661.40.20.10.30	IFTC Transport Cask non-Site-Specific	22	24	$271	$2,125	$0	$240	$2,635	COMMON	CONSTRUCTION
661.40.20.20	IFTC Transport Casks for Whiteshell	24	54	$0	$5	$0	$0	$5	AECL	CONSTRUCTION
661.40.20.30	IFTC Transport Casks for Bruce	24	54	$0	$28,445	$0	$2,844	$31,289	OPG	CONSTRUCTION
661.40.20.40	IFTC Transport Casks for Pickering	24	54	$0	$15,026	$0	$1,503	$16,529	OPG	CONSTRUCTION
661.40.20.50	IFTC Transport Casks for Darlington	24	54	$0	$16,190	$0	$1,619	$17,809	OPG	CONSTRUCTION
661.40.20.60	IFTC Transport Casks for Point Lepreau	24	54	$0	$3,467	$0	$347	$3,814	NBP	CONSTRUCTION
661.40.20.70	IFTC Transport Casks for Chalk River	24	54	$0	$63	$0	$6	$69	AECL	CONSTRUCTION
661.40.20.80	IFTC Transport Casks for Gentilly 1	24	54	$0	$42	$0	$4	$46	AECL	CONSTRUCTION
661.40.20.90	IFTC Transport Casks for Gentilly 2	24	54	$0	$3,306	$0	$331	$3,637	HQ	CONSTRUCTION
661.40.20.100	IFTC Transport Casks for Douglas Point	24	54	$0	$289	$0	$29	$318	AECL	CONSTRUCTION
661.40.20.110	IFTC Transportation Cask for New Build A	24	54	$0	$9,818	$0	$982	$10,800	NEW BUILD A	CONSTRUCTION
661.40.20.120	IFTC Transportation Cask for New Build B	24	54	$0	$10,348	$0	$1,035	$11,383	NEW BUILD B	CONSTRUCTION
661.40.30	Equipment for IFTC Transport Cask Loading	20	66	$40,483	$170,286	$8,396	$32,875	$252,040	-	-
661.40.30.10	Equipment for IFTC Transport Cask Loading non-Site-Specific	20	25	$1,082	$0	$0	$162	$1,245	COMMON	CONSTRUCTION
661.40.30.20	Equipment for IFTC Transport Cask Loading at Whiteshell	50	51	$282	$639	$75	$149	$1,145	AECL	CONSTRUCTION
661.40.30.30	Equipment for IFTC Transport Cask Loading at Bruce	20	25	$5,492	$23,901	$1,166	$4,584	$35,143	OPG	CONSTRUCTION
661.40.30.40	Equipment for IFTC Transport Cask Loading at Pickering	20	25	$5,548	$24,144	$1,178	$4,631	$35,501	OPG	CONSTRUCTION
661.40.30.50	Equipment for IFTC Transport Cask Loading at Darlington	20	25	$5,548	$24,144	$1,178	$4,631	$35,501	OPG	CONSTRUCTION
661.40.30.60	Equipment for IFTC Transport Cask Loading at Point Lepreau	35	40	$5,548	$24,144	$1,178	$4,631	$35,501	NBP	CONSTRUCTION
661.40.30.70	Equipment for IFTC Transport Cask Loading at Chalk River	50	51	$282	$639	$75	$149	$1,145	AECL	CONSTRUCTION
661.40.30.80	Equipment for IFTC Transport Cask Loading at Gentilly 1	35	40	$70	$303	$15	$58	$445	AECL	CONSTRUCTION
661.40.30.90	Equipment for IFTC Transport Cask Loading at Gentilly 2	35	40	$5,478	$23,841	$1,163	$4,572	$35,055	HQ	CONSTRUCTION
661.40.30.100	Equipment for IFTC Transport Cask Loading Douglas Point	20	25	$56	$243	$12	$47	$357	AECL	CONSTRUCTION
661.40.30.110	Equipment for IFTC Transportation Cask for New Build A	61	66	$5,548	$24,144	$1,178	$4,631	$35,501	NEW BUILD A	CONSTRUCTION
661.40.30.120	Equipment for IFTC Transportation Cask for New Build B	60	65	$5,548	$24,144	$1,178	$4,631	$35,501	NEW BUILD B	CONSTRUCTION
661.40.40	Equipment for IFTC Transportation Logistics at DGR	24	85	$541	$8,441	$3,798	$1,917	$14,697	-	-
661.40.40.10	Equipment for IFTC Transportation Logistics for Real Time Tracking	24	85	$180	$4,209	$3,798	$1,228	$9,415	COMMON	CONSTRUCTION
661.40.40.20	Equipment for IFTC Transportation Logistics for Emergency Response	24	54	$361	$4,232	$0	$689	$5,282	COMMON	CONSTRUCTION

Alternate Case (2010 $K: 7.2M Bundles)										
WBS Number	Title	Start Year	Finish Year	Labour	Material	Other	Allowance	Total	Owner	Phase
661.50	Operations	16	85	$581,976	$0	$93,033	$101,251	$776,261	-	-
661.50.10	Project Management	16	25	$16,070	$0	$0	$2,410	$18,480	COMMON	OPERATION
661.50.20	IFTC Transport Cask Loading	24	85	$115,263	$0	$0	$17,290	$132,553	-	-
661.50.20.10	IFTC Transport Cask Loading non-Site-Specific	24	25	$361	$0	$0	$54	$415	COMMON	OPERATION
661.50.20.20	IFTC Transport Cask Loading at Whiteshell	51	51	$7	$0	$0	$1	$8	AECL	OPERATION
661.50.20.30	IFTC Transport Cask Loading at Bruce	26	77	$37,565	$0	$0	$5,635	$43,200	OPG	OPERATION
661.50.20.40	IFTC Transport Cask Loading at Pickering	26	66	$19,844	$0	$0	$2,977	$22,821	OPG	OPERATION
661.50.20.50	IFTC Transport Cask Loading at Darlington	26	69	$21,382	$0	$0	$3,207	$24,589	OPG	OPERATION
661.50.20.60	IFTC Transport Cask Loading at Point Lepreau	41	74	$4,579	$0	$0	$687	$5,266	NBP	OPERATION
661.50.20.70	IFTC Transport Cask Loading at Chalk River	51	55	$90	$0	$0	$13	$103	AECL	OPERATION
661.50.20.80	IFTC Transport Cask Loading at Gentilly 1	51	55	$55	$0	$0	$8	$64	AECL	OPERATION
661.50.20.90	IFTC Transport Cask Loading at Gentilly 2	41	72	$4,366	$0	$0	$655	$5,021	HQ	OPERATION
661.50.20.100	IFTC Transport Cask Loading at Douglas Point	41	51	$382	$0	$0	$57	$439	AECL	OPERATION
661.50.20.110	IFTC Transportation Cask for New Build A	67	85	$12,966	$0	$0	$1,945	$14,911	NEW BUILD A	OPERATION
661.50.20.120	IFTC Transportation Cask for New Build B	66	85	$13,666	$0	$0	$2,050	$15,716	NEW BUILD B	OPERATION
661.50.30	IFTC Transportation Logistics	26	85	$327,289	$0	$57,254	$57,681	$442,224	-	-
661.50.30.10	IFTC Transportation Logistics from Whiteshell to DGR	51	51	$17	$0	$3	$3	$23	AECL	OPERATION
661.50.30.20	IFTC Transportation Logistics from Bruce to DGR	26	77	$103,353	$0	$17,348	$18,105	$138,806	OPG	OPERATION
661.50.30.30	IFTC Transportation Logistics from Pickering to DGR	26	66	$54,597	$0	$9,164	$9,564	$73,325	OPG	OPERATION
661.50.30.40	IFTC Transportation Logistics from Darlington to DGR	26	69	$58,827	$0	$9,874	$10,305	$79,007	OPG	OPERATION
661.50.30.50	IFTC Transportation Logistics from Point LePreau to DGR	41	74	$21,169	$0	$5,287	$3,968	$30,424	NBP	OPERATION
661.50.30.60	IFTC Transportation Logistics from Chalk River to DGR	51	55	$229	$0	$38	$40	$307	AECL	OPERATION
661.50.30.70	IFTC Transportation Logistics from Gentilly 1 to DGR	51	55	$185	$0	$38	$34	$257	AECL	OPERATION
661.50.30.80	IFTC Transportation Logistics from Gentilly 2 to DGR	41	72	$14,588	$0	$3,025	$2,642	$20,255	HQ	OPERATION
661.50.30.90	IFTC Transportation Logistics from Douglas Point to DGR	41	51	$1,051	$0	$176	$184	$1,412	AECL	OPERATION
661.50.30.100	IFTC Transportation Logistics from New Build A	67	85	$35,674	$0	$5,988	$6,249	$47,912	NEW BUILD A	OPERATION
661.50.30.110	IFTC Transportation Logistics from New Build B	66	85	$37,599	$0	$6,311	$6,587	$50,497	NEW BUILD B	OPERATION
661.50.40	IFTC Transportation Logistics at DGR	26	85	$123,353	$0	$0	$18,503	$141,857	-	-
661.50.40.10	IFTC Transportation Logistics DGR Emergency Response	26	85	$21,238	$0	$0	$3,186	$24,424	COMMON	OPERATION
661.50.40.20	IFTC Transportation Logistics DGR Real Time Tracking	26	85	$102,116	$0	$0	$15,317	$117,433	COMMON	OPERATION
661.50.50	IFTC Transportation Vehicles Maintenance	25	85	$0	$0	$35,780	$5,367	$41,147	COMMON	OPERATION
661.55	Environmental Management	16	87	$7,189	$0	$0	$2,157	$9,346	COMMON	OPERATION
661.60	Decommissioning	80	87	$8,724	$0	$25,266	$5,099	$39,089	COMMON	CLOSURE AND DECOMMISSIONING
661.90	Program Management	4	85	$194,348	$0	$1,189	$0	$195,537	COMMON	OPERATION

APPENDIX B:
WORK ELEMENT DEFINITION SHEETS

Work Element Definition Sheet

16-Sep-2010 3:06:16 PM WEDS ID # 9001

Organization Name: NWMO - Nuclear Waste Management Organization
Prepared by: U. Stahmer Reviewed by:
Modified by: Last Modification Date:

WBS Case: 660 ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)
WBS Number: 660.20 ROUTE AND SYSTEM DEVELOPMENT

WBS Description:

Route Development
-Feasibility Study & Selection (Y01 to Y09)
-Identify preferred used fuel shipping routes via road between each potential candidate site and the DGR
-Recommend possible routes to be used
-Site Licensing & Construction Preparation (Y10 to Y15)
-Support EA, Site Licensing Application and Site Construction Preparation
System Development
-Definition and advancement of the transportation conceptual design reflective of site specificity
-Advancement of the transportation preliminary and detailed design reflective of site specificity
-Manufacture and commissioning of the used fuel transportation system reflective of site specificity

WBS Deliverable:

Route Development
-High level transportation analyses to support feasibility studies in 10 communities
-Feasibility studies on UF transport routes for two candidate sites
-Ad hoc support as required.
System Development
Conceptual / Preliminary (Y01 to Y09)
-Transport Package Options Study
-Conceptual design reports for: IFTC
-Trailer, restraints, cask handling equipment, facilities
-Logistical infrastructure
-Security and Emergency Response
Preliminary / Detailed Engineering (Y10 to Y15)
-Design Requirements and Technical Specifications for:
-IFTC
-Trailer, restraints, cask handling equipment, facilities
-Logistical infrastructure
-Creation of Security, Emergency Response and Transportation Logistics programs
Implementation / Test / Oversight (Y16 to Y25)
-Prototype Used Fuel Transportation Package
-Engineering support for the manufacturing, testing and commissioning of all components of the used fuel transportation system
-Commissioning of Security, Emergency Response and Transportation Logistics programs

WBS Assumptions:

Route Development
-10 feasibility studies looking into transport routes (Y02 to Y03) Assume 5 of these are contracted out at $20,000 per study (or $50,000 per year Y02 to Y03)
-2 detailed transportation studies (Y04 to Y05)
Travel assumption is 6 trips to communities per year at $1,500 per trip ($9,000 in travel and expenses per year) (Y01 to Y09)
-Transportation program is de-coupled from the site licensing / EA process; however, questions would be expected during the site license
-3 trips to CNSC per year at $1,500 per trip ($4,500 per annum) (Y10 to Y15)
-4 trips to communities $1,500 per trip ($6,000 total) (Y10 to Y15) [LB: Assume 2 trips in Y10, 1 trip in Y11 and 1 trip in Y12

- to be confirmed]
System Development
-Transport Options Study (Y04 to Y06)
Review existing fuel storage methods and proposed UF Container design and examine options to transport UF to DGR. Recommend best option and establish preliminary transport package and transport system design requirements.
Frozen UF container design is required before work on transport options study can begin.
Output from this study has implications on UFPP design.
-Travel assumption: trips (5) (3 in Y04 and 2 in Y05) to existing storage facilities at $1,500 per trip.
-IFTC Preliminary Design (Y07 to Y09)
Based on Transport Options Study, develop conceptual design(s) for UF transport package(s). IFTC is reference design. Alternative designs are recommended in Options Study. Prepare Preliminary Design Report in Y09 to support EA.
-Transport System Conceptual Design (Y04 to Y09)
Review existing system designs and prepare conceptual design report based on Options Study. System must consider transport modes and package designs.
Contract Conceptual report $200,000 ($100,000 in each of years Y07 and Y08) to support EA.
-Travel assumption: trips (2) (1 in Y06 and 1 in Y08) to existing storage facilities at $1,500 per trip.
-Logistical Infrastructure Conceptual Design (Y08 to Y09)
Conceptual design to consider transport modes, route options and alternatives, shipments frequency, transport restrictions (weather, seasonal, weight limits (bridges, overpasses)),
Contract Conceptual Design report $150,000 ($75,000 in each of years Y08 and Y09) to support EA.
-Security and Emergency Response Preliminary Design
Meet with governmental representatives to determine security and emergency response requirements. Establish map of existing emergency responders along routes to favoured sites. Contract Conceptual Scoping Report in Y04 $50,000 to summarize requirements. Contract Preliminary Design Report $200,000 ($100,000 in each of years Y08 and Y09) to support EA.
-Travel assumption: One trip annually to regulators in Y02 to Y04 at $1,500 per trip. Two trips annually to regulators in Y08 and Y09 at $1,500 per trip.
-Transportation program is de-coupled from the site licensing / EA process
-Package Detailed Design (Y10 to Y15)
Prepare design requirements and technical specifications for transport package as described in the transportation options study. Initiate package design. Prepare requirements documents for analyses and testing. Contract out package design analyses (finite element structural, thermal and impact analyses) at $150,000 per year in Y12 and Y13. Design scale models for physical drop tests. Contract out scale model manufacture at $500,000 per year in Y14 and Y15.
Travel assumption: 5 trips per year to vendors during Y12, Y13, Y14 and Y15 at $1,500 per trip.
-Transport System Preliminary Design (Y10 to Y15)
Prepare design requirements and technical specifications for trucks, trailers, and ancillary equipment (lifting beams, cranes, hot cell access, etc). Contract out preliminary design of trailers, lifting beams, cranes at $100,000 per year in Y13 and Y14.
Travel assumption: trips (2) per year to existing vendors/contractors at $1,500 per trip.
-Logistical Infrastructure Preliminary Design (Y10 to Y15)

Provide support to EA. Prepare design requirements and technical specifications for logistics equipment. Contract out logistics equipment selection at $50,000 in Y14.

-Security and Emergency Response Preliminary Design

Provide support to EA. Meet with governmental representatives to establish security and emergency response programs based on requirements previously defined. Start liaisons with security and emergency response forces along routes. Establish training program requirements, and high level program implementation. Contract work out at $200,000 ($100,000 in each of years Y14 and Y15)

-Provide support for transportation component of EA

Travel assumption: One trip annually to regulators in Y10 to Y15 at $1,500 per trip.

-Package Test, Manufacture and Commissioning (Y16 to Y25)

Package detailed design, analysis and certification completed by Y19. Full scale prototype manufactured during years Y17 through Y19. Construction Cost estimated at $4,000,000. Vendor selection and inspection for production package fleet during years Y18 and Y19. Oversight of production package manufacture and commissioning in years Y20 through Y25.

Travel assumption: 5 trips per year to vendors at $2,000 per trip.

-Transport System Manufacture and Commissioning (Y16 to Y25)

Oversight of transportation system equipment manufacture and commissioning in years Y16 through Y25.

Travel assumption: trips (2) per year to existing vendors/contractors at $2,000 per trip.

-Logistical Infrastructure Implementation Design (Y16 to Y25)

Development, implementation and commissioning of logistics system.

-Security and Emergency Response Implementation

Oversee the creation of training programs and implementation. Meet with governmental representatives for final design and implementation establish security and emergency response programs based on requirements previously defined. Continue liaisons with security and emergency response forces along routes.

Misc. Travel assumptions: 2 trips annually to vendors (logistics, in Y16 to Y25 at $2,000 per trip. One trip annually to regulator years Y16 through Y25 at $1,500 per trip.

Exclusive of Contingency.

WBS Allowance Basis:

Detailed NMWO estimate is conservative, no additional allowance (0% applied)

Start Year: 1 Finish Year: 25 Duration: 25 year(s) WBS Type: Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$10,317,019		$6,836,999	$17,154,018	0%	$17,154,018

WBS Specific Supporting Documentation:
SNC APM Master Estimate 660 D1 Rev. 10 Route and System Development.xlsx
Multi Element Supporting Documentation:

Work Element Definition Sheet

16-Sep-2010 5:06:42 PM WEDS ID # 9003

Organization Name: NWMO - Nuclear Waste Management Organization
Prepared by: N. Hunt, P. Gierszewski Reviewed by:
Modified by: Last Modification Date:

WBS Case: 660 ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)
WBS Number: 660.25 SAFETY ASSESSMENT

WBS Description:

This task is for performing safety assessments in support of transportation.

WBS Deliverable:

- Transportation safety assessments as required.
- Information packages for, and meetings with, local communities.
- Contribution to Environmental Assessment (EA) (66X.55) and Preliminary Safety Report (PSR) submissions.

WBS Assumptions:

- Does not include work to design and licence the transport packages.
- Does not include work related to security arrangements for transport.
- After the EA and Construction Licence application has been approved, the costs for further transport work is included as part of the ongoing Safety Assessment activities supporting the DGR Operating Licence.
- A large component of this work will be visiting local communities along the possible routes to understand local concerns, discuss options, and present assessment results.
- Most of the technical analyses will be conducted by contractors.

NWMO staffing is 0.25 NWMO-03 FTE in Y1, 0.5 NWMO-03 FTE in each of Y2 to Y09 and 1 NWMO-3 FTE in each of Y10 to Y15.
Staff travel cost is 5 k$/a for Y4-Y12.
Funding for contractor support is $300K/a for Y4 to Y9 (Candidate Site Phases), $300K/a for Y10 to Y12 (Construction Licence Phase), and $50 k/a for Y13 to Y15 (EA/PSR Hearings).

Exclusive of Contingency.

WBS Allowance Basis:

Start Year: 1 Finish Year: 15 Duration: 15 year(s) WBS Type: Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$1,334,378		$2,895,000	$4,229,378	0%	$4,229,378

WBS Specific Supporting Documentation:
SNC APM Master Estimate 660 D1 Rev. 10 Transportation Safety Assessment.xlsx
Multi Element Supporting Documentation:

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1002

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	17-Feb-2010

WBS Case: 660 ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)

WBS Number: 660.40.10.10 IFTC Transportation Vehicle for non-Site-Specific

WBS Description:

The design, procurement, testing and commissioning of Irradiated Fuel Transport Cask (IFTC) Transportation Vehicles for mock-up.

WBS Deliverable:

- Completed system design basis documentation.
- Completed detailed design of the IFTC Transport Vehicles.

Completed testing and licensing documentation, the Safety Analysis Report, for submission to the Competent Authority.

- An approved Design Package Approval Certificate issued by the Competent Authority as per 660.90.
- A licensed IFTC Transport Vehicle system and the approved commissioning plans.

IFTC Transportation Vehicle - Escort Vehicle (customized security vehicle), including:

- Anti-theft electronic immobilizer system.
- On board real-time tracking system.
- On-board biometrics system (biometric fingerprint and/or retinal scan).
- Vehicle security enhancements (e.g., typical customization done to RCMP, Police and Homeland security vehicles).

IFTC Transportation Vehicle - Tractor, including:

- Customized tractor similar to those used by US Department of Energy (DOE) "safeguards transporter".
- Electronic Speed Limiter for Ontario- Limits speed to 80km/hr.
- On board real-time tracking system.
- OnGuard Collision Safety System.
- Anti-theft electronic immobilizer system.
- Passenger-mounted LCD touch-screen PC.
- Sleeping berth to accommodate 2 persons.
- On-board biometrics system (biometric fingerprint and/or retinal scan).

IFTC Transportation Vehicle - Trailer (Customized Trailer), including:

- Marking and labeling.
- Hazardous Material Placards.
- On board real-time tracking system.
- Modified 48-foot flatbed trailer with integrated tie-down.
- Trailer equipped with hydraulic or air ride suspension to cushion the load.
- Trailer equipped with four axles.
- Weather cover.
- One frame for IFTC Transport Cask.
- A set of specific equipment (GPS, turning lights, tool box)

Exclusive of Contingency.

WBS Assumptions:

- The Standard IFTC Transport Vehicle and Escort Vehicle will be used for IFTC (Transport Cask) Mock-up
- The total cost of the IFTC Transport Vehicles with Escort Vehicle mock-up is not specific to Reactor Storage Facility
- IFTC Transport Vehicles with Escort Vehicle for mock-up is allocated to the licensing requirement for services and testing
- See 660.40.40.10 (Equipment for IFTC Transportation Logistics for Real Time Tracking) for acquisition of satellite phones

and GPS systems.
- Pricing basis is commercial, off-the-shelf items verbally confirmed with vendors in the Toronto region by PDD, November 2009 to April 2010. Pricing is representative for most of Ontario and in current (2010) dollars.
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

WBS Allowance Basis:

Standard

Start Year: 22 Finish Year: 24 Duration: 3 year(s) WBS Type: Step-Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$360,800	$518,000		$878,800	10%	$966,680

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Base Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1003

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	17-Feb-2010

WBS Case:	660	ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)
WBS Number:	660.40.10.20	IFTC Transportation Vehicles for Whiteshell

WBS Description:

The procurement, test and commissioning of IFTC Transportation Vehicles for Whiteshell.

WBS Deliverable:

IFTC Transportation Vehicle - Escort Vehicle (customized security vehicle), including:
- Anti-theft electronic immobilizer system.
- On board real-time tracking system.
- On-board biometrics system (biometric fingerprint and/or retinal scan).
- Vehicle security enhancements (e.g., typical customization done to RCMP, Police and Homeland security vehicles).

IFTC Transportation Vehicle - Tractor, including:
- Customized tractor similar to those used by US Department of Energy (DOE) "safeguards transporter".
- Electronic Speed Limiter for Ontario- Limits speed to 80km/hr.
- On board real-time tracking system.
- OnGuard Collision Safety System.
- Anti-theft electronic immobilizer system.
- Passenger-mounted LCD touch-screen PC.
- Sleeping berth to accommodate 2 persons.
- On-board biometrics system (biometric fingerprint and/or retinal scan).

IFTC Transportation Vehicle - Trailer (Customized Trailer), including:
- Marking and labeling.
- Hazardous Material Placards.
- On board real-time tracking system.
- Modified 48-foot flatbed trailer with integrated tie-down.
- Trailer equipped with hydraulic or air ride suspension to cushion the load.
- Trailer equipped with four axles.
- Weather cover.
- One frame for IFTC Transport Cask.
- A set of specific equipment (GPS, turning lights, tool box)

WBS Assumptions:

- IFTC Transport Vehicles with Escort Vehicles will be used to ship all Used Fuel from owner Reactor Storage Facilities in IFTCs (Transport Casks).
- Total Project Fleet costs calculated separately and allocated to work element based on share of total fuel bundle count. Derivation of fleet costs and relative allocations attached as .xls under "Multi Element Supporting Information"
- IFTC Transportation Vehicles Escort Vehicle design life is assumed to be 4 years. After initial purchase, units are replaced 7 times over 30 years from initial service date.
- IFTC Transportation Vehicle Tractor design life is assumed to be 7 years. After initial purchase, units are replaced 4 times over 30 years from initial service date.
- IFTC Transportation Vehicles Trailer design life is assumed to be 10 years. After initial purchase, units are replaced 2 times over the 30 years from initial service date.
- No allowance for remaining useful life/salvage at time of replacement or retirement.
- See 660.40.40.10 (Equipment for IFTC Transportation Logistics for Real Time Tracking) for acquisition of satellite phones and GPS systems.

- Pricing based on commercial off-the-shelf items verbally confirmed with vendors in the Toronto region by PDD, November 2009 to April 2010. Pricing representative for most of Ontario and in current (2010) dollars.
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 25 Finish Year: 55 Duration: 31 year(s) WBS Type: Step-Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
	$4,151		$4,151	10%	$4,566

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Base Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1004

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	17-Feb-2010

WBS Case: 660 ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)

WBS Number: 660.40.10.30 IFTC Transportation Vehicles for Bruce

WBS Description:

The procurement, test and commissioning of IFTC Transportation Vehicles for Bruce.

WBS Deliverable:

IFTC Transportation Vehicle - Escort Vehicle (customized security vehicle), including:
- Anti-theft electronic immobilizer system.
- On board real-time tracking system.
- On-board biometrics system (biometric fingerprint and/or retinal scan).
- Vehicle security enhancements (e.g., typical customization done to RCMP, Police and Homeland security vehicles).

IFTC Transportation Vehicle - Tractor, including:
- Customized tractor similar to those used by US Department of Energy (DOE) "safeguards transporter".
- Electronic Speed Limiter for Ontario- Limits speed to 80km/hr.
- On board real-time tracking system.
- OnGuard Collision Safety System.
- Anti-theft electronic immobilizer system.
- Passenger-mounted LCD touch-screen PC.
- Sleeping berth to accommodate 2 persons.
- On-board biometrics system (biometric fingerprint and/or retinal scan).

IFTC Transportation Vehicle - Trailer (Customized Trailer), including:
- Marking and labeling.
- Hazardous Material Placards.
- On board real-time tracking system.
- Modified 48-foot flatbed trailer with integrated tie-down.
- Trailer equipped with hydraulic or air ride suspension to cushion the load.
- Trailer equipped with four axles.
- Weather cover.
- One frame for IFTC Transport Cask.
- A set of specific equipment (GPS, turning lights, tool box)

WBS Assumptions:

- IFTC Transport Vehicles with Escort Vehicles will be used to ship all Used Fuel from owner Reactor Storage Facilities in IFTCs (Transport Casks).
- Total Project Fleet costs calculated separately and allocated to work element based on share of total fuel bundle count. Derivation of fleet costs and relative allocations attached as .xls under "Multi Element Supporting Information"
- IFTC Transportation Vehicles Escort Vehicle design life is assumed to be 4 years. After initial purchase, units are replaced 7 times over 30 years from initial service date.
- IFTC Transportation Vehicle Tractor design life is assumed to be 7 years. After initial purchase, units are replaced 4 times over 30 years from initial service date.
- IFTC Transportation Vehicles Trailer design life is assumed to be 10 years. After initial purchase, units are replaced 2 times over the 30 years from initial service date.
- No allowance for remaining useful life/salvage at time of replacement or retirement.
- See 660.40.40.10 (Equipment for IFTC Transportation Logistics for Real Time Tracking) for acquisition of satellite phones and GPS systems.

- Pricing based on commercial off-the-shelf items verbally confirmed with vendors in the Toronto region by PDD, November 2009 to April 2010. Pricing representative for most of Ontario and in current (2010) dollars.
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 25 Finish Year: 55 Duration: 31 year(s) WBS Type: Step-Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
	$16,484,220		$16,484,220	10%	$18,132,642

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Base Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1005

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	17-Feb-2010

WBS Case:	660	ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)
WBS Number:	660.40.10.40	IFTC Transportation Vehicles for Pickering

WBS Description:

The procurement, test and commissioning of IFTC Transportation Vehicles for Pickering.

WBS Deliverable:

IFTC Transportation Vehicle - Escort Vehicle (customized security vehicle), including:
- Anti-theft electronic immobilizer system.
- On board real-time tracking system.
- On-board biometrics system (biometric fingerprint and/or retinal scan).
- Vehicle security enhancements (e.g., typical customization done to RCMP, Police and Homeland security vehicles).

IFTC Transportation Vehicle - Tractor, including:
- Customized tractor similar to those used by US Department of Energy (DOE) "safeguards transporter".
- Electronic Speed Limiter for Ontario- Limits speed to 80km/hr.
- On board real-time tracking system.
- OnGuard Collision Safety System.
- Anti-theft electronic immobilizer system.
- Passenger-mounted LCD touch-screen PC.
- Sleeping berth to accommodate 2 persons.
- On-board biometrics system (biometric fingerprint and/or retinal scan).

IFTC Transportation Vehicle - Trailer (Customized Trailer), including:
- Marking and labeling.
- Hazardous Material Placards.
- On board real-time tracking system.
- Modified 48-foot flatbed trailer with integrated tie-down.
- Trailer equipped with hydraulic or air ride suspension to cushion the load.
- Trailer equipped with four axles.
- Weather cover.
- One frame for IFTC Transport Cask.
- A set of specific equipment (GPS, turning lights, tool box)

WBS Assumptions:

- IFTC Transport Vehicles with Escort Vehicles will be used to ship all Used Fuel from owner Reactor Storage Facilities in IFTCs (Transport Casks).
- Total Project Fleet costs calculated separately and allocated to work element based on share of total fuel bundle count. Derivation of fleet costs and relative allocations attached as .xls under "Multi Element Supporting Information"
- IFTC Transportation Vehicles Escort Vehicle design life is assumed to be 4 years. After initial purchase, units are replaced 7 times over 30 years from initial service date.
- IFTC Transportation Vehicle Tractor design life is assumed to be 7 years. After initial purchase, units are replaced 4 times over 30 years from initial service date.
- IFTC Transportation Vehicles Trailer design life is assumed to be 10 years. After initial purchase units are replaced 2 times over the 30 years from initial service date.
- No allowance for remaining useful life/salvage at time of replacement or retirement.
- See 660.40.40.10 (Equipment for IFTC Transportation Logistics for Real Time Tracking) for acquisition of satellite phones and GPS systems.

- Pricing based on commercial off-the-shelf items verbally confirmed with vendors in the Toronto region by PDD, November 2009 to April 2010. Pricing representative for most of Ontario and in current (2010) dollars.
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 25 Finish Year: 55 Duration: 31 year(s) WBS Type: Step-Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
	$9,259,142		$9,259,142	10%	$10,185,056

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Base Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1006

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	17-Feb-2010

WBS Case:	660	ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)
WBS Number:	660.40.10.50	IFTC Transportation Vehicles for Darlington

WBS Description:

The procurement, test and commissioning of IFTC Transportation Vehicles for Darlington.

WBS Deliverable:

IFTC Transportation Vehicle - Escort Vehicle (customized security vehicle), including:
- Anti-theft electronic immobilizer system.
- On board real-time tracking system.
- On-board biometrics system (biometric fingerprint and/or retinal scan).
- Vehicle security enhancements (e.g., typical customization done to RCMP, Police and Homeland security vehicles).

IFTC Transportation Vehicle - Tractor, including:
- Customized tractor similar to those used by US Department of Energy (DOE) "safeguards transporter".
- Electronic Speed Limiter for Ontario- Limits speed to 80km/hr.
- On board real-time tracking system.
- OnGuard Collision Safety System.
- Anti-theft electronic immobilizer system.
- Passenger-mounted LCD touch-screen PC.
- Sleeping berth to accommodate 2 persons.
- On-board biometrics system (biometric fingerprint and/or retinal scan).

IFTC Transportation Vehicle - Trailer (Customized Trailer), including:
- Marking and labeling.
- Hazardous Material Placards.
- On board real-time tracking system.
- Modified 48-foot flatbed trailer with integrated tie-down.
- Trailer equipped with hydraulic or air ride suspension to cushion the load.
- Trailer equipped with four axles.
- Weather cover.
- One frame for IFTC Transport Cask.
- A set of specific equipment (GPS, turning lights, tool box)

WBS Assumptions:

- IFTC Transport Vehicles with Escort Vehicles will be used to ship all Used Fuel from owner Reactor Storage Facilities in IFTCs (Transport Casks).
- Total Project Fleet costs calculated separately and allocated to work element based on share of total fuel bundle count. Derivation of fleet costs and relative allocations attached as .xls under "Multi Element Supporting Information"
- IFTC Transportation Vehicles Escort Vehicle design life is assumed to be 4 years. After initial purchase, units are replaced 7 times over 30 years from initial service date.
- IFTC Transportation Vehicle Tractor design life is assumed to be 7 years. After initial purchase, units are replaced 4 times over 30 years from initial service date.
- IFTC Transportation Vehicles Trailer design life is assumed to be 10 years. After initial purchase units are replaced 2 times over the 30 years from initial service date.
- No allowance for remaining useful life/salvage at time of replacement or retirement.
- See 660.40.40.10 (Equipment for IFTC Transportation Logistics for Real Time Tracking) for acquisition of satellite phones and GPS systems.

- Pricing based on commercial off-the-shelf items verbally confirmed with vendors in the Toronto region by PDD, November 2009 to April 2010. Pricing representative for most of Ontario and in current (2010) dollars.
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 25 Finish Year: 55 Duration: 31 year(s) WBS Type: Step-Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
	$9,638,972		$9,638,972	10%	$10,602,870

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Base Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1007

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	17-Feb-2010

WBS Case:	660	ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)
WBS Number:	660.40.10.60	IFTC Transportation Vehicles for Point Lepreau

WBS Description:

The procurement, test and commissioning of IFTC Transportation Vehicles for Point Lepreau

WBS Deliverable:

IFTC Transportation Vehicle - Escort Vehicle (customized security vehicle), including:
- Anti-theft electronic immobilizer system.
- On board real-time tracking system.
- On-board biometrics system (biometric fingerprint and/or retinal scan).
- Vehicle security enhancements (e.g., typical customization done to RCMP, Police and Homeland security vehicles).

IFTC Transportation Vehicle - Tractor, including:
- Customized tractor similar to those used by US Department of Energy (DOE) "safeguards transporter".
- Electronic Speed Limiter for Ontario- Limits speed to 80km/hr.
- On board real-time tracking system.
- OnGuard Collision Safety System.
- Anti-theft electronic immobilizer system.
- Passenger-mounted LCD touch-screen PC.
- Sleeping berth to accommodate 2 persons.
- On-board biometrics system (biometric fingerprint and/or retinal scan).

IFTC Transportation Vehicle - Trailer (Customized Trailer), including:
- Marking and labeling.
- Hazardous Material Placards.
- On board real-time tracking system.
- Modified 48-foot flatbed trailer with integrated tie-down.
- Trailer equipped with hydraulic or air ride suspension to cushion the load.
- Trailer equipped with four axles.
- Weather cover.
- One frame for IFTC Transport Cask.
- A set of specific equipment (GPS, turning lights, tool box).

WBS Assumptions:

- IFTC Transport Vehicles with Escort Vehicles will be used to ship all Used Fuel from owner Reactor Storage Facilities in IFTCs (Transport Casks).
- Total Project Fleet costs calculated separately and allocated to work element based on share of total fuel bundle count. Derivation of fleet costs and relative allocations attached as .xls under "Multi Element Supporting Information"
- IFTC Transportation Vehicles Escort Vehicle design life is assumed to be 4 years. After initial purchase, units are replaced 7 times over 30 years from initial service date.
- IFTC Transportation Vehicle Tractor design life is assumed to be 7 years. After initial purchase, units are replaced 4 times over 30 years from initial service date.
- IFTC Transportation Vehicles Trailer design life is assumed to be 10 years. After initial purchase, units are replaced 2 times over the 30 years from initial service date.
- No allowance for remaining useful life/salvage at time of replacement or retirement.
- See 660.40.40.10 (Equipment for IFTC Transportation Logistics for Real Time Tracking) for acquisition of satellite phones and GPS systems.

- Pricing based on commercial off-the-shelf items verbally confirmed with vendors in the Toronto region by PDD, November 2009 to April 2010. Pricing representative for most of Ontario and in current (2010) dollars.
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 25 Finish Year: 55 Duration: 31 year(s) WBS Type: Step-Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
	$1,320,066		$1,320,066	10%	$1,452,073

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Base Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1008

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	17-Feb-2010

WBS Case:	660	ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)
WBS Number:	660.40.10.70	IFTC Transportation Vehicles for Chalk River

WBS Description:

The procurement, test and commissioning of IFTC Transportation Vehicles for Chalk River.

WBS Deliverable:

IFTC Transportation Vehicle - Escort Vehicle (customized security vehicle), including:
- Anti-theft electronic immobilizer system.
- On board real-time tracking system.
- On-board biometrics system (biometric fingerprint and/or retinal scan).
- Vehicle security enhancements (e.g., typical customization done to RCMP, Police and Homeland security vehicles).

IFTC Transportation Vehicle - Tractor, including:
- Customized tractor similar to those used by US Department of Energy (DOE) "safeguards transporter".
- Electronic Speed Limiter for Ontario- Limits speed to 80km/hr.
- On board real-time tracking system.
- OnGuard Collision Safety System.
- Anti-theft electronic immobilizer system.
- Passenger-mounted LCD touch-screen PC.
- Sleeping berth to accommodate 2 persons.
- On-board biometrics system (biometric fingerprint and/or retinal scan).

IFTC Transportation Vehicle - Trailer (Customized Trailer), including:
- Marking and labeling.
- Hazardous Material Placards.
- On board real-time tracking system.
- Modified 48-foot flatbed trailer with integrated tie-down.
- Trailer equipped with hydraulic or air ride suspension to cushion the load.
- Trailer equipped with four axles.
- Weather cover.
- One frame for IFTC Transport Cask.
- A set of specific equipment (GPS, turning lights, tool box).

WBS Assumptions:

- IFTC Transport Vehicles with Escort Vehicles will be used to ship all Used Fuel from owner Reactor Storage Facilities in IFTCs (Transport Casks).
- Total Project Fleet costs calculated separately and allocated to work element based on share of total fuel bundle count. Derivation of fleet costs and relative allocations attached as .xls under "Multi Element Supporting Information"
- IFTC Transportation Vehicles Escort Vehicle design life is assumed to be 4 years. After initial purchase, units are replaced 7 times over 30 years from initial service date.
- IFTC Transportation Vehicle Tractor design life is assumed to be 7 years. After initial purchase, units are replaced 4 times over 30 years from initial service date.
- IFTC Transportation Vehicles Trailer design life is assumed to be 10 years. After initial purchase, units are replaced 2 times over the 30 years from initial service date.
- No allowance for remaining useful life/salvage at time of replacement or retirement.
- See 660.40.40.10 (Equipment for IFTC Transportation Logistics for Real Time Tracking) for acquisition of satellite phones and GPS systems.

- Pricing based on commercial off-the-shelf items verbally confirmed with vendors in the Toronto region by PDD, November 2009 to April 2010. Pricing representative for most of Ontario and in current (2010) dollars.
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 25 Finish Year: 55 Duration: 31 year(s) WBS Type: Step-Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
	$56,041		$56,041	10%	$61,645

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Base Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1009

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	17-Feb-2010

WBS Case:	660	ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)
WBS Number:	660.40.10.80	IFTC Transportation Vehicles for Gentilly 1

WBS Description:

The procurement, test and commissioning of IFTC Transportation Vehicles for Gentilly 1.

WBS Deliverable:

IFTC Transportation Vehicle - Escort Vehicle (customized security vehicle), including:
- Anti-theft electronic immobilizer system.
- On board real-time tracking system.
- On-board biometrics system (biometric fingerprint and/or retinal scan).
- Vehicle security enhancements (e.g., typical customization done to RCMP, Police and Homeland security vehicles).

IFTC Transportation Vehicle - Tractor, including:
- Customized tractor similar to those used by US Department of Energy (DOE) "safeguards transporter".
- Electronic Speed Limiter for Ontario- Limits speed to 80km/hr.
- On board real-time tracking system.
- OnGuard Collision Safety System.
- Anti-theft electronic immobilizer system.
- Passenger-mounted LCD touch-screen PC.
- Sleeping berth to accommodate 2 persons.
- On-board biometrics system (biometric fingerprint and/or retinal scan).

IFTC Transportation Vehicle - Trailer (Customized Trailer), including:
- Marking and labeling.
- Hazardous Material Placards.
- On board real-time tracking system.
- Modified 48-foot flatbed trailer with integrated tie-down.
- Trailer equipped with hydraulic or air ride suspension to cushion the load.
- Trailer equipped with four axles.
- Weather cover.
- One frame for IFTC Transport Cask.
- A set of specific equipment (GPS, turning lights, tool box).

WBS Assumptions:

- IFTC Transport Vehicles with Escort Vehicles will be used to ship all Used Fuel from owner Reactor Storage Facilities in IFTCs (Transport Casks).
- Total Project Fleet costs calculated separately and allocated to work element based on share of total fuel bundle count. Derivation of fleet costs and relative allocations attached as .xls under "Multi Element Supporting Information"
- IFTC Transportation Vehicles Escort Vehicle design life is assumed to be 4 years. After initial purchase, units are replaced 7 times over 30 years from initial service date.
- IFTC Transportation Vehicle Tractor design life is assumed to be 7 years. After initial purchase, units are replaced 4 times over 30 years from initial service date.
- IFTC Transportation Vehicles Trailer design life is assumed to be 10 years. After initial purchase, units are replaced 2 times over the 30 years from initial service date.
- No allowance for remaining useful life/salvage at time of replacement or retirement.
- See 660.40.40.10 (Equipment for IFTC Transportation Logistics for Real Time Tracking) for acquisition of satellite phones and GPS systems.

- Pricing based on commercial off-the-shelf items verbally confirmed with vendors in the Toronto region by PDD, November 2009 to April 2010. Pricing representative for most of Ontario and in current (2010) dollars.
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 25 Finish Year: 55 Duration: 31 year(s) WBS Type: Step-Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
	$37,360		$37,360	10%	$41,096

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Base Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

28-Apr-2010 3:30:06 PM WEDS ID # 1115

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	28-Apr-2010

WBS Case:	660	ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)
WBS Number:	660.40.10.90	IFTC Transportation Vehicles for Gentilly 2

WBS Description:

The design, procurement, test and commissioning of IFTC Transportation Vehicles for Gentilly 2

WBS Deliverable:

IFTC Transportation Vehicle - Escort Vehicle (customized security vehicle), including:
- Anti-theft electronic immobilizer system.
- On board real-time tracking system.
- On-board biometrics system (biometric fingerprint and/or retinal scan).
- Vehicle security enhancements (e.g., typical customization done to RCMP, Police and Homeland security vehicles).

IFTC Transportation Vehicle - Tractor, including:
- Customized tractor similar to those used by US Department of Energy (DOE) "safeguards transporter".
- Electronic Speed Limiter for Ontario- Limits speed to 80km/hr.
- On board real-time tracking system.
- OnGuard Collision Safety System.
- Anti-theft electronic immobilizer system.
- Passenger-mounted LCD touch-screen PC.
- Sleeping berth to accommodate 2 persons.
- On-board biometrics system (biometric fingerprint and/or retinal scan).

IFTC Transportation Vehicle - Trailer (Customized Trailer), including:
- Marking and labeling.
- Hazardous Material Placards.
- On board real-time tracking system.
- Modified 48-foot flatbed trailer with integrated tie-down.
- Trailer equipped with hydraulic or air ride suspension to cushion the load.
- Trailer equipped with four axles.
- Weather cover.
- One frame for IFTC Transport Cask.
- A set of specific equipment (GPS, turning lights, tool box).

WBS Assumptions:

- IFTC Transport Vehicles with Escort Vehicle will be used to ship all Used Fuel from owner Reactor Storage Facilities in IFTC Transport Casks.
- Total Project Fleet costs calculated separately and allocated to work element based on share of total fuel bundle count. Derivation of fleet costs and relative allocations attached as .xls under "Multi Element Supporting Information".
- IFTC Transportation Vehicles Escort Vehicle design life is assumed to be 4 years. After initial purchase, units are replaced 7 times over 30 years from initial service date.
- IFTC Transportation Vehicle Tractor design life is assumed to be 7 years. After initial purchase, units are replaced 4 times over 30 years from initial service date.
- IFTC Transportation Vehicles Trailer design life is assumed to be 10 years. After initial purchase units are replaced 3 times over the 30 years from initial service date.
- No allowance for remaining useful life/salvage at time of replacement or retirement.
- See also 660.40.10
- Pricing based on commercial off-the-shelf items verbally confirmed with vendors in the Toronto region by PDD,

November 2009 to April 2010. Pricing representative for most of Ontario and in current (2010) dollars.
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 25 Finish Year: 55 Duration: 31 year(s) WBS Type: Step-Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
	$1,446,676		$1,446,676	10%	$1,591,344

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Base Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1010

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	17-Feb-2010

WBS Case:	660	ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)
WBS Number:	660.40.10.100	IFTC Transportation Vehicles for Douglas Point

WBS Description:

The procurement, test and commissioning of IFTC Transportation Vehicles for Douglas Point.

WBS Deliverable:

IFTC Transportation Vehicle - Escort Vehicle (customized security vehicle), including:
- Anti-theft electronic immobilizer system.
- On board real-time tracking system.
- On-board biometrics system (biometric fingerprint and/or retinal scan).
- Vehicle security enhancements (e.g., typical customization done to RCMP, Police and Homeland security vehicles).

IFTC Transportation Vehicle - Tractor, including:
- Customized tractor similar to those used by US Department of Energy (DOE) "safeguards transporter".
- Electronic Speed Limiter for Ontario- Limits speed to 80km/hr.
- On board real-time tracking system.
- OnGuard Collision Safety System.
- Anti-theft electronic immobilizer system.
- Passenger-mounted LCD touch-screen PC.
- Sleeping berth to accommodate 2 persons.
- On-board biometrics system (biometric fingerprint and/or retinal scan).

IFTC Transportation Vehicle - Trailer (Customized Trailer), including:
- Marking and labeling.
- Hazardous Material Placards.
- On board real-time tracking system.
- Modified 48-foot flatbed trailer with integrated tie-down.
- Trailer equipped with hydraulic or air ride suspension to cushion the load.
- Trailer equipped with four axles.
- Weather cover.
- One frame for IFTC Transport Cask.
- A set of specific equipment (GPS, turning lights, tool box).

WBS Assumptions:

- IFTC Transport Vehicles with Escort Vehicles will be used to ship all Used Fuel from owner Reactor Storage Facilities in IFTCs (Transport Casks).
- Total Project Fleet costs calculated separately and allocated to work element based on share of total fuel bundle count. Derivation of fleet costs and relative allocations attached as .xls under "Multi Element Supporting Information"
- IFTC Transportation Vehicles Escort Vehicle design life is assumed to be 4 years. After initial purchase, units are replaced 7 times over 30 years from initial service date.
- IFTC Transportation Vehicle Tractor design life is assumed to be 7 years. After initial purchase, units are replaced 4 times over 30 years from initial service date.
- IFTC Transportation Vehicles Trailer design life is assumed to be 10 years. After initial purchase, units are replaced 2 times over the 30 years from initial service date.
- No allowance for remaining useful life/salvage at time of replacement or retirement.
- See 660.40.40.10 (Equipment for IFTC Transportation Logistics for Real Time Tracking) for acquisition of satellite phones and GPS systems.

- Pricing based on commercial off-the-shelf items verbally confirmed with vendors in the Toronto region by PDD, November 2009 to April 2010. Pricing representative for most of Ontario and in current (2010) dollars.
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 25 Finish Year: 55 Duration: 31 year(s) WBS Type: Step-Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
	$257,371		$257,371	10%	$283,108

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Base Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1016

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 17-Feb-2010

WBS Case: 660 ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)
WBS Number: 660.40.20.10.30 IFTC Transport Cask non-Site-Specific

WBS Description:

The design, procurement, test and commissioning of Irradiated Fuel Transport Cask (IFTC) system Transport Cask and Impact Limiter for mock-up.

WBS Deliverable:

- Completed system design basis documentation.
- An approved Design Package Approval Certificate issued by the Competent Authority as per Program Management (660.90).
- A licensed IFTC system and the approved commissioning plans.

IFTC Transportation Cask and Impact Limiter, including:
- Marking and labeling
- Real-time tracking system
- Design features for repeat usage
- Design features for mounting on IFTC Transport Vehicle Trailer Frame

WBS Assumptions:

- One IFTC Transport Cask and Impact Limiter will be used for mock-up/demonstration.
- IFTC Transport Cask and Impact Limiter design life is assumed to be 30 years from initial service date
- The total cost of the Transport Cask and Impact Limiter mock-up is not specific to Reactor Storage Facility
- Transport Cask and Impact Limiter mock-up is allocated to the licensing requirement for services and testing
- See 660.40.40.10 (Equipment for IFTC Transportation Logistics for Real Time Tracking) for acquisition of satellite phones and GPS systems.
- See 660.40.40.20 (Equipment for IFTC Transportation Logistics for Emergency Response) for acquisition of emergency response equipment, including spare set of transportation equipment.
- Pricing based on costs for specialty items identified by Cogema (2003) adjusted for new requirements, location and current dollars by PDD using professional judgement.
- Also subject to overall UFTS assumptions.

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 22 Finish Year: 24 Duration: 3 year(s) WBS Type: Step-Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$270,600	$2,125,000		$2,395,600	10%	$2,635,160

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Base Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1011

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 17-Feb-2010

WBS Case: 660 ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)
WBS Number: 660.40.20.20 IFTC Transport Casks for Whiteshell

WBS Description:

The procurement, test and commissioning of IFTC Transport Casks and Impact Limiters for Whiteshell.

WBS Deliverable:

IFTC Transportation Cask and Impact Limiter, including:
- Marking and labeling
- Real-time tracking system
- Design features for repeat usage
- Design features for mounting on IFTC Transport Vehicle Trailer Frame

WBS Assumptions:

- The IFTC Transport Cask and Impact Limiter will be used to ship all Used Fuel in Modules from owner Reactor Storage Facilities.
- IFTC Transport Cask and Impact Limiter design life is assumed to be approximately 30 years (no replacement during shipping period).
- See 660.40.40.10 (Equipment for IFTC Transportation Logistics for Real Time Tracking) for acquisition of satellite phones and GPS systems.
- See 660.40.40.20 (Equipment for IFTC Transportation Logistics for Emergency Response) for acquisition of emergency response equipment, including spare set of transportation equipment.
- Pricing for specialty items identified by Cogema (2003) adjusted for new requirements, location and current dollars by PDD using professional judgement.
- Total Project fleet costs calculated separately and allocated to work element based on share of total fuel bundle count. - Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 24 Finish Year: 25 Duration: 2 year(s) WBS Type: Step-Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
	$3,881		$3,881	10%	$4,269

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Base Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1019

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 17-Feb-2010

WBS Case: 660 ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)
WBS Number: 660.40.20.30 IFTC Transport Casks for Bruce

WBS Description:

The procurement, test and commissioning of IFTC Transport Casks and Impact Limiters for Bruce.

WBS Deliverable:

IFTC Transportation Cask and Impact Limiter, including:
- Marking and labeling
- Real-time tracking system
- Design features for repeat usage
- Design features for mounting on IFTC Transport Vehicle Trailer Frame

WBS Assumptions:

- The IFTC Transport Cask and Impact Limiter will be used to ship all Used Fuel in Modules from owner Reactor Storage Facilities.
- IFTC Transport Cask and Impact Limiter design life is assumed to be approximately 30 years (no replacement during shipping period).
- See 660.40.40.10 (Equipment for IFTC Transportation Logistics for Real Time Tracking) for acquisition of satellite phones and GPS systems.
- See 660.40.40.20 (Equipment for IFTC Transportation Logistics for Emergency Response) for acquisition of emergency response equipment, including spare set of transportation equipment.
- Pricing for specialty items identified by Cogema (2003) adjusted for new requirements, location and current dollars by PDD using professional judgement.
- Total Project fleet costs calculated separately and allocated to work element based on share of total fuel bundle count. - Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard
Start Year: 24 Finish Year: 25 Duration: 2 year(s) WBS Type: Step-Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
	$15,412,216		$15,412,216	10%	$16,953,437

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Base Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1013

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 17-Feb-2010

WBS Case: 660 ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)
WBS Number: 660.40.20.40 IFTC Transport Casks for Pickering

WBS Description:

The procurement, test and commissioning of IFTC Transport Casks and Impact Limiters for Pickering.

WBS Deliverable:

IFTC Transportation Cask and Impact Limiter, including:
- Marking and labeling
- Real-time tracking system
- Design features for repeat usage
- Design features for mounting on IFTC Transport Vehicle Trailer Frame

WBS Assumptions:

- The IFTC Transport Cask and Impact Limiter will be used to ship all Used Fuel in Modules from owner Reactor Storage Facilities.
- IFTC Transport Cask and Impact Limiter design life is assumed to be approximately 30 years (no replacement during shipping period).
- See 660.40.40.10 (Equipment for IFTC Transportation Logistics for Real Time Tracking) for acquisition of satellite phones and GPS systems.
- See 660.40.40.20 (Equipment for IFTC Transportation Logistics for Emergency Response) for acquisition of emergency response equipment, including spare set of transportation equipment.
- Pricing for specialty items identified by Cogema (2003) adjusted for new requirements, location and current dollars by PDD using professional judgement.
- Total Project fleet costs calculated separately and allocated to work element based on share of total fuel bundle count. - Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard
Start Year: 24 Finish Year: 25 Duration: 2 year(s) WBS Type: Step-Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
	$8,656,999		$8,656,999	10%	$9,522,699

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Base Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1014

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 17-Feb-2010

WBS Case: 660 ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)
WBS Number: 660.40.20.50 IFTC Transport Casks for Darlington

WBS Description:

The procurement, test and commissioning of IFTC Transport Casks and Impact Limiters for Darlington.

WBS Deliverable:

IFTC Transportation Cask and Impact Limiter, including:
- Marking and labeling
- Real-time tracking system
- Design features for repeat usage
- Design features for mounting on IFTC Transport Vehicle Trailer Frame

WBS Assumptions:

- The IFTC Transport Cask and Impact Limiter will be used to ship all Used Fuel in Modules from owner Reactor Storage Facilities.
- IFTC Transport Cask and Impact Limiter design life is assumed to be approximately 30 years (no replacement during shipping period).
- See 660.40.40.10 (Equipment for IFTC Transportation Logistics for Real Time Tracking) for acquisition of satellite phones and GPS systems.
- See 660.40.40.20 (Equipment for IFTC Transportation Logistics for Emergency Response) for acquisition of emergency response equipment, including spare set of transportation equipment.
- Pricing for specialty items identified by Cogema (2003) adjusted for new requirements, location and current dollars by PDD using professional judgement.
- Total Project fleet costs calculated separately and allocated to work element based on share of total fuel bundle count. - Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard
Start Year: 24 Finish Year: 25 Duration: 2 year(s) WBS Type: Step-Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
	$9,012,128		$9,012,128	10%	$9,913,341

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Base Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1015

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 17-Feb-2010

WBS Case: 660 ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)
WBS Number: 660.40.20.60 IFTC Transport Casks for Point Lepreau

WBS Description:

The procurement, test and commissioning of IFTC Transport Casks and Impact Limiters for Point Lepreau.

WBS Deliverable:

IFTC Transportation Cask and Impact Limiter, including:
- Marking and labeling
- Real-time tracking system
- Design features for repeat usage
- Design features for mounting on IFTC Transport Vehicle Trailer Frame

WBS Assumptions:

- The IFTC Transport Cask and Impact Limiter will be used to ship all Used Fuel in Modules from owner Reactor Storage Facilities.
- IFTC Transport Cask and Impact Limiter design life is assumed to be approximately 30 years (no replacement during shipping period).
- See 660.40.40.10 (Equipment for IFTC Transportation Logistics for Real Time Tracking) for acquisition of satellite phones and GPS systems.
- See 660.40.40.20 (Equipment for IFTC Transportation Logistics for Emergency Response) for acquisition of emergency response equipment, including spare set of transportation equipment.
- Pricing for specialty items identified by Cogema (2003) adjusted for new requirements, location and current dollars by PDD using professional judgement.
- Total Project fleet costs calculated separately and allocated to work element based on share of total fuel bundle count. - Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard
Start Year: 24 Finish Year: 25 Duration: 2 year(s) WBS Type: Step-Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
	$1,234,220		$1,234,220	10%	$1,357,642

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Base Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

28-Apr-2010 3:21:38 PM WEDS ID # 1112

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 28-Apr-2010

WBS Case: 660 ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)
WBS Number: 660.40.20.70 IFTC Transport Casks for Chalk River

WBS Description:

The design, procurement, test and commissioning of IFTC Transport Casks and Impact Limiters for Chalk River.

WBS Deliverable:

IFTC Transport Cask and Impact Limiter, including:
- Marking and labeling
- Real-time tracking system
- Design features for repeat usage
- Design features for mounting on IFTC Transport Vehicle Trailer Frame

WBS Assumptions:

- The IFTC Transport Cask and Impact Limiter will be used to ship all Used Fuel in Modules from owner Reactor Storage Facilities.
- IFTC Transport Cask and Impact Limiter design life is assumed to be approximately 30 years (no replacement during shipping period).
- See 660.40.40.10 (Equipment for IFTC Transportation Logistics for Real Time Tracking) for acquisition of satellite phones and GPS systems.
- See 660.40.40.20 (Equipment for IFTC Transportation Logistics for Emergency Response) for acquisition of emergency response equipment, including spare set of transportation equipment.
- Pricing for specialty items identified by Cogema (2003) adjusted for new requirements, location and current dollars by PDD using professional judgement.
- Total Project fleet costs calculated separately and allocated to work element based on share of total fuel bundle count. - Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 24 Finish Year: 25 Duration: 2 year(s) WBS Type: Step-Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
	$52,394		$52,394	10%	$57,634

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Base Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1017

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 17-Feb-2010

WBS Case: 660 ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)
WBS Number: 660.40.20.80 IFTC Transport Casks for Gentilly 1

WBS Description:

The procurement, test and commissioning of the IFTC Transport Cask and Impact Limiter for Gentilly 1.

WBS Deliverable:

IFTC Transportation Cask and Impact Limiter, including:
- Marking and labeling
- Real-time tracking system
- Design features for repeat usage
- Design features for mounting on IFTC Transport Vehicle Trailer Frame

WBS Assumptions:

- The IFTC Transport Cask and Impact Limiter will be used to ship all Used Fuel in Modules from owner Reactor Storage Facilities.
- IFTC Transport Cask and Impact Limiter design life is assumed to be approximately 30 years (no replacement during shipping period).
- See 660.40.40.10 (Equipment for IFTC Transportation Logistics for Real Time Tracking) for acquisition of satellite phones and GPS systems.
- See 660.40.40.20 (Equipment for IFTC Transportation Logistics for Emergency Response) for acquisition of emergency response equipment, including spare set of transportation equipment.
- Pricing for specialty items identified by Cogema (2003) adjusted for new requirements, location and current dollars by PDD using professional judgement.
- Total Project fleet costs calculated separately and allocated to work element based on share of total fuel bundle count. - Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 24 Finish Year: 25 Duration: 2 year(s) WBS Type: Step-Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
	$34,931		$34,931	10%	$38,424

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Base Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

28-Apr-2010 3:25:16 PM WEDS ID # 1113

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 28-Apr-2010

WBS Case: 660 ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)
WBS Number: 660.40.20.90 IFTC Transport Casks for Gentilly 2

WBS Description:

The design, procurement, test and commissioning of IFTC Transport Casks and Impact Limiters for Gentilly 2.

WBS Deliverable:

IFTC Transport Cask and Impact Limiter, including:
- Marking and labeling
- Real-time tracking system
- Design features for repeat usage
- Design features for mounting on IFTC Transport Vehicle Trailer Frame

WBS Assumptions:

- The IFTC Transport Cask and Impact Limiter will be used to ship all Used Fuel in Modules from owner Reactor Storage Facilities.
- IFTC Transport Cask and Impact Limiter design life is assumed to be approximately 30 years (no replacement during shipping period).
- See 660.40.40.10 (Equipment for IFTC Transportation Logistics for Real Time Tracking) for acquisition of satellite phones and GPS systems.
- See 660.40.40.20 (Equipment for IFTC Transportation Logistics for Emergency Response) for acquisition of emergency response equipment, including spare set of transportation equipment.
- Pricing for specialty items identified by Cogema (2003) adjusted for new requirements, location and current dollars by PDD using professional judgement.
- Total Project fleet costs calculated separately and allocated to work element based on share of total fuel bundle count. - Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard
Start Year: 24 Finish Year: 25 Duration: 2 year(s) WBS Type: Step-Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
	$1,352,596		$1,352,596	10%	$1,487,855

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Base Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1012

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 17-Feb-2010

WBS Case: 660 ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)
WBS Number: 660.40.20.100 IFTC Transport Casks for Douglas Point

WBS Description:

The procurement, test and commissioning of IFTC Transport Casks and Impact Limiters for Douglas Point.

WBS Deliverable:

IFTC Transportation Cask and Impact Limiter, including:
- Marking and labeling
- Real-time tracking system
- Design features for repeat usage
- Design features for mounting on IFTC Transport Vehicle Trailer Frame

WBS Assumptions:

- The IFTC Transport Cask and Impact Limiter will be used to ship all Used Fuel in Modules from owner Reactor Storage Facilities.
- IFTC Transport Cask and Impact Limiter design life is assumed to be approximately 30 years (no replacement during shipping period).
- See 660.40.40.10 (Equipment for IFTC Transportation Logistics for Real Time Tracking) for acquisition of satellite phones and GPS systems.
- See 660.40.40.20 (Equipment for IFTC Transportation Logistics for Emergency Response) for acquisition of emergency response equipment, including spare set of transportation equipment.
- Pricing for specialty items identified by Cogema (2003) adjusted for new requirements, location and current dollars by PDD using professional judgement.
- Total Project fleet costs calculated separately and allocated to work element based on share of total fuel bundle count. - Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 24 Finish Year: 25 Duration: 2 year(s) WBS Type: Step-Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
	$240,635		$240,635	10%	$264,698

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Base Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1030

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 17-Feb-2010

WBS Case: 660 ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)
WBS Number: 660.40.30.10 Equipment for IFTC Transport Cask Loading non-Site-Specific

WBS Description:

Final design/design integration for Irradiated Fuel Transport Cask (IFTC) loading (modules to cask and cask to transporter) at reactor sites.

WBS Deliverable:

Completed system design basis for the integration of the Equipment for IFTC Transport Cask Loading at the different sites, including:
- Conceptual design
- Licensing documentation
- Detailed design files and related procurement specifications

WBS Assumptions:

- Equipment procurement, inspection, site-specific supervision, facility development, testing & commissioning is accounted for in individual facility costs (660.40.30.20 through 660.40.30. 100).
- Site-specific loading mock-ups at each Reactor Storage Facilities are accounted for per facility; the equipment used for the mock-ups will be the same equipment subsequently used for IFTC Loading.
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 20 Finish Year: 25 Duration: 6 year(s) WBS Type: Step-Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$1,082,400			$1,082,400	15%	$1,244,760

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Base Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1018

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	17-Feb-2010

WBS Case: 660 ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)

WBS Number: 660.40.30.20 Equipment for IFTC Transport Cask Loading at Whiteshell

WBS Description:

The design, procurement, test and commissioning of equipment for IFTC Transport Cask loading at Whiteshell.

WBS Deliverable:

One set of Transport Cask loading facilities for transfer-plate based fuel transfer (no Hot Cell), as follows:

Transfer Area Equipment:
- IFTC Transfer Plate
- Remote Camera System
- Owner's Flask Docking System
- Owner's Flask Lock Equipment
- Leakage and purging equipment (Air/water separator, pump, vacuum gauges, valves, compressed air line, helium)
- Air Pressure Decay Test Equipment
- Smear Test Equipment Sets & Radiameters
- IFTC/M Bolt Driver

Decontamination Area/Booth:
- Miscellaneous equipment, scaffolding, etc.

Shipment Area (also used as Transfer Area):
- (leased) 100 ton portable crane (for loading the IFTC Transportation Cask onto IFTC Transportation Vehicle, loading the Owners Flask on IFTC Transfer Plate and loading Impact Limiter)
- Three Lifting beams (IFTC Transport Cask, Impact Limiter, and Owner's Flask onto IFTC Transfer Plate)

WBS Assumptions:

- The design life of the UFTS equipment is assumed to be at least 30 years from initial service date.
- Single process line.
- Host facility provides all working, transfer, laydown, staff support and holding areas at no cost to Project.
- Host facility provides all effort and equipment to retrieve fuel and place it, in modules, on the IFTC transfer plate at no cost to Project.
- Host facility provides all effort and equipment related to site security, management of conventional and radiological waste material, etc., at no cost to Project.
- Design is conceptual: minor and incidental costs up to and including aspects such as a local service point for the tracking and emergency response network ("crisis room") are included in "Allowance".
- Cask decontamination is assumed to be a manual operation with minimal equipment requirements.
- Whiteshell facility is assumed to supply Owner's Transfer Flask, Transport Vehicle for Owner's Transfer Flask, 30 ton gantry crane and 60 ton crane at no cost to Project.
- Whiteshell and Chalk River may share equipment, including leakage and purging equipment, tooling, lifting beams, smear testing equipment and radiameters; current estimate carries unique equipment sets for each Site.
- Owners Transfer Flask is owner's responsibility and will be used to load IFTC Transport Cask
- Rented crane is used for the transfer operation (100 ton specified; 60 ton minimum).
- Pricing for custom equipment based on recent (2000 to 2010) PDD project data, adjusted by PDD for unique requirements, location and current dollars using professional judgement.
- Pricing for specialty items identified by Cogema (2003) adjusted for new requirements, location and current dollars by PDD using professional judgement.

- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 50 Finish Year: 51 Duration: 2 year(s) WBS Type: Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$281,710	$639,000	$75,000	$995,710	15%	$1,145,067

WBS Specific Supporting Documentation:
ID 54 100 ton portable crane 3900_001-GMK4115Cost.pdf
ID 54 100 ton portable crane GMK4100B_PG.pdf
Multi Element Supporting Documentation:
RC DETS Base Case Final Sept 9, 10.xlsTM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1021

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	17-Feb-2010

WBS Case:	660	ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)
WBS Number:	660.40.30.30	Equipment for IFTC Transport Cask Loading at Bruce

WBS Description:

The design, procurement, test and commissioning of the Equipment for IFTC Transport Cask Loading at Bruce.

WBS Deliverable:

One set of Transport Cask loading facilities for hot-cell-based fuel transfer, as follows:

Dedicated Building/New Construction

Equipped Hot Cell, including:
- Hoist n° 1 with one gripper to remove Transfer Clamp and to open or close the Owner's Cask Lid
- Hoist n° 2 with one gripper to unload the modules from the Owner's Casks and load the IFTC Cask
- Hoist n° 3 with one gripper to open or close the IFTC Cask lid
- Lifting Beam for Lid of the Owner's Cask
- Lifting Beam for Lid of the IFTC Transport Cask
- Master-slave telemanipulators
- Shielded windows
- Lining
- Misc. hot cell equipment
- Remote Camera system
- Vacuum Cleaning Unit
- Shielded equipment door
- Hot Cell Shuttle- Owner's Cask
- Hot Cell Pit Shielding Cover - Owner's Cask
- Owner's Cask Lift
- Owner's Cask Docking Port and Gate
- Owner's Cask Lift Lock
- Hot Cell Shuttle- IFTC Cask
- Hot Cell Pit Shielding Cover - IFTC Cask
- IFTC Cask Lift
- IFTC Cask Docking Port and Gate
- IFTC Cask Lift Lock

Additional Equipment, including:
- Leakage and purging equipment (air/water separator, pump, vacuum gauges, valves, compressed air line, helium)
- Air Pressure Decay test equipment
- Smear testing equipment & radiometers
- IFTC Lid Transfer Clamp
- IFTC Bolt Driver

Decontamination Area/Booth:
- Miscellaneous equipment, walkways, etc;

Shipping Area, including:
- Two Gantry Cranes (10 ton crane for loading the Impact Limiters; 60 ton crane for loading the IFTC Transportation Cask onto IFTC Transportation Vehicle Trailer, loading IFTC into Hot Cell Loading Pit and loading DSC into Hot Cell Loading Pit)

- Three Lifting beams (Owner's Cask, IFTC Transport Cask and IFTC Impact Limiter)

WBS Assumptions:

- The design life of the UFTS equipment and new Transfer Facilities Building is assumed to be 60 years from initial service date.
- Bruce Hot Cell and related equipment is shared with Douglas Point. Costs apportioned between the two on bundle count (Approx. 98.4% assigned to Bruce).
- Single process line.
- Pricing based on installation in Western Used Fuel Dry Storage Facility (WUFDSF) or similar.
- Host facility provides building area, working, transfer, laydown, staff support and holding areas at no cost to Project.
- Host facility provides all effort and equipment to retrieve fuel and place it into the Hot Cell at no cost to Project.
- Host facility provides all effort and equipment related to site security, management of conventional and radiological waste material, etc., at no cost to Project.
- Design is conceptual: minor and incidental costs up to and including aspects such as a local service point for the tracking and emergency response network ("crisis room") are included in "Allowance".
- Cask decontamination is assumed to be a manual operation with minimal equipment requirements.
- Pricing for custom equipment based on recent (2000 to 2010) PDD project data, adjusted by PDD for unique requirements, location and current dollars using professional judgement.
- Pricing for specialty items identified by Cogema (2003) adjusted for new requirements, location and current dollars by PDD using professional judgement.
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 20 Finish Year: 25 Duration: 6 year(s) WBS Type: Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$5,462,870	$23,772,830	$1,159,890	$30,395,590	15%	$34,954,929

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Base Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1022

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	17-Feb-2010

WBS Case:	660	ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)
WBS Number:	660.40.30.40	Equipment for IFTC Transport Cask Loading at Pickering

WBS Description:

The design, procurement, test and commissioning of the Equipment for IFTC Transport Cask Loading at Pickering.

WBS Deliverable:

One set of Transport Cask loading facilities for hot-cell-based fuel transfer, as follows:

Dedicated Building/New Construction

Equipped Hot Cell, including:
- Hoist n° 1 with one gripper to remove Transfer Clamp and to open or close the Owner's Cask Lid
- Hoist n° 2 with one gripper to unload the modules from the Owner's Casks and load the IFTC Cask
- Hoist n° 3 with one gripper to open or close the IFTC Cask lid
- Lifting Beam for Lid of the Owner's Cask
- Lifting Beam for Lid of the IFTC Transport Cask
- Master-slave telemanipulators
- Shielded windows
- Lining
- Misc. hot cell equipment
- Remote Camera system
- Vacuum Cleaning Unit
- Shielded equipment door
- Hot Cell Shuttle- Owner's Cask
- Hot Cell Pit Shielding Cover - Owner's Cask
- Owner's Cask Lift
- Owner's Cask Docking Port and Gate
- Owner's Cask Lift Lock
- Hot Cell Shuttle- IFTC Cask
- Hot Cell Pit Shielding Cover - IFTC Cask
- IFTC Cask Lift
- IFTC Cask Docking Port and Gate
- IFTC Cask Lift Lock

Additional Equipment, including:
- Leakage and purging equipment (air/water separator, pump, vacuum gauges, valves, compressed air line, helium)
- Air Pressure Decay test equipment
- Smear testing equipment & radiometers
- IFTC Lid Transfer Clamp
- IFTC Bolt Driver

Decontamination Area/Booth:
- Miscellaneous equipment, walkways, etc;

Shipping Area, including:
- Two Gantry Cranes (10 ton crane for loading the Impact Limiters; 60 ton crane for loading the IFTC Transportation Cask onto IFTC Transportation Vehicle Trailer, loading IFTC into Hot Cell Loading Pit and loading DSC into Hot Cell Loading Pit)

- Three Lifting beams (Owner's Cask, IFTC Transport Cask and IFTC Impact Limiter)

WBS Assumptions:

- The design life of the UFTS equipment and new Transfer Facilities Building is assumed to be 60 years from initial service date.
- Single process line.
- Pricing based on installation in Pickering Used Fuel Dry Storage Facility (PUFDSF) or similar.
- Host facility provides building area, working, transfer, laydown, staff support and holding areas at no cost to Project.
- Host facility provides all effort and equipment to retrieve fuel and place it into the Hot Cell at no cost to Project.
- Host facility provides all effort and equipment related to site security, management of conventional and radiological waste material, etc., at no cost to Project.
- Design is conceptual: minor and incidental costs up to and including aspects such as a local service point for the tracking and emergency response network ("crisis room") are included in "Allowance".
- Cask decontamination is assumed to be a manual operation with minimal equipment requirements.
- Pricing for custom equipment based on recent (2000 to 2010) PDD project data, adjusted by PDD for unique requirements, location and current dollars using professional judgement.
- Pricing for specialty items identified by Cogema (2003) adjusted for new requirements, location and current dollars by PDD using professional judgement.
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 20 Finish Year: 25 Duration: 6 year(s) WBS Type: Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$5,548,180	$24,144,000	$1,178,000	$30,870,180	15%	$35,500,707

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Base Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1023

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 17-Feb-2010

WBS Case: 660 ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)
WBS Number: 660.40.30.50 Equipment for IFTC Transport Cask Loading at Darlington

WBS Description:

The design, procurement, test and commissioning of the Equipment for IFTC Transport Cask Loading at Darlington.

WBS Deliverable:

One set of Transport Cask loading facilities for hot-cell-based fuel transfer, as follows:

Dedicated Building/New Construction

Equipped Hot Cell, including:
- Hoist n° 1 with one gripper to remove Transfer Clamp and to open or close the Owner's Cask Lid
- Hoist n° 2 with one gripper to unload the modules from the Owner's Casks and load the IFTC Cask
- Hoist n° 3 with one gripper to open or close the IFTC Cask lid
- Lifting Beam for Lid of the Owner's Cask
- Lifting Beam for Lid of the IFTC Transport Cask
- Master-slave telemanipulators
- Shielded windows
- Lining
- Misc. hot cell equipment
- Remote Camera system
- Vacuum Cleaning Unit
- Shielded equipment door
- Hot Cell Shuttle- Owner's Cask
- Hot Cell Pit Shielding Cover - Owner's Cask
- Owner's Cask Lift
- Owner's Cask Docking Port and Gate
- Owner's Cask Lift Lock
- Hot Cell Shuttle- IFTC Cask
- Hot Cell Pit Shielding Cover - IFTC Cask
- IFTC Cask Lift
- IFTC Cask Docking Port and Gate
- IFTC Cask Lift Lock

Additional Equipment, including:
- Leakage and purging equipment (air/water separator, pump, vacuum gauges, valves, compressed air line, helium)
- Air Pressure Decay test equipment
- Smear testing equipment & radiometers
- IFTC Lid Transfer Clamp
- IFTC Bolt Driver

Decontamination Area/Booth:
- Miscellaneous equipment, walkways, etc.

Shipping Area, including:
- Two Gantry Cranes (10 ton crane for loading the Impact Limiters; 60 ton crane for loading the IFTC Transportation Cask onto IFTC Transportation Vehicle Trailer, loading IFTC into Hot Cell Loading Pit and loading DSC into Hot Cell Loading Pit)
- Three Lifting beams (Owner's Cask, IFTC Transport Cask and IFTC Impact Limiter)

WBS Assumptions:

- The design life of the UFTS equipment and new Transfer Facilities Building is assumed to be 60 years from initial service date.
- Single process line.
- Pricing based on installation in Darlington Used Fuel Dry Storage Facility (DUFDSF) or similar.
- Host facility provides building area, working, transfer, laydown, staff support and holding areas at no cost to Project.
- Host facility provides all effort and equipment to retrieve fuel and place it into the Hot Cell at no cost to Project.
- Host facility provides all effort and equipment related to site security, management of conventional and radiological waste material, etc., at no cost to Project.
- Design is conceptual: minor and incidental costs up to and including aspects such as a local service point for the tracking and emergency response network ("crisis room") are included in "Allowance".
- Cask decontamination is assumed to be a manual operation with minimal equipment requirements.
- Pricing for custom equipment based on recent (2000 to 2010) PDD project data, adjusted by PDD for unique requirements, location and current dollars using professional judgement.
- Pricing for specialty items identified by Cogema (2003) adjusted for new requirements, location and current dollars by PDD using professional judgement.
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 20 Finish Year: 25 Duration: 6 year(s) WBS Type: Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$5,548,180	$24,144,000	$1,178,000	$30,870,180	15%	$35,500,707

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Base Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1024

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	17-Feb-2010

WBS Case: 660 ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)

WBS Number: 660.40.30.60 Equipment for IFTC Transport Cask Loading at Point Lepreau

WBS Description:

The design, procurement, test and commissioning of the Equipment for IFTC Transport Cask Loading at Point Lepreau.

WBS Deliverable:

One set of Transport Cask loading facilities for hot-cell-based fuel transfer, as follows:

Dedicated Building/New Construction

Equipped Hot Cell, including:
- Hoist n° 1 with one gripper to remove Transfer Clamp and to open or close the Owner's Cask Lid
- Hoist n° 2 with one gripper to unload the modules from the Owner's Casks and load the IFTC Cask
- Hoist n° 3 with one gripper to open or close the IFTC Cask lid
- Lifting Beam for Lid of the Owner's Cask
- Lifting Beam for Lid of the IFTC Transport Cask
- Master-slave telemanipulators
- Shielded windows
- Lining
- Misc. hot cell equipment
- Remote Camera system
- Vacuum Cleaning Unit
- Shielded equipment door
- Hot Cell Shuttle- Owner's Cask
- Hot Cell Pit Shielding Cover - Owner's Cask
- Owner's Cask Lift
- Owner's Cask Docking Port and Gate
- Owner's Cask Lift Lock
- Hot Cell Shuttle- IFTC Cask
- Hot Cell Pit Shielding Cover - IFTC Cask
- IFTC Cask Lift
- IFTC Cask Docking Port and Gate
- IFTC Cask Lift Lock

Additional Equipment, including:
- Leakage and purging equipment (air/water separator, pump, vacuum gauges, valves, compressed air line, helium)
- Air Pressure Decay test equipment
- Smear testing equipment & radiometers
- IFTC Lid Transfer Clamp
- IFTC Bolt Driver

Decontamination Area/Booth:
- Miscellaneous equipment, walkways, etc;

Shipping Area, including:
- Two Gantry Cranes (10 ton crane for loading the Impact Limiters; 60 ton crane for loading the IFTC Transportation Cask onto IFTC Transportation Vehicle Trailer, loading IFTC into Hot Cell Loading Pit and loading DSC into Hot Cell Loading Pit)

- Three Lifting beams (Owner's Cask, IFTC Transport Cask and IFTC Impact Limiter)

WBS Assumptions:

- The design life of the UFTS equipment and new Transfer Facilities Building is assumed to be 60 years from initial service date.
- Single process line.
- Host facility provides building area, working, transfer, laydown, staff support and holding areas at no cost to Project.
- Host facility provides all effort and equipment to retrieve fuel and place it into the Hot Cell at no cost to Project.
- Host facility provides all effort and equipment related to site security, management of conventional and radiological waste material, etc., at no cost to Project.
- Design is conceptual: minor and incidental costs up to and including aspects such as a local service point for the tracking and emergency response network ("crisis room") are included in "Allowance".
- Cask decontamination is assumed to be a manual operation with minimal equipment requirements.
- Pricing for custom equipment based on recent (2000 to 2010) PDD project data, adjusted by PDD for unique requirements, location and current dollars using professional judgement.
- Pricing for specialty items identified by Cogema (2003) adjusted for new requirements, location and current dollars by PDD using professional judgement.
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 35 Finish Year: 40 Duration: 6 year(s) WBS Type: Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$5,548,180	$24,144,000	$1,178,000	$30,870,180	15%	$35,500,707

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Base Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1025

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	17-Feb-2010

WBS Case:	660	ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)
WBS Number:	660.40.30.70	Equipment for IFTC Transport Cask Loading at Chalk River

WBS Description:

The design, procurement, test and commissioning of the Equipment for IFTC Transport Cask Loading at Chalk River.

WBS Deliverable:

One set of Transport Cask loading facilities for transfer-plate based fuel transfer (no Hot Cell), as follows:

Transfer Area Equipment:

- IFTC Transfer Plate
- Remote Camera System
- Owner's Flask Docking System
- Owner's Flask Lock Equipment
- Leakage and purging equipment (Air/water separator, pump, vacuum gauges, valves, compressed air line, helium)
- Air Pressure Decay Test Equipment
- Smear Test Equipment Sets & Radiameters
- IFTC Bolt Driver

Decontamination Area/Booth:

- Miscellaneous equipment, scaffolding, etc.

Shipment Area (also used as Transfer Area):

- (leased) 100 ton portable crane (for loading the IFTC Transportation Cask onto IFTC Transportation Vehicle, loading the Owners Flask on IFTC Transfer Plate and loading Impact Limiter)
- Three Lifting beams (IFTC Transport Cask, Impact Limiter, and Owner's Flask onto IFTC Transfer Plate)

WBS Assumptions:

- The design life of the UFTS equipment is assumed to be at least 30 years from initial service date.
- Single process line.
- Host facility provides all working, transfer, laydown, staff support and holding areas at no cost to Project.
- Host facility provides all effort and equipment to retrieve fuel and place it, in modules, on the IFTC transfer plate at no cost to Project.
- Host facility provides all effort and equipment related to site security, management of conventional and radiological waste material, etc., at no cost to Project.
- Design is conceptual: minor and incidental costs up to and including aspects such as a local service point for the tracking and emergency response network ("crisis room") are included in "Allowance".
- Cask decontamination is assumed to be a manual operation with minimal equipment requirements.
- Chalk River facility is assumed to supply Owner's Transfer Flask, Transport Vehicle for Owner's Transfer Flask, 30 ton gantry crane and 60 ton crane at no cost to Project.
- Chalk River and Whiteshell may share equipment, including leakage and purging equipment, tooling, lifting beams, smear testing equipment and radiameters; current estimate carries unique equipment sets for each Site.
- Owners Transfer Flask is owner's responsibility and will be used to load IFTC Transport Cask
- Rented crane is used transfer operation (100 ton specified; 60 ton minimum).
- Pricing for custom equipment based on recent (2000 to 2010) PDD project data, adjusted by PDD for unique requirements, location and current dollars using professional judgement.
- Pricing for specialty items identified by Cogema (2003) adjusted for new requirements, location and current dollars by

PDD using professional judgement.
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 50 Finish Year: 51 Duration: 2 year(s) WBS Type: Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$281,710	$639,000	$75,000	$995,710	15%	$1,145,067

WBS Specific Supporting Documentation:
ID 54 100 ton portable crane 3900_001-GMK4115Cost.pdf
ID 54 100 ton portable crane GMK4100B_PG.pdf
Multi Element Supporting Documentation:
RC DETS Base Case Final Sept 9, 10.xlsTM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1026

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	17-Feb-2010

WBS Case:	660	ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)
WBS Number:	660.40.30.80	Equipment for IFTC Transport Cask Loading at Gentilly 1

WBS Description:

The design, procurement, test and commissioning of the Equipment for IFTC Transport Cask Loading at Gentilly 1.

WBS Deliverable:

One set of Transport Cask loading facilities for hot-cell-based fuel transfer, as follows:

Dedicated Building/New Construction

Equipped Hot Cell, including:
- Hoist n° 1 with one gripper to remove Transfer Clamp and to open or close the Owner's Cask Lid
- Hoist n° 2 with one gripper to unload the modules from the Owner's Casks and load the IFTC Cask
- Hoist n° 3 with one gripper to open or close the IFTC Cask lid
- Lifting Beam for Lid of the Owner's Cask
- Lifting Beam for Lid of the IFTC Transport Cask
- Master-slave telemanipulators
- Shielded windows
- Lining
- Misc. hot cell equipment
- Remote Camera system
- Vacuum Cleaning Unit
- Shielded equipment door
- Hot Cell Shuttle- Owner's Cask
- Hot Cell Pit Shielding Cover - Owner's Cask
- Owner's Cask Lift
- Owner's Cask Docking Port and Gate
- Owner's Cask Lift Lock
- Hot Cell Shuttle- IFTC Cask
- Hot Cell Pit Shielding Cover - IFTC Cask
- IFTC Cask Lift
- IFTC Cask Docking Port and Gate
- IFTC Cask Lift Lock

Additional Equipment, including:
- Leakage and purging equipment (air/water separator, pump, vacuum gauges, valves, compressed air line, helium)
- Air Pressure Decay test equipment
- Smear testing equipment & radiometers
- IFTC Lid Transfer Clamp
- IFTC Bolt Driver

Decontamination Area/Booth:
- Miscellaneous equipment, walkways, etc;

Shipping Area, including:
- Two Gantry Cranes (10 ton crane for loading the Impact Limiters; 60 ton crane for loading the IFTC Transportation Cask onto IFTC Transportation Vehicle Trailer, loading IFTC into Hot Cell Loading Pit and loading DSC into Hot Cell Loading Pit)
- Three Lifting beams (Owner's Cask, IFTC Transport Cask and IFTC Impact Limiter)

WBS Assumptions:

The design life of the UFTS equipment and new Transfer Facilities Building is assumed to be 30 years from initial service date
- Gentilly 1 is assumed to host new Transfer Facilities Building
- Gentilly 1 will share Hot Cell, Shipping Facility, Gantry Cranes and equipment with Gentilly 2. Equipment cost is apportioned between Gentilly 1 and 2 according to bundle count (approx. 2.6% to Gentilly 1).
- The design life of the UFTS equipment and new Transfer Facilities Building is assumed to be 30 years from initial service date.
- Single process line.
- Host facility provides building area, working, transfer, laydown, staff support and holding areas at no cost to Project.
- Host facility provides all effort and equipment to retrieve fuel and place it into the Hot Cell at no cost to Project.
- Host facility provides all effort and equipment related to site security, management of conventional and radiological waste material, etc., at no cost to Project.
- Design is conceptual: minor and incidental costs up to and including aspects such as a local service point for the tracking and emergency response network ("crisis room") are included in "Allowance".
- Cask decontamination is assumed to be a manual operation with minimal equipment requirements.
- Pricing for custom equipment based on recent (2000 to 2010) PDD project data, adjusted by PDD for unique requirements, location and current dollars using professional judgement.
- Pricing for specialty items identified by Cogema (2003) adjusted for new requirements, location and current dollars by PDD using professional judgement.
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 35 Finish Year: 40 Duration: 6 year(s) WBS Type: Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$139,688	$607,821	$29,656	$777,165	15%	$893,739

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Base Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1027

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	17-Feb-2010

WBS Case: 660 ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)

WBS Number: 660.40.30.90 Equipment for IFTC Transport Cask Loading at Gentilly 2

WBS Description:

The design, procurement, test and commissioning of the Equipment for IFTC Transport Cask Loading at Gentilly 2.

WBS Deliverable:

One set of Transport Cask loading facilities for hot-cell-based fuel transfer, as follows:

Dedicated Building/New Construction

Equipped Hot Cell, including:
- Hoist n° 1 with one gripper to remove Transfer Clamp and to open or close the Owner's Cask Lid
- Hoist n° 2 with one gripper to unload the modules from the Owner's Casks and load the IFTC Cask
- Hoist n° 3 with one gripper to open or close the IFTC Cask lid
- Lifting Beam for Lid of the Owner's Cask
- Lifting Beam for Lid of the IFTC Transport Cask
- Master-slave telemanipulators
- Shielded windows
- Lining
- Misc. hot cell equipment
- Remote Camera system
- Vacuum Cleaning Unit
- Shielded equipment door
- Hot Cell Shuttle- Owner's Cask
- Hot Cell Pit Shielding Cover - Owner's Cask
- Owner's Cask Lift
- Owner's Cask Docking Port and Gate
- Owner's Cask Lift Lock
- Hot Cell Shuttle- IFTC Cask
- Hot Cell Pit Shielding Cover - IFTC Cask
- IFTC Cask Lift
- IFTC Cask Docking Port and Gate
- IFTC Cask Lift Lock

Additional Equipment, including:
- Leakage and purging equipment (air/water separator, pump, vacuum gauges, valves, compressed air line, helium)
- Air Pressure Decay test equipment
- Smear testing equipment & radiometers
- IFTC Lid Transfer Clamp
- IFTC Bolt Driver

Decontamination Area/Booth:
- Miscellaneous equipment, walkways, etc;

Shipping Area, including:
- Two Gantry Cranes (10 ton crane for loading the Impact Limiters; 60 ton crane for loading the IFTC Transportation Cask onto IFTC Transportation Vehicle Trailer, loading IFTC into Hot Cell Loading Pit and loading DSC into Hot Cell Loading Pit)
- Three Lifting beams (Owner's Cask, IFTC Transport Cask and IFTC Impact Limiter)

WBS Assumptions:

- The design life of the UFTS equipment and new Transfer Facilities Building is assumed to be 30 years from initial service date
- Gentilly 1 is assumed to host new Transfer Facilities Building
- Gentilly 1 will share Hot Cell, Shipping Facility, Gantry Cranes and equipment with Gentilly 2. Equipment cost is apportioned between Gentilly 1 and 2 according to bundle count (approx. 97.4% to Gentilly 2).
- The design life of the UFTS equipment and new Transfer Facilities Building is assumed to be 30 years from initial service date.
- Single process line.
- Host facility provides building area, working, transfer, laydown, staff support and holding areas at no cost to Project.
- Host facility provides all effort and equipment to retrieve fuel and place it into the Hot Cell at no cost to Project.
- Host facility provides all effort and equipment related to site security, management of conventional and radiological waste material, etc., at no cost to Project.
- Design is conceptual: minor and incidental costs up to and including aspects such as a local service point for the tracking and emergency response network ("crisis room") are included in "Allowance".
- Cask decontamination is assumed to be a manual operation with minimal equipment requirements.
- Pricing for custom equipment based on recent (2000 to 2010) PDD project data, adjusted by PDD for unique requirements, location and current dollars using professional judgement.
- Pricing for specialty items identified by Cogema (2003) adjusted for new requirements, location and current dollars by PDD using professional judgement.
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 35 Finish Year: 40 Duration: 6 year(s) WBS Type: Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$5,408,462	$23,536,179	$1,148,344	$30,092,985	15%	$34,606,933

WBS Specific Supporting Documentation:

Multi Element Supporting Documentation:

RC DETS Base Case Final Sept 9, 10.xls

TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1028

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 17-Feb-2010

WBS Case: 660 ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)
WBS Number: 660.40.30.100 Equipment for IFTC Transport Cask Loading at Douglas Point

WBS Description:

The design, procurement, test and commissioning of the Equipment for IFTC Transport Cask Loading at Douglas Point.

WBS Deliverable:

Douglas Point to share Transfer Facilities Building at Bruce to load the IFTC Transport Cask and to unload, prepare and load the IFTC Transport Cask from the IFTC Transport Vehicle trailer.

WBS Assumptions:

- The design life of the UFTS equipment and new Transfer Facilities Building is assumed to be 30 years from initial service date.
- Bruce Hot Cell and related equipment is shared with Douglas Point. Costs apportioned between the two on bundle count (approx. 1.6% assigned to Douglas Point).
- Single process line.
- Pricing based on installation in Western Used Fuel Dry Storage Facility (WUFDSF) or similar.
- Host facility provides building area, working, transfer, laydown, staff support and holding areas at no cost to Project.
- Host facility provides all effort and equipment to retrieve fuel and place it into the Hot Cell at no cost to Project.
- Host facility provides all effort and equipment related to site security, management of conventional and radiological waste material, etc., at no cost to Project.
- Design is conceptual: minor and incidental costs up to and including aspects such as a local service point for the tracking and emergency response network ("crisis room") are included in "Allowance".
- Cask decontamination is assumed to be a manual operation with minimal equipment requirements.
- Pricing for custom equipment based on recent (2000 to 2010) PDD project data, adjusted by PDD for unique requirements, location and current dollars using professional judgement.
- Pricing for specialty items identified by Cogema (2003) adjusted for new requirements, location and current dollars by PDD using professional judgement.
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 20 Finish Year: 25 Duration: 6 year(s) WBS Type: Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$85,264	$371,170	$18,110	$474,544	15%	$545,725

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Base Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1029

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 17-Feb-2010

WBS Case: 660 ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)
WBS Number: 660.40.40.10 Equipment for IFTC Transportation Logistics for Real Time Tracking

WBS Description:

The development, procurement, testing and commissioning of Real Time Tracking System equipment and procedures, including:
- Development of specifications for Real Time Tracking System
- Preparation of tendering documentation and issue of Requests for Proposals (RFPs)
- Selection of design/build contractors
- Placing of orders/letting of contracts
- Review of design/build contractor engineering documentation & engineering drawings
- Supervision/inspection of equipment installation
- Preparation, supervision and performance of tests and commissioning

WBS Deliverable:

- Complete system design for the Real Time Tracking System
- Communication center located at the DGR and fully equipped with communication means (Vehicle Tracking System, Telephones, Teleconference System, etc.)
- Central GPS Tracking System at DGR, including tracking system software customization for central system and vehicle mounted systems, surge protection, un-interruptible power supply (UPS) emergency power backup and GPS Monthly System Access Fees

- Real Time Tracking Equipment in the Vehicle and IFTC Fleet:

IFTC Transport Vehicle Tractors:
- Satellite phone: Cab
- GPS no.1 : main unit available to driver and passenger
- GPS no.2: hidden back-up on tractor

IFTC Transport Vehicle Trailers:
- GPS no.3: On trailer
- GPS no.4: hidden back-up on trailer

IFTC Transport Casks:
- GPS no. 5: on Transport Cask
- GPS no.6: hidden back-up on Transport Cask

Escort Vehicle:
- Satellite phone: Cab
- GPS no.7 : Escort vehicle
- GPS no.8 : Escort vehicle backup

WBS Assumptions:

- Communication center for Real Time Tracking will be combined with Crisis Centre for Emergency Response (see 660.40.40.20, Equipment for IFTC Transportation Logistics for Emergency Response) to form one Communication and Crisis Centre at DGR fully equipped with communication equipment and emergency response equipment.
- Design is conceptual: minor and incidental costs up to and including aspects such as a physical space for the central system at the DGR are included in "Allowance".
- Weather conditions on roads used for travel to and from the DGR will be monitored 12 hours ahead of planned shipments.

- Includes GPS system access fee for 32 years (years 24 to 55)
- Pricing for commercial off-the-shelf items verbally confirmed with vendors in the Toronto region by PDD, November 2009 to April 2010. Pricing representative for most of Ontario and in current (2010) dollars.
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 24 Finish Year: 55 Duration: 32 year(s) WBS Type: Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$180,400	$1,929,900	$1,818,944	$3,929,244	15%	$4,518,631

WBS Specific Supporting Documentation:
ID 10, 71 Satellite Phone Security From Globalstar.pdf
Multi Element Supporting Documentation:
RC DETS Base Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

28-Apr-2010 3:27:36 PM WEDS ID # 1114

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	28-Apr-2010

WBS Case: 660 ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)

WBS Number: 660.40.40.20 Equipment for IFTC Transportation Logistics for Emergency Response

WBS Description:

The development, procurement, testing and commissioning of the Emergency Response System, including:
- Development of specifications for the Emergency Response System
- Preparation of tendering documentation and issue of Requests for Proposals (RFPs)
- Selection of design/build contractors
- Placing of orders/letting of contracts
- Review of design/build contractor engineering documentation & engineering drawings
- Supervision/inspection of equipment installation
- Preparation, supervision and performance of tests and commissioning

WBS Deliverable:

- Complete system design for the Emergency Response System
- Emergency means designed to protect and/ or recover one element of the transportation system in the event of incident or accident.
- Crisis center located at the DGR and fully equipped with communication means (interface with Vehicle Tracking System, telephones, teleconference system, etc.)

Emergency Response Equipment Located at DGR:
- 100 ton portable crane, max. speed 85km/hr
- IFTC Transport Vehicle Tractor (not counted as part of operating fleet)
- IFTC Transport Vehicle Trailer (weather cover, frame, turning light, etc) (not counted as part of operating fleet)
- Impact Limiters (not counted as part of operating fleet)
- Escort Vehicle (not counted as part of operating fleet)
- Lifting Beam for IFTC Transport Cask
- Lifting Beam for Impact limiter of the IFTC
- Misc. Equipment

Emergency Response Equipment Located at Bruce:
- Lifting Beam for IFTC Transport Cask
- Lifting Beam for Impact limiter of the IFTC
- Misc. Equipment

Emergency Response Equipment Located at Darlington:
- Lifting Beam for IFTC Transport Cask
- Lifting Beam for Impact limiter of the IFTC
- Misc. Equipment

Emergency Response Equipment Located at Gentilly:
- Lifting Beam for IFTC Transport Cask
- Lifting Beam for Impact limiter of the IFTC
- Misc. Equipment

WBS Assumptions:

- Crisis Centre for Emergency Response will be combined with Communication Centre for Real Time Tracking (see 660.40.40.20, Equipment for IFTC Transportation Logistics for Emergency Response) to form one Communication and Crisis Centre at DGR, fully equipped with communication equipment and emergency response equipment.
- Three sites (Bruce, Darlington and Gentilly) have been chosen along the transportation route to house extra handling

equipment. This equipment can be used with an available IFTC Transport Vehicle and Escort and with local contracted portable crane if deemed necessary.
- Working areas at Bruce, Darlington and Gentilly are assumed to be provided by Owners at no cost to Project.
- Design is conceptual: minor and incidental costs up to and including aspects such as housing/designation of the central system at the DGR and related staging areas at Bruce, Darlington and Gentilly are included in "Allowance".
- Pricing for commercial off-the-shelf items verbally confirmed with vendors in the Toronto region by PDD, November 2009 to April 2010. Pricing representative for most of Ontario and in current (2010) dollars.
- Pricing for custom equipment based on recent (2000 to 2010) PDD project data, adjusted by PDD for unique requirements, location and current dollars using professional judgement.
- Pricing for specialty items identified by Cogema (2003) adjusted for new requirements, location and current dollars by PDD using professional judgement.
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 24 Finish Year: 25 Duration: 2 year(s) WBS Type: Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$360,800	$2,116,000		$2,476,800	15%	$2,848,320

WBS Specific Supporting Documentation:
ID 54 100 ton portable crane 3900_001-GMK4115Cost.pdf
ID 54 100 ton portable crane GMK4100B_PG.pdf
Multi Element Supporting Documentation:
RC DETS Base Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1031

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 17-Feb-2010

WBS Case: 660 ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)
WBS Number: 660.50.10 PROJECT MANAGEMENT

WBS Description:

Management of UFTS components and reporting on the project's progress to Program Management, including:
- Preparation of project management documentation.
- Interfacing with engineering, procurement, operations and contractors to ensure that milestones are obtained as planned.
- Project Close Out

WBS Deliverable:

Management of UFTS components and reporting on the project's progress to Program Management, including:
- Project management documentation (Project Charters, Project Execution Plans, Business Case Summaries, Release Quality Estimates, Scope Sheets, Change Control Forms and Schedules),
- Approved project schedules and information on the project costs throughout its duration.
- Regular Project Meetings to discuss schedule, project status, issues, and cash flows.
- Reporting to Program Management on the project's progress.

WBS Assumptions:

- Project management is carried out by a core team including a project manager, a scheduler/cost controller, and a contract administrator. Additional roles include co-ordinators for current storage types (DSC, Wet Bay, silo/CANSTOR), administrative assistant(s), quality assurance/control staff and legal assistance.
- See labour costs for detailed hours/FTEs
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

15% covers consumables and incidentals

Start Year: 16 Finish Year: 25 Duration: 10 year(s) WBS Type: Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$16,069,893			$16,069,893	15%	$18,480,377

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Base Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1032

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 17-Feb-2010

WBS Case: 660 ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)
WBS Number: 660.50.20.10 IFTC Transport Cask Loading non-Site-Specific

WBS Description:

Assess the IFTC Transportation Cask Loading Mock-ups at Transfer Facilities (Hot Cells) and designated Transfer Areas (Transfer Plates).

WBS Deliverable:

- Completion of IFTC Transport Cask Loading Mock-ups at owner Reactor Storage Facilities (non-Site Specific).

WBS Assumptions:

- This cost element allows for minor centralized effort not directly attributable to individual sites.
- Approx. one full-time staff assigned over six-year period.
- Site-specific loading mock-ups at each Reactor Storage Facility are accounted for per facility; the equipment used for the mock-ups will be the same equipment subsequently used for IFTC Loading.
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 24 Finish Year: 25 Duration: 2 year(s) WBS Type: Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$360,800			$360,800	15%	$414,920

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Base Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1033

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	17-Feb-2010

WBS Case:	660	ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)
WBS Number:	660.50.20.20	IFTC Transport Cask Loading Whiteshell

WBS Description:

The loading of used fuel into IFTC Transport Casks and pre-shipment preparation of the IFTC for Whiteshell, including:
- Loading of IFTC Transfer Plate onto IFTC
- Placing of owner's Transfer Flask onto the IFTC Transfer Plate
- Loading of fuel modules from owner's Transfer Flask into the IFTC Transport Cask
- Pre-shipment preparation of IFTC Transport Cask
- Loading of the IFTC Impact Limiter onto IFTC Transport Cask

WBS Deliverable:

- Loaded IFTCs with Impact Limiters in secure area ready for transfer to trailer and subsequent road transport.

Loading of used fuel into IFTC Transport Casks and pre-shipment preparation of IFTCs includes:

Preparation of IFTC Transport Cask
- Take IFTC Transport Cask from secure storage or trailer
- Transfer IFTC Transport Cask to Transfer Area
- Remove IFTC Impact Limiter Bolts
- Remove IFTC Impact Limiter
- Remove IFTC Transport Cask Lid Bolts
- Remove IFTC Transport Cask Lid
- Place IFTC Transfer Plate
- Inspect IFTC Transport Cask

Transfer of used fuel modules into IFTC Transport Cask (repeated twice, one module per transfer)
- Place Owner's Transfer Flask on IFTC Transfer Plate
- Open Owner's Transfer Flask Slide
- Lower fuel module from owner's Transfer Flask into IFTC Cask
- Inspect IFTC/M Transport Cask ("IFTC/M" denotes loaded IFTC)
- Remove Owner's Transfer Flask from IFTC Transfer Plate

Closing of IFTC/M Transport Cask
- Inspect IFTC/M Transport Cask
- Remove IFTC Transfer Plate
- Place Lid on IFTC/M Transport Cask
- Attach IFTC Transport Cask Lid Bolts
- Decontaminate IFTC/M Transport Cask
- Carry out Smear Test for decontamination
- Carry out air pressure decay (seal) test

Placement of IFTC Impact Limiter on filled IFTC/M Transport Cask
- Identify IFTC Impact Limiter in secure storage
- Carry out pre-loading inspection of filled IFTC/M Transport Cask
- Transfer IFTC Impact Limiter from Storage
- Carry out pre-loading inspection of IFTC Impact Limiter
- Place IFTC Transport Cask Impact Limiter onto IFTC/M Transport Cask
- Attach IFTC Impact Limiter Bolts

- Carry out Smear Test
- Verify/complete security and safeguard seals

WBS Assumptions:

Costs based on number of Used Fuel Bundles and Shipments
- Number of bundles = 360
- Number of shipments = 2

- Owner bears all costs to prepare and provide loaded transfer cask with fuel in modules for IFTC loading, as well as all costs related to transfer cask management, repeated use and eventual decommissioning.
- Estimate based on 42 labour hours per transfer-plate-based loading operation.
- Minor incidentals, including working area services, consumables, conventional and radiological waste handling, etc., accommodated in "Allowance".
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 51 Finish Year: 51 Duration: 1 year(s) WBS Type: Variable

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$6,637			$6,637	15%	$7,632

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Base Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1034

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	17-Feb-2010

WBS Case:	660	ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)
WBS Number:	660.50.20.30	IFTC Transport Cask Loading at Bruce

WBS Description:

The loading of used fuel into IFTC Transport Casks, pre-shipment preparation of the IFTC and placement in Shipment Area for Bruce, including:
- Loading of used fuel from owner's Cask into the IFTC Transport Cask in a Hot Cell
- Pre-shipment preparation of IFTC Transport Cask
- Internal transfer of the loaded IFTC Transport Cask to Shipment Area
- Loading of the IFTC Impact Limiter onto IFTC Transport Cask

WBS Deliverable:

- Loaded IFTCs with Impact Limiters in Shipment Area ready for transfer to trailer and subsequent road transport.

Loading of used fuel into IFTC Transport Casks and pre-shipment preparation of IFTCs includes:

Preparation of Owner's Cask with fuel in modules (not considered part of this study)

Preparation of IFTC Transport Cask
- Identify IFTC Transport Cask in secure storage or Shipment Area
- Remove IFTC Impact Limiter Bolts
- Remove IFTC Impact Limiter
- Transfer IFTC Transport Cask from Storage
- Transfer IFTC Transport Cask to Hot Cell Loading Pit
- Remove IFTC Transport Cask Lid Bolts
- Transfer IFTC under Hot Cell Docking Gate
- Insert IFTC into Docking Gate
- Remove IFTC Lid
- Inspect IFTC Transport Cask

Removal of Owner's cask from Hot Cell (not considered part of this study)

Transfer of used fuel to IFTC Transport Cask and transfer of loaded IFTC Transport Cask to Shipment Area.
- Unload modules from Owner's Cask
- Load modules into IFTC Transport Cask
- Inspect IFTC/M Transport Cask ("IFTC/M" denotes loaded IFTC)
- Place Lid on IFTC/M Transport Cask
- Lower IFTC/M Transport Cask from Hot Cell
- Shuttle IFTC/M Transport Cask to Loading Pit
- Attach IFTC Lid Bolts
- Decontaminate IFTC/M Transport Cask
- Carry out Smear Test
- Transfer IFTC/M Transport Cask from Hot Cell Pit
- Carry out air pressure decay (seal) test
- Transfer IFTC/M Transport Cask to Shipment Area

Placement of IFTC Impact Limiter on filled IFTC/M Transport Cask
- Identify IFTC Impact Limiter in secure storage
- Identify Filled IFTC/M Transport Cask in Shipment Area

- Carry out pre-loading inspection of filled IFTC/M Transport Cask
- Transfer IFTC Impact Limiter from Storage
- Carry out pre-loading inspection of IFTC Impact Limiter
- Place IFTC Transport Cask Impact Limiter onto IFTC/M Transport Cask
- Attach IFTC Impact Limiter Bolts
- Carry out Smear Test
- Verify/complete security and safeguard seals

WBS Assumptions:

Costs based on number of Used Fuel Bundles and Shipments
- Number of bundles = 1,524,545
- Number of shipments = 7,942

- Owner bears all costs to prepare and provide loaded cask with fuel in modules for IFTC loading, as well as all costs related to owner's cask management, repeated use and eventual decommissioning.
- Estimate based on 39 labour hours per Hot-Cell-based loading operation.
- Minor incidentals, including working area services, consumables, conventional and radiological waste handling, etc., accommodated in "Allowance".
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 26 Finish Year: 55 Duration: 30 year(s) WBS Type: Variable

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$24,472,399			$24,472,399	15%	$28,143,259

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Base Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1035

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	17-Feb-2010

WBS Case:	660	ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)
WBS Number:	660.50.20.40	IFTC Transport Cask Loading at Pickering

WBS Description:

The loading of used fuel into IFTC Transport Casks, pre-shipment preparation of the IFTC and placement in Shipment Area for Pickering, including:
- Loading of used fuel from owner's Cask into the IFTC Transport Cask in a Hot Cell
- Pre-shipment preparation of IFTC Transport Cask
- Internal transfer of the loaded IFTC Transport Cask to Shipment Area
- Loading of the IFTC Impact Limiter onto IFTC Transport Cask

WBS Deliverable:

- Loaded IFTCs with Impact Limiters in Shipment Area ready for transfer to trailer and subsequent road transport.

Loading of used fuel into IFTC Transport Casks and pre-shipment preparation of IFTCs includes:

Preparation of Owner's Cask with fuel in modules (not considered part of this study)

Preparation of IFTC Transport Cask
- Identify IFTC Transport Cask in secure storage or Shipment Area
- Remove IFTC Impact Limiter Bolts
- Remove IFTC Impact Limiter
- Transfer IFTC Transport Cask from Storage
- Transfer IFTC Transport Cask to Hot Cell Loading Pit
- Remove IFTC Transport Cask Lid Bolts
- Transfer IFTC under Hot Cell Docking Gate
- Insert IFTC into Docking Gate
- Remove IFTC Lid
- Inspect IFTC Transport Cask

Removal of Owner's cask from Hot Cell (not considered part of this study)

Transfer of used fuel to IFTC Transport Cask and transfer of loaded IFTC Transport Cask to Shipment Area.
- Unload modules from Owner's Cask
- Load modules into IFTC Transport Cask
- Inspect IFTC/M Transport Cask ("IFTC/M" denotes loaded IFTC)
- Place Lid on IFTC/M Transport Cask
- Lower IFTC/M Transport Cask from Hot Cell
- Shuttle IFTC/M Transport Cask to Loading Pit
- Attach IFTC Lid Bolts
- Decontaminate IFTC/M Transport Cask
- Carry out Smear Test
- Transfer IFTC/M Transport Cask from Hot Cell Pit
- Carry out air pressure decay (seal) test
- Transfer IFTC/M Transport Cask to Shipment Area

Placement of IFTC Impact Limiter on filled IFTC/M Transport Cask
- Identify IFTC Impact Limiter in secure storage
- Identify Filled IFTC/M Transport Cask in Shipment Area

- Carry out pre-loading inspection of filled IFTC/M Transport Cask
- Transfer IFTC Impact Limiter from Storage
- Carry out pre-loading inspection of IFTC Impact Limiter
- Place IFTC Transport Cask Impact Limiter onto IFTC/M Transport Cask
- Attach IFTC Impact Limiter Bolts
- Carry out Smear Test
- Verify/complete security and safeguard seals

WBS Assumptions:

Costs based on number of Used Fuel Bundles and Shipments
- Number of bundles = 856,113
- Number of shipments = 4,461

- Owner bears all costs to prepare and provide loaded cask with fuel in modules for IFTC loading, as well as all costs related to owner's cask management, repeated use and eventual decommissioning.
- Estimate based on 39 labour hours per Hot-Cell-based loading operation.
- Minor incidentals, including working area services, consumables, conventional and radiological waste handling, etc., accommodated in "Allowance".
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 26 Finish Year: 55 Duration: 30 year(s) WBS Type: Variable

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$13,746,081			$13,746,081	15%	$15,807,993

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Base Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1036

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	17-Feb-2010

WBS Case:	660	ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)
WBS Number:	660.50.20.50	IFTC Transport Cask Loading at Darlington

WBS Description:

The loading of used fuel into IFTC Transport Casks, pre-shipment preparation of the IFTC and placement in Shipment Area for Darlington, including:
- Loading of used fuel from owner's Cask into the IFTC Transport Cask in a Hot Cell
- Pre-shipment preparation of IFTC Transport Cask
- Internal transfer of the loaded IFTC Transport Cask to Shipment Area
- Loading of the IFTC Impact Limiter onto IFTC Transport Cask

WBS Deliverable:

- Loaded IFTCs with Impact Limiters in Shipment Area ready for transfer to trailer and subsequent road transport.

Loading of used fuel into IFTC Transport Casks and pre-shipment preparation of IFTCs includes:

Preparation of Owner's Cask with fuel in modules (not considered part of this study)

Preparation of IFTC Transport Cask
- Identify IFTC Transport Cask in secure storage or Shipment Area
- Remove IFTC Impact Limiter Bolts
- Remove IFTC Impact Limiter
- Transfer IFTC Transport Cask from Storage
- Transfer IFTC Transport Cask to Hot Cell Loading Pit
- Remove IFTC Transport Cask Lid Bolts
- Transfer IFTC under Hot Cell Docking Gate
- Insert IFTC into Docking Gate
- Remove IFTC Lid
- Inspect IFTC Transport Cask

Removal of Owner's cask from Hot Cell (not considered part of this study)

Transfer of used fuel to IFTC Transport Cask and transfer of loaded IFTC Transport Cask to Shipment Area.
- Unload modules from Owner's Cask
- Load modules into IFTC Transport Cask
- Inspect IFTC/M Transport Cask ("IFTC/M" denotes loaded IFTC)
- Place Lid on IFTC/M Transport Cask
- Lower IFTC/M Transport Cask from Hot Cell
- Shuttle IFTC/M Transport Cask to Loading Pit
- Attach IFTC Lid Bolts
- Decontaminate IFTC/M Transport Cask
- Carry out Smear Test
- Transfer IFTC/M Transport Cask from Hot Cell Pit
- Carry out air pressure decay (seal) test
- Transfer IFTC/M Transport Cask to Shipment Area

Placement of IFTC Impact Limiter on filled IFTC/M Transport Cask
- Identify IFTC Impact Limiter in secure storage
- Identify Filled IFTC/M Transport Cask in Shipment Area

- Carry out pre-loading inspection of filled IFTC/M Transport Cask
- Transfer IFTC Impact Limiter from Storage
- Carry out pre-loading inspection of IFTC Impact Limiter
- Place IFTC Transport Cask Impact Limiter onto IFTC/M Transport Cask
- Attach IFTC Impact Limiter Bolts
- Carry out Smear Test
- Verify/complete security and safeguard seals

WBS Assumptions:

Costs based on number of Used Fuel Bundles and Shipments
- Number of bundles = 891,482
- Number of shipments = 4,644

- Owner bears all costs to prepare and provide loaded cask with fuel in modules for IFTC loading, as well as all costs related to owner's cask management, repeated use and eventual decommissioning.
- Estimate based on 39 labour hours per Hot-Cell-based loading operation.
- Minor incidentals, including working area services, consumables, conventional and radiological waste handling, etc., accommodated in "Allowance".
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 26 Finish Year: 55 Duration: 30 year(s) WBS Type: Variable

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$14,309,975			$14,309,975	15%	$16,456,471

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Base Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1037

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	17-Feb-2010

WBS Case:	660	ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)
WBS Number:	660.50.20.60	IFTC Transport Cask Loading at Point Lepreau

WBS Description:

The loading of used fuel into IFTC Transport Casks, pre-shipment preparation of the IFTC and placement in Shipment Area for Point Lepreau, including:
- Loading of used fuel from owner's Cask into the IFTC Transport Cask in a Hot Cell
- Pre-shipment preparation of IFTC Transport Cask
- Internal transfer of the loaded IFTC Transport Cask to Shipment Area
- Loading of the IFTC Impact Limiter onto IFTC Transport Cask

WBS Deliverable:

- Loaded IFTCs with Impact Limiters in Shipment Area ready for transfer to trailer and subsequent road transport.

Loading of used fuel into IFTC Transport Casks and pre-shipment preparation of IFTCs includes:

Preparation of Owner's Cask with fuel in modules (not considered part of this study)

Preparation of IFTC Transport Cask
- Identify IFTC Transport Cask in secure storage or Shipment Area
- Remove IFTC Impact Limiter Bolts
- Remove IFTC Impact Limiter
- Transfer IFTC Transport Cask from Storage
- Transfer IFTC Transport Cask to Hot Cell Loading Pit
- Remove IFTC Transport Cask Lid Bolts
- Transfer IFTC under Hot Cell Docking Gate
- Insert IFTC into Docking Gate
- Remove IFTC Lid
- Inspect IFTC Transport Cask

Removal of Owner's cask from Hot Cell (not considered part of this study)

Transfer of used fuel to IFTC Transport Cask and transfer of loaded IFTC Transport Cask to Shipment Area.
- Unload modules from Owner's Cask
- Load modules into IFTC Transport Cask
- Inspect IFTC/M Transport Cask ("IFTC/M" denotes loaded IFTC)
- Place Lid on IFTC/M Transport Cask
- Lower IFTC/M Transport Cask from Hot Cell
- Shuttle IFTC/M Transport Cask to Loading Pit
- Attach IFTC Lid Bolts
- Decontaminate IFTC/M Transport Cask
- Carry out Smear Test
- Transfer IFTC/M Transport Cask from Hot Cell Pit
- Carry out air pressure decay (seal) test
- Transfer IFTC/M Transport Cask to Shipment Area

Placement of IFTC Impact Limiter on filled IFTC/M Transport Cask
- Identify IFTC Impact Limiter in secure storage
- Identify Filled IFTC/M Transport Cask in Shipment Area

- Carry out pre-loading inspection of filled IFTC/M Transport Cask
- Transfer IFTC Impact Limiter from Storage
- Carry out pre-loading inspection of IFTC Impact Limiter
- Place IFTC Transport Cask Impact Limiter onto IFTC/M Transport Cask
- Attach IFTC Impact Limiter Bolts
- Carry out Smear Test
- Verify/complete security and safeguard seals

WBS Assumptions:

Costs based on number of Used Fuel Bundles and Shipments
- Number of bundles = 121,758
- Number of shipments = 636

- Owner bears all costs to prepare and provide loaded cask with fuel in modules for IFTC loading, as well as all costs related to owner's cask management, repeated use and eventual decommissioning.
- Estimate based on 39 labour hours per Hot-Cell-based loading operation.
- Minor incidentals, including working area services, consumables, conventional and radiological waste handling, etc., accommodated in "Allowance".
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 41 Finish Year: 55 Duration: 15 year(s) WBS Type: Variable

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$1,959,764			$1,959,764	15%	$2,253,729

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Base Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1038

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	17-Feb-2010

WBS Case:	660	ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)
WBS Number:	660.50.20.70	IFTC Transport Cask Loading at Chalk River

WBS Description:

The loading of used fuel into IFTC Transport Casks and pre-shipment preparation of the IFTC for Chalk River, including:
- Loading of IFTC Transfer Plate onto IFTC
- Placing of owner's Transfer Flask onto the IFTC Transfer Plate
- Loading of fuel modules from owner's Transfer Flask into the IFTC Transport Cask
- Pre-shipment preparation of IFTC Transport Cask
- Loading of the IFTC Impact Limiter onto IFTC Transport Cask

WBS Deliverable:

- Loaded IFTCs with Impact Limiters in secure area ready for transfer to trailer and subsequent road transport.

Loading of used fuel into IFTC Transport Casks and pre-shipment preparation of IFTCs includes:

Preparation of IFTC Transport Cask
- Take IFTC Transport Cask from secure storage or trailer
- Transfer IFTC Transport Cask to Transfer Area
- Remove IFTC Impact Limiter Bolts
- Remove IFTC Impact Limiter
- Remove IFTC Transport Cask Lid Bolts
- Remove IFTC Transport Cask Lid
- Place IFTC Transfer Plate
- Inspect IFTC Transport Cask

Transfer of used fuel modules into IFTC Transport Cask (repeated twice, one module per transfer)
- Place Owner's Transfer Flask on IFTC Transfer Plate
- Open Owner's Transfer Flask Slide
- Lower fuel module from owner's Transfer Flask into IFTC Cask
- Inspect IFTC/M Transport Cask ("IFTC/M" denotes loaded IFTC)
- Remove Owner's Transfer Flask from IFTC Transfer Plate

Closing of IFTC/M Transport Cask
- Inspect IFTC/M Transport Cask
- Remove IFTC Transfer Plate
- Place Lid on IFTC/M Transport Cask
- Attach IFTC Transport Cask Lid Bolts
- Decontaminate IFTC/M Transport Cask
- Carry out Smear Test for decontamination
- Carry out air pressure decay (seal) test

Placement of IFTC Impact Limiter on filled IFTC/M Transport Cask
- Identify IFTC Impact Limiter in secure storage
- Carry out pre-loading inspection of filled IFTC/M Transport Cask
- Transfer IFTC Impact Limiter from Storage
- Carry out pre-loading inspection of IFTC Impact Limiter
- Place IFTC Transport Cask Impact Limiter onto IFTC/M Transport Cask
- Attach IFTC Impact Limiter Bolts

- Carry out Smear Test
- Verify/complete security and safeguard seals

WBS Assumptions:

Costs based on number of Used Fuel Bundles and Shipments
- Number of bundles = 4,886
- Number of shipments = 27

- Owner bears all costs to prepare and provide loaded transfer cask with fuel in modules for IFTC loading, as well as all costs related to transfer cask management, repeated use and eventual decommissioning.
- Estimate based on 42 labour hours per transfer-plate-based loading operation.
- Minor incidentals, including working area services, consumables, conventional and radiological waste handling, etc., accommodated in "Allowance".
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 52 Finish Year: 55 Duration: 4 year(s) WBS Type: Variable

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$89,597			$89,597	15%	$103,037

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Base Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1039

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	17-Feb-2010

WBS Case:	660	ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)
WBS Number:	660.50.20.80	IFTC Transport Cask Loading at Gentilly 1

WBS Description:

The loading of used fuel into IFTC Transport Casks, pre-shipment preparation of the IFTC and placement in Shipment Area for Gentilly 1, including:
- Loading of used fuel from owner's Cask into the IFTC Transport Cask in a Hot Cell
- Pre-shipment preparation of IFTC Transport Cask
- Internal transfer of the loaded IFTC Transport Cask to Shipment Area
- Loading of the IFTC Impact Limiter onto IFTC Transport Cask

WBS Deliverable:

- Loaded IFTCs with Impact Limiters in Shipment Area ready for transfer to trailer and subsequent road transport.

Loading of used fuel into IFTC Transport Casks and pre-shipment preparation of IFTCs includes:

Preparation of Owner's Cask with fuel in modules (not considered part of this study)

Preparation of IFTC Transport Cask
- Identify IFTC Transport Cask in secure storage or Shipment Area
- Remove IFTC Impact Limiter Bolts
- Remove IFTC Impact Limiter
- Transfer IFTC Transport Cask from Storage
- Transfer IFTC Transport Cask to Hot Cell Loading Pit
- Remove IFTC Transport Cask Lid Bolts
- Transfer IFTC under Hot Cell Docking Gate
- Insert IFTC into Docking Gate
- Remove IFTC Lid
- Inspect IFTC Transport Cask

Removal of Owner's cask from Hot Cell (not considered part of this study)

Transfer of used fuel to IFTC Transport Cask and transfer of loaded IFTC Transport Cask to Shipment Area.
- Unload modules from Owner's Cask
- Load modules into IFTC Transport Cask
- Inspect IFTC/M Transport Cask ("IFTC/M" denotes loaded IFTC)
- Place Lid on IFTC/M Transport Cask
- Lower IFTC/M Transport Cask from Hot Cell
- Shuttle IFTC/M Transport Cask to Loading Pit
- Attach IFTC Lid Bolts
- Decontaminate IFTC/M Transport Cask
- Carry out Smear Test
- Transfer IFTC/M Transport Cask from Hot Cell Pit
- Carry out air pressure decay (seal) test
- Transfer IFTC/M Transport Cask to Shipment Area

Placement of IFTC Impact Limiter on filled IFTC/M Transport Cask
- Identify IFTC Impact Limiter in secure storage
- Identify Filled IFTC/M Transport Cask in Shipment Area

- Carry out pre-loading inspection of filled IFTC/M Transport Cask
- Transfer IFTC Impact Limiter from Storage
- Carry out pre-loading inspection of IFTC Impact Limiter
- Place IFTC Transport Cask Impact Limiter onto IFTC/M Transport Cask
- Attach IFTC Impact Limiter Bolts
- Carry out Smear Test
- Verify/complete security and safeguard seals

WBS Assumptions:

Costs based on number of Used Fuel Bundles and Shipments
- Number of bundles = 3,213
- Number of shipments = 18

- Owner bears all costs to prepare and provide loaded cask with fuel in modules for IFTC loading, as well as all costs related to owner's cask management, repeated use and eventual decommissioning.
- Estimate based on 39 labour hours per Hot-Cell-based loading operation.
- Minor incidentals, including working area services, consumables, conventional and radiological waste handling, etc., accommodated in "Allowance".
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 52 Finish Year: 55 Duration: 4 year(s) WBS Type: Variable

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$55,465			$55,465	15%	$63,785

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Base Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1040

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	17-Feb-2010

WBS Case:	660	ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)
WBS Number:	660.50.20.90	IFTC Transport Cask Loading at Gentilly 2

WBS Description:

The loading of used fuel into IFTC Transport Casks, pre-shipment preparation of the IFTC and placement in Shipment Area for Gentilly 2, including:
- Loading of used fuel from owner's Cask into the IFTC Transport Cask in a Hot Cell
- Pre-shipment preparation of IFTC Transport Cask
- Internal transfer of the loaded IFTC Transport Cask to Shipment Area
- Loading of the IFTC Impact Limiter onto IFTC Transport Cask

WBS Deliverable:

- Loaded IFTCs with Impact Limiters in Shipment Area ready for transfer to trailer and subsequent road transport.

Loading of used fuel into IFTC Transport Casks and pre-shipment preparation of IFTCs includes:

Preparation of Owner's Cask with fuel in modules (not considered part of this study)

Preparation of IFTC Transport Cask
- Identify IFTC Transport Cask in secure storage or Shipment Area
- Remove IFTC Impact Limiter Bolts
- Remove IFTC Impact Limiter
- Transfer IFTC Transport Cask from Storage
- Transfer IFTC Transport Cask to Hot Cell Loading Pit
- Remove IFTC Transport Cask Lid Bolts
- Transfer IFTC under Hot Cell Docking Gate
- Insert IFTC into Docking Gate
- Remove IFTC Lid
- Inspect IFTC Transport Cask

Removal of Owner's cask from Hot Cell (not considered part of this study)

Transfer of used fuel to IFTC Transport Cask and transfer of loaded IFTC Transport Cask to Shipment Area.
- Unload modules from Owner's Cask
- Load modules into IFTC Transport Cask
- Inspect IFTC/M Transport Cask ("IFTC/M" denotes loaded IFTC)
- Place Lid on IFTC/M Transport Cask
- Lower IFTC/M Transport Cask from Hot Cell
- Shuttle IFTC/M Transport Cask to Loading Pit
- Attach IFTC Lid Bolts
- Decontaminate IFTC/M Transport Cask
- Carry out Smear Test
- Transfer IFTC/M Transport Cask from Hot Cell Pit
- Carry out air pressure decay (seal) test
- Transfer IFTC/M Transport Cask to Shipment Area

Placement of IFTC Impact Limiter on filled IFTC/M Transport Cask
- Identify IFTC Impact Limiter in secure storage
- Identify Filled IFTC/M Transport Cask in Shipment Area

- Carry out pre-loading inspection of filled IFTC/M Transport Cask
- Transfer IFTC Impact Limiter from Storage
- Carry out pre-loading inspection of IFTC Impact Limiter
- Place IFTC Transport Cask Impact Limiter onto IFTC/M Transport Cask
- Attach IFTC Impact Limiter Bolts
- Carry out Smear Test
- Verify/complete security and safeguard seals

WBS Assumptions:

Costs based on number of Used Fuel Bundles and Shipments
- Number of bundles = 132,838
- Number of shipments = 697

- Owner bears all costs to prepare and provide loaded cask with fuel in modules for IFTC loading, as well as all costs related to owner's cask management, repeated use and eventual decommissioning.
- Estimate based on 39 labour hours per Hot-Cell-based loading operation.
- Minor incidentals, including working area services, consumables, conventional and radiological waste handling, etc., accommodated in "Allowance".
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 41 Finish Year: 55 Duration: 15 year(s) WBS Type: Variable

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$2,147,729			$2,147,729	15%	$2,469,888

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Base Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1041

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	17-Feb-2010

WBS Case:	660	ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)
WBS Number:	660.50.20.100	IFTC Transport Cask Loading Douglas Point

WBS Description:

The loading of used fuel into IFTC Transport Casks, pre-shipment preparation of the IFTC and placement in Shipment Area for Douglas Point, including:
- Loading of used fuel from owner's Cask into the IFTC Transport Cask in a Hot Cell
- Pre-shipment preparation of IFTC Transport Cask
- Internal transfer of the loaded IFTC Transport Cask to Shipment Area
- Loading of the IFTC Impact Limiter onto IFTC Transport Cask

WBS Deliverable:

- Loaded IFTCs with Impact Limiters in Shipment Area ready for transfer to trailer and subsequent road transport.

Loading of used fuel into IFTC Transport Casks and pre-shipment preparation of IFTCs includes:

Preparation of Owner's Cask with fuel in modules (not considered part of this study)

Preparation of IFTC Transport Cask
- Identify IFTC Transport Cask in secure storage or Shipment Area
- Remove IFTC Impact Limiter Bolts
- Remove IFTC Impact Limiter
- Transfer IFTC Transport Cask from Storage
- Transfer IFTC Transport Cask to Hot Cell Loading Pit
- Remove IFTC Transport Cask Lid Bolts
- Transfer IFTC under Hot Cell Docking Gate
- Insert IFTC into Docking Gate
- Remove IFTC Lid
- Inspect IFTC Transport Cask

Removal of Owner's cask from Hot Cell (not considered part of this study)

Transfer of used fuel to IFTC Transport Cask and transfer of loaded IFTC Transport Cask to Shipment Area.
- Unload modules from Owner's Cask
- Load modules into IFTC Transport Cask
- Inspect IFTC/M Transport Cask ("IFTC/M" denotes loaded IFTC)
- Place Lid on IFTC/M Transport Cask
- Lower IFTC/M Transport Cask from Hot Cell
- Shuttle IFTC/M Transport Cask to Loading Pit
- Attach IFTC Lid Bolts
- Decontaminate IFTC/M Transport Cask
- Carry out Smear Test
- Transfer IFTC/M Transport Cask from Hot Cell Pit
- Carry out air pressure decay (seal) test
- Transfer IFTC/M Transport Cask to Shipment Area

Placement of IFTC Impact Limiter on filled IFTC/M Transport Cask
- Identify IFTC Impact Limiter in secure storage
- Identify Filled IFTC/M Transport Cask in Shipment Area

- Carry out pre-loading inspection of filled IFTC/M Transport Cask
- Transfer IFTC Impact Limiter from Storage
- Carry out pre-loading inspection of IFTC Impact Limiter
- Place IFTC Transport Cask Impact Limiter onto IFTC/M Transport Cask
- Attach IFTC Impact Limiter Bolts
- Carry out Smear Test
- Verify/complete security and safeguard seals

WBS Assumptions:

Costs based on number of Used Fuel Bundles and Shipments
- Number of bundles = 22,256
- Number of shipments = 124

- Owner bears all costs to prepare and provide loaded cask with fuel in modules for IFTC loading, as well as all costs related to owner's cask management, repeated use and eventual decommissioning.
- Estimate based on 39 labour hours per Hot-Cell-based loading operation.
- Minor incidentals, including working area services, consumables, conventional and radiological waste handling, etc., accommodated in "Allowance".
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 41 Finish Year: 51 Duration: 11 year(s) WBS Type: Variable

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$382,061			$382,061	15%	$439,370

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Base Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1042

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 17-Feb-2010

WBS Case: 660 ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)
WBS Number: 660.50.30.10 IFTC Transportation Logistics from Whiteshell to DGR

WBS Description:

The operation of the Transportation System from Whiteshell to DGR, including:
- Loading of IFTC/M Transport Cask Assembly (filled IFTC Transport Cask and Impact Limiter) onto the IFTC Transport Vehicle Trailers
- Transportation to DGR
- Return empty IFTC Transport Cask Assembly and IFTC Transportation Vehicles to owner Reactor Storage Facility

WBS Deliverable:

- IFTC/M delivered at DGR Used Fuel Processing Plant (UFPP)
- Empty IFTC assembly delivered at reactor site

The complete operation includes:

Tractor-Trailer and Escort Vehicle Operation from the DGR to the reactor site and back

Unloading of incoming IFTC Transport Vehicle
- Identify Incoming IFTC Transport Vehicle with empty IFTC with Impact Limiter
- Open Weather Cover on IFTC Transport Vehicle
- Inspect IFTC Transport Vehicle with empty IFTC with Impact Limiter
- Conduct Smear Test, including radiological survey
- Remove Tie-Downs on IFTC with Impact Limiter
- Unload IFTC with Impact Limiter from IFTC Transport Vehicle

Preparation of IFTC Transport Vehicle
- Identify Empty IFTC Transport Vehicle
- Conduct Pre-Loading Inspection of Empty IFTC Transport Vehicle
- Position IFTC Transport Vehicle

Transfer of IFTC/M ("IFTC/M" denotes IFTC loaded with modules) Transport Cask onto IFTC Transport Vehicle
- Load IFTC/M Transport Cask and Impact Limiter on IFTC Transport Vehicle
- Attach Tie-Downs to IFTC/M Transport Cask Assembly
- Conduct Post-Loading Inspection
- Conduct Smear Test
- Close Weather Cover on IFTC Transport Vehicle
- Conduct Final inspection of IFTC Transport Vehicle
- Dispatch Loaded IFTC Transport Vehicle

WBS Assumptions:

- Distance from Whiteshell to DGR site: 1,000 km
- Number of shipments = 2
- Approx. 18.3 hr effort per shipment for vehicle prep, loading & unloading (3 person crew)
- Approx. 89 hrs effort per shipment for driving cycle (4 person crew)
- Costs based on average shipment effort. Slight variation in individual shipment effort due to, e.g., pre-loaded trailer swaps.
- Includes fuel and insurance.
- Does not include fleet maintenance - See 660.50.50 (IFTC Transportation Vehicles Maintenance)
- Does not include operation of Emergency Response System - See 660.50.40.10 (IFTC Transportation System Logistics DGR

Emergency Response)
- Does not include operation of Real-Time Tracking System - See 660.50.40.20 (IFTC Transportation System Logistics DGR Real Time Tracking)
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 51 Finish Year: 51 Duration: 1 year(s) WBS Type: Variable

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$16,956		$2,846	$19,802	15%	$22,772

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Base Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1043

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 17-Feb-2010

WBS Case: 660 ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)
WBS Number: 660.50.30.20 IFTC Transportation Logistics from Bruce to DGR

WBS Description:

The operation of the Transportation System from Bruce to DGR, including:
- Loading of IFTC/M Transport Cask Assembly (filled IFTC Transport Cask and Impact Limiter) onto the IFTC Transport Vehicle Trailers
- Transportation to DGR
- Return empty IFTC Transport Cask Assembly and IFTC Transportation Vehicles to owner Reactor Storage Facility

WBS Deliverable:

- IFTC/M delivered at DGR Used Fuel Processing Plant (UFPP)
- Empty IFTC assembly delivered at reactor site

The complete operation includes:

Tractor-Trailer and Escort Vehicle Operation from the DGR to the reactor site and back

Unloading of incoming IFTC Transport Vehicle
- Identify Incoming IFTC Transport Vehicle with empty IFTC with Impact Limiter
- Open Weather Cover on IFTC Transport Vehicle
- Inspect IFTC Transport Vehicle with empty IFTC with Impact Limiter
- Conduct Smear Test, including radiological survey
- Remove Tie-Downs on IFTC with Impact Limiter
- Unload IFTC with Impact Limiter from IFTC Transport Vehicle

Preparation of IFTC Transport Vehicle
- Identify Empty IFTC Transport Vehicle
- Conduct Pre-Loading Inspection of Empty IFTC Transport Vehicle
- Position IFTC Transport Vehicle

Transfer of IFTC/M ("IFTC/M" denotes IFTC loaded with modules) Transport Cask onto IFTC Transport Vehicle
- Load IFTC/M Transport Cask and Impact Limiter on IFTC Transport Vehicle
- Attach Tie-Downs to IFTC/M Transport Cask Assembly
- Conduct Post-Loading Inspection
- Conduct Smear Test
- Close Weather Cover on IFTC Transport Vehicle
- Conduct Final inspection of IFTC Transport Vehicle
- Dispatch Loaded IFTC Transport Vehicle

WBS Assumptions:

- Distance from Bruce A/B to DGR site: 1,000 km
- Number of shipments = 7,942
- Approx. 18.3 hr effort per shipment for vehicle prep, loading & unloading (3 person crew)
- Approx. 89 hrs effort per shipment for driving cycle (4 person crew)
- Costs based on average shipment effort. Slight variation in individual shipment effort due to, e.g., pre-loaded trailer swaps.
- Includes fuel and insurance.
- Does not include fleet maintenance - See 660.50.50 (IFTC Transportation Vehicles Maintenance)
- Does not include operation of Emergency Response System - See 660.50.40.10 (IFTC Transportation System Logistics DGR

Emergency Response)
- Does not include operation of Real-Time Tracking System - See 660.50.40.20 (IFTC Transportation System Logistics DGR Real Time Tracking)
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 26 Finish Year: 55 Duration: 30 year(s) WBS Type: Variable

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$67,330,474		$11,301,720	$78,632,194	15%	$90,427,023

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Base Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1044

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 17-Feb-2010

WBS Case: 660 ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)
WBS Number: 660.50.30.30 IFTC Transportation Logistics from Pickering to DGR

WBS Description:

The operation of the Transportation System from Pickering to DGR, including:
- Loading of IFTC/M Transport Cask Assembly (filled IFTC Transport Cask and Impact Limiter) onto the IFTC Transport Vehicle Trailers
- Transportation to DGR
- Return empty IFTC Transport Cask Assembly and IFTC Transportation Vehicles to owner Reactor Storage Facility

WBS Deliverable:

- IFTC/M delivered at DGR Used Fuel Processing Plant (UFPP)
- Empty IFTC assembly delivered at reactor site

The complete operation includes:

Tractor-Trailer and Escort Vehicle Operation from the DGR to the reactor site and back

Unloading of incoming IFTC Transport Vehicle
- Identify Incoming IFTC Transport Vehicle with empty IFTC with Impact Limiter
- Open Weather Cover on IFTC Transport Vehicle
- Inspect IFTC Transport Vehicle with empty IFTC with Impact Limiter
- Conduct Smear Test, including radiological survey
- Remove Tie-Downs on IFTC with Impact Limiter
- Unload IFTC with Impact Limiter from IFTC Transport Vehicle

Preparation of IFTC Transport Vehicle
- Identify Empty IFTC Transport Vehicle
- Conduct Pre-Loading Inspection of Empty IFTC Transport Vehicle
- Position IFTC Transport Vehicle

Transfer of IFTC/M ("IFTC/M" denotes IFTC loaded with modules) Transport Cask onto IFTC Transport Vehicle
- Load IFTC/M Transport Cask and Impact Limiter on IFTC Transport Vehicle
- Attach Tie-Downs to IFTC/M Transport Cask Assembly
- Conduct Post-Loading Inspection
- Conduct Smear Test
- Close Weather Cover on IFTC Transport Vehicle
- Conduct Final inspection of IFTC Transport Vehicle
- Dispatch Loaded IFTC Transport Vehicle

WBS Assumptions:

- Distance from Pickering A/B to DGR site: 1,000 km
- Number of shipments = 4,461
- Approx. 18.3 hr effort per shipment for vehicle prep, loading & unloading (3 person crew)
- Approx. 89 hrs effort per shipment for driving cycle (4 person crew)
- Costs based on average shipment effort. Slight variation in individual shipment effort due to, e.g., pre-loaded trailer swaps.
- Includes fuel and insurance.
- Does not include fleet maintenance - See 660.50.50 (IFTC Transportation Vehicles Maintenance)
- Does not include operation of Emergency Response System - See 660.50.40.10 (IFTC Transportation System Logistics DGR

Emergency Response)
- Does not include operation of Real-Time Tracking System - See 660.50.40.20 (IFTC Transportation System Logistics DGR Real Time Tracking)
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 26 Finish Year: 55 Duration: 30 year(s) WBS Type: Variable

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$37,819,345		$6,348,150	$44,167,495	15%	$50,792,620

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Base Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1045

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 17-Feb-2010

WBS Case: 660 ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)
WBS Number: 660.50.30.40 IFTC Transportation Logistics from Darlington to DGR

WBS Description:

The operation of the Transportation System from Darlington to DGR, including:
- Loading of IFTC/M Transport Cask Assembly (filled IFTC Transport Cask and Impact Limiter) onto the IFTC Transport Vehicle Trailers
- Transportation to DGR
- Return empty IFTC Transport Cask Assembly and IFTC Transportation Vehicles to owner Reactor Storage Facility

WBS Deliverable:

- IFTC/M delivered at DGR Used Fuel Processing Plant (UFPP)
- Empty IFTC assembly delivered at reactor site

The complete operation includes:

Tractor-Trailer and Escort Vehicle Operation from the DGR to the reactor site and back

Unloading of incoming IFTC Transport Vehicle
- Identify Incoming IFTC Transport Vehicle with empty IFTC with Impact Limiter
- Open Weather Cover on IFTC Transport Vehicle
- Inspect IFTC Transport Vehicle with empty IFTC with Impact Limiter
- Conduct Smear Test, including radiological survey
- Remove Tie-Downs on IFTC with Impact Limiter
- Unload IFTC with Impact Limiter from IFTC Transport Vehicle

Preparation of IFTC Transport Vehicle
- Identify Empty IFTC Transport Vehicle
- Conduct Pre-Loading Inspection of Empty IFTC Transport Vehicle
- Position IFTC Transport Vehicle

Transfer of IFTC/M ("IFTC/M" denotes IFTC loaded with modules) Transport Cask onto IFTC Transport Vehicle
- Load IFTC/M Transport Cask and Impact Limiter on IFTC Transport Vehicle
- Attach Tie-Downs to IFTC/M Transport Cask Assembly
- Conduct Post-Loading Inspection
- Conduct Smear Test
- Close Weather Cover on IFTC Transport Vehicle
- Conduct Final inspection of IFTC Transport Vehicle
- Dispatch Loaded IFTC Transport Vehicle

WBS Assumptions:

- Distance from Darlington to DGR site: 1,000 km
- Number of shipments = 4,644
- Approx. 18.3 hr effort per shipment for vehicle prep, loading & unloading (3 person crew)
- Approx. 89 hrs effort per shipment for driving cycle (4 person crew)
- Costs based on average shipment effort. Slight variation in individual shipment effort due to, e.g., pre-loaded trailer swaps.
- Includes fuel and insurance.
- Does not include fleet maintenance - See 660.50.50 (IFTC Transportation Vehicles Maintenance)
- Does not include operation of Emergency Response System - See 660.50.40.10 (IFTC Transportation System Logistics DGR

Emergency Response)
- Does not include operation of Real-Time Tracking System - See 660.50.40.20 (IFTC Transportation System Logistics DGR Real Time Tracking)
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 26 Finish Year: 55 Duration: 30 year(s) WBS Type: Variable

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$39,370,778		$6,608,580	$45,979,358	15%	$52,876,261

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Base Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1046

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 17-Feb-2010

WBS Case: 660 ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)
WBS Number: 660.50.30.50 IFTC Transportation Logistics from Point LePreau to DGR

WBS Description:

The operation of the Transportation System from Point Lepreau to DGR, including:
- Loading of IFTC/M Transport Cask Assembly (filled IFTC Transport Cask and Impact Limiter) onto the IFTC Transport Vehicle Trailers
- Transportation to DGR
- Return empty IFTC Transport Cask Assembly and IFTC Transportation Vehicles to owner Reactor Storage Facility

WBS Deliverable:

- IFTC/M delivered at DGR Used Fuel Processing Plant (UFPP)
- Empty IFTC assembly delivered at reactor site

The complete operation includes:

Tractor-Trailer and Escort Vehicle Operation from the DGR to the reactor site and back

Unloading of incoming IFTC Transport Vehicle
- Identify Incoming IFTC Transport Vehicle with empty IFTC with Impact Limiter
- Open Weather Cover on IFTC Transport Vehicle
- Inspect IFTC Transport Vehicle with empty IFTC with Impact Limiter
- Conduct Smear Test, including radiological survey
- Remove Tie-Downs on IFTC with Impact Limiter
- Unload IFTC with Impact Limiter from IFTC Transport Vehicle

Preparation of IFTC Transport Vehicle
- Identify Empty IFTC Transport Vehicle
- Conduct Pre-Loading Inspection of Empty IFTC Transport Vehicle
- Position IFTC Transport Vehicle

Transfer of IFTC/M ("IFTC/M" denotes IFTC loaded with modules) Transport Cask onto IFTC Transport Vehicle
- Load IFTC/M Transport Cask and Impact Limiter on IFTC Transport Vehicle
- Attach Tie-Downs to IFTC/M Transport Cask Assembly
- Conduct Post-Loading Inspection
- Conduct Smear Test
- Close Weather Cover on IFTC Transport Vehicle
- Conduct Final inspection of IFTC Transport Vehicle
- Dispatch Loaded IFTC Transport Vehicle

WBS Assumptions:

- Distance from Pt. Lepreau to DGR site: 2,500 km
- Number of shipments = 636
- Approx. 18.3 hr effort per shipment for vehicle prep, loading & unloading (3 person crew)
- Approx. 162 hr effort per shipment for driving cycle (4 person crew)
- Costs based on average shipment effort. Slight variation in individual shipment effort due to, e.g., pre-loaded trailer swaps.
- Includes fuel and insurance.
- Does not include fleet maintenance - See 660.50.50 (IFTC Transportation Vehicles Maintenance)
- Does not include operation of Emergency Response System - See 660.50.40.10 (IFTC Transportation System Logistics DGR

Emergency Response)
- Does not include operation of Real-Time Tracking System - See 660.50.40.20 (IFTC Transportation System Logistics DGR Real Time Tracking)
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 41 Finish Year: 55 Duration: 15 year(s) WBS Type: Variable

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$9,060,140		$2,262,630	$11,322,770	15%	$13,021,185

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Base Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1047

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	17-Feb-2010

WBS Case: 660 ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)

WBS Number: 660.50.30.60 IFTC Transportation Logistics from Chalk River to DGR

WBS Description:

The operation of the Transportation System from Chalk River to DGR, including:
- Loading of IFTC/M Transport Cask Assembly (filled IFTC Transport Cask and Impact Limiter) onto the IFTC Transport Vehicle Trailers
- Transportation to DGR
- Return empty IFTC Transport Cask Assembly and IFTC Transportation Vehicles to owner Reactor Storage Facility

WBS Deliverable:

- IFTC/M delivered at DGR Used Fuel Processing Plant (UFPP)
- Empty IFTC assembly delivered at reactor site

The complete operation includes:

Tractor-Trailer and Escort Vehicle Operation from the DGR to the reactor site and back

Unloading of incoming IFTC Transport Vehicle
- Identify Incoming IFTC Transport Vehicle with empty IFTC with Impact Limiter
- Open Weather Cover on IFTC Transport Vehicle
- Inspect IFTC Transport Vehicle with empty IFTC with Impact Limiter
- Conduct Smear Test, including radiological survey
- Remove Tie-Downs on IFTC with Impact Limiter
- Unload IFTC with Impact Limiter from IFTC Transport Vehicle

Preparation of IFTC Transport Vehicle
- Identify Empty IFTC Transport Vehicle
- Conduct Pre-Loading Inspection of Empty IFTC Transport Vehicle
- Position IFTC Transport Vehicle

Transfer of IFTC/M ("IFTC/M" denotes IFTC loaded with modules) Transport Cask onto IFTC Transport Vehicle
- Load IFTC/M Transport Cask and Impact Limiter on IFTC Transport Vehicle
- Attach Tie-Downs to IFTC/M Transport Cask Assembly
- Conduct Post-Loading Inspection
- Conduct Smear Test
- Close Weather Cover on IFTC Transport Vehicle
- Conduct Final inspection of IFTC Transport Vehicle
- Dispatch Loaded IFTC Transport Vehicle

WBS Assumptions:

- Distance from Chalk River to DGR site: 1,000 km
- Number of shipments = 27
- Approx. 18.3 hr effort per shipment for vehicle prep, loading & unloading (3 person crew)
- Approx. 89 hrs effort per shipment for driving cycle (4 person crew)
- Costs based on average shipment effort. Slight variation in individual shipment effort due to, e.g., pre-loaded trailer swaps.
- Includes fuel and insurance.
- Does not include fleet maintenance - See 660.50.50 (IFTC Transportation Vehicles Maintenance)
- Does not include operation of Emergency Response System - See 660.50.40.10 (IFTC Transportation System Logistics DGR

Emergency Response)
- Does not include operation of Real-Time Tracking System - See 660.50.40.20 (IFTC Transportation System Logistics DGR Real Time Tracking)
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 52 Finish Year: 55 Duration: 4 year(s) WBS Type: Variable

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$228,901		$38,420	$267,321	15%	$307,420

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Base Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1048

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	17-Feb-2010

WBS Case:	660	ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)
WBS Number:	660.50.30.70	IFTC Transportation Logistics from Gentilly 1 to DGR

WBS Description:

The operation of the Transportation System from Gentilly 1 to DGR, including:
- Loading of IFTC/M Transport Cask Assembly (filled IFTC Transport Cask and Impact Limiter) onto the IFTC Transport Vehicle Trailers
- Transportation to DGR
- Return empty IFTC Transport Cask Assembly and IFTC Transportation Vehicles to owner Reactor Storage Facility

WBS Deliverable:

- IFTC/M delivered at DGR Used Fuel Processing Plant (UFPP)
- Empty IFTC assembly delivered at reactor site

The complete operation includes:

Tractor-Trailer and Escort Vehicle Operation from the DGR to the reactor site and back

Unloading of incoming IFTC Transport Vehicle
- Identify Incoming IFTC Transport Vehicle with empty IFTC with Impact Limiter
- Open Weather Cover on IFTC Transport Vehicle
- Inspect IFTC Transport Vehicle with empty IFTC with Impact Limiter
- Conduct Smear Test, including radiological survey
- Remove Tie-Downs on IFTC with Impact Limiter
- Unload IFTC with Impact Limiter from IFTC Transport Vehicle

Preparation of IFTC Transport Vehicle
- Identify Empty IFTC Transport Vehicle
- Conduct Pre-Loading Inspection of Empty IFTC Transport Vehicle
- Position IFTC Transport Vehicle

Transfer of IFTC/M ("IFTC/M" denotes IFTC loaded with modules) Transport Cask onto IFTC Transport Vehicle
- Load IFTC/M Transport Cask and Impact Limiter on IFTC Transport Vehicle
- Attach Tie-Downs to IFTC/M Transport Cask Assembly
- Conduct Post-Loading Inspection
- Conduct Smear Test
- Close Weather Cover on IFTC Transport Vehicle
- Conduct Final inspection of IFTC Transport Vehicle
- Dispatch Loaded IFTC Transport Vehicle

WBS Assumptions:

- Distance from Gentilly 1 to DGR site: 1,500 km
- Number of shipments = 18
- Approx. 18.3 hr effort per shipment for vehicle prep, loading & unloading (3 person crew)
- Approx. 112 hr effort per shipment for driving cycle (4 person crew)
- Costs based on average shipment effort. Slight variation in individual shipment effort due to, e.g., pre-loaded trailer swaps.
- Includes fuel and insurance.
- Does not include fleet maintenance - See 660.50.50 (IFTC Transportation Vehicles Maintenance)
- Does not include operation of Emergency Response System - See 660.50.40.10 (IFTC Transportation System Logistics DGR

Emergency Response)
- Does not include operation of Real-Time Tracking System - See 660.50.40.20 (IFTC Transportation System Logistics DGR Real Time Tracking)
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 52 Finish Year: 55 Duration: 4 year(s) WBS Type: Variable

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$185,310		$38,420	$223,730	15%	$257,290

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Base Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1049

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 17-Feb-2010

WBS Case: 660 ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)
WBS Number: 660.50.30.80 IFTC Transportation Logistics from Gentilly 2 to DGR

WBS Description:

The operation of the Transportation System from Gentilly 2 to DGR, including:
- Loading of IFTC/M Transport Cask Assembly (filled IFTC Transport Cask and Impact Limiter) onto the IFTC Transport Vehicle Trailers
- Transportation to DGR
- Return empty IFTC Transport Cask Assembly and IFTC Transportation Vehicles to owner Reactor Storage Facility

WBS Deliverable:

- IFTC/M delivered at DGR Used Fuel Processing Plant (UFPP)
- Empty IFTC assembly delivered at reactor site

The complete operation includes:

Tractor-Trailer and Escort Vehicle Operation from the DGR to the reactor site and back

Unloading of incoming IFTC Transport Vehicle
- Identify Incoming IFTC Transport Vehicle with empty IFTC with Impact Limiter
- Open Weather Cover on IFTC Transport Vehicle
- Inspect IFTC Transport Vehicle with empty IFTC with Impact Limiter
- Conduct Smear Test, including radiological survey
- Remove Tie-Downs on IFTC with Impact Limiter
- Unload IFTC with Impact Limiter from IFTC Transport Vehicle

Preparation of IFTC Transport Vehicle
- Identify Empty IFTC Transport Vehicle
- Conduct Pre-Loading Inspection of Empty IFTC Transport Vehicle
- Position IFTC Transport Vehicle

Transfer of IFTC/M ("IFTC/M" denotes IFTC loaded with modules) Transport Cask onto IFTC Transport Vehicle
- Load IFTC/M Transport Cask and Impact Limiter on IFTC Transport Vehicle
- Attach Tie-Downs to IFTC/M Transport Cask Assembly
- Conduct Post-Loading Inspection
- Conduct Smear Test
- Close Weather Cover on IFTC Transport Vehicle
- Conduct Final inspection of IFTC Transport Vehicle
- Dispatch Loaded IFTC Transport Vehicle

WBS Assumptions:

- Distance from Gentilly 2 to DGR site: 1,500 km
- Number of shipments = 697
- Approx. 18.3 hr effort per shipment for vehicle prep, loading & unloading (3 person crew)
- Approx. 112 hr effort per shipment for driving cycle (4 person crew)
- Costs based on average shipment effort. Slight variation in individual shipment effort due to, e.g., pre-loaded trailer swaps.
- Includes fuel and insurance.
- Does not include fleet maintenance - See 660.50.50 (IFTC Transportation Vehicles Maintenance)
- Does not include operation of Emergency Response System - See 660.50.40.10 (IFTC Transportation System Logistics DGR

Emergency Response)
- Does not include operation of Real-Time Tracking System - See 660.50.40.20 (IFTC Transportation System Logistics DGR Real Time Tracking)
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 41 Finish Year: 55 Duration: 15 year(s) WBS Type: Variable

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$7,175,609		$1,487,775	$8,663,384	15%	$9,962,892

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Base Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1050

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 17-Feb-2010

WBS Case: 660 ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)
WBS Number: 660.50.30.90 IFTC Transportation Logistics from Douglas Point to DGR

WBS Description:

The operation of the Transportation System from Douglas Point to DGR, including:
- Loading of IFTC/M Transport Cask Assembly (filled IFTC Transport Cask and Impact Limiter) onto the IFTC Transport Vehicle Trailers
- Transportation to DGR
- Return empty IFTC Transport Cask Assembly and IFTC Transportation Vehicles to owner Reactor Storage Facility

WBS Deliverable:

- IFTC/M delivered at DGR Used Fuel Processing Plant (UFPP)
- Empty IFTC assembly delivered at reactor site

The complete operation includes:

Tractor-Trailer and Escort Vehicle Operation from the DGR to the reactor site and back

Unloading of incoming IFTC Transport Vehicle
- Identify Incoming IFTC Transport Vehicle with empty IFTC with Impact Limiter
- Open Weather Cover on IFTC Transport Vehicle
- Inspect IFTC Transport Vehicle with empty IFTC with Impact Limiter
- Conduct Smear Test, including radiological survey
- Remove Tie-Downs on IFTC with Impact Limiter
- Unload IFTC with Impact Limiter from IFTC Transport Vehicle

Preparation of IFTC Transport Vehicle
- Identify Empty IFTC Transport Vehicle
- Conduct Pre-Loading Inspection of Empty IFTC Transport Vehicle
- Position IFTC Transport Vehicle

Transfer of IFTC/M ("IFTC/M" denotes IFTC loaded with modules) Transport Cask onto IFTC Transport Vehicle
- Load IFTC/M Transport Cask and Impact Limiter on IFTC Transport Vehicle
- Attach Tie-Downs to IFTC/M Transport Cask Assembly
- Conduct Post-Loading Inspection
- Conduct Smear Test
- Close Weather Cover on IFTC Transport Vehicle
- Conduct Final inspection of IFTC Transport Vehicle
- Dispatch Loaded IFTC Transport Vehicle

WBS Assumptions:

- Distance from Douglas Point to DGR site: 1,000 km
- Number of shipments = 124
- Approx. 18.3 hr effort per shipment for vehicle prep, loading & unloading (3 person crew)
- Approx. 89 hrs effort per shipment for driving cycle (4 person crew)
- Costs based on average shipment effort. Slight variation in individual shipment effort due to, e.g., pre-loaded trailer swaps.
- Includes fuel and insurance.
- Does not include fleet maintenance - See 660.50.50 (IFTC Transportation Vehicles Maintenance)
- Does not include operation of Emergency Response System - See 660.50.40.10 (IFTC Transportation System Logistics DGR

Emergency Response)
- Does not include operation of Real-Time Tracking System - See 660.50.40.20 (IFTC Transportation System Logistics DGR Real Time Tracking)
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 41 Finish Year: 51 Duration: 11 year(s) WBS Type: Variable

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$1,051,241		$176,451	$1,227,692	15%	$1,411,845

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Base Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1051

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	17-Feb-2010

WBS Case: 660 ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)

WBS Number: 660.50.40.10.10 IFTC Transportation Logistics DGR Emergency Response

WBS Description:

The implementation and maintenance of the Emergency Response System, including communications, operations and documentation for the duration for the UFTS.

WBS Deliverable:

- An on-going Emergency Response System ready to respond to any accident or incident during the operation of the transportation system.

Operation of the Emergency Response System includes:
- Completed emergency response plan with all the necessary documentation (references to applicable regulations, emergency procedures, maps, safety files, Transport Emergency Response Plan (TERP), emergency response assistance plan (ERAP), etc.).
- Staffed emergency system ready to raise alarm, conduct situation analysis, activate response agencies, notify authorities, activate part-time personnel and deploy a recovery system for the transportation package.

When required, core staff will activate emergency response teams, such as:

Command and Decision Team:
- Logistic and technical assistance to Authorities
- Decision on proper technical means to be implemented
- Management of other teams

Technical Analysis Team:
- Estimation of the technical state of the packaging and of associated impacts
- Proposition of technical emergency and assistance solutions

Mobile Command Team:
- Implementation of command, information and expertise near the incident
- First intervention equipment (satellite communication system, radio or chemical protection, equipment, camera, and computers). (This team implements processes to minimize consequences or to bring a solution to the situation)

Communications Team:
- Preparation and development of crisis communication especially dedicated to the media situation
- Provision of a specific communication plan
- Provide incident information to regulator
- Provide information for the press and for other communication entities
- Accept information from the press

WBS Assumptions:

- One annual emergency exercise/year (600 person-hours)
- One actual emergency exercise/year (600 person-hours)
- Two full-time equivalent (FTE) technicians to maintain and operate the recovery equipment and to update the necessary documentation (~3280 hr/yr)
- Minor incidentals, including working area services, consumables, conventional and radiological waste handling, etc., accommodated in "Allowance".

- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 26 Finish Year: 55 Duration: 30 year(s) WBS Type: Variable

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$10,618,944			$10,618,944	15%	$12,211,786

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Base Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1052

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 17-Feb-2010

WBS Case: 660 ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)
WBS Number: 660.50.40.10.20 IFTC Transportation Logistics DGR Real Time Tracking

WBS Description:

The implementation and maintenance of the Real Time Tracking System for the duration of the UFTS.

WBS Deliverable:

- Secure, real-time reporting on the current position of transportation system components

Operation of the Real Time Tracking System includes:
- Real time information on IFTC Transport Cask, IFTC Transport Vehicle and Escort locations
- Provision of progress information for transport operations
- Maintaining the security of transmitted information

WBS Assumptions:

- Real Time Tracking System operates 24 hr per day, 7 days a week (8760 hrs/year)
- System uses three shifts of two controllers
- System management requires one full-time-equivalent (FTE) supervisor and one FTE administrative individual
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 26 Finish Year: 55 Duration: 30 year(s) WBS Type: Variable

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$51,057,804			$51,057,804	15%	$58,716,475

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Base Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1053

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 17-Feb-2010

WBS Case: 660 ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)
WBS Number: 660.50.50 IFTC Transportation Vehicles Maintenance

WBS Description:

IFTC Transportation Vehicle Maintenance.

WBS Deliverable:

Perform preventive maintenance of the Transportation Vehicle Trailers, Tractors and Escorts.

WBS Assumptions:

- The maintenance of the IFTC Transport Vehicles will be contracted to a third party specializing in maintenance of long haul transport vehicles.
-The maintenance cost of Transportation Vehicles is equivalent to 5% of one-time fleet procurement cost per year
-The tire replacement cost for Transportation Vehicles is equivalent to 2% one-time fleet procurement cost per year
- Every 3.5 years a complete overhaul of the IFTC Transport Vehicle Tractor and Trailers is performed
- Incidental maintenance of low-mileage non-fleet vehicles (mock-ups, emergency response fleet) accounted for under "allowance".
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 25 Finish Year: 55 Duration: 31 year(s) WBS Type: Variable

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
		$16,041,900	$16,041,900	15%	$18,448,185

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Base Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1020

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 17-Feb-2010

WBS Case: 660 ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)
WBS Number: 660.55 ENVIRONMENTAL MANAGEMENT

WBS Description:

The set-up, and monitoring, of transportation aspects within an Environmental Management System (EMS) for NWMO in accordance with ISO 14001, including:
- Auditing of supplier EMSs, and review of proposals.
- Liaison with regulators regarding environmental and other regulatory requirements.
- Assistance with transportation aspects of Environmental Assessment (EA).
- Planning of environmental monitoring activities as needed.
- Ensuring that all environmental requirements are met by transportation system equipment and facilities.

WBS Deliverable:

- Input to NWMO EMS.
- Communications with regulators.
- Plans, audits and reports as required by EMS.

WBS Assumptions:

- Work starts at the time engineering work starts on the transportation system (year 16) and continues throughout operation.
- Approximately two full-time equivalents (FTEs) from commencement of engineering work to start of operations.
- 1640 hr/yr labour during Transport Operations.
- Expenses and incidentals included in "Allowance".
- Preparation of material for application for IFTC Transport Cask approval certificate(s) and approvals for Equipment for IFTC Transport Case are included in the cost estimates for those components (WBS 660.40.20).
- Administrative support is covered by Program Management (WBS 660.50.10).
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 16 Finish Year: 57 Duration: 42 year(s) WBS Type: Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$5,010,725			$5,010,725	30%	$6,513,942

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Base Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

28-Apr-2010 2:06:53 PM WEDS ID # 1111

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 28-Apr-2010

WBS Case: 660 ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)
WBS Number: 660.60 DECOMMISSIONING

WBS Description:

The development and implementation of plans to decommission the Used Fuel Transportation System (UFTS) and associated loading facilities.

Decommissioning includes:
- Decontaminating related Used Fuel equipment and preparing such for landfill.
- Decommission the UFTS and associated loading facilities.
- Consigning controlled decommissioning waste to a suitable disposal facility

WBS Deliverable:

- A deactivated and decommissioned UFTS

Decommissioning includes:
- An approved plan for decommissioning the Used Fuel Transportation Systems and associated loading facilities
- Decontaminated UF equipment, prepared for landfill
- Dismantled and decommissioned UFTS and associated loading facilities
- Decommissioning waste stored in an owner disposal facility

WBS Assumptions:

- Estimate adapted from Cogema (2003)
- It is assumed that the Used Fuel Transportation System and associated loading facilities do not have any major contamination and have not experienced a major irradiation incident or accident.
- It is assumed that the Used Fuel Transportation System and associated loading facilities have been maintained according to procedures and will be decommissioned without any difficulties.
- Contractor, non-permanent equipment and non-permanent material costs ("Other") of decommissioning is estimated as 10% (approx. $20M) of the capital cost sum for IFTC Transport Casks, Impact Limiters, IFTC Transport Vehicles and Equipment for IFTC Transport Cask Loading (approx. $200M). An allowance for disposal operation cost of decommissioning waste is included in this sum.
- Labour hours are estimated by taking an allowance of 30% of "Other" decom. costs discussed above and dividing this by a nominal hourly rate of approximately $59, resulting in an estimate of approx. 101,000 hr.
- No credit for remaining useful life or salvage value at time of decommissioning.
- Also subject to overall UFTS assumptions.

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 50 Finish Year: 57 Duration: 8 year(s) WBS Type: Step-Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$6,863,644		$19,877,383	$26,741,027	15%	$30,752,181

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Base Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

16-Sep-2010 4:38:38 PM WEDS ID # 9002

Organization Name:	NWMO - Nuclear Waste Management Organization		
Prepared by:	U. Stahmer	Reviewed by:	
Modified by:		Last Modification Date:	

WBS Case:	660	ALL ROAD TRANSPORT SYSTEM (based on 3.6M fuel bundles)
WBS Number:	660.90	PROGRAM MANAGEMENT

WBS Description:

Organizational structure to support / manage transportation program.

WBS Deliverable:

- Siting (Y01 to Y09)
- Project schedule
- Project business plan inputs on a yearly basis
- Program definition required to achieve implementation objectives
- Resourcing plan
- Regulatory work regulatory review to identify applicable regulations and assess impact of regulatory changes

- Site Licensing Phase (Y10 to Y15)
- Program definition required to achieve implementation objectives
- Resourcing plan
- Support to EA

- Manufacturing (Y16 to Y25)
- Oversight of Project Management team
- Project schedule
- Program business plan inputs on a yearly basis
- objectives
- Resourcing plan
- Certificate for Transport Package Design (Y20) recertification (Y24)
- Licence to Transport Category II Nuclear Material

- Operations (Y26 to Y54)
- Manage resources, facilities and infrastructures required for operating and maintaining the Used Fuel Transportation System
- Organizational structure to support / manage transportation program
- Operate, manage and administer the Used Fuel Transportation System.
- Project schedule
- Project business plan inputs on a yearly basis
- Program definition required to achieve implementation objectives
- Resourcing plan

WBS Assumptions:

- Regulatory work includes recertification of active transport certificates (transfer of IFTC ownership from OPG to NWMO is anticipated by Y03, certificate renewal is required in Y04), keeping abreast of current regulatory issues and determining impact of regulatory changes (IAEA, CNSC, TDG, provincial transport regulations)
- Travel assumption is 1 trip to regulator every 2 years (Y04, Y06 and Y08) at $1,500 per trip.
- Work on Route development (660.55) during EA (Y13, Y14 and Y15) is anticipated to be minimal and is assumed to be captured under this WEDS.
- Travel assumption is 1 trip to regulator every 2 years (Y10, Y12 and Y14) at $1,500 per trip.
- The Program Management includes 2 FTE persons during the entire period of Used Fuel transportation package manufacturing assumed to span 10 years and includes:
  - One program director,
  - One program administrator,

- Travel assumption: 10 trips annually to DGR site and manufacturing facilities at $1,500 per trip
- Lump sum allocation for new Production Package Certificate application(s) $24,000 in Year Y19.
- Lump sum allocation for Package Design Certificate recertification(s) in Y24 at $1,000.
- Licence to Transport in Y24 and renewals as required by the regulator
- The team to manage the Used Fuel Transportation System includes a staffed team of 14 FTE persons during the entire period of Used Fuel transportation assumed to span 31 years and includes:
  - One transport manager,
  - One maintenance supervisor,
  - Three engineers (one design/regulatory responsible, one package maintenance engineer and one equipment maintenance engineer)- Four Transportation Officers (one per main storage site (3) and one at the UFPP),
  - One scheduler,
  - One secretary,
  - Two forwarding technicians,
  - One Quality Assurance and Inspection technician,
- Travel assumption: 10 trips annually between UFPP and sites at $1,500 per trip.
- Certificate recertifications (7) every 4 years at $1,000 per recertification

Exclusive of Contingency.

WBS Allowance Basis:

Start Year: 4 Finish Year: 55 Duration: 52 year(s) WBS Type: Variable

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$101,379,491		$683,000	$102,062,491	0%	$102,062,491

WBS Specific Supporting Documentation:
SNC APM Master Estimate 660 D1 Rev. 10 Program Management.xlsx
Multi Element Supporting Documentation:

Work Element Definition Sheet

16-Sep-2010 3:06:16 PM WEDS ID # 9008

Organization Name:	NWMO - Nuclear Waste Management Organization		
Prepared by:	U. Stahmer	Reviewed by:	
Modified by:		Last Modification Date:	

WBS Case:	661	ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)
WBS Number:	661.20	ROUTE AND SYSTEM DEVELOPMENT

WBS Description:

Route Development
-Feasibility Study & Selection (Y01 to Y09)
-Identify preferred used fuel shipping routes via road between each potential candidate site and the DGR
-Recommend possible routes to be used
-Site Licensing & Construction Preparation (Y10 to Y15)
-Support EA, Site Licensing Application and Site Construction Preparation
System Development
-Definition and advancement of the transportation conceptual design reflective of site specificity
-Advancement of the transportation preliminary and detailed design reflective of site specificity
-Manufacture and commissioning of the used fuel transportation system reflective of site specificity

WBS Deliverable:

Route Development
-High level transportation analyses to support feasibility studies in 10 communities
-Feasibility studies on UF transport routes for two candidate sites
-Ad hoc support as required.
System Development
Conceptual / Preliminary (Y01 to Y09)
-Transport Package Options Study
-Conceptual design reports for: IFTC
-Trailer, restraints, cask handling equipment, facilities
-Logistical infrastructure
-Security and Emergency Response
Preliminary / Detailed Engineering (Y10 to Y15)
-Design Requirements and Technical Specifications for:
-IFTC
-Trailer, restraints, cask handling equipment, facilities
-Logistical infrastructure
-Creation of Security, Emergency Response and Transportation Logistics programs
Implementation / Test / Oversight (Y16 to Y25)
-Prototype Used Fuel Transportation Package
-Engineering support for the manufacturing, testing and commissioning of all components of the used fuel transportation system
-Commissioning of Security, Emergency Response and Transportation Logistics programs

WBS Assumptions:

Route Development

-10 feasibility studies looking into transport routes (Y02 to Y03) Assume 5 of these are contracted out at $20,000 per study (or $50,000 per year Y02 to Y03)

-2 detailed transportation studies (Y04 to Y05)

Travel assumption is 6 trips to communities per year at $1,500 per trip ($9,000 in travel and expenses per year) (Y01 to Y09)

-Transportation program is de-coupled from the site licensing / EA process; however, questions would be expected during the site license
-3 trips to CNSC per year at $1,500 per trip ($4,500 per annum) (Y10 to Y15)
-4 trips to communities $1,500 per trip ($6,000 total) (Y10 to Y15) [LB: Assume 2 trips in Y10, 1 trip in Y11 and 1 trip in Y12 - to be confirmed]
System Development
-Transport Options Study (Y04 to Y06)
Review existing fuel storage methods and proposed UF Container design and examine options to transport UF to DGR. Recommend best option and establish preliminary transport package and transport system design requirements.
Frozen UF container design is required before work on transport options study can begin.
Output from this study has implications on UFPP design.
-Travel assumption: trips (5) (3 in Y04 and 2 in Y05) to existing storage facilities at $1,500 per trip.
-IFTC Preliminary Design (Y07 to Y09)
Based on Transport Options Study, develop conceptual design(s) for UF transport package(s). IFTC is reference design. Alternative designs are recommended in Options Study. Prepare Preliminary Design Report in Y09 to support EA.
-Transport System Conceptual Design (Y04 to Y09)
Review existing system designs and prepare conceptual design report based on Options Study. System must consider transport modes and package designs.
Contract Conceptual report $200,000 ($100,000 in each of years Y07 and Y08) to support EA.
-Travel assumption: trips (2) (1 in Y06 and 1 in Y08) to existing storage facilities at $1,500 per trip.
-Logistical Infrastructure Conceptual Design (Y08 to Y09)
Conceptual design to consider transport modes, route options and alternatives, shipments frequency, transport restrictions (weather, seasonal, weight limits (bridges, overpasses)),
Contract Conceptual Design report $150,000 ($75,000 in each of years Y08 and Y09) to support EA.
-Security and Emergency Response Preliminary Design
Meet with governmental representatives to determine security and emergency response requirements. Establish map of existing emergency responders along routes to favoured sites. Contract Conceptual Scoping Report in Y04 $50,000 to summarize requirements. Contract Preliminary Design Report $200,000 ($100,000 in each of years Y08 and Y09) to support EA.
-Travel assumption: One trip annually to regulators in Y02 to Y04 at $1,500 per trip. Two trips annually to regulators in Y08 and Y09 at $1,500 per trip.
-Transportation program is de-coupled from the site licensing / EA process
-Package Detailed Design (Y10 to Y15)
Prepare design requirements and technical specifications for transport package as described in the transportation options study. Initiate package design. Prepare requirements documents for analyses and testing. Contract out package design analyses (finite element structural, thermal and impact analyses) at $150,000 per year in Y12 and Y13. Design scale models for physical drop tests. Contract out scale model manufacture at $500,000 per year in Y14 and Y15.
Travel assumption: 5 trips per year to vendors during Y12, Y13, Y14 and Y15 at $1,500 per trip.

-Transport System Preliminary Design (Y10 to Y15)
Prepare design requirements and technical specifications for trucks, trailers, and ancillary equipment (lifting beams, cranes, hot cell access, etc). Contract out preliminary design of trailers, lifting beams, cranes at $100,000 per year in Y13 and Y14.
Travel assumption: trips (2) per year to existing vendors/contractors at $1,500 per trip.
-Logistical Infrastructure Preliminary Design (Y10 to Y15).

Provide support to EA. Prepare design requirements and technical specifications for logistics equipment. Contract out logistics equipment selection at $50,000 in Y14.

-Security and Emergency Response Preliminary Design

Provide support to EA. Meet with governmental representatives to establish security and emergency response programs based on requirements previously defined. Start liaisons with security and emergency response forces along routes. Establish training program requirements, and high level program implementation. Contract work out at $200,000 ($100,000 in each of years Y14 and Y15)

-Provide support for transportation component of EA

Travel assumption: One trip annually to regulators in Y10 to Y15 at $1,500 per trip.

-Package Test, Manufacture and Commissioning (Y16 to Y25)

Package detailed design, analysis and certification completed by Y19. Full scale prototype manufactured during years Y17 through Y19. Construction Cost estimated at $4,000,000. Vendor selection and inspection for production package fleet during years Y18 and Y19. Oversight of production package manufacture and commissioning in years Y20 through Y25.

Travel assumption: 5 trips per year to vendors at $2,000 per trip.

-Transport System Manufacture and Commissioning (Y16 to Y25)

Oversight of transportation system equipment manufacture and commissioning in years Y16 through Y25.

Travel assumption: trips (2) per year to existing vendors/contractors at $2,000 per trip.

-Logistical Infrastructure Implementation Design (Y16 to Y25)

Development, implementation and commissioning of logistics system.

-Security and Emergency Response Implementation

Oversee the creation of training programs and implementation. Meet with governmental representatives for final design and implementation establish security and emergency response programs based on requirements previously defined. Continue liaisons with security and emergency response forces along routes.

Misc. Travel assumptions: 2 trips annually to vendors (logistics, in Y16 to Y25 at $2,000 per trip. One trip annually to regulator years Y16 through Y25 at $1,500 per trip.

Exclusive of Contingency.

WBS Allowance Basis:

Detailed NMWO estimate is conservative, no additional allowance (0% applied)

Start Year: 1 Finish Year: 25 Duration: 25 year(s) WBS Type: Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$10,317,019		$6,836,999	$17,154,018	0%	$17,154,018

WBS Specific Supporting Documentation:
SNC APM Master Estimate 660 D1 Rev. 10 Route and System Development.xlsx
Multi Element Supporting Documentation:

Work Element Definition Sheet

17-Sep-2010 2:46:25 PM WEDS ID # 9009

Organization Name: NWMO - Nuclear Waste Management Organization
Prepared by: N. Hunt, P. Gierszewski Reviewed by:
Modified by: Last Modification Date:

WBS Case: 661 ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)
WBS Number: 661.25 SAFETY ASSESSMENT

WBS Description:

This task is for performing safety assessments in support of transportation.

WBS Deliverable:

- Transportation safety assessments as required.
- Information packages for, and meetings with, local communities.
- Contribution to Environmental Assessment (EA) (66X.55) and Preliminary Safety Report (PSR) submissions.

WBS Assumptions:

- Does not include work to design and licence the transport packages.
- Does not include work related to security arrangements for transport.
- After the EA and Construction Licence application has been approved, the costs for further transport work is included as part of the ongoing Safety Assessment activities supporting the receiving facility Operating Licence.
- A large component of this work will be visiting local communities along the possible routes to understand local concerns, discuss options, and present assessment results.
- Most of the technical analyses will be conducted by contractors.

NWMO staffing is 0.25 NWMO-03 FTE in Y1, 0.5 NWMO-03 FTE in each of Y2 to Y09 and 1 NWMO-3 FTE in each of Y10 to Y15.
Staff travel cost is 5 k$/a for Y4-Y12.
Funding for contractor support is $300K/a for Y4 to Y9 (Candidate Site Phases), $300K/a for Y10 to Y12 (Construction Licence Phase), and $50 k/a for Y13 to Y15 (EA/PSR Hearings).

Exclusive of Contingency.

WBS Allowance Basis:

Start Year: 1 Finish Year: 15 Duration: 15 year(s) WBS Type: Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$1,334,378		$2,895,000	$4,229,378	0%	$4,229,378

WBS Specific Supporting Documentation:
SNC APM Master Estimate 660 D1 Rev. 10 Transportation Safety Assessment.xlsx
Multi Element Supporting Documentation:

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1056

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	17-Feb-2010

WBS Case: 661 ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)

WBS Number: 661.40.10.10 IFTC Transportation Vehicles for non-Site-Specific

WBS Description:

The design, procurement, testing and commissioning of Irradiated Fuel Transport Cask (IFTC) Transportation Vehicles for mock-up (demonstration units).

WBS Deliverable:

- Completed system design basis documentation.
- Completed detailed design of the IFTC Transport Vehicles.

Completed testing and licensing documentation, the Safety Analysis Report, for submission to the Competent Authority.

- An approved Design Package Approval Certificate issued by the Competent Authority as per 661.90.
- A licensed IFTC Transport Vehicle system and the approved commissioning plans.

IFTC Transportation Vehicle - Escort Vehicle (customized security vehicle), including:

- Anti-theft electronic immobilizer system.
- On board real-time tracking system.
- On-board biometrics system (biometric fingerprint and/or retinal scan).
- Vehicle security enhancements (e.g., typical customization done to RCMP, Police and Homeland security vehicles).

IFTC Transportation Vehicle - Tractor, including:

- Customized tractor similar to those used by US Department of Energy (DOE) "safeguards transporter".
- Electronic Speed Limiter for Ontario- Limits speed to 80km/hr.
- On board real-time tracking system.
- OnGuard Collision Safety System.
- Anti-theft electronic immobilizer system.
- Passenger-mounted LCD touch-screen PC.
- Sleeping berth to accommodate 2 persons.
- On-board biometrics system (biometric fingerprint and/or retinal scan).

IFTC Transportation Vehicle - Trailer (Customized Trailer), including:

- Marking and labeling.
- Hazardous Material Placards.
- On board real-time tracking system.
- Modified 48-foot flatbed trailer with integrated tie-down.
- Trailer equipped with hydraulic or air ride suspension to cushion the load.
- Trailer equipped with four axles.
- Weather cover.
- One frame for IFTC Transport Cask.
- A set of specific equipment (GPS, turning lights, tool box)

WBS Assumptions:

- The Standard IFTC Transport Vehicle and Escort Vehicle will be used for IFTC (Transport Cask) Mock-up
- The total cost of the IFTC Transport Vehicles with Escort Vehicle mock-up is not specific to Reactor Storage Facility
- IFTC Transport Vehicles with Escort Vehicle for mock-up is allocated to the licensing requirement for services and testing
- See 661.40.40.10 (Equipment for IFTC Transportation Logistics for Real Time Tracking) for acquisition of satellite phones and GPS systems.
- Pricing basis is commercial, off-the-shelf items verbally confirmed with vendors in the Toronto region by PDD, November 2009 to April 2010. Pricing is representative for most of Ontario and in current (2010) dollars.
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting

Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 22 Finish Year: 24 Duration: 3 year(s) WBS Type: Step-Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$360,800	$518,000		$878,800	10%	$966,680

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1057

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	17-Feb-2010

WBS Case: 661 ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)

WBS Number: 661.40.10.20 IFTC Transportation Vehicles for Whiteshell

WBS Description:

The procurement, test and commissioning of IFTC Transportation Vehicles for Whiteshell.

WBS Deliverable:

IFTC Transportation Vehicle - Escort Vehicle (customized security vehicle), including:
- Anti-theft electronic immobilizer system.
- On board real-time tracking system.
- On-board biometrics system (biometric fingerprint and/or retinal scan).
- Vehicle security enhancements (e.g., typical customization done to RCMP, Police and Homeland security vehicles).

IFTC Transportation Vehicle - Tractor, including:
- Customized tractor similar to those used by US Department of Energy (DOE) "safeguards transporter".
- Electronic Speed Limiter for Ontario- Limits speed to 80km/hr.
- On board real-time tracking system.
- OnGuard Collision Safety System.
- Anti-theft electronic immobilizer system.
- Passenger-mounted LCD touch-screen PC.
- Sleeping berth to accommodate 2 persons.
- On-board biometrics system (biometric fingerprint and/or retinal scan).

IFTC Transportation Vehicle - Trailer (Customized Trailer), including:
- Marking and labeling.
- Hazardous Material Placards.
- On board real-time tracking system.
- Modified 48-foot flatbed trailer with integrated tie-down.
- Trailer equipped with hydraulic or air ride suspension to cushion the load.
- Trailer equipped with four axles.
- Weather cover.
- One frame for IFTC Transport Cask.
- A set of specific equipment (GPS, turning lights, tool box)

WBS Assumptions:

- IFTC Transport Vehicles with Escort Vehicles will be used to ship all Used Fuel from owner Reactor Storage Facilities in IFTCs (Transport Casks).
- Total Project Fleet costs calculated separately and allocated to work element based on share of total fuel bundle count. Derivation of fleet costs and relative allocations attached as .xls under "Multi Element Supporting Information"
- IFTC Transportation Vehicles Escort Vehicle design life is assumed to be 4 years. After initial purchase, units are replaced 14 times over the 60 years from initial service date
- IFTC Transportation Vehicle Tractor design life is assumed to be 7 years. After initial purchase, units are replaced 8 times over the 60 years from initial service date
- IFTC Transportation Vehicles Trailer design life is assumed to be 10 years. After initial purchase, units are replaced 5 times over the 60 years from initial service date
- No allowance for remaining useful life/salvage at time of replacement or retirement.
- See 661.40.40.10 (Equipment for IFTC Transportation Logistics for Real Time Tracking) for acquisition of satellite phones and GPS systems.
- Pricing based on commercial off-the-shelf items verbally confirmed with vendors in the Toronto region by PDD, November 2009 to April 2010. Pricing representative for most of Ontario and in current (2010) dollars.

- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 25 Finish Year: 85 Duration: 61 year(s) WBS Type: Step-Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
	$4,286		$4,286	10%	$4,715

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1058

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 17-Feb-2010

WBS Case: 661 ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)
WBS Number: 661.40.10.30 IFTC Transportation Vehicles for Bruce

WBS Description:

The procurement, test and commissioning of IFTC Transportation Vehicles for Bruce.

WBS Deliverable:

IFTC Transportation Vehicle - Escort Vehicle (customized security vehicle), including:
- Anti-theft electronic immobilizer system.
- On board real-time tracking system.
- On-board biometrics system (biometric fingerprint and/or retinal scan).
- Vehicle security enhancements (e.g., typical customization done to RCMP, Police and Homeland security vehicles).

IFTC Transportation Vehicle - Tractor, including:
- Customized tractor similar to those used by US Department of Energy (DOE) "safeguards transporter".
- Electronic Speed Limiter for Ontario- Limits speed to 80km/hr.
- On board real-time tracking system.
- OnGuard Collision Safety System.
- Anti-theft electronic immobilizer system.
- Passenger-mounted LCD touch-screen PC.
- Sleeping berth to accommodate 2 persons.
- On-board biometrics system (biometric fingerprint and/or retinal scan).

IFTC Transportation Vehicle - Trailer (Customized Trailer), including:
- Marking and labeling.
- Hazardous Material Placards.
- On board real-time tracking system.
- Modified 48-foot flatbed trailer with integrated tie-down.
- Trailer equipped with hydraulic or air ride suspension to cushion the load.
- Trailer equipped with four axles.
- Weather cover.
- One frame for IFTC Transport Cask.
- A set of specific equipment (GPS, turning lights, tool box)

WBS Assumptions:

- IFTC Transport Vehicles with Escort Vehicles will be used to ship all Used Fuel from owner Reactor Storage Facilities in IFTCs (Transport Casks).
- Total Project Fleet costs calculated separately and allocated to work element based on share of total fuel bundle count. Derivation of fleet costs and relative allocations attached as .xls under "Multi Element Supporting Information"
- IFTC Transportation Vehicles Escort Vehicle design life is assumed to be 4 years. After initial purchase, units are replaced 14 times over the 60 years from initial service date
- IFTC Transportation Vehicle Tractor design life is assumed to be 7 years. After initial purchase, units are replaced 8 times over the 60 years from initial service date
- IFTC Transportation Vehicles Trailer design life is assumed to be 10 years. After initial purchase, units are replaced 5 times over the 60 years from initial service date
- No allowance for remaining useful life/salvage at time of replacement or retirement.
- See 661.40.40.10 (Equipment for IFTC Transportation Logistics for Real Time Tracking) for acquisition of satellite phones and GPS systems.
- Pricing based on commercial off-the-shelf items verbally confirmed with vendors in the Toronto region by PDD, November 2009 to April 2010. Pricing representative for most of Ontario and in current (2010) dollars.

- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard
Start Year: 25 Finish Year: 85 Duration: 61 year(s) WBS Type: Step-Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
	$26,145,570		$26,145,570	10%	$28,760,127

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1059

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 17-Feb-2010

WBS Case: 661 ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)
WBS Number: 661.40.10.40 IFTC Transportation Vehicles for Pickering

WBS Description:

The procurement, test and commissioning of IFTC Transportation Vehicles for Pickering.

WBS Deliverable:

IFTC Transportation Vehicle - Escort Vehicle (customized security vehicle), including:
- Anti-theft electronic immobilizer system.
- On board real-time tracking system.
- On-board biometrics system (biometric fingerprint and/or retinal scan).
- Vehicle security enhancements (e.g., typical customization done to RCMP, Police and Homeland security vehicles).

IFTC Transportation Vehicle - Tractor, including:
- Customized tractor similar to those used by US Department of Energy (DOE) "safeguards transporter".
- Electronic Speed Limiter for Ontario- Limits speed to 80km/hr.
- On board real-time tracking system.
- OnGuard Collision Safety System.
- Anti-theft electronic immobilizer system.
- Passenger-mounted LCD touch-screen PC.
- Sleeping berth to accommodate 2 persons.
- On-board biometrics system (biometric fingerprint and/or retinal scan).

IFTC Transportation Vehicle - Trailer (Customized Trailer), including:
- Marking and labeling.
- Hazardous Material Placards.
- On board real-time tracking system.
- Modified 48-foot flatbed trailer with integrated tie-down.
- Trailer equipped with hydraulic or air ride suspension to cushion the load.
- Trailer equipped with four axles.
- Weather cover.
- One frame for IFTC Transport Cask.
- A set of specific equipment (GPS, turning lights, tool box)

WBS Assumptions:

- IFTC Transport Vehicles with Escort Vehicles will be used to ship all Used Fuel from owner Reactor Storage Facilities in IFTCs (Transport Casks).
- Total Project Fleet costs calculated separately and allocated to work element based on share of total fuel bundle count. Derivation of fleet costs and relative allocations attached as .xls under "Multi Element Supporting Information"
- IFTC Transportation Vehicles Escort Vehicle design life is assumed to be 4 years. After initial purchase, units are replaced 14 times over the 60 years from initial service date
- IFTC Transportation Vehicle Tractor design life is assumed to be 7 years. After initial purchase, units are replaced 8 times over the 60 years from initial service date
- IFTC Transportation Vehicles Trailer design life is assumed to be 10 years. After initial purchase, units are replaced 5 times over the 60 years from initial service date
- No allowance for remaining useful life/salvage at time of replacement or retirement.
- See 661.40.40.10 (Equipment for IFTC Transportation Logistics for Real Time Tracking) for acquisition of satellite phones and GPS systems.
- Pricing based on commercial off-the-shelf items verbally confirmed with vendors in the Toronto region by PDD, November 2009 to April 2010. Pricing representative for most of Ontario and in current (2010) dollars.

- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard
Start Year: 25 Finish Year: 85 Duration: 61 year(s) WBS Type: Step-Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
	$13,811,625		$13,811,625	10%	$15,192,788

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1060

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 17-Feb-2010

WBS Case: 661 ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)
WBS Number: 661.40.10.50 IFTC Transportation Vehicles for Darlington

WBS Description:

The procurement, test and commissioning of IFTC Transportation Vehicles for Darlington

WBS Deliverable:

IFTC Transportation Vehicle - Escort Vehicle (customized security vehicle), including:
- Anti-theft electronic immobilizer system.
- On board real-time tracking system.
- On-board biometrics system (biometric fingerprint and/or retinal scan).
- Vehicle security enhancements (e.g., typical customization done to RCMP, Police and Homeland security vehicles).

IFTC Transportation Vehicle - Tractor, including:
- Customized tractor similar to those used by US Department of Energy (DOE) "safeguards transporter".
- Electronic Speed Limiter for Ontario- Limits speed to 80km/hr.
- On board real-time tracking system.
- OnGuard Collision Safety System.
- Anti-theft electronic immobilizer system.
- Passenger-mounted LCD touch-screen PC.
- Sleeping berth to accommodate 2 persons.
- On-board biometrics system (biometric fingerprint and/or retinal scan).

IFTC Transportation Vehicle - Trailer (Customized Trailer), including:
- Marking and labeling.
- Hazardous Material Placards.
- On board real-time tracking system.
- Modified 48-foot flatbed trailer with integrated tie-down.
- Trailer equipped with hydraulic or air ride suspension to cushion the load.
- Trailer equipped with four axles.
- Weather cover.
- One frame for IFTC Transport Cask.
- A set of specific equipment (GPS, turning lights, tool box)

WBS Assumptions:

- IFTC Transport Vehicles with Escort Vehicles will be used to ship all Used Fuel from owner Reactor Storage Facilities in IFTCs (Transport Casks).
- Total Project Fleet costs calculated separately and allocated to work element based on share of total fuel bundle count. Derivation of fleet costs and relative allocations attached as .xls under "Multi Element Supporting Information"
- IFTC Transportation Vehicles Escort Vehicle design life is assumed to be 4 years. After initial purchase, units are replaced 14 times over the 60 years from initial service date
- IFTC Transportation Vehicle Tractor design life is assumed to be 7 years. After initial purchase, units are replaced 8 times over the 60 years from initial service date
- IFTC Transportation Vehicles Trailer design life is assumed to be 10 years. After initial purchase, units are replaced 5 times over the 60 years from initial service date
- No allowance for remaining useful life/salvage at time of replacement or retirement.
- See 661.40.40.10 (Equipment for IFTC Transportation Logistics for Real Time Tracking) for acquisition of satellite phones and GPS systems.
- Pricing based on commercial off-the-shelf items verbally confirmed with vendors in the Toronto region by PDD, November 2009 to April 2010. Pricing representative for most of Ontario and in current (2010) dollars.

- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard
Start Year: 25 Finish Year: 85 Duration: 61 year(s) WBS Type: Step-Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
	$14,881,805		$14,881,805	10%	$16,369,985

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1061

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 17-Feb-2010

WBS Case: 661 ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)
WBS Number: 661.40.10.60 IFTC Transportation Vehicles for Point Lepreau

WBS Description:

The procurement, test and commissioning of IFTC Transportation Vehicles for Point Lepreau

WBS Deliverable:

IFTC Transportation Vehicle - Escort Vehicle (customized security vehicle), including:
- Anti-theft electronic immobilizer system.
- On board real-time tracking system.
- On-board biometrics system (biometric fingerprint and/or retinal scan).
- Vehicle security enhancements (e.g., typical customization done to RCMP, Police and Homeland security vehicles).

IFTC Transportation Vehicle - Tractor, including:
- Customized tractor similar to those used by US Department of Energy (DOE) "safeguards transporter".
- Electronic Speed Limiter for Ontario- Limits speed to 80km/hr.
- On board real-time tracking system.
- OnGuard Collision Safety System.
- Anti-theft electronic immobilizer system.
- Passenger-mounted LCD touch-screen PC.
- Sleeping berth to accommodate 2 persons.
- On-board biometrics system (biometric fingerprint and/or retinal scan).

IFTC Transportation Vehicle - Trailer (Customized Trailer), including:
- Marking and labeling.
- Hazardous Material Placards.
- On board real-time tracking system.
- Modified 48-foot flatbed trailer with integrated tie-down.
- Trailer equipped with hydraulic or air ride suspension to cushion the load.
- Trailer equipped with four axles.
- Weather cover.
- One frame for IFTC Transport Cask.
- A set of specific equipment (GPS, turning lights, tool box)

WBS Assumptions:

- IFTC Transport Vehicles with Escort Vehicles will be used to ship all Used Fuel from owner Reactor Storage Facilities in IFTCs (Transport Casks).
- Total Project Fleet costs calculated separately and allocated to work element based on share of total fuel bundle count. Derivation of fleet costs and relative allocations attached as .xls under "Multi Element Supporting Information"
- IFTC Transportation Vehicles Escort Vehicle design life is assumed to be 4 years. After initial purchase, units are replaced 14 times over the 60 years from initial service date
- IFTC Transportation Vehicle Tractor design life is assumed to be 7 years. After initial purchase, units are replaced 8 times over the 60 years from initial service date
- IFTC Transportation Vehicles Trailer design life is assumed to be 10 years. After initial purchase, units are replaced 5 times over the 60 years from initial service date
- No allowance for remaining useful life/salvage at time of replacement or retirement.
- See 661.40.40.10 (Equipment for IFTC Transportation Logistics for Real Time Tracking) for acquisition of satellite phones and GPS systems.
- Pricing based on commercial off-the-shelf items verbally confirmed with vendors in the Toronto region by PDD, November 2009 to April 2010. Pricing representative for most of Ontario and in current (2010) dollars.

- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard
Start Year: 25 Finish Year: 85 Duration: 61 year(s) WBS Type: Step-Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
	$3,186,965		$3,186,965	10%	$3,505,661

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1062

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	17-Feb-2010

WBS Case: 661 ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)

WBS Number: 661.40.10.70 IFTC Transportation Vehicles for Chalk River

WBS Description:

The procurement, test and commissioning of IFTC Transportation Vehicles for Chalk River.

WBS Deliverable:

IFTC Transportation Vehicle - Escort Vehicle (customized security vehicle), including:
- Anti-theft electronic immobilizer system.
- On board real-time tracking system.
- On-board biometrics system (biometric fingerprint and/or retinal scan).
- Vehicle security enhancements (e.g., typical customization done to RCMP, Police and Homeland security vehicles).

IFTC Transportation Vehicle - Tractor, including:
- Customized tractor similar to those used by US Department of Energy (DOE) "safeguards transporter".
- Electronic Speed Limiter for Ontario- Limits speed to 80km/hr.
- On board real-time tracking system.
- OnGuard Collision Safety System.
- Anti-theft electronic immobilizer system.
- Passenger-mounted LCD touch-screen PC.
- Sleeping berth to accommodate 2 persons.
- On-board biometrics system (biometric fingerprint and/or retinal scan).

IFTC Transportation Vehicle - Trailer (Customized Trailer), including:
- Marking and labeling.
- Hazardous Material Placards.
- On board real-time tracking system.
- Modified 48-foot flatbed trailer with integrated tie-down.
- Trailer equipped with hydraulic or air ride suspension to cushion the load.
- Trailer equipped with four axles.
- Weather cover.
- One frame for IFTC Transport Cask.
- A set of specific equipment (GPS, turning lights, tool box)

WBS Assumptions:

- IFTC Transport Vehicles with Escort Vehicles will be used to ship all Used Fuel from owner Reactor Storage Facilities in IFTCs (Transport Casks).
- Total Project Fleet costs calculated separately and allocated to work element based on share of total fuel bundle count. Derivation of fleet costs and relative allocations attached as .xls under "Multi Element Supporting Information"
- IFTC Transportation Vehicles Escort Vehicle design life is assumed to be 4 years. After initial purchase, units are replaced 14 times over the 60 years from initial service date
- IFTC Transportation Vehicle Tractor design life is assumed to be 7 years. After initial purchase, units are replaced 8 times over the 60 years from initial service date
- IFTC Transportation Vehicles Trailer design life is assumed to be 10 years. After initial purchase, units are replaced 5 times over the 60 years from initial service date
- No allowance for remaining useful life/salvage at time of replacement or retirement.
- See 661.40.40.10 (Equipment for IFTC Transportation Logistics for Real Time Tracking) for acquisition of satellite phones and GPS systems.
- Pricing based on commercial off-the-shelf items verbally confirmed with vendors in the Toronto region by PDD, November 2009 to April 2010. Pricing representative for most of Ontario and in current (2010) dollars.

- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 25 Finish Year: 85 Duration: 61 year(s) WBS Type: Step-Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
	$57,905		$57,905	10%	$63,695

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1063

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	17-Feb-2010

WBS Case: 661 ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)

WBS Number: 661.40.10.80 IFTC Transportation Vehicles for Gentilly 1

WBS Description:

The procurement, test and commissioning of IFTC Transportation Vehicles for Gentilly 1.

WBS Deliverable:

IFTC Transportation Vehicle - Escort Vehicle (customized security vehicle), including:
- Anti-theft electronic immobilizer system.
- On board real-time tracking system.
- On-board biometrics system (biometric fingerprint and/or retinal scan).
- Vehicle security enhancements (e.g., typical customization done to RCMP, Police and Homeland security vehicles).

IFTC Transportation Vehicle - Tractor, including:
- Customized tractor similar to those used by US Department of Energy (DOE) "safeguards transporter".
- Electronic Speed Limiter for Ontario- Limits speed to 80km/hr.
- On board real-time tracking system.
- OnGuard Collision Safety System.
- Anti-theft electronic immobilizer system.
- Passenger-mounted LCD touch-screen PC.
- Sleeping berth to accommodate 2 persons.
- On-board biometrics system (biometric fingerprint and/or retinal scan).

IFTC Transportation Vehicle - Trailer (Customized Trailer), including:
- Marking and labeling.
- Hazardous Material Placards.
- On board real-time tracking system.
- Modified 48-foot flatbed trailer with integrated tie-down.
- Trailer equipped with hydraulic or air ride suspension to cushion the load.
- Trailer equipped with four axles.
- Weather cover.
- One frame for IFTC Transport Cask.
- A set of specific equipment (GPS, turning lights, tool box)

WBS Assumptions:

- IFTC Transport Vehicles with Escort Vehicles will be used to ship all Used Fuel from owner Reactor Storage Facilities in IFTCs (Transport Casks).
- Total Project Fleet costs calculated separately and allocated to work element based on share of total fuel bundle count. Derivation of fleet costs and relative allocations attached as .xls under "Multi Element Supporting Information"
- IFTC Transportation Vehicles Escort Vehicle design life is assumed to be 4 years. After initial purchase, units are replaced 14 times over the 60 years from initial service date
- IFTC Transportation Vehicle Tractor design life is assumed to be 7 years. After initial purchase, units are replaced 8 times over the 60 years from initial service date
- IFTC Transportation Vehicles Trailer design life is assumed to be 10 years. After initial purchase, units are replaced 5 times over the 60 years from initial service date
- No allowance for remaining useful life/salvage at time of replacement or retirement.
- See 661.40.40.10 (Equipment for IFTC Transportation Logistics for Real Time Tracking) for acquisition of satellite phones and GPS systems.
- Pricing based on commercial off-the-shelf items verbally confirmed with vendors in the Toronto region by PDD, November 2009 to April 2010. Pricing representative for most of Ontario and in current (2010) dollars.

- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 25 Finish Year: 85 Duration: 61 year(s) WBS Type: Step-Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
	$38,601		$38,601	10%	$42,461

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

30-Apr-2010 2:33:52 PM WEDS ID # 1127

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	30-Apr-2010

WBS Case: 661 ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)

WBS Number: 661.40.10.90 IFTC Transportation Vehicles for Gentilly 2

WBS Description:

The procurement, test and commissioning of IFTC Transportation Vehicles for Gentilly 2.

WBS Deliverable:

IFTC Transportation Vehicle - Escort Vehicle (customized security vehicle), including:
- Anti-theft electronic immobilizer system.
- On board real-time tracking system.
- On-board biometrics system (biometric fingerprint and/or retinal scan).
- Vehicle security enhancements (e.g., typical customization done to RCMP, Police and Homeland security vehicles).

IFTC Transportation Vehicle - Tractor, including:
- Customized tractor similar to those used by US Department of Energy (DOE) "safeguards transporter".
- Electronic Speed Limiter for Ontario- Limits speed to 80km/hr.
- On board real-time tracking system.
- OnGuard Collision Safety System.
- Anti-theft electronic immobilizer system.
- Passenger-mounted LCD touch-screen PC.
- Sleeping berth to accommodate 2 persons.
- On-board biometrics system (biometric fingerprint and/or retinal scan).

IFTC Transportation Vehicle - Trailer (Customized Trailer), including:
- Marking and labeling.
- Hazardous Material Placards.
- On board real-time tracking system.
- Modified 48-foot flatbed trailer with integrated tie-down.
- Trailer equipped with hydraulic or air ride suspension to cushion the load.
- Trailer equipped with four axles.
- Weather cover.
- One frame for IFTC Transport Cask.
- A set of specific equipment (GPS, turning lights, tool box)

WBS Assumptions:

- IFTC Transport Vehicles with Escort Vehicles will be used to ship all Used Fuel from owner Reactor Storage Facilities in IFTCs (Transport Casks).
- Total Project Fleet costs calculated separately and allocated to work element based on share of total fuel bundle count. Derivation of fleet costs and relative allocations attached as .xls under "Multi Element Supporting Information"
- IFTC Transportation Vehicles Escort Vehicle design life is assumed to be 4 years. After initial purchase, units are replaced 14 times over the 60 years from initial service date
- IFTC Transportation Vehicle Tractor design life is assumed to be 7 years. After initial purchase, units are replaced 8 times over the 60 years from initial service date
- IFTC Transportation Vehicles Trailer design life is assumed to be 10 years. After initial purchase, units are replaced 5 times over the 60 years from initial service date
- No allowance for remaining useful life/salvage at time of replacement or retirement.
- See 661.40.40.10 (Equipment for IFTC Transportation Logistics for Real Time Tracking) for acquisition of satellite phones and GPS systems.
- Pricing based on commercial off-the-shelf items verbally confirmed with vendors in the Toronto region by PDD, November 2009 to April 2010. Pricing representative for most of Ontario and in current (2010) dollars.

- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard
Start Year: 25 Finish Year: 85 Duration: 61 year(s) WBS Type: Step-Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
	$3,038,984		$3,038,984	10%	$3,342,882

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1064

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 17-Feb-2010

WBS Case: 661 ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)
WBS Number: 661.40.10.100 IFTC Transportation Vehicles for Douglas Point

WBS Description:

The procurement, test and commissioning of IFTC Transportation Vehicles for Douglas Point

WBS Deliverable:

IFTC Transportation Vehicle - Escort Vehicle (customized security vehicle), including:
- Anti-theft electronic immobilizer system.
- On board real-time tracking system.
- On-board biometrics system (biometric fingerprint and/or retinal scan).
- Vehicle security enhancements (e.g., typical customization done to RCMP, Police and Homeland security vehicles).

IFTC Transportation Vehicle - Tractor, including:
- Customized tractor similar to those used by US Department of Energy (DOE) "safeguards transporter".
- Electronic Speed Limiter for Ontario- Limits speed to 80km/hr.
- On board real-time tracking system.
- OnGuard Collision Safety System.
- Anti-theft electronic immobilizer system.
- Passenger-mounted LCD touch-screen PC.
- Sleeping berth to accommodate 2 persons.
- On-board biometrics system (biometric fingerprint and/or retinal scan).

IFTC Transportation Vehicle - Trailer (Customized Trailer), including:
- Marking and labeling.
- Hazardous Material Placards.
- On board real-time tracking system.
- Modified 48-foot flatbed trailer with integrated tie-down.
- Trailer equipped with hydraulic or air ride suspension to cushion the load.
- Trailer equipped with four axles.
- Weather cover.
- One frame for IFTC Transport Cask.
- A set of specific equipment (GPS, turning lights, tool box)

WBS Assumptions:

- IFTC Transport Vehicles with Escort Vehicles will be used to ship all Used Fuel from owner Reactor Storage Facilities in IFTCs (Transport Casks).
- Total Project Fleet costs calculated separately and allocated to work element based on share of total fuel bundle count. Derivation of fleet costs and relative allocations attached as .xls under "Multi Element Supporting Information"
- IFTC Transportation Vehicles Escort Vehicle design life is assumed to be 4 years. After initial purchase, units are replaced 14 times over the 60 years from initial service date
- IFTC Transportation Vehicle Tractor design life is assumed to be 7 years. After initial purchase, units are replaced 8 times over the 60 years from initial service date
- IFTC Transportation Vehicles Trailer design life is assumed to be 10 years. After initial purchase, units are replaced 5 times over the 60 years from initial service date
- No allowance for remaining useful life/salvage at time of replacement or retirement.
- See 661.40.40.10 (Equipment for IFTC Transportation Logistics for Real Time Tracking) for acquisition of satellite phones and GPS systems.
- Pricing based on commercial off-the-shelf items verbally confirmed with vendors in the Toronto region by PDD, November 2009 to April 2010. Pricing representative for most of Ontario and in current (2010) dollars.

- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 25 Finish Year: 85 Duration: 61 year(s) WBS Type: Step-Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
	$265,942		$265,942	10%	$292,536

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

29-Apr-2010 4:27:42 PM WEDS ID # 1117

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 29-Apr-2010

WBS Case: 661 ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)
WBS Number: 661.40.10.110 IFTC Transportation Vehicles for New Build A

WBS Description:

The design, procurement, test and commissioning of IFTC Transportation Vehicles for New Build A.

WBS Deliverable:

IFTC Transportation Vehicle - Escort Vehicle (customized security vehicle), including:
- Anti-theft electronic immobilizer system.
- On board real-time tracking system.
- On-board biometrics system (biometric fingerprint and/or retinal scan).
- Vehicle security enhancements (e.g., typical customization done to RCMP, Police and Homeland security vehicles).

IFTC Transportation Vehicle - Tractor, including:
- Customized tractor similar to those used by US Department of Energy (DOE) "safeguards transporter".
- Electronic Speed Limiter for Ontario- Limits speed to 80km/hr.
- On board real-time tracking system.
- OnGuard Collision Safety System.
- Anti-theft electronic immobilizer system.
- Passenger-mounted LCD touch-screen PC.
- Sleeping berth to accommodate 2 persons.
- On-board biometrics system (biometric fingerprint and/or retinal scan).

IFTC Transportation Vehicle - Trailer (Customized Trailer), including:
- Marking and labeling.
- Hazardous Material Placards.
- On board real-time tracking system.
- Modified 48-foot flatbed trailer with integrated tie-down.
- Trailer equipped with hydraulic or air ride suspension to cushion the load.
- Trailer equipped with four axles.
- Weather cover.
- One frame for IFTC Transport Cask.
- A set of specific equipment (GPS, turning lights, tool box).

WBS Assumptions:

- IFTC Transport Vehicles with Escort Vehicles will be used to ship all Used Fuel from owner Reactor Storage Facilities in IFTCs (Transport Casks).
- Total Project Fleet costs calculated separately and allocated to work element based on share of total fuel bundle count. Derivation of fleet costs and relative allocations attached as .xls under "Multi Element Supporting Information"
- IFTC Transportation Vehicles Escort Vehicle design life is assumed to be 4 years. After initial purchase, units are replaced 14 times over the 60 years from initial service date
- IFTC Transportation Vehicle Tractor design life is assumed to be 7 years. After initial purchase, units are replaced 8 times over the 60 years from initial service date
- IFTC Transportation Vehicles Trailer design life is assumed to be 10 years. After initial purchase, units are replaced 5 times over the 60 years from initial service date
- No allowance for remaining useful life/salvage at time of replacement or retirement.
- See 661.40.40.10 (Equipment for IFTC Transportation Logistics for Real Time Tracking) for acquisition of satellite phones and GPS systems.
- Pricing based on commercial off-the-shelf items verbally confirmed with vendors in the Toronto region by PDD, November 2009 to April 2010. Pricing representative for most of Ontario and in current (2010) dollars.

- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard
Start Year: 25 Finish Year: 85 Duration: 61 year(s) WBS Type: Step-Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
	$9,024,733		$9,024,733	10%	$9,927,206

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

29-Apr-2010 4:44:00 PM WEDS ID # 1118

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 29-Apr-2010

WBS Case: 661 ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)
WBS Number: 661.40.10.120 IFTC Transportation Vehicles for New Build B

WBS Description:

The design, procurement, test and commissioning of IFTC Transportation Vehicles for New Build B.

WBS Deliverable:

IFTC Transportation Vehicle - Escort Vehicle (customized security vehicle), including:
- Anti-theft electronic immobilizer system.
- On board real-time tracking system.
- On-board biometrics system (biometric fingerprint and/or retinal scan).
- Vehicle security enhancements (e.g., typical customization done to RCMP, Police and Homeland security vehicles).

IFTC Transportation Vehicle - Tractor, including:
- Customized tractor similar to those used by US Department of Energy (DOE) "safeguards transporter".
- Electronic Speed Limiter for Ontario- Limits speed to 80km/hr.
- On board real-time tracking system.
- OnGuard Collision Safety System.
- Anti-theft electronic immobilizer system.
- Passenger-mounted LCD touch-screen PC.
- Sleeping berth to accommodate 2 persons.
- On-board biometrics system (biometric fingerprint and/or retinal scan).

IFTC Transportation Vehicle - Trailer (Customized Trailer), including:
- Marking and labeling.
- Hazardous Material Placards.
- On board real-time tracking system.
- Modified 48-foot flatbed trailer with integrated tie-down.
- Trailer equipped with hydraulic or air ride suspension to cushion the load.
- Trailer equipped with four axles.
- Weather cover.
- One frame for IFTC Transport Cask.
- A set of specific equipment (GPS, turning lights, tool box).

WBS Assumptions:

- IFTC Transport Vehicles with Escort Vehicles will be used to ship all Used Fuel from owner Reactor Storage Facilities in IFTCs (Transport Casks).
- Total Project Fleet costs calculated separately and allocated to work element based on share of total fuel bundle count. Derivation of fleet costs and relative allocations attached as .xls under "Multi Element Supporting Information"
- IFTC Transportation Vehicles Escort Vehicle design life is assumed to be 4 years. After initial purchase, units are replaced 14 times over the 60 years from initial service date
- IFTC Transportation Vehicle Tractor design life is assumed to be 7 years. After initial purchase, units are replaced 8 times over the 60 years from initial service date
- IFTC Transportation Vehicles Trailer design life is assumed to be 10 years. After initial purchase, units are replaced 5 times over the 60 years from initial service date
- No allowance for remaining useful life/salvage at time of replacement or retirement.
- See 661.40.40.10 (Equipment for IFTC Transportation Logistics for Real Time Tracking) for acquisition of satellite phones and GPS systems.
- Pricing based on commercial off-the-shelf items verbally confirmed with vendors in the Toronto region by PDD, November 2009 to April 2010. Pricing representative for most of Ontario and in current (2010) dollars.

- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard
Start Year: 25 Finish Year: 85 Duration: 61 year(s) WBS Type: Step-Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
	$9,511,578		$9,511,578	10%	$10,462,736

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1070

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 17-Feb-2010

WBS Case: 661 ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)
WBS Number: 661.40.20.10.30 IFTC Transport Cask non-Site-Specific

WBS Description:

The design, procurement, test and commissioning of IFTC Transport Cask and Impact Limiter for mock-up (demonstration units).

WBS Deliverable:

- Completed system design basis documentation.
- An approved Design Package Approval Certificate issued by the Competent Authority.
- A licensed IFTC system and the approved commissioning plans.

IFTC Transport Cask and Impact Limiter, including:
- Marking and labeling
- Real-time tracking system
- Design features for repeat usage
- Design features for mounting on IFTC Transport Vehicle Trailer Frame

WBS Assumptions:

- One IFTC Transport Cask and Impact Limiter will be used for mock-up/demonstration.
- IFTC Transport Cask and Impact Limiter design life is assumed to be 30 years from initial service date, however, no replacement of mock-up assumed.
- The total cost of the Transport Cask and Impact Limiter mock-up is not specific to the Reactor Storage Facility
- Transport Cask and Impact Limiter mock-up is allocated to the licensing requirement for services and testing
- See 661.40.40.10 (Equipment for IFTC Transportation Logistics for Real Time Tracking) for acquisition of satellite phones and GPS systems.
- See 661.40.40.20 (Equipment for IFTC Transportation Logistics for Emergency Response) for acquisition of emergency response equipment, including spare set of transportation equipment.
- Pricing based on costs for specialty items identified by Cogema (2003) adjusted for new requirements, location and current dollars by PDD using professional judgement.
- Also subject to overall UFTS assumptions.

Exclusive of Contingency.

WBS Allowance Basis:

Standard
Start Year: 22 Finish Year: 24 Duration: 3 year(s) WBS Type: Step-Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$270,600	$2,125,000		$2,395,600	10%	$2,635,160

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1065

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 17-Feb-2010

WBS Case: 661 ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)
WBS Number: 661.40.20.20 IFTC Transport Casks for Whiteshell

WBS Description:

The procurement, test and commissioning of IFTC Transport Casks and Impact Limiters for Whiteshell.

WBS Deliverable:

IFTC Transport Cask and Impact Limiter, including:
- Marking and labeling
- Real-time tracking system
- Design features for repeat usage
- Design features for mounting on IFTC Transport Vehicle Trailer Frame

WBS Assumptions:

- The IFTC Transport Cask and Impact Limiter will be used to ship all Used Fuel in Modules from owner Reactor Storage Facilities.
- Total Project fleet costs calculated separately and allocated to work element based on share of total fuel bundle count. - IFTC Transport Cask and Impact Limiter design life is assumed to be approximately 30 years (one replacement during shipping period).
- See 661.40.40.10 (Equipment for IFTC Transportation Logistics for Real Time Tracking) for acquisition of satellite phones and GPS systems.
- See 661.40.40.20 (Equipment for IFTC Transportation Logistics for Emergency Response) for acquisition of emergency response equipment, including spare set of transportation equipment.
- Pricing for specialty items identified by Cogema (2003) adjusted for new requirements, location and current dollars by PDD using professional judgement.
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 24 Finish Year: 54 Duration: 31 year(s) WBS Type: Step-Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
	$4,663		$4,663	10%	$5,130

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1073

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 17-Feb-2010

WBS Case: 661 ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)
WBS Number: 661.40.20.30 IFTC Transport Casks for Bruce

WBS Description:

The procurement, test and commissioning of IFTC Transport Casks and Impact Limiters for Bruce.

WBS Deliverable:

IFTC Transport Cask and Impact Limiter, including:
- Marking and labeling
- Real-time tracking system
- Design features for repeat usage
- Design features for mounting on IFTC Transport Vehicle Trailer Frame

WBS Assumptions:

- The IFTC Transport Cask and Impact Limiter will be used to ship all Used Fuel in Modules from owner Reactor Storage Facilities.
- Total Project fleet costs calculated separately and allocated to work element based on share of total fuel bundle count. - IFTC Transport Cask and Impact Limiter design life is assumed to be approximately 30 years (one replacement during shipping period).
- See 661.40.40.10 (Equipment for IFTC Transportation Logistics for Real Time Tracking) for acquisition of satellite phones and GPS systems.
- See 661.40.40.20 (Equipment for IFTC Transportation Logistics for Emergency Response) for acquisition of emergency response equipment, including spare set of transportation equipment.
- Pricing for specialty items identified by Cogema (2003) adjusted for new requirements, location and current dollars by PDD using professional judgement.
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard
Start Year: 24 Finish Year: 54 Duration: 31 year(s) WBS Type: Step-Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
	$28,444,685		$28,444,685	10%	$31,289,153

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1067

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 17-Feb-2010

WBS Case: 661 ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)
WBS Number: 661.40.20.40 IFTC Transport Casks for Pickering

WBS Description:

The procurement, test and commissioning of IFTC Transport Casks and Impact Limiters for Pickering.

WBS Deliverable:

IFTC Transport Cask and Impact Limiter, including:
- Marking and labeling
- Real-time tracking system
- Design features for repeat usage
- Design features for mounting on IFTC Transport Vehicle Trailer Frame

WBS Assumptions:

- The IFTC Transport Cask and Impact Limiter will be used to ship all Used Fuel in Modules from owner Reactor Storage Facilities.
- Total Project fleet costs calculated separately and allocated to work element based on share of total fuel bundle count. - IFTC Transport Cask and Impact Limiter design life is assumed to be approximately 30 years (one replacement during shipping period).
- See 661.40.40.10 (Equipment for IFTC Transportation Logistics for Real Time Tracking) for acquisition of satellite phones and GPS systems.
- See 661.40.40.20 (Equipment for IFTC Transportation Logistics for Emergency Response) for acquisition of emergency response equipment, including spare set of transportation equipment.
- Pricing for specialty items identified by Cogema (2003) adjusted for new requirements, location and current dollars by PDD using professional judgement.
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard
Start Year: 24 Finish Year: 54 Duration: 31 year(s) WBS Type: Step-Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
	$15,026,153		$15,026,153	10%	$16,528,768

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1068

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 17-Feb-2010

WBS Case: 661 ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)
WBS Number: 661.40.20.50 IFTC Transport Casks for Darlington

WBS Description:

The procurement, test and commissioning of IFTC Transport Casks and Impact Limiters for Darlington.

WBS Deliverable:

IFTC Transportat Cask and Impact Limiter, including:
- Marking and labeling
- Real-time tracking system
- Design features for repeat usage
- Design features for mounting on IFTC Transport Vehicle Trailer Frame

WBS Assumptions:

- The IFTC Transport Cask and Impact Limiter will be used to ship all Used Fuel in Modules from owner Reactor Storage Facilities.
- Total Project fleet costs calculated separately and allocated to work element based on share of total fuel bundle count. - IFTC Transport Cask and Impact Limiter design life is assumed to be approximately 30 years (one replacement during shipping period).
- See 661.40.40.10 (Equipment for IFTC Transportation Logistics for Real Time Tracking) for acquisition of satellite phones and GPS systems.
- See 661.40.40.20 (Equipment for IFTC Transportation Logistics for Emergency Response) for acquisition of emergency response equipment, including spare set of transportation equipment.
- Pricing for specialty items identified by Cogema (2003) adjusted for new requirements, location and current dollars by PDD using professional judgement.
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard
Start Year: 24 Finish Year: 54 Duration: 31 year(s) WBS Type: Step-Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
	$16,190,439		$16,190,439	10%	$17,809,483

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1069

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 17-Feb-2010

WBS Case: 661 ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)
WBS Number: 661.40.20.60 IFTC Transport Casks for Point Lepreau

WBS Description:

The procurement, test and commissioning of IFTC Transport Casks and Impact Limiters for Point Lepreau.

WBS Deliverable:

IFTC Transport Cask and Impact Limiter, including:
- Marking and labeling
- Real-time tracking system
- Design features for repeat usage
- Design features for mounting on IFTC Transport Vehicle Trailer Frame

WBS Assumptions:

- The IFTC Transport Cask and Impact Limiter will be used to ship all Used Fuel in Modules from owner Reactor Storage Facilities
- Total Project fleet costs calculated separately and allocated to work element based on share of total fuel bundle count. - IFTC Transport Cask and Impact Limiter design life is assumed to be approximately 30 years (one replacement during shipping period).
- See 661.40.40.10 (Equipment for IFTC Transportation Logistics for Real Time Tracking) for acquisition of satellite phones and GPS systems.
- See 661.40.40.20 (Equipment for IFTC Transportation Logistics for Emergency Response) for acquisition of emergency response equipment, including spare set of transportation equipment.
- Pricing for specialty items identified by Cogema (2003) adjusted for new requirements, location and current dollars by PDD using professional judgement.
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard
Start Year: 24 Finish Year: 54 Duration: 31 year(s) WBS Type: Step-Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
	$3,467,211		$3,467,211	10%	$3,813,932

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

30-Apr-2010 5:43:24 PM WEDS ID # 1129

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 30-Apr-2010

WBS Case: 661 ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)
WBS Number: 661.40.20.70 IFTC Transport Casks for Chalk River

WBS Description:

The procurement, test and commissioning of IFTC Transport Casks and Impact Limiters for Chalk River.

WBS Deliverable:

IFTC Transportation Cask and Impact Limiter, including:
- Marking and labeling
- Real-time tracking system
- Design features for repeat usage
- Design features for mounting on IFTC Transport Vehicle Trailer Frame

WBS Assumptions:

- The IFTC Transport Cask and Impact Limiter will be used to ship all Used Fuel in Modules from owner Reactor Storage Facilities.
- Total Project fleet costs calculated separately and allocated to work element based on share of total fuel bundle count. - IFTC Transport Cask and Impact Limiter design life is assumed to be approximately 30 years (one replacement during shipping period).
- See 661.40.40.10 (Equipment for IFTC Transportation Logistics for Real Time Tracking) for acquisition of satellite phones and GPS systems.
- See 661.40.40.20 (Equipment for IFTC Transportation Logistics for Emergency Response) for acquisition of emergency response equipment, including spare set of transportation equipment.
- Pricing for specialty items identified by Cogema (2003) adjusted for new requirements, location and current dollars by PDD using professional judgement.
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 24 Finish Year: 54 Duration: 31 year(s) WBS Type: Step-Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
	$62,997		$62,997	10%	$69,296

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1071

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 17-Feb-2010

WBS Case: 661 ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)
WBS Number: 661.40.20.80 IFTC Transport Casks for Gentilly 1

WBS Description:

The procurement, test and commissioning of IFTC Transport Casks and Impact Limiters for Gentilly 1.

WBS Deliverable:

IFTC Transport Cask and Impact Limiter, including:
- Marking and labeling
- Real-time tracking system
- Design features for repeat usage
- Design features for mounting on IFTC Transport Vehicle Trailer Frame

WBS Assumptions:

- The IFTC Transport Cask and Impact Limiter will be used to ship all Used Fuel in Modules from owner Reactor Storage Facilities.
- Total Project fleet costs calculated separately and allocated to work element based on share of total fuel bundle count. - IFTC Transport Cask and Impact Limiter design life is assumed to be approximately 30 years (one replacement during shipping period).
- See 661.40.40.10 (Equipment for IFTC Transportation Logistics for Real Time Tracking) for acquisition of satellite phones and GPS systems.
- See 661.40.40.20 (Equipment for IFTC Transportation Logistics for Emergency Response) for acquisition of emergency response equipment, including spare set of transportation equipment.
- Pricing for specialty items identified by Cogema (2003) adjusted for new requirements, location and current dollars by PDD using professional judgement.
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 24 Finish Year: 54 Duration: 31 year(s) WBS Type: Step-Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
	$41,995		$41,995	10%	$46,194

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

4-Jun-2010 8:24:14 AM WEDS ID # 1130

Organization Name: Palladium Product Development & Design
Prepared by: Richard Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date:

WBS Case: 661 ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)
WBS Number: 661.40.20.90 IFTC Transport Casks for Gentilly 2

WBS Description:

The procurement, test and commissioning of IFTC Transport Casks and Impact Limiters for Gentilly 2.

WBS Deliverable:

IFTC Transportation Cask and Impact Limiter, including:
- Marking and labeling
- Real-time tracking system
- Design features for repeat usage
- Design features for mounting on IFTC Transport Vehicle Trailer Frame

WBS Assumptions:

- The IFTC Transport Cask and Impact Limiter will be used to ship all Used Fuel in Modules from owner Reactor Storage Facilities.
- Total Project fleet costs calculated separately and allocated to work element based on share of total fuel bundle count. - IFTC Transport Cask and Impact Limiter design life is assumed to be approximately 30 years (one replacement during shipping period).
- See 661.40.40.10 (Equipment for IFTC Transportation Logistics for Real Time Tracking) for acquisition of satellite phones and GPS systems.
- See 661.40.40.20 (Equipment for IFTC Transportation Logistics for Emergency Response) for acquisition of emergency response equipment, including spare set of transportation equipment.
- Pricing for specialty items identified by Cogema (2003) adjusted for new requirements, location and current dollars by PDD using professional judgement.
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard
Start Year: 24 Finish Year: 54 Duration: 31 year(s) WBS Type: Step-Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
	$3,306,218		$3,306,218	10%	$3,636,839

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1066

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 17-Feb-2010

WBS Case: 661 ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)
WBS Number: 661.40.20.100 IFTC Transport Casks for Douglas Point

WBS Description:

The procurement, test and commissioning of IFTC Transport Casks and Impact Limiters for Douglas Point.

WBS Deliverable:

IFTC Transport Cask and Impact Limiter, including:
- Marking and labeling
- Real-time tracking system
- Design features for repeat usage
- Design features for mounting on IFTC Transport Vehicle Trailer Frame

WBS Assumptions:

- The IFTC Transport Cask and Impact Limiter will be used to ship all Used Fuel in Modules from owner Reactor Storage Facilities.
- Total Project fleet costs calculated separately and allocated to work element based on share of total fuel bundle count. - IFTC Transport Cask and Impact Limiter design life is assumed to be approximately 30 years (one replacement during shipping period).
- See 661.40.40.10 (Equipment for IFTC Transportation Logistics for Real Time Tracking) for acquisition of satellite phones and GPS systems.
- See 661.40.40.20 (Equipment for IFTC Transportation Logistics for Emergency Response) for acquisition of emergency response equipment, including spare set of transportation equipment.
- Pricing for specialty items identified by Cogema (2003) adjusted for new requirements, location and current dollars by PDD using professional judgement.
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 24 Finish Year: 54 Duration: 31 year(s) WBS Type: Step-Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
	$289,327		$289,327	10%	$318,260

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

29-Apr-2010 4:45:29 PM WEDS ID # 1119

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 29-Apr-2010

WBS Case: 661 ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)
WBS Number: 661.40.20.110 IFTC Transportation Cask for New Build A

WBS Description:

The design, procurement, test and commissioning of IFTC Transport Casks and Impact Limiters for New Build A.

WBS Deliverable:

IFTC Transport Cask and Impact Limiter, including:
- Marking and labeling
- Real-time tracking system
- Design features for repeat usage
- Design features for mounting on IFTC Transport Vehicle Trailer Frame

WBS Assumptions:

- The IFTC Transport Cask and Impact Limiter will be used to ship all Used Fuel in Modules from owner Reactor Storage Facilities.
- IFTC Transport Cask and Impact Limiter design life is assumed to be approximately 30 years (one replacement during shipping period).
- See 661.40.40.10 (Equipment for IFTC Transportation Logistics for Real Time Tracking) for acquisition of satellite phones and GPS systems.
- See 661.40.40.20 (Equipment for IFTC Transportation Logistics for Emergency Response) for acquisition of emergency response equipment, including spare set of transportation equipment.
- Pricing for specialty items identified by Cogema (2003) adjusted for new requirements, location and current dollars by PDD using professional judgement.
- Total Project fleet costs calculated separately and allocated to work element based on share of total fuel bundle count. - Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard
Start Year: 24 Finish Year: 54 Duration: 31 year(s) WBS Type: Step-Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
	$9,818,324		$9,818,324	10%	$10,800,157

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

29-Apr-2010 4:46:11 PM WEDS ID # 1120

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 29-Apr-2010

WBS Case: 661 ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)
WBS Number: 661.40.20.120 IFTC Transportation Cask for New Build B

WBS Description:

The design, procurement, test and commissioning of IFTC Transport Casks and Impact Limiters for New Build B.

WBS Deliverable:

IFTC Transport Cask and Impact Limiter, including:
- Marking and labeling
- Real-time tracking system
- Design features for repeat usage
- Design features for mounting on IFTC Transport Vehicle Trailer Frame

WBS Assumptions:

- The IFTC Transport Cask and Impact Limiter will be used to ship all Used Fuel in Modules from owner Reactor Storage Facilities.
- IFTC Transport Cask and Impact Limiter design life is assumed to be approximately 30 years (one replacement during shipping period).
- See 661.40.40.10 (Equipment for IFTC Transportation Logistics for Real Time Tracking) for acquisition of satellite phones and GPS systems.
- See 661.40.40.20 (Equipment for IFTC Transportation Logistics for Emergency Response) for acquisition of emergency response equipment, including spare set of transportation equipment.
- Pricing for specialty items identified by Cogema (2003) adjusted for new requirements, location and current dollars by PDD using professional judgement.
- Total Project fleet costs calculated separately and allocated to work element based on share of total fuel bundle count. - Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 24 Finish Year: 54 Duration: 31 year(s) WBS Type: Step-Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
	$10,347,980		$10,347,980	10%	$11,382,778

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1084

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 17-Feb-2010

WBS Case: 661 ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)
WBS Number: 661.40.30.10 Equipment for IFTC Transport Cask Loading non-Site-Specific

WBS Description:

Final design/design integration for Irradiated Fuel Transport Cask (IFTC) loading (modules to cask and cask to transporter) at reactor sites.

WBS Deliverable:

Completed system design basis for the integration of the Equipment for IFTC Transport Cask Loading at the different sites, including:
- Conceptual design
- Licensing documentation
- Detailed design files and related procurement specifications

WBS Assumptions:

- Equipment procurement, inspection, site-specific supervision, facility development, testing & commissioning is accounted for in individual facility costs (661.40.30.20 through 661.40.30. 120).
- Site-specific loading mock-ups at each Reactor Storage Facilities are accounted for per facility; the equipment used for the mock-ups will be the same equipment subsequently used for IFTC Loading.
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 20 Finish Year: 25 Duration: 6 year(s) WBS Type: Step-Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$1,082,400			$1,082,400	15%	$1,244,760

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1072

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	17-Feb-2010

WBS Case: 661 ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)

WBS Number: 661.40.30.20 Equipment for IFTC Transport Cask Loading at Whiteshell

WBS Description:

The design, procurement, test and commissioning of equipment for IFTC Transport Cask loading at Whiteshell.

WBS Deliverable:

One set of Transport Cask loading facilities for transfer-plate based fuel transfer (no Hot Cell), as follows:

Transfer Area Equipment:

- IFTC Transfer Plate
- Remote Camera System
- Owner's Flask Docking System
- Owner's Flask Lock Equipment
- Leakage and purging equipment (Air/water separator, pump, vacuum gauges, valves, compressed air line, helium)
- Air Pressure Decay Test Equipment
- Smear Test Equipment Sets & Radiameters
- IFTC Bot Driver

Decontamination Area/Booth:

- Miscellaneous equipment, scaffolding, etc.

Shipment Area (also used as Transfer Area):

- (leased) 100 ton portable crane (for loading the IFTC Transportation Cask onto IFTC Transportation Vehicle, loading the Owners Flask on IFTC Transfer Plate and loading Impact Limiter)
- Three Lifting beams (IFTC Transport Cask, Impact Limiter, and Owner's Flask onto IFTC Transfer Plate)

WBS Assumptions:

- The design life of the UFTS equipment is assumed to be at least 30 years from initial service date (no replacement).
- Single process line.
- Host facility provides all working, transfer, laydown, staff support and holding areas at no cost to Project.
- Host facility provides all effort and equipment to retrieve fuel and place it, in modules, on the IFTC transfer plate at no cost to Project.
- Host facility provides all effort and equipment related to site security, management of conventional and radiological waste material, etc., at no cost to Project.
- Design is conceptual: minor and incidental costs up to and including aspects such as a local service point for the tracking and emergency response network ("crisis room") are included in "Allowance".
- Cask decontamination is assumed to be a manual operation with minimal equipment requirements.
- Whiteshell facility is assumed to supply Owner's Transfer Flask, Transport Vehicle for Owner's Transfer Flask, 30 ton gantry crane and 60 ton crane at no cost to Project.
- Whiteshell and Chalk River may share equipment, including leakage and purging equipment, tooling, lifting beams, smear testing equipment and radiameters; current estimate carries unique equipment sets for each Site.
- Owners Transfer Flask is owner's responsibility and will be used to load IFTC Transport Cask
- Rented crane is used transfer operation (100 ton specified; 60 ton minimum).
- Pricing for custom equipment based on recent (2000 to 2010) PDD project data, adjusted by PDD for unique requirements, location and current dollars using professional judgement.

- Pricing for specialty items identified by Cogema (2003) adjusted for new requirements, location and current dollars by PDD using professional judgement.
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 50 Finish Year: 51 Duration: 2 year(s) WBS Type: Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$281,710	$639,000	$75,000	$995,710	15%	$1,145,067

WBS Specific Supporting Documentation:
ID 54 100 ton portable crane 3900_001-GMK4115Cost.pdf
ID 54 100 ton portable crane GMK4100B_PG.pdf
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xlsTM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1075

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	17-Feb-2010

WBS Case: 661 ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)

WBS Number: 661.40.30.30 Equipment for IFTC Transport Cask Loading at Bruce

WBS Description:

The design, procurement, test and commissioning of the Equipment for IFTC Transport Cask Loading at Bruce.

WBS Deliverable:

One set of Transport Cask loading facilities for hot-cell-based fuel transfer, as follows:

Dedicated Building/New Construction

Equipped Hot Cell, including:
- Hoist n° 1 with one gripper to remove Transfer Clamp and to open or close the Owner's Cask Lid
- Hoist n° 2 with one gripper to unload the modules from the Owner's Casks and load the IFTC Cask
- Hoist n° 3 with one gripper to open or close the IFTC Cask lid
- Lifting Beam for Lid of the Owner's Cask
- Lifting Beam for Lid of the IFTC Transport Cask
- Master-slave telemanipulators
- Shielded windows
- Lining
- Misc. hot cell equipment
- Remote Camera system
- Vacuum Cleaning Unit
- Shielded equipment door
- Hot Cell Shuttle- Owner's Cask
- Hot Cell Pit Shielding Cover - Owner's Cask
- Owner's Cask Lift
- Owner's Cask Docking Port and Gate
- Owner's Cask Lift Lock
- Hot Cell Shuttle- IFTC Cask
- Hot Cell Pit Shielding Cover - IFTC Cask
- IFTC Cask Lift
- IFTC Cask Docking Port and Gate
- IFTC Cask Lift Lock

Additional Equipment, including:
- Leakage and purging equipment (air/water separator, pump, vacuum gauges, valves, compressed air line, helium)
- Air Pressure Decay test equipment
- Smear testing equipment & radiometers
- IFTC Lid Transfer Clamp
- IFTC Bot Driver

Decontamination Area/Booth:
- Miscellaneous equipment, walkways, etc;

Shipping Area, including:
- Two Gantry Cranes (10 ton crane for loading the Impact Limiters; 60 ton crane for loading the IFTC Transportation Cask onto IFTC Transportation Vehicle Trailer, loading IFTC into Hot Cell Loading Pit and loading DSC into Hot Cell Loading Pit)
- Three Lifting beams (Owner's Cask, IFTC Transport Cask and IFTC Impact Limiter)

WBS Assumptions:

- The design life of the UFTS equipment and new Transfer Facilities Building is assumed to be 60 years from initial service date (no replacement).
- Bruce Hot Cell and related equipment is shared with Douglas Point. Costs apportioned between the two on bundle count (Approx. 99% assigned to Bruce).
- Single process line.
- Pricing based on installation in Western Used Fuel Dry Storage Facility (WUFDSF) or similar.
- Host facility provides building area, working, transfer, laydown, staff support and holding areas at no cost to Project.
- Host facility provides all effort and equipment to retrieve fuel and place it into the Hot Cell at no cost to Project.
- Host facility provides all effort and equipment related to site security, management of conventional and radiological waste material, etc., at no cost to Project.
- Design is conceptual: minor and incidental costs up to and including aspects such as a local service point for the tracking and emergency response network ("crisis room") are included in "Allowance".
- Cask decontamination is assumed to be a manual operation with minimal equipment requirements.
- Pricing for custom equipment based on recent (2000 to 2010) PDD project data, adjusted by PDD for unique requirements, location and current dollars using professional judgement.
- Pricing for specialty items identified by Cogema (2003) adjusted for new requirements, location and current dollars by PDD using professional judgement.
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 20 Finish Year: 25 Duration: 6 year(s) WBS Type: Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$5,492,316	$23,900,894	$1,166,019	$30,559,228	15%	$35,143,112

WBS Specific Supporting Documentation:

Multi Element Supporting Documentation:

RC DETS Alternate Case Final Sept 9, 10.xls

TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1076

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	17-Feb-2010

WBS Case:	661	ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)
WBS Number:	661.40.30.40	Equipment for IFTC Transport Cask Loading at Pickering

WBS Description:

The design, procurement, test and commissioning of the Equipment for IFTC Transport Cask Loading at Pickering.

WBS Deliverable:

One set of Transport Cask loading facilities for hot-cell-based fuel transfer, as follows:

Dedicated Building/New Construction

Equipped Hot Cell, including:
- Hoist n° 1 with one gripper to remove Transfer Clamp and to open or close the Owner's Cask Lid
- Hoist n° 2 with one gripper to unload the modules from the Owner's Casks and load the IFTC Cask
- Hoist n° 3 with one gripper to open or close the IFTC Cask lid
- Lifting Beam for Lid of the Owner's Cask
- Lifting Beam for Lid of the IFTC Transport Cask
- Master-slave telemanipulators
- Shielded windows
- Lining
- Misc. hot cell equipment
- Remote Camera system
- Vacuum Cleaning Unit
- Shielded equipment door
- Hot Cell Shuttle- Owner's Cask
- Hot Cell Pit Shielding Cover - Owner's Cask
- Owner's Cask Lift
- Owner's Cask Docking Port and Gate
- Owner's Cask Lift Lock
- Hot Cell Shuttle- IFTC Cask
- Hot Cell Pit Shielding Cover - IFTC Cask
- IFTC Cask Lift
- IFTC Cask Docking Port and Gate
- IFTC Cask Lift Lock

Additional Equipment, including:
- Leakage and purging equipment (air/water separator, pump, vacuum gauges, valves, compressed air line, helium)
- Air Pressure Decay test equipment
- Smear testing equipment & radiometers
- IFTC Lid Transfer Clamp
- IFTC Bolt Driver

Decontamination Area/Booth:
- Miscellaneous equipment, walkways, etc;

Shipping Area, including:
- Two Gantry Cranes (10 ton crane for loading the Impact Limiters; 60 ton crane for loading the IFTC Transportation Cask onto IFTC Transportation Vehicle Trailer, loading IFTC into Hot Cell Loading Pit and loading DSC into Hot Cell Loading Pit)
- Three Lifting beams (Owner's Cask, IFTC Transport Cask and IFTC Impact Limiter)

WBS Assumptions:

- The design life of the UFTS equipment and new Transfer Facilities Building is assumed to be 60 years from initial service date (no replacement).
- Single process line.
- Pricing based on installation in Pickering Used Fuel Dry Storage Facility (PUFDSF) or similar.
- Host facility provides building area, working, transfer, laydown, staff support and holding areas at no cost to Project.
- Host facility provides all effort and equipment to retrieve fuel and place it into the Hot Cell at no cost to Project.
- Host facility provides all effort and equipment related to site security, management of conventional and radiological waste material, etc., at no cost to Project.
- Design is conceptual: minor and incidental costs up to and including aspects such as a local service point for the tracking and emergency response network ("crisis room") are included in "Allowance".
- Cask decontamination is assumed to be a manual operation with minimal equipment requirements.
- Pricing for custom equipment based on recent (2000 to 2010) PDD project data, adjusted by PDD for unique requirements, location and current dollars using professional judgement.
- Pricing for specialty items identified by Cogema (2003) adjusted for new requirements, location and current dollars by PDD using professional judgement.
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 20 Finish Year: 25 Duration: 6 year(s) WBS Type: Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$5,548,180	$24,144,000	$1,178,000	$30,870,180	15%	$35,500,707

WBS Specific Supporting Documentation:

Multi Element Supporting Documentation:

RC DETS Alternate Case Final Sept 9, 10.xls

TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1077

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	17-Feb-2010

WBS Case: 661 ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)

WBS Number: 661.40.30.50 Equipment for IFTC Transport Cask Loading at Darlington

WBS Description:

The design, procurement, test and commissioning of the Equipment for IFTC Transport Cask Loading at Darlington.

WBS Deliverable:

One set of Transport Cask loading facilities for hot-cell-based fuel transfer, as follows:

Dedicated Building/New Construction

Equipped Hot Cell, including:
- Hoist n° 1 with one gripper to remove Transfer Clamp and to open or close the Owner's Cask Lid
- Hoist n° 2 with one gripper to unload the modules from the Owner's Casks and load the IFTC Cask
- Hoist n° 3 with one gripper to open or close the IFTC Cask lid
- Lifting Beam for Lid of the Owner's Cask
- Lifting Beam for Lid of the IFTC Transport Cask
- Master-slave telemanipulators
- Shielded windows
- Lining
- Misc. hot cell equipment
- Remote Camera system
- Vacuum Cleaning Unit
- Shielded equipment door
- Hot Cell Shuttle- Owner's Cask
- Hot Cell Pit Shielding Cover - Owner's Cask
- Owner's Cask Lift
- Owner's Cask Docking Port and Gate
- Owner's Cask Lift Lock
- Hot Cell Shuttle- IFTC Cask
- Hot Cell Pit Shielding Cover - IFTC Cask
- IFTC Cask Lift
- IFTC Cask Docking Port and Gate
- IFTC Cask Lift Lock

Additional Equipment, including:
- Leakage and purging equipment (air/water separator, pump, vacuum gauges, valves, compressed air line, helium)
- Air Pressure Decay test equipment
- Smear testing equipment & radiometers
- IFTC Lid Transfer Clamp
- IFTC Bolt Driver

Decontamination Area/Booth:
- Miscellaneous equipment, walkways, etc.

Shipping Area, including:
- Two Gantry Cranes (10 ton crane for loading the Impact Limiters; 60 ton crane for loading the IFTC Transportation Cask onto IFTC Transportation Vehicle Trailer, loading IFTC into Hot Cell Loading Pit and loading DSC into Hot Cell Loading Pit)
- Three Lifting beams (Owner's Cask, IFTC Transport Cask and IFTC Impact Limiter)

WBS Assumptions:

- The design life of the UFTS equipment and new Transfer Facilities Building is assumed to be 60 years from initial service date (no replacement).
- Single process line.
- Pricing based on installation in Darlington Used Fuel Dry Storage Facility (DUFDSF) or similar.
- Host facility provides building area, working, transfer, laydown, staff support and holding areas at no cost to Project.
- Host facility provides all effort and equipment to retrieve fuel and place it into the Hot Cell at no cost to Project.
- Host facility provides all effort and equipment related to site security, management of conventional and radiological waste material, etc., at no cost to Project.
- Design is conceptual: minor and incidental costs up to and including aspects such as a local service point for the tracking and emergency response network ("crisis room") are included in "Allowance".
- Cask decontamination is assumed to be a manual operation with minimal equipment requirements.
- Pricing for custom equipment based on recent (2000 to 2010) PDD project data, adjusted by PDD for unique requirements, location and current dollars using professional judgement.
- Pricing for specialty items identified by Cogema (2003) adjusted for new requirements, location and current dollars by PDD using professional judgement.
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 20 Finish Year: 25 Duration: 6 year(s) WBS Type: Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$5,548,180	$24,144,000	$1,178,000	$30,870,180	15%	$35,500,707

WBS Specific Supporting Documentation:

Multi Element Supporting Documentation:

RC DETS Alternate Case Final Sept 9, 10.xls

TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1078

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	17-Feb-2010

WBS Case: 661 ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)

WBS Number: 661.40.30.60 Equipment for IFTC Transport Cask Loading at Point Lepreau

WBS Description:

The design, procurement, test and commissioning of the Equipment for IFTC Transport Cask Loading at Point Lepreau.

WBS Deliverable:

One set of Transport Cask loading facilities for hot-cell-based fuel transfer, as follows:

Dedicated Building/New Construction

Equipped Hot Cell, including:
- Hoist n° 1 with one gripper to remove Transfer Clamp and to open or close the Owner's Cask Lid
- Hoist n° 2 with one gripper to unload the modules from the Owner's Casks and load the IFTC Cask
- Hoist n° 3 with one gripper to open or close the IFTC Cask lid
- Lifting Beam for Lid of the Owner's Cask
- Lifting Beam for Lid of the IFTC Transport Cask
- Master-slave telemanipulators
- Shielded windows
- Lining
- Misc. hot cell equipment
- Remote Camera system
- Vacuum Cleaning Unit
- Shielded equipment door
- Hot Cell Shuttle- Owner's Cask
- Hot Cell Pit Shielding Cover - Owner's Cask
- Owner's Cask Lift
- Owner's Cask Docking Port and Gate
- Owner's Cask Lift Lock
- Hot Cell Shuttle- IFTC Cask
- Hot Cell Pit Shielding Cover - IFTC Cask
- IFTC Cask Lift
- IFTC Cask Docking Port and Gate
- IFTC Cask Lift Lock

Additional Equipment, including:
- Leakage and purging equipment (air/water separator, pump, vacuum gauges, valves, compressed air line, helium)
- Air Pressure Decay test equipment
- Smear testing equipment & radiometers
- IFTC Lid Transfer Clamp
- IFTC Bolt Driver

Decontamination Area/Booth:
- Miscellaneous equipment, walkways, etc;

Shipping Area, including:
- Two Gantry Cranes (10 ton crane for loading the Impact Limiters; 60 ton crane for loading the IFTC Transportation Cask onto IFTC Transportation Vehicle Trailer, loading IFTC into Hot Cell Loading Pit and loading DSC into Hot Cell Loading Pit)
- Three Lifting beams (Owner's Cask, IFTC Transport Cask and IFTC Impact Limiter)

WBS Assumptions:

- The design life of the UFTS equipment and new Transfer Facilities Building is assumed to be 60 years from initial service date (no replacement).
- Single process line.
- Host facility provides building area, working, transfer, laydown, staff support and holding areas at no cost to Project.
- Host facility provides all effort and equipment to retrieve fuel and place it into the Hot Cell at no cost to Project.
- Host facility provides all effort and equipment related to site security, management of conventional and radiological waste material, etc., at no cost to Project.
- Design is conceptual: minor and incidental costs up to and including aspects such as a local service point for the tracking and emergency response network ("crisis room") are included in "Allowance".
- Cask decontamination is assumed to be a manual operation with minimal equipment requirements.
- Pricing for custom equipment based on recent (2000 to 2010) PDD project data, adjusted by PDD for unique requirements, location and current dollars using professional judgement.
- Pricing for specialty items identified by Cogema (2003) adjusted for new requirements, location and current dollars by PDD using professional judgement.
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 35 Finish Year: 40 Duration: 6 year(s) WBS Type: Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$5,548,180	$24,144,000	$1,178,000	$30,870,180	15%	$35,500,707

WBS Specific Supporting Documentation:

Multi Element Supporting Documentation:

RC DETS Alternate Case Final Sept 9, 10.xls

TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1079

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 17-Feb-2010

WBS Case: 661 ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)
WBS Number: 661.40.30.70 Equipment for IFTC Transport Cask Loading at Chalk River

WBS Description:

The design, procurement, test and commissioning of the Equipment for IFTC Transport Cask Loading at Chalk River.

WBS Deliverable:

One set of Transport Cask loading facilities for transfer-plate based fuel transfer (no Hot Cell), as follows:

Transfer Area Equipment:

- IFTC Transfer Plate
- Remote Camera System
- Owner's Flask Docking System
- Owner's Flask Lock Equipment
- Leakage and purging equipment (Air/water separator, pump, vacuum gauges, valves, compressed air line, helium)
- Air Pressure Decay Test Equipment
- Smear Test Equipment Sets & Radiameters
- IFTC Bolt Driver

Decontamination Area/Booth:

- Miscellaneous equipment, scaffolding, etc.

Shipment Area (also used as Transfer Area):

- (leased) 100 ton portable crane (for loading the IFTC Transportation Cask onto IFTC Transportation Vehicle, loading the Owners Flask on IFTC Transfer Plate and loading Impact Limiter)
- Three Lifting beams (IFTC Transport Cask, Impact Limiter, and Owner's Flask onto IFTC Transfer Plate)

WBS Assumptions:

- The design life of the UFTS equipment is assumed to be at least 30 years from initial service date (no replacement).
- Single process line.
- Host facility provides all working, transfer, laydown, staff support and holding areas at no cost to Project.
- Host facility provides all effort and equipment to retrieve fuel and place it, in modules, on the IFTC transfer plate at no cost to Project.
- Host facility provides all effort and equipment related to site security, management of conventional and radiological waste material, etc., at no cost to Project.
- Design is conceptual: minor and incidental costs up to and including aspects such as a local service point for the tracking and emergency response network ("crisis room") are included in "Allowance".
- Cask decontamination is assumed to be a manual operation with minimal equipment requirements.
- Chalk River facility is assumed to supply Owner's Transfer Flask, Transport Vehicle for Owner's Transfer Flask, 30 ton gantry crane and 60 ton crane at no cost to Project.
- Chalk River and Whiteshell may share equipment, including leakage and purging equipment, tooling, lifting beams, smear testing equipment and radiameters; current estimate carries unique equipment sets for each Site.
- Owners Transfer Flask is owner's responsibility and will be used to load IFTC Transport Cask
- Rented crane is used transfer operation (100 ton specified; 60 ton minimum).
- Pricing for custom equipment based on recent (2000 to 2010) PDD project data, adjusted by PDD for unique requirements, location and current dollars using professional judgement.
- Pricing for specialty items identified by Cogema (2003) adjusted for new requirements, location and current dollars by

PDD using professional judgement.
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 50 Finish Year: 51 Duration: 2 year(s) WBS Type: Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$281,710	$639,000	$75,000	$995,710	15%	$1,145,067

WBS Specific Supporting Documentation:
ID 54 100 ton portable crane 3900_001-GMK4115Cost.pdf
ID 54 100 ton portable crane GMK4100B_PG.pdf
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xlsTM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1080

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	17-Feb-2010

WBS Case:	661	ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)
WBS Number:	661.40.30.80	Equipment for IFTC Transport Cask Loading at Gentilly 1

WBS Description:

The design, procurement, test and commissioning of the Equipment for IFTC Transport Cask Loading at Gentilly 1.

WBS Deliverable:

One set of Transport Cask loading facilities for hot-cell-based fuel transfer, as follows:

Dedicated Building/New Construction

Equipped Hot Cell, including:
- Hoist n° 1 with one gripper to remove Transfer Clamp and to open or close the Owner's Cask Lid
- Hoist n° 2 with one gripper to unload the modules from the Owner's Casks and load the IFTC Cask
- Hoist n° 3 with one gripper to open or close the IFTC Cask lid
- Lifting Beam for Lid of the Owner's Cask
- Lifting Beam for Lid of the IFTC Transport Cask
- Master-slave telemanipulators
- Shielded windows
- Lining
- Misc. hot cell equipment
- Remote Camera system
- Vacuum Cleaning Unit
- Shielded equipment door
- Hot Cell Shuttle- Owner's Cask
- Hot Cell Pit Shielding Cover - Owner's Cask
- Owner's Cask Lift
- Owner's Cask Docking Port and Gate
- Owner's Cask Lift Lock
- Hot Cell Shuttle- IFTC Cask
- Hot Cell Pit Shielding Cover - IFTC Cask
- IFTC Cask Lift
- IFTC Cask Docking Port and Gate
- IFTC Cask Lift Lock

Additional Equipment, including:
- Leakage and purging equipment (air/water separator, pump, vacuum gauges, valves, compressed air line, helium)
- Air Pressure Decay test equipment
- Smear testing equipment & radiometers
- IFTC Lid Transfer Clamp
- IFTC Bolt Driver

Decontamination Area/Booth:
- Miscellaneous equipment, walkways, etc;

Shipping Area, including:
- Two Gantry Cranes (10 ton crane for loading the Impact Limiters; 60 ton crane for loading the IFTC Transportation Cask onto IFTC Transportation Vehicle Trailer, loading IFTC into Hot Cell Loading Pit and loading DSC into Hot Cell Loading Pit)
- Three Lifting beams (Owner's Cask, IFTC Transport Cask and IFTC Impact Limiter)

WBS Assumptions:

The design life of the UFTS equipment and new Transfer Facilities Building is assumed to be 60 years from initial service date (no replacement).
- Gentilly 1 is assumed to host new Transfer Facilities Building
- Gentilly 1 will share Hot Cell, Shipping Facility, Gantry Cranes and equipment with Gentilly 2. Equipment cost is apportioned between Gentilly 1 and 2 according to bundle count (approx. 1.3% to Gentilly 1). - Single process line.
- Host facility provides building area, working, transfer, laydown, staff support and holding areas at no cost to Project.
- Host facility provides all effort and equipment to retrieve fuel and place it into the Hot Cell at no cost to Project.
- Host facility provides all effort and equipment related to site security, management of conventional and radiological waste material, etc., at no cost to Project.
- Design is conceptual: minor and incidental costs up to and including aspects such as a local service point for the tracking and emergency response network ("crisis room") are included in "Allowance".
- Cask decontamination is assumed to be a manual operation with minimal equipment requirements.
- Pricing for custom equipment based on recent (2000 to 2010) PDD project data, adjusted by PDD for unique requirements, location and current dollars using professional judgement.
- Pricing for specialty items identified by Cogema (2003) adjusted for new requirements, location and current dollars by PDD using professional judgement.
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 35 Finish Year: 40 Duration: 6 year(s) WBS Type: Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$69,681	$302,852	$14,776	$387,309	15%	$445,405

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1081

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	17-Feb-2010

WBS Case: 661 ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)

WBS Number: 661.40.30.90 Equipment for IFTC Transport Cask Loading at Gentilly 2

WBS Description:

The design, procurement, test and commissioning of the Equipment for IFTC Transport Cask Loading at Gentilly 2.

WBS Deliverable:

One set of Transport Cask loading facilities for hot-cell-based fuel transfer, as follows:

Dedicated Building/New Construction

Equipped Hot Cell, including:
- Hoist n° 1 with one gripper to remove Transfer Clamp and to open or close the Owner's Cask Lid
- Hoist n° 2 with one gripper to unload the modules from the Owner's Casks and load the IFTC Cask
- Hoist n° 3 with one gripper to open or close the IFTC Cask lid
- Lifting Beam for Lid of the Owner's Cask
- Lifting Beam for Lid of the IFTC Transport Cask
- Master-slave telemanipulators
- Shielded windows
- Lining
- Misc. hot cell equipment
- Remote Camera system
- Vacuum Cleaning Unit
- Shielded equipment door
- Hot Cell Shuttle- Owner's Cask
- Hot Cell Pit Shielding Cover - Owner's Cask
- Owner's Cask Lift
- Owner's Cask Docking Port and Gate
- Owner's Cask Lift Lock
- Hot Cell Shuttle- IFTC Cask
- Hot Cell Pit Shielding Cover - IFTC Cask
- IFTC Cask Lift
- IFTC Cask Docking Port and Gate
- IFTC Cask Lift Lock

Additional Equipment, including:
- Leakage and purging equipment (air/water separator, pump, vacuum gauges, valves, compressed air line, helium)
- Air Pressure Decay test equipment
- Smear testing equipment & radiometers
- IFTC Lid Transfer Clamp
- IFTC Bolt Driver

Decontamination Area/Booth:
- Miscellaneous equipment, walkways, etc;

Shipping Area, including:
- Two Gantry Cranes (10 ton crane for loading the Impact Limiters; 60 ton crane for loading the IFTC Transportation Cask onto IFTC Transportation Vehicle Trailer, loading IFTC into Hot Cell Loading Pit and loading DSC into Hot Cell Loading Pit)
- Three Lifting beams (Owner's Cask, IFTC Transport Cask and IFTC Impact Limiter)

WBS Assumptions:

- The design life of the UFTS equipment and new Transfer Facilities Building is assumed to be 60 years from initial service date (no replacement).
- Gentilly 1 is assumed to host new Transfer Facilities Building
- Gentilly 1 will share Hot Cell, Shipping Facility, Gantry Cranes and equipment with Gentilly 2. Equipment cost is apportioned between Gentilly 1 and 2 according to bundle count (approx. 99% to Gentilly 2). - Single process line.
- Host facility provides building area, working, transfer, laydown, staff support and holding areas at no cost to Project.
- Host facility provides all effort and equipment to retrieve fuel and place it into the Hot Cell at no cost to Project.
- Host facility provides all effort and equipment related to site security, management of conventional and radiological waste material, etc., at no cost to Project.
- Design is conceptual: minor and incidental costs up to and including aspects such as a local service point for the tracking and emergency response network ("crisis room") are included in "Allowance".
- Cask decontamination is assumed to be a manual operation with minimal equipment requirements.
- Pricing for custom equipment based on recent (2000 to 2010) PDD project data, adjusted by PDD for unique requirements, location and current dollars using professional judgement.
- Pricing for specialty items identified by Cogema (2003) adjusted for new requirements, location and current dollars by PDD using professional judgement.
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 35 Finish Year: 40 Duration: 6 year(s) WBS Type: Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$5,478,493	$23,841,148	$1,163,224	$30,482,866	15%	$35,055,295

WBS Specific Supporting Documentation:

Multi Element Supporting Documentation:

RC DETS Alternate Case Final Sept 9, 10.xls

TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1082

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 17-Feb-2010

WBS Case: 661 ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)
WBS Number: 661.40.30.100 Equipment for IFTC Transport Cask Loading Douglas Point

WBS Description:

The design, procurement, test and commissioning of the Equipment for IFTC Transport Cask Loading at Douglas Point.

WBS Deliverable:

Douglas Point to share Transfer Facilities Building at Bruce to load the IFTC Transport Cask and to unload, prepare and load the IFTC Transport Cask from the IFTC Transport Vehicle trailer

WBS Assumptions:

- The design life of the UFTS equipment and new Transfer Facilities Building is assumed to be 60 years from initial service date (no replacement).
- Bruce Hot Cell and related equipment is shared with Douglas Point. Costs apportioned between the two on bundle count (Approx. 1% assigned to Douglas Point).

- Single process line.
- Pricing based on installation in Western Used Fuel Dry Storage Facility (WUFDSF) or similar.
- Host facility provides building area, working, transfer, laydown, staff support and holding areas at no cost to Project.
- Host facility provides all effort and equipment to retrieve fuel and place it into the Hot Cell at no cost to Project.
- Host facility provides all effort and equipment related to site security, management of conventional and radiological waste material, etc., at no cost to Project.
- Design is conceptual: minor and incidental costs up to and including aspects such as a local service point for the tracking and emergency response network ("crisis room") are included in "Allowance".
- Cask decontamination is assumed to be a manual operation with minimal equipment requirements.
- Pricing for custom equipment based on recent (2000 to 2010) PDD project data, adjusted by PDD for unique requirements, location and current dollars using professional judgement.
- Pricing for specialty items identified by Cogema (2003) adjusted for new requirements, location and current dollars by PDD using professional judgement.
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 20 Finish Year: 25 Duration: 6 year(s) WBS Type: Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$55,732	$243,106	$11,861	$310,700	15%	$357,305

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

29-Apr-2010 4:48:14 PM WEDS ID # 1121

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	29-Apr-2010

WBS Case: 661 ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)

WBS Number: 661.40.30.110 Equipment for IFTC Transportation Cask for New Build A

WBS Description:

The design, procurement, test and commissioning of the Equipment for IFTC Transport Cask Loading at New Build A.

WBS Deliverable:

One set of Transport Cask loading facilities for hot-cell-based fuel transfer, as follows:

Dedicated Building/New Construction

Equipped Hot Cell, including:
- Hoist n° 1 with one gripper to remove Transfer Clamp and to open or close the Owner's Cask Lid
- Hoist n° 2 with one gripper to unload the modules from the Owner's Casks and load the IFTC Cask
- Hoist n° 3 with one gripper to open or close the IFTC Cask lid
- Lifting Beam for Lid of the Owner's Cask
- Lifting Beam for Lid of the IFTC Transport Cask
- Master-slave telemanipulators
- Shielded windows
- Lining
- Misc. hot cell equipment
- Remote Camera system
- Vacuum Cleaning Unit
- Shielded equipment door
- Hot Cell Shuttle- Owner's Cask
- Hot Cell Pit Shielding Cover - Owner's Cask
- Owner's Cask Lift
- Owner's Cask Docking Port and Gate
- Owner's Cask Lift Lock
- Hot Cell Shuttle- IFTC Cask
- Hot Cell Pit Shielding Cover - IFTC Cask
- IFTC Cask Lift
- IFTC Cask Docking Port and Gate
- IFTC Cask Lift Lock

Additional Equipment, including:
- Leakage and purging equipment (air/water separator, pump, vacuum gauges, valves, compressed air line, helium)
- Air Pressure Decay test equipment
- Smear testing equipment & radiometers
- IFTC Lid Transfer Clamp
- IFTC Bolt Driver

Decontamination Area/Booth:
- Miscellaneous equipment, walkways, etc;

Shipping Area, including:
- Two Gantry Cranes (10 ton crane for loading the Impact Limiters; 60 ton crane for loading the IFTC Transportation Cask onto IFTC Transportation Vehicle Trailer, loading IFTC into Hot Cell Loading Pit and loading DSC into Hot Cell Loading Pit)
- Three Lifting beams (Owner's Cask, IFTC Transport Cask and IFTC Impact Limiter)

WBS Assumptions:

- The design life of the UFTS equipment and new Transfer Facilities Building is assumed to be 60 years from initial service date (no replacement).
- Single process line.
- Host facility provides building area, working, transfer, laydown, staff support and holding areas at no cost to Project.
- Host facility provides all effort and equipment to retrieve fuel and place it into the Hot Cell at no cost to Project.
- Host facility provides all effort and equipment related to site security, management of conventional and radiological waste material, etc., at no cost to Project.
- Design is conceptual: minor and incidental costs up to and including aspects such as a local service point for the tracking and emergency response network ("crisis room") are included in "Allowance".
- Cask decontamination is assumed to be a manual operation with minimal equipment requirements.
- Pricing for custom equipment based on recent (2000 to 2010) PDD project data, adjusted by PDD for unique requirements, location and current dollars using professional judgement.
- Pricing for specialty items identified by Cogema (2003) adjusted for new requirements, location and current dollars by PDD using professional judgement.
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 61 Finish Year: 66 Duration: 6 year(s) WBS Type: Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$5,548,180	$24,144,000	$1,178,000	$30,870,180	15%	$35,500,707

WBS Specific Supporting Documentation:

Multi Element Supporting Documentation:

RC DETS Alternate Case Final Sept 9, 10.xls

TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

29-Apr-2010 4:49:02 PM WEDS ID # 1122

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	29-Apr-2010

WBS Case: 661 ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)

WBS Number: 661.40.30.120 Equipment for IFTC Transportation Cask for New Build B

WBS Description:

The design, procurement, test and commissioning of the Equipment for IFTC Transport Cask Loading at New Build B.

WBS Deliverable:

One set of Transport Cask loading facilities for hot-cell-based fuel transfer, as follows:

Dedicated Building/New Construction

Equipped Hot Cell, including:
- Hoist n° 1 with one gripper to remove Transfer Clamp and to open or close the Owner's Cask Lid
- Hoist n° 2 with one gripper to unload the modules from the Owner's Casks and load the IFTC Cask
- Hoist n° 3 with one gripper to open or close the IFTC Cask lid
- Lifting Beam for Lid of the Owner's Cask
- Lifting Beam for Lid of the IFTC Transport Cask
- Master-slave telemanipulators
- Shielded windows
- Lining
- Misc. hot cell equipment
- Remote Camera system
- Vacuum Cleaning Unit
- Shielded equipment door
- Hot Cell Shuttle- Owner's Cask
- Hot Cell Pit Shielding Cover - Owner's Cask
- Owner's Cask Lift
- Owner's Cask Docking Port and Gate
- Owner's Cask Lift Lock
- Hot Cell Shuttle- IFTC Cask
- Hot Cell Pit Shielding Cover - IFTC Cask
- IFTC Cask Lift
- IFTC Cask Docking Port and Gate
- IFTC Cask Lift Lock

Additional Equipment, including:
- Leakage and purging equipment (air/water separator, pump, vacuum gauges, valves, compressed air line, helium)
- Air Pressure Decay test equipment
- Smear testing equipment & radiometers
- IFTC Lid Transfer Clamp
- IFTC Bolt Driver

Decontamination Area/Booth:
- Miscellaneous equipment, walkways, etc;

Shipping Area, including:
- Two Gantry Cranes (10 ton crane for loading the Impact Limiters; 60 ton crane for loading the IFTC Transportation Cask onto IFTC Transportation Vehicle Trailer, loading IFTC into Hot Cell Loading Pit and loading DSC into Hot Cell Loading Pit)
- Three Lifting beams (Owner's Cask, IFTC Transport Cask and IFTC Impact Limiter)

WBS Assumptions:

- The design life of the UFTS equipment and new Transfer Facilities Building is assumed to be 60 years from initial service date (no replacement).
- Single process line.
- Host facility provides building area, working, transfer, laydown, staff support and holding areas at no cost to Project.
- Host facility provides all effort and equipment to retrieve fuel and place it into the Hot Cell at no cost to Project.
- Host facility provides all effort and equipment related to site security, management of conventional and radiological waste material, etc., at no cost to Project.
- Design is conceptual: minor and incidental costs up to and including aspects such as a local service point for the tracking and emergency response network ("crisis room") are included in "Allowance".
- Cask decontamination is assumed to be a manual operation with minimal equipment requirements.
- Pricing for custom equipment based on recent (2000 to 2010) PDD project data, adjusted by PDD for unique requirements, location and current dollars using professional judgement.
- Pricing for specialty items identified by Cogema (2003) adjusted for new requirements, location and current dollars by PDD using professional judgement.
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 60 Finish Year: 65 Duration: 6 year(s) WBS Type: Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$5,548,180	$24,144,000	$1,178,000	$30,870,180	15%	$35,500,707

WBS Specific Supporting Documentation:

Multi Element Supporting Documentation:

RC DETS Alternate Case Final Sept 9, 10.xls

TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1083

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 17-Feb-2010

WBS Case: 661 ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)
WBS Number: 661.40.40.10 Equipment for IFTC Transportation Logistics for Real Time Tracking

WBS Description:

The development, procurement, testing and commissioning of Real Time Tracking System equipment and procedures, including:
- Development of specifications for Real Time Tracking System
- Preparation of tendering documentation and issue of Requests for Proposals (RFPs)
- Selection of design/build contractors
- Placing of orders/letting of contracts
- Review of design/build contractor engineering documentation & engineering drawings
- Supervision/inspection of equipment installation
- Preparation, supervision and performance of tests and commissioning

WBS Deliverable:

- Complete system design for the Real Time Tracking System
- Communication center located at the DGR and fully equipped with communication means (Vehicle Tracking System, Telephones, Teleconference System, etc.)
- Central GPS Tracking System at DGR, including tracking system software customization for central system and vehicle mounted systems, surge protection, un-interruptible power supply (UPS) emergency power backup and GPS Monthly System Access Fees

- Real Time Tracking Equipment in the Vehicle and IFTC Fleet:

IFTC Transport Vehicle Tractors:
- Satellite phone: Cab
- GPS no.1 : main unit available to driver and passenger
- GPS no.2: hidden back-up on tractor

IFTC Transport Vehicle Trailers:
- GPS no.3: On trailer
- GPS no.4: hidden back-up on trailer

IFTC Transport Casks:
- GPS no. 5: on Transport Cask
- GPS no.6: hidden back-up on Transport Cask

Escort Vehicle:
- Satellite phone: Cab
- GPS no.7 : Escort vehicle
- GPS no.8 : Escort vehicle backup

WBS Assumptions:

- Communication center for Real Time Tracking will be combined with Crisis Centre for Emergency Response (see 661.40.40.20, Equipment for IFTC Transportation Logistics for Emergency Response) to form one Communication and Crisis Centre at DGR fully equipped with communication equipment and emergency response equipment.
- Design is conceptual: minor and incidental costs up to and including aspects such as a physical space for the central system at the DGR are included in "Allowance".
- Weather conditions on roads used for travel to and from the DGR will be monitored 12 hours ahead of planned shipments.

- Includes GPS system access fee for 60 years (years 24 to 85)
- Pricing for commercial off-the-shelf items verbally confirmed with vendors in the Toronto region by PDD, November 2009 to April 2010. Pricing representative for most of Ontario and in current (2010) dollars.
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 24 Finish Year: 85 Duration: 62 year(s) WBS Type: Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$180,400	$4,209,000	$3,797,984	$8,187,384	15%	$9,415,492

WBS Specific Supporting Documentation:
ID 10, 71 Satellite Phone Security From Globalstar.pdf
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

30-Apr-2010 3:05:03 PM WEDS ID # 1128

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 30-Apr-2010

WBS Case: 661 ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)
WBS Number: 661.40.40.20 Equipment for IFTC Transportation Logistics for Emergency Response

WBS Description:

The development, procurement, testing and commissioning of the Emergency Response System, including:
- Development of specifications for the Emergency Response System
- Preparation of tendering documentation and issue of Requests for Proposals (RFPs)
- Selection of design/build contractors
- Placing of orders/letting of contracts
- Review of design/build contractor engineering documentation & engineering drawings
- Supervision/inspection of equipment installation
- Preparation, supervision and performance of tests and commissioning

WBS Deliverable:

- Complete system design for the Emergency Response System
- Emergency means designed to protect and/ or recover one element of the transportation system in the event of incident or accident.
- Crisis center located at the DGR and fully equipped with communication means (interface with Vehicle Tracking System, telephones, teleconference system, etc.)

Emergency Response Equipment Located at DGR:
- 100 ton portable crane, max. speed 85km/hr
- IFTC Transport Vehicle Tractor (not counted as part of operating fleet)
- IFTC Transport Vehicle Trailer (weather cover, frame, turning light, etc) (not counted as part of operating fleet)
- Impact Limiters (not counted as part of operating fleet)
- Escort Vehicle (not counted as part of operating fleet)
- Lifting Beam for IFTC Transport Cask
- Lifting Beam for Impact limiter of the IFTC
- Misc. Equipment

Emergency Response Equipment Located at Bruce:
- Lifting Beam for IFTC Transport Cask
- Lifting Beam for Impact limiter of the IFTC
- Misc. Equipment

Emergency Response Equipment Located at Darlington:
- Lifting Beam for IFTC Transport Cask
- Lifting Beam for Impact limiter of the IFTC
- Misc. Equipment

Emergency Response Equipment Located at Gentilly:
- Lifting Beam for IFTC Transport Cask
- Lifting Beam for Impact limiter of the IFTC
- Misc. Equipment

WBS Assumptions:

- Crisis Centre for Emergency Response will be combined with Communication Centre for Real Time Tracking (see 661.40.40.10, Equipment for IFTC Transportation Logistics for Real Time Tracking) to form one Communication and Crisis Centre at DGR, fully equipped with communication equipment and emergency response equipment.
- Three sites (Bruce, Darlington and Gentilly) have been chosen along the transportation route to house extra handling

equipment. This equipment can be used with an available IFTC Transport Vehicle and Escort and with local contracted portable crane if deemed necessary.
- Working areas at Bruce, Darlington and Gentilly are assumed to be provided by Owners at no cost to Project.
- Design is conceptual: minor and incidental costs up to and including aspects such as housing/designation of the central system at the DGR and related staging areas at Bruce, Darlington and Gentilly are included in "Allowance".
- Pricing for commercial off-the-shelf items verbally confirmed with vendors in the Toronto region by PDD, November 2009 to April 2010. Pricing representative for most of Ontario and in current (2010) dollars.
- Pricing for custom equipment based on recent (2000 to 2010) PDD project data, adjusted by PDD for unique requirements, location and current dollars using professional judgement.
- Pricing for specialty items identified by Cogema (2003) adjusted for new requirements, location and current dollars by PDD using professional judgement.
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 24 Finish Year: 54 Duration: 31 year(s) WBS Type: Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$360,800	$4,232,000		$4,592,800	15%	$5,281,720

WBS Specific Supporting Documentation:
ID 54 100 ton portable crane 3900_001-GMK4115Cost.pdf
ID 54 100 ton portable crane GMK4100B_PG.pdf
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1085

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 17-Feb-2010

WBS Case: 661 ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)
WBS Number: 661.50.10 PROJECT MANAGEMENT

WBS Description:

Management of UFTS components and reporting on the project's progress to Line Management, including:
- Preparation of project management documentation.
- Interfacing with engineering, procurement, operations and contractors to ensure that milestones are obtained as planned.
- Project Close-Out

WBS Deliverable:

Management of UFTS components and reporting on the project's progress to Line Management, including:
- Project management documentation (Project Charters, Project Execution Plans, Business Case Summaries, Release Quality Estimates, Scope Sheets, Change Control Forms and Schedules),
- Approved project schedules and information on the project costs throughout its duration.
- Regular Project Meetings to discuss schedule, project status, issues, and cash flows.
- Reporting to Program Management on the project's progress.

WBS Assumptions:

- Project management is carried out by a core team including a project manager, a scheduler/cost controller, and a contract administrator. Additional roles include co-ordinators for current storage types (DSC, Wet Bay, silo/CANSTOR), administrative assistant(s), quality assurance/control staff and legal assistance.
- See labour costs for detailed hours/FTEs
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 16 Finish Year: 25 Duration: 10 year(s) WBS Type: Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$16,069,893			$16,069,893	15%	$18,480,377

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1086

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 17-Feb-2010

WBS Case: 661 ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)
WBS Number: 661.50.20.10 IFTC Transport Cask Loading non-Site-Specific

WBS Description:

Assess the IFTC Transportation Cask Loading Mock-ups at Transfer Facilities (Hot Cells) and designated Transfer Areas (Transfer Plates).

WBS Deliverable:

- Completion of IFTC Transport Cask Loading Mock-ups at owner Reactor Storage Facilities (non-Site Specific).

WBS Assumptions:

- This cost element allows for minor centralized effort not directly attributable to individual sites.
- Approx. one full-time staff assigned over six-year period.
- Site-specific loading mock-ups at each Reactor Storage Facility are accounted for per facility; the equipment used for the mock-ups will be the same equipment subsequently used for IFTC Loading.
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 24 Finish Year: 25 Duration: 2 year(s) WBS Type: Variable

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$360,800			$360,800	15%	$414,920

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1087

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	17-Feb-2010

WBS Case:	661	ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)
WBS Number:	661.50.20.20	IFTC Transport Cask Loading at Whiteshell

WBS Description:

The loading of used fuel into IFTC Transport Casks and pre-shipment preparation of the IFTC for Whiteshell, including:
- Loading of IFTC Transfer Plate onto IFTC
- Placing of owner's Transfer Flask onto the IFTC Transfer Plate
- Loading of fuel modules from owner's Transfer Flask into the IFTC Transport Cask
- Pre-shipment preparation of IFTC Transport Cask
- Loading of the IFTC Impact Limiter onto IFTC Transport Cask

WBS Deliverable:

- Loaded IFTCs with Impact Limiters in secure area ready for transfer to trailer and subsequent road transport.

Loading of used fuel into IFTC Transport Casks and pre-shipment preparation of IFTCs includes:

Preparation of IFTC Transport Cask
- Take IFTC Transport Cask from secure storage or trailer
- Transfer IFTC Transport Cask to Transfer Area
- Remove IFTC Impact Limiter Bolts
- Remove IFTC Impact Limiter
- Remove IFTC Transport Cask Lid Bolts
- Remove IFTC Transport Cask Lid
- Place IFTC Transfer Plate
- Inspect IFTC Transport Cask

Transfer of used fuel modules into IFTC Transport Cask (repeated twice, one module per transfer)
- Place Owner's Transfer Flask on IFTC Transfer Plate
- Open Owner's Transfer Flask Slide
- Lower fuel module from owner's Transfer Flask into IFTC Cask
- Inspect IFTC/M Transport Cask ("IFTC/M" denotes loaded IFTC)
- Remove Owner's Transfer Flask from IFTC Transfer Plate

Closing of IFTC/M Transport Cask
- Inspect IFTC/M Transport Cask
- Remove IFTC Transfer Plate
- Place Lid on IFTC/M Transport Cask
- Attach IFTC Transport Cask Lid Bolts
- Decontaminate IFTC/M Transport Cask
- Carry out Smear Test for decontamination
- Carry out air pressure decay (seal) test

Placement of IFTC Impact Limiter on filled IFTC/M Transport Cask
- Identify IFTC Impact Limiter in secure storage
- Carry out pre-loading inspection of filled IFTC/M Transport Cask
- Transfer IFTC Impact Limiter from Storage
- Carry out pre-loading inspection of IFTC Impact Limiter
- Place IFTC Transport Cask Impact Limiter onto IFTC/M Transport Cask
- Attach IFTC Impact Limiter Bolts

- Carry out Smear Test
- Verify/complete security and safeguard seals

WBS Assumptions:

Number of Used Fuel Bundles and Shipments
- Number of bundles = 360
- Number of shipments = 2

- Owner bears all costs to prepare and provide loaded transfer cask with fuel in modules for IFTC loading, as well as all costs related to transfer cask management, repeated use and eventual decommissioning.
- Estimate based on 42 labour hours per transfer-plate-based loading operation.
- Minor incidentals, including working area services, consumables, conventional and radiological waste handling, etc., accommodated in "Allowance".
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 51 Finish Year: 51 Duration: 1 year(s) WBS Type: Variable

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$6,637			$6,637	15%	$7,632

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1088

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	17-Feb-2010

WBS Case:	661	ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)
WBS Number:	661.50.20.30	IFTC Transport Cask Loading at Bruce

WBS Description:

The loading of used fuel into IFTC Transport Casks, pre-shipment preparation of the IFTC and placement in Shipment Area for Bruce, including:
- Loading of used fuel from owner's Cask into the IFTC Transport Cask in a Hot Cell
- Pre-shipment preparation of IFTC Transport Cask
- Internal transfer of the loaded IFTC Transport Cask to Shipment Area
- Loading of the IFTC Impact Limiter onto IFTC Transport Cask

WBS Deliverable:

- Loaded IFTCs with Impact Limiters in Shipment Area ready for transfer to trailer and subsequent road transport.

Loading of used fuel into IFTC Transport Casks and pre-shipment preparation of IFTCs includes:

Preparation of Owner's Cask with fuel in modules (not considered part of this study)

Preparation of IFTC Transport Cask
- Identify IFTC Transport Cask in secure storage or Shipment Area
- Remove IFTC Impact Limiter Bolts
- Remove IFTC Impact Limiter
- Transfer IFTC Transport Cask from Storage
- Transfer IFTC Transport Cask to Hot Cell Loading Pit
- Remove IFTC Transport Cask Lid Bolts
- Transfer IFTC under Hot Cell Docking Gate
- Insert IFTC into Docking Gate
- Remove IFTC Lid
- Inspect IFTC Transport Cask

Removal of Owner's cask from Hot Cell (not considered part of this study)

Transfer of used fuel to IFTC Transport Cask and transfer of loaded IFTC Transport Cask to Shipment Area.
- Unload modules from Owner's Cask
- Load modules into IFTC Transport Cask
- Inspect IFTC/M Transport Cask ("IFTC/M" denotes loaded IFTC)
- Place Lid on IFTC/M Transport Cask
- Lower IFTC/M Transport Cask from Hot Cell
- Shuttle IFTC/M Transport Cask to Loading Pit
- Attach IFTC Lid Bolts
- Decontaminate IFTC/M Transport Cask
- Carry out Smear Test
- Transfer IFTC/M Transport Cask from Hot Cell Pit
- Carry out air pressure decay (seal) test
- Transfer IFTC/M Transport Cask to Shipment Area

Placement of IFTC Impact Limiter on filled IFTC/M Transport Cask
- Identify IFTC Impact Limiter in secure storage
- Identify Filled IFTC/M Transport Cask in Shipment Area

- Carry out pre-loading inspection of filled IFTC/M Transport Cask
- Transfer IFTC Impact Limiter from Storage
- Carry out pre-loading inspection of IFTC Impact Limiter
- Place IFTC Transport Cask Impact Limiter onto IFTC/M Transport Cask
- Attach IFTC Impact Limiter Bolts
- Carry out Smear Test
- Verify/complete security and safeguard seals

WBS Assumptions:

Costs based on number of Used Fuel Bundles and Shipments
- Number of bundles = 2,340,197
- Number of shipments = 12,191

- Owner bears all costs to prepare and provide loaded cask with fuel in modules for IFTC loading, as well as all costs related to owner's cask management, repeated use and eventual decommissioning.
- Estimate based on 39 labour hours per Hot-Cell-based loading operation.
- Minor incidentals, including working area services, consumables, conventional and radiological waste handling, etc., accommodated in "Allowance".
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 26 Finish Year: 77 Duration: 52 year(s) WBS Type: Variable

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$37,565,225			$37,565,225	15%	$43,200,009

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1089

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	17-Feb-2010

WBS Case:	661	ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)
WBS Number:	661.50.20.40	IFTC Transport Cask Loading at Pickering

WBS Description:

The loading of used fuel into IFTC Transport Casks, pre-shipment preparation of the IFTC and placement in Shipment Area for Pickering, including:
- Loading of used fuel from owner's Cask into the IFTC Transport Cask in a Hot Cell
- Pre-shipment preparation of IFTC Transport Cask
- Internal transfer of the loaded IFTC Transport Cask to Shipment Area
- Loading of the IFTC Impact Limiter onto IFTC Transport Cask

WBS Deliverable:

- Loaded IFTCs with Impact Limiters in Shipment Area ready for transfer to trailer and subsequent road transport.

Loading of used fuel into IFTC Transport Casks and pre-shipment preparation of IFTCs includes:

Preparation of Owner's Cask with fuel in modules (not considered part of this study)

Preparation of IFTC Transport Cask
- Identify IFTC Transport Cask in secure storage or Shipment Area
- Remove IFTC Impact Limiter Bolts
- Remove IFTC Impact Limiter
- Transfer IFTC Transport Cask from Storage
- Transfer IFTC Transport Cask to Hot Cell Loading Pit
- Remove IFTC Transport Cask Lid Bolts
- Transfer IFTC under Hot Cell Docking Gate
- Insert IFTC into Docking Gate
- Remove IFTC Lid
- Inspect IFTC Transport Cask

Removal of Owner's cask from Hot Cell (not considered part of this study)

Transfer of used fuel to IFTC Transport Cask and transfer of loaded IFTC Transport Cask to Shipment Area.
- Unload modules from Owner's Cask
- Load modules into IFTC Transport Cask
- Inspect IFTC/M Transport Cask ("IFTC/M" denotes loaded IFTC)
- Place Lid on IFTC/M Transport Cask
- Lower IFTC/M Transport Cask from Hot Cell
- Shuttle IFTC/M Transport Cask to Loading Pit
- Attach IFTC Lid Bolts
- Decontaminate IFTC/M Transport Cask
- Carry out Smear Test
- Transfer IFTC/M Transport Cask from Hot Cell Pit
- Carry out air pressure decay (seal) test
- Transfer IFTC/M Transport Cask to Shipment Area

Placement of IFTC Impact Limiter on filled IFTC/M Transport Cask
- Identify IFTC Impact Limiter in secure storage
- Identify Filled IFTC/M Transport Cask in Shipment Area

- Carry out pre-loading inspection of filled IFTC/M Transport Cask
- Transfer IFTC Impact Limiter from Storage
- Carry out pre-loading inspection of IFTC Impact Limiter
- Place IFTC Transport Cask Impact Limiter onto IFTC/M Transport Cask
- Attach IFTC Impact Limiter Bolts
- Carry out Smear Test
- Verify/complete security and safeguard seals

WBS Assumptions:

Number of Used Fuel Bundles and Shipments

Costs based on number of Used Fuel Bundles and Shipments
- Number of bundles = 1,235,943
- Number of shipments = 6,440

- Owner bears all costs to prepare and provide loaded cask with fuel in modules for IFTC loading, as well as all costs related to owner's cask management, repeated use and eventual decommissioning.
- Estimate based on 39 labour hours per Hot-Cell-based loading operation.
- Minor incidentals, including working area services, consumables, conventional and radiological waste handling, etc., accommodated in "Allowance".
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 26 Finish Year: 66 Duration: 41 year(s) WBS Type: Variable

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$19,844,140			$19,844,140	15%	$22,820,761

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1090

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	17-Feb-2010

WBS Case:	661	ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)
WBS Number:	661.50.20.50	IFTC Transport Cask Loading at Darlington

WBS Description:

The loading of used fuel into IFTC Transport Casks, pre-shipment preparation of the IFTC and placement in Shipment Area for Darlington, including:
- Loading of used fuel from owner's Cask into the IFTC Transport Cask in a Hot Cell
- Pre-shipment preparation of IFTC Transport Cask
- Internal transfer of the loaded IFTC Transport Cask to Shipment Area
- Loading of the IFTC Impact Limiter onto IFTC Transport Cask

WBS Deliverable:

- Loaded IFTCs with Impact Limiters in Shipment Area ready for transfer to trailer and subsequent road transport.

Loading of used fuel into IFTC Transport Casks and pre-shipment preparation of IFTCs includes:

Preparation of Owner's Cask with fuel in modules (not considered part of this study)

Preparation of IFTC Transport Cask
- Identify IFTC Transport Cask in secure storage or Shipment Area
- Remove IFTC Impact Limiter Bolts
- Remove IFTC Impact Limiter
- Transfer IFTC Transport Cask from Storage
- Transfer IFTC Transport Cask to Hot Cell Loading Pit
- Remove IFTC Transport Cask Lid Bolts
- Transfer IFTC under Hot Cell Docking Gate
- Insert IFTC into Docking Gate
- Remove IFTC Lid
- Inspect IFTC Transport Cask

Removal of Owner's cask from Hot Cell (not considered part of this study)

Transfer of used fuel into IFTC Transport Cask and transfer of loaded IFTC Transport Cask to Shipment Area.
- Unload modules from Owner's Cask
- Load modules into IFTC Transport Cask
- Inspect IFTC/M Transport Cask ("IFTC/M" denotes loaded IFTC)
- Place Lid on IFTC/M Transport Cask
- Lower IFTC/M Transport Cask from Hot Cell
- Shuttle IFTC/M Transport Cask to Loading Pit
- Attach IFTC Lid Bolts
- Decontaminate IFTC/M Transport Cask
- Carry out Smear Test
- Transfer IFTC/M Transport Cask from Hot Cell Pit
- Carry out air pressure decay (seal) test
- Transfer IFTC/M Transport Cask to Shipment Area

Placement of IFTC Impact Limiter on filled IFTC/M Transport Cask
- Identify IFTC Impact Limiter in secure storage
- Identify Filled IFTC/M Transport Cask in Shipment Area

- Carry out pre-loading inspection of filled IFTC/M Transport Cask
- Transfer IFTC Impact Limiter from Storage
- Carry out pre-loading inspection of IFTC Impact Limiter
- Place IFTC Transport Cask Impact Limiter onto IFTC/M Transport Cask
- Attach IFTC Impact Limiter Bolts
- Carry out Smear Test
- Verify/complete security and safeguard seals

WBS Assumptions:

Costs based on number of Used Fuel Bundles and Shipments
- Number of bundles = 1,332,037
- Number of shipments = 6,939

- Owner bears all costs to prepare and provide loaded cask with fuel in modules for IFTC loading, as well as all costs related to owner's cask management, repeated use and eventual decommissioning.
- Estimate based on 39 labour hours per Hot-Cell-based loading operation.
- Minor incidentals, including working area services, consumables, conventional and radiological waste handling, etc., accommodated in "Allowance".
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 26 Finish Year: 69 Duration: 44 year(s) WBS Type: Variable

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$21,381,775			$21,381,775	15%	$24,589,041

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1091

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	17-Feb-2010

WBS Case:	661	ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)
WBS Number:	661.50.20.60	IFTC Transport Cask Loading at Point Lepreau

WBS Description:

The loading of used fuel into IFTC Transport Casks, pre-shipment preparation of the IFTC and placement in Shipment Area for Point Lepreau, including:
- Loading of used fuel from owner's Cask into the IFTC Transport Cask in a Hot Cell
- Pre-shipment preparation of IFTC Transport Cask
- Internal transfer of the loaded IFTC Transport Cask to Shipment Area
- Loading of the IFTC Impact Limiter onto the IFTC Transport Cask

WBS Deliverable:

- Loaded IFTCs with Impact Limiters in Shipment Area ready for transfer to trailer and subsequent road transport.

Loading of used fuel into IFTC Transport Casks and pre-shipment preparation of IFTCs includes:

Preparation of Owner's Cask with fuel in modules (not considered part of this study)

Preparation of IFTC Transport Cask
- Identify IFTC Transport Cask in secure storage or Shipment Area
- Remove IFTC Impact Limiter Bolts
- Remove IFTC Impact Limiter
- Transfer IFTC Transport Cask from Storage
- Transfer IFTC Transport Cask to Hot Cell Loading Pit
- Remove IFTC Transport Cask Lid Bolts
- Transfer IFTC under Hot Cell Docking Gate
- Insert IFTC into Docking Gate
- Remove IFTC Lid
- Inspect IFTC Transport Cask

Removal of Owner's cask from Hot Cell (not considered part of this study)

Transfer of used fuel to IFTC Transport Cask and transfer of loaded IFTC Transport Cask to Shipment Area.
- Unload modules from Owner's Cask
- Load modules into IFTC Transport Cask
- Inspect IFTC/M Transport Cask ("IFTC/M" denotes loaded IFTC)
- Place Lid on IFTC/M Transport Cask
- Lower IFTC/M Transport Cask from Hot Cell
- Shuttle IFTC/M Transport Cask to Loading Pit
- Attach IFTC Lid Bolts
- Decontaminate IFTC/M Transport Cask
- Carry out Smear Test
- Transfer IFTC/M Transport Cask from Hot Cell Pit
- Carry out air pressure decay (seal) test
- Transfer IFTC/M Transport Cask to Shipment Area

Placement of IFTC Impact Limiter on filled IFTC/M Transport Cask
- Identify IFTC Impact Limiter in secure storage
- Identify Filled IFTC/M Transport Cask in Shipment Area

- Carry out pre-loading inspection of filled IFTC/M Transport Cask
- Transfer IFTC Impact Limiter from Storage
- Carry out pre-loading inspection of IFTC Impact Limiter
- Place IFTC Transport Cask Impact Limiter onto IFTC/M Transport Cask
- Attach IFTC Impact Limiter Bolts
- Carry out Smear Test
- Verify/complete security and safeguard seals

WBS Assumptions:

Costs based on number of Used Fuel Bundles and Shipments
- Number of bundles = 285,000
- Number of shipments = 1,486

- Owner bears all costs to prepare and provide loaded cask with fuel in modules for IFTC loading, as well as all costs related to owner's cask management, repeated use and eventual decommissioning.
- Estimate based on 39 labour hours per Hot-Cell-based loading operation.
- Minor incidentals, including working area services, consumables, conventional and radiological waste handling, etc., accommodated in "Allowance".
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 41 Finish Year: 74 Duration: 34 year(s) WBS Type: Variable

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$4,578,947			$4,578,947	15%	$5,265,789

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1092

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	17-Feb-2010

WBS Case:	661	ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)
WBS Number:	661.50.20.70	IFTC Transport Cask Loading at Chalk River

WBS Description:

The loading of used fuel into IFTC Transport Casks and pre-shipment preparation of the IFTC for Chalk River, including:
- Loading of IFTC Transfer Plate onto IFTC
- Placing of owner's Transfer Flask onto the IFTC Transfer Plate
- Loading of fuel modules from owner's Transfer Flask into the IFTC Transport Cask
- Pre-shipment preparation of IFTC Transport Cask
- Loading of the IFTC Impact Limiter onto IFTC Transport Cask

WBS Deliverable:

- Loaded IFTCs with Impact Limiters in secure area ready for transfer to trailer and subsequent road transport.

Loading of used fuel into IFTC Transport Casks and pre-shipment preparation of IFTCs includes:

Preparation of IFTC Transport Cask
- Take IFTC Transport Cask from secure storage or trailer
- Transfer IFTC Transport Cask to Transfer Area
- Remove IFTC Impact Limiter Bolts
- Remove IFTC Impact Limiter
- Remove IFTC Transport Cask Lid Bolts
- Remove IFTC Transport Cask Lid
- Place IFTC Transfer Plate
- Inspect IFTC Transport Cask

Transfer of used fuel modules into IFTC Transport Cask (repeated twice, one module per transfer)
- Place Owner's Transfer Flask on IFTC Transfer Plate
- Open Owner's Transfer Flask Slide
- Lower fuel module from owner's Transfer Flask into IFTC Cask
- Inspect IFTC/M Transport Cask ("IFTC/M" denotes loaded IFTC)
- Remove Owner's Transfer Flask from IFTC Transfer Plate

Closing of IFTC/M Transport Cask
- Inspect IFTC/M Transport Cask
- Remove IFTC Transfer Plate
- Place Lid on IFTC/M Transport Cask
- Attach IFTC Transport Cask Lid Bolts
- Decontaminate IFTC/M Transport Cask
- Carry out Smear Test for decontamination
- Carry out air pressure decay (seal) test

Placement of IFTC Impact Limiter on filled IFTC/M Transport Cask
- Identify IFTC Impact Limiter in secure storage
- Carry out pre-loading inspection of filled IFTC/M Transport Cask
- Transfer IFTC Impact Limiter from Storage
- Carry out pre-loading inspection of IFTC Impact Limiter
- Place IFTC Transport Cask Impact Limiter onto IFTC/M Transport Cask
- Attach IFTC Impact Limiter Bolts

- Carry out Smear Test
- Verify/complete security and safeguard seals

WBS Assumptions:

Costs based on number of Used Fuel Bundles and Shipments
- Number of bundles = 4,886
- Number of shipments = 27

- Owner bears all costs to prepare and provide loaded transfer cask with fuel in modules for IFTC loading, as well as all costs related to transfer cask management, repeated use and eventual decommissioning.
- Estimate based on 42 labour hours per transfer-plate-based loading operation.
- Minor incidentals, including working area services, consumables, conventional and radiological waste handling, etc., accommodated in "Allowance".
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 51 Finish Year: 55 Duration: 5 year(s) WBS Type: Variable

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$89,597			$89,597	15%	$103,037

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1093

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	17-Feb-2010

WBS Case:	661	ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)
WBS Number:	661.50.20.80	IFTC Transport Cask Loading at Gentilly 1

WBS Description:

The loading of used fuel into IFTC Transport Casks, pre-shipment preparation of the IFTC and placement in Shipment Area for Gentilly 1, including:
- Loading of used fuel from owner's Cask into the IFTC Transport Cask in a Hot Cell
- Pre-shipment preparation of IFTC Transport Cask
- Internal transfer of the loaded IFTC Transport Cask to Shipment Area
- Loading of the IFTC Impact Limiter onto IFTC Transport Cask

WBS Deliverable:

- Loaded IFTCs with Impact Limiters in Shipment Area ready for transfer to trailer and subsequent road transport.

Loading of used fuel into IFTC Transport Casks and pre-shipment preparation of IFTCs includes:

Preparation of Owner's Cask with fuel in modules (not considered part of this study)

Preparation of IFTC Transport Cask
- Identify IFTC Transport Cask in secure storage or Shipment Area
- Remove IFTC Impact Limiter Bolts
- Remove IFTC Impact Limiter
- Transfer IFTC Transport Cask from Storage
- Transfer IFTC Transport Cask to Hot Cell Loading Pit
- Remove IFTC Transport Cask Lid Bolts
- Transfer IFTC under Hot Cell Docking Gate
- Insert IFTC into Docking Gate
- Remove IFTC Lid
- Inspect IFTC Transport Cask

Removal of Owner's cask from Hot Cell (not considered part of this study)

Transfer of used fuel to IFTC Transport Cask and transfer of loaded IFTC Transport Cask to Shipment Area.
- Unload modules from Owner's Cask
- Load modules into IFTC Transport Cask
- Inspect IFTC/M Transport Cask ("IFTC/M" denotes loaded IFTC)
- Place Lid on IFTC/M Transport Cask
- Lower IFTC/M Transport Cask from Hot Cell
- Shuttle IFTC/M Transport Cask to Loading Pit
- Attach IFTC Lid Bolts
- Decontaminate IFTC/M Transport Cask
- Carry out Smear Test
- Transfer IFTC/M Transport Cask from Hot Cell Pit
- Carry out air pressure decay (seal) test
- Transfer IFTC/M Transport Cask to Shipment Area

Placement of IFTC Impact Limiter on filled IFTC/M Transport Cask
- Identify IFTC Impact Limiter in secure storage
- Identify Filled IFTC/M Transport Cask in Shipment Area

- Carry out pre-loading inspection of filled IFTC/M Transport Cask
- Transfer IFTC Impact Limiter from Storage
- Carry out pre-loading inspection of IFTC Impact Limiter
- Place IFTC Transport Cask Impact Limiter onto IFTC/M Transport Cask
- Attach IFTC Impact Limiter Bolts
- Carry out Smear Test
- Verify/complete security and safeguard seals

WBS Assumptions:

Costs based on number of Used Fuel Bundles and Shipments
- Number of bundles = 3,213
- Number of shipments = 18

- Owner bears all costs to prepare and provide loaded cask with fuel in modules for IFTC loading, as well as all costs related to owner's cask management, repeated use and eventual decommissioning.
- Estimate based on 39 labour hours per Hot-Cell-based loading operation.
- Minor incidentals, including working area services, consumables, conventional and radiological waste handling, etc., accommodated in "Allowance".
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 51 Finish Year: 55 Duration: 5 year(s) WBS Type: Variable

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$55,465			$55,465	15%	$63,785

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1094

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	17-Feb-2010

WBS Case:	661	ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)
WBS Number:	661.50.20.90	IFTC Transport Cask Loading at Gentilly 2

WBS Description:

The loading of used fuel into IFTC Transport Casks, pre-shipment preparation of the IFTC and placement in Shipment Area for Gentilly 2, including:
- Loading of used fuel from owner's Cask into the IFTC Transport Cask in a Hot Cell
- Pre-shipment preparation of IFTC Transport Cask
- Internal transfer of the loaded IFTC Transport Cask to Shipment Area
- Loading of the IFTC Impact Limiter onto IFTC Transport Cask

WBS Deliverable:

- Loaded IFTCs with Impact Limiters in Shipment Area ready for transfer to trailer and subsequent road transport.

Loading of used fuel into IFTC Transport Casks and pre-shipment preparation of IFTCs includes:

Preparation of Owner's Cask with fuel in modules (not considered part of this study)

Preparation of IFTC Transport Cask
- Identify IFTC Transport Cask in secure storage or Shipment Area
- Remove IFTC Impact Limiter Bolts
- Remove IFTC Impact Limiter
- Transfer IFTC Transport Cask from Storage
- Transfer IFTC Transport Cask to Hot Cell Loading Pit
- Remove IFTC Transport Cask Lid Bolts
- Transfer IFTC under Hot Cell Docking Gate
- Insert IFTC into Docking Gate
- Remove IFTC Lid
- Inspect IFTC Transport Cask

Removal of Owner's cask from Hot Cell (not considered part of this study)

Transfer of used fuel to IFTC Transport Cask and transfer of loaded IFTC Transport Cask to Shipment Area.
- Unload modules from Owner's Cask
- Load modules into IFTC Transport Cask
- Inspect IFTC/M Transport Cask ("IFTC/M" denotes loaded IFTC)
- Place Lid on IFTC/M Transport Cask
- Lower IFTC/M Transport Cask from Hot Cell
- Shuttle IFTC/M Transport Cask to Loading Pit
- Attach IFTC Lid Bolts
- Decontaminate IFTC/M Transport Cask
- Carry out Smear Test
- Transfer IFTC/M Transport Cask from Hot Cell Pit
- Carry out air pressure decay (seal) test
- Transfer IFTC/M Transport Cask to Shipment Area

Placement of IFTC Impact Limiter on filled IFTC/M Transport Cask
- Identify IFTC Impact Limiter in secure storage
- Identify Filled IFTC/M Transport Cask in Shipment Area

- Carry out pre-loading inspection of filled IFTC/M Transport Cask
- Transfer IFTC Impact Limiter from Storage
- Carry out pre-loading inspection of IFTC Impact Limiter
- Place IFTC Transport Cask Impact Limiter onto IFTC/M Transport Cask
- Attach IFTC Impact Limiter Bolts
- Carry out Smear Test
- Verify/complete security and safeguard seals

WBS Assumptions:

Costs based on number of Used Fuel Bundles and Shipments
- Number of bundles = 272,000
- Number of shipments = 1,417

- Owner bears all costs to prepare and provide loaded cask with fuel in modules for IFTC loading, as well as all costs related to owner's cask management, repeated use and eventual decommissioning.
- Estimate based on 39 labour hours per Hot-Cell-based loading operation.
- Minor incidentals, including working area services, consumables, conventional and radiological waste handling, etc., accommodated in "Allowance".
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 41 Finish Year: 72 Duration: 32 year(s) WBS Type: Variable

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$4,366,333			$4,366,333	15%	$5,021,283

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1095

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	17-Feb-2010

WBS Case:	661	ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)
WBS Number:	661.50.20.100	IFTC Transport Cask Loading at Douglas Point

WBS Description:

The loading of used fuel into IFTC Transport Casks, pre-shipment preparation of the IFTC and placement in Shipment Area for Douglas Point, including:
- Loading of used fuel from owner's Cask into the IFTC Transport Cask in a Hot Cell
- Pre-shipment preparation of IFTC Transport Cask
- Internal transfer of the loaded IFTC Transport Cask to Shipment Area
- Loading of the IFTC Impact Limiter onto IFTC Transport Cask

WBS Deliverable:

- Loaded IFTCs with Impact Limiters in Shipment Area ready for transfer to trailer and subsequent road transport.

Loading of used fuel into IFTC Transport Casks and pre-shipment preparation of IFTCs includes:

Preparation of Owner's Cask with fuel in modules (not considered part of this study)

Preparation of IFTC Transport Cask
- Identify IFTC Transport Cask in secure storage or Shipment Area
- Remove IFTC Impact Limiter Bolts
- Remove IFTC Impact Limiter
- Transfer IFTC Transport Cask from Storage
- Transfer IFTC Transport Cask to Hot Cell Loading Pit
- Remove IFTC Transport Cask Lid Bolts
- Transfer IFTC under Hot Cell Docking Gate
- Insert IFTC into Docking Gate
- Remove IFTC Lid
- Inspect IFTC Transport Cask

Removal of Owner's cask from Hot Cell (not considered part of this study)

Transfer of used fuel to IFTC Transport Cask and transfer of loaded IFTC Transport Cask to Shipment Area.
- Unload modules from Owner's Cask
- Load modules into IFTC Transport Cask
- Inspect IFTC/M Transport Cask ("IFTC/M" denotes loaded IFTC)
- Place Lid on IFTC/M Transport Cask
- Lower IFTC/M Transport Cask from Hot Cell
- Shuttle IFTC/M Transport Cask to Loading Pit
- Attach IFTC Lid Bolts
- Decontaminate IFTC/M Transport Cask
- Carry out Smear Test
- Transfer IFTC/M Transport Cask from Hot Cell Pit
- Carry out air pressure decay (seal) test
- Transfer IFTC/M Transport Cask to Shipment Area

Placement of IFTC Impact Limiter on filled IFTC/M Transport Cask
- Identify IFTC Impact Limiter in secure storage
- Identify Filled IFTC/M Transport Cask in Shipment Area

- Carry out pre-loading inspection of filled IFTC/M Transport Cask
- Transfer IFTC Impact Limiter from Storage
- Carry out pre-loading inspection of IFTC Impact Limiter
- Place IFTC Transport Cask Impact Limiter onto IFTC/M Transport Cask
- Attach IFTC Impact Limiter Bolts
- Carry out Smear Test
- Verify/complete security and safeguard seals

WBS Assumptions:

Costs based on number of Used Fuel Bundles and Shipments
- Number of bundles = 22,256
- Number of shipments = 124

- Owner bears all costs to prepare and provide loaded cask with fuel in modules for IFTC loading, as well as all costs related to owner's cask management, repeated use and eventual decommissioning.
- Estimate based on 39 labour hours per Hot-Cell-based loading operation.
- Minor incidentals, including working area services, consumables, conventional and radiological waste handling, etc., accommodated in "Allowance".
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 41 Finish Year: 51 Duration: 11 year(s) WBS Type: Variable

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$382,061			$382,061	15%	$439,370

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

29-Apr-2010 4:53:01 PM WEDS ID # 1123

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	29-Apr-2010

WBS Case:	661	ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)
WBS Number:	661.50.20.110	IFTC Transportation Cask for New Build A

WBS Description:

The loading of used fuel into IFTC Transport Casks, pre-shipment preparation of the IFTC and placement in Shipment Area for New Build A, including:
- Loading of used fuel from owner's Cask into the IFTC Transport Cask in a Hot Cell
- Pre-shipment preparation of IFTC Transport Cask
- Internal transfer of the loaded IFTC Transport Cask to Shipment Area
- Loading of the IFTC Impact Limiter onto IFTC Transport Cask

WBS Deliverable:

- Loaded IFTCs with Impact Limiters in Shipment Area ready for transfer to trailer and subsequent road transport.

Loading of used fuel into IFTC Transport Casks and pre-shipment preparation of IFTCs includes:

Preparation of Owner's Cask with fuel in modules (not considered part of this study)

Preparation of IFTC Transport Cask
- Identify IFTC Transport Cask in secure storage or Shipment Area
- Remove IFTC Impact Limiter Bolts
- Remove IFTC Impact Limiter
- Transfer IFTC Transport Cask from Storage
- Transfer IFTC Transport Cask to Hot Cell Loading Pit
- Remove IFTC Transport Cask Lid Bolts
- Transfer IFTC under Hot Cell Docking Gate
- Insert IFTC into Docking Gate
- Remove IFTC Lid
- Inspect IFTC Transport Cask

Removal of Owner's cask from Hot Cell (not considered part of this study)

Transfer of used fuel to IFTC Transport Cask and transfer of loaded IFTC Transport Cask to Shipment Area.
- Unload modules from Owner's Cask
- Load modules into IFTC Transport Cask
- Inspect IFTC/M Transport Cask ("IFTC/M" denotes loaded IFTC)
- Place Lid on IFTC/M Transport Cask
- Lower IFTC/M Transport Cask from Hot Cell
- Shuttle IFTC/M Transport Cask to Loading Pit
- Attach IFTC Lid Bolts
- Decontaminate IFTC/M Transport Cask
- Carry out Smear Test
- Transfer IFTC/M Transport Cask from Hot Cell Pit
- Carry out air pressure decay (seal) test
- Transfer IFTC/M Transport Cask to Shipment Area

Placement of IFTC Impact Limiter on filled IFTC/M Transport Cask
- Identify IFTC Impact Limiter in secure storage
- Identify Filled IFTC/M Transport Cask in Shipment Area

- Carry out pre-loading inspection of filled IFTC/M Transport Cask
- Transfer IFTC Impact Limiter from Storage
- Carry out pre-loading inspection of IFTC Impact Limiter
- Place IFTC Transport Cask Impact Limiter onto IFTC/M Transport Cask
- Attach IFTC Impact Limiter Bolts
- Carry out Smear Test
- Verify/complete security and safeguard seals

WBS Assumptions:

Costs based on number of Used Fuel Bundles and Shipments
- Number of bundles = 807,738
- Number of shipments = 4,208

- Owner bears all costs to prepare and provide loaded cask with fuel in modules for IFTC loading, as well as all costs related to owner's cask management, repeated use and eventual decommissioning.
- Estimate based on 39 labour hours per Hot-Cell-based loading operation.
- Minor incidentals, including working area services, consumables, conventional and radiological waste handling, etc., accommodated in "Allowance".
- Also subject to overall UFTS assumptions.

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 67 Finish Year: 85 Duration: 19 year(s) WBS Type: Variable

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$12,966,484			$12,966,484	15%	$14,911,456

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

29-Apr-2010 4:55:09 PM WEDS ID # 1124

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	29-Apr-2010

WBS Case:	661	ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)
WBS Number:	661.50.20.120	IFTC Transportation Cask for New Build B

WBS Description:

The loading of used fuel into IFTC Transport Casks, pre-shipment preparation of the IFTC and placement in Shipment Area for New Build B, including:
- Loading of used fuel from owner's Cask into the IFTC Transport Cask in a Hot Cell
- Pre-shipment preparation of IFTC Transport Cask
- Internal transfer of the loaded IFTC Transport Cask to Shipment Area
- Loading of the IFTC Impact Limiter onto IFTC Transport Cask

WBS Deliverable:

- Loaded IFTCs with Impact Limiters in Shipment Area ready for transfer to trailer and subsequent road transport.

Loading of used fuel into IFTC Transport Casks and pre-shipment preparation of IFTCs includes:

Preparation of Owner's Cask with fuel in modules (not considered part of this study)

Preparation of IFTC Transport Cask
- Identify IFTC Transport Cask in secure storage or Shipment Area
- Remove IFTC Impact Limiter Bolts
- Remove IFTC Impact Limiter
- Transfer IFTC Transport Cask from Storage
- Transfer IFTC Transport Cask to Hot Cell Loading Pit
- Remove IFTC Transport Cask Lid Bolts
- Transfer IFTC under Hot Cell Docking Gate
- Insert IFTC into Docking Gate
- Remove IFTC Lid
- Inspect IFTC Transport Cask

Removal of Owner's cask from Hot Cell (not considered part of this study)

Transfer of used fuel to IFTC Transport Cask and transfer of loaded IFTC Transport Cask to Shipment Area.
- Unload modules from Owner's Cask
- Load modules into IFTC Transport Cask
- Inspect IFTC/M Transport Cask ("IFTC/M" denotes loaded IFTC)
- Place Lid on IFTC/M Transport Cask
- Lower IFTC/M Transport Cask from Hot Cell
- Shuttle IFTC/M Transport Cask to Loading Pit
- Attach IFTC Lid Bolts
- Decontaminate IFTC/M Transport Cask
- Carry out Smear Test
- Transfer IFTC/M Transport Cask from Hot Cell Pit
- Carry out air pressure decay (seal) test
- Transfer IFTC/M Transport Cask to Shipment Area

Placement of IFTC Impact Limiter on filled IFTC/M Transport Cask
- Identify IFTC Impact Limiter in secure storage
- Identify Filled IFTC/M Transport Cask in Shipment Area

- Carry out pre-loading inspection of filled IFTC/M Transport Cask
- Transfer IFTC Impact Limiter from Storage
- Carry out pre-loading inspection of IFTC Impact Limiter
- Place IFTC Transport Cask Impact Limiter onto IFTC/M Transport Cask
- Attach IFTC Impact Limiter Bolts
- Carry out Smear Test
- Verify/complete security and safeguard seals

WBS Assumptions:

Costs based on number of Used Fuel Bundles and Shipments
- Number of bundles = 851,313
- Number of shipments = 4,435

- Owner bears all costs to prepare and provide loaded cask with fuel in modules for IFTC loading, as well as all costs related to owner's cask management, repeated use and eventual decommissioning.
- Estimate based on 39 labour hours per Hot-Cell-based loading operation.
- Minor incidentals, including working area services, consumables, conventional and radiological waste handling, etc., accommodated in "Allowance".
- Also subject to overall UFTS assumptions.

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 66 Finish Year: 85 Duration: 20 year(s) WBS Type: Variable

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$13,665,965			$13,665,965	15%	$15,715,859

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1096

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	17-Feb-2010

WBS Case: 661 ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)

WBS Number: 661.50.30.10 IFTC Transportation Logistics from Whiteshell to DGR

WBS Description:

The operation of the Transportation System from Whiteshell to DGR, including:
- Loading of IFTC/M Transport Cask Assembly (filled IFTC Transport Cask and Impact Limiter) onto the IFTC Transport Vehicle Trailers
- Transportation to DGR
- Return empty IFTC Transport Cask Assembly and IFTC Transportation Vehicles to owner Reactor Storage Facility

WBS Deliverable:

- IFTC/M delivered at DGR Used Fuel Processing Plant (UFPP)
- Empty IFTC delivered at reactor site

The complete operation includes:

Tractor-Trailer and Escort Vehicle Operation from the DGR to the reactor site and back

Unloading of incoming IFTC Transport Vehicle
- Identify Incoming IFTC Transport Vehicle with empty IFTC with Impact Limiter
- Open Weather Cover on IFTC Transport Vehicle
- Inspect IFTC Transport Vehicle with empty IFTC with Impact Limiter
- Conduct Smear Test, including radiological survey
- Remove Tie-Downs on IFTC with Impact Limiter
- Unload IFTC with Impact Limiter from IFTC Transport Vehicle

Preparation of IFTC Transport Vehicle
- Identify Empty IFTC Transport Vehicle
- Conduct Pre-Loading Inspection of Empty IFTC Transport Vehicle
- Position IFTC Transport Vehicle

Transfer of IFTC/M ("IFTC/M" denotes IFTC loaded with modules) Transport Cask onto IFTC Transport Vehicle
- Load IFTC/M Transport Cask and Impact Limiter on IFTC Transport Vehicle
- Attach Tie-Downs to IFTC/M Transport Cask Assembly
- Conduct Post-Loading Inspection
- Conduct Smear Test
- Close Weather Cover on IFTC Transport Vehicle
- Conduct Final inspection of IFTC Transport Vehicle
- Dispatch Loaded IFTC Transport Vehicle

WBS Assumptions:

- Distance from Whiteshell to DGR site: 1,000 km
- Number of shipments = 2
- Approx. 18.3 hr effort per shipment for vehicle prep, loading & unloading (3 person crew)
- Approx. 89 hrs effort per shipment for driving cycle (4 person crew)
- Costs based on average shipment effort. Slight variation in individual shipment effort due to, e.g., pre-loaded trailer swaps.
- Includes fuel and insurance.
- Does not include fleet maintenance - See 661.50.50 (IFTC Transportation Vehicles Maintenance)
- Does not include operation of Emergency Response System - See 661.50.40.10 (IFTC Transportation System Logistics DGR

Emergency Response)
- Does not include operation of Real-Time Tracking System - See 661.50.40.20 (IFTC Transportation System Logistics DGR Real Time Tracking)
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 51 Finish Year: 51 Duration: 1 year(s) WBS Type: Variable

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$16,956		$2,846	$19,802	15%	$22,772

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1097

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 17-Feb-2010

WBS Case: 661 ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)
WBS Number: 661.50.30.20 IFTC Transportation Logistics from Bruce to DGR

WBS Description:

The operation of the Transportation System from Bruce to DGR, including:
- Loading of IFTC/M Transport Cask Assembly (filled IFTC Transport Cask and Impact Limiter) onto the IFTC Transport Vehicle Trailers
- Transportation to DGR
- Return empty IFTC Transport Cask Assembly and IFTC Transportation Vehicles to owner Reactor Storage Facility

WBS Deliverable:

- IFTC/M delivered at DGR Used Fuel Processing Plant (UFPP)
- Empty IFTC delivered at reactor site

The complete operation includes:

Tractor-Trailer and Escort Vehicle Operation from the DGR to the reactor site and back

Unloading of incoming IFTC Transport Vehicle
- Identify Incoming IFTC Transport Vehicle with empty IFTC with Impact Limiter
- Open Weather Cover on IFTC Transport Vehicle
- Inspect IFTC Transport Vehicle with empty IFTC with Impact Limiter
- Conduct Smear Test, including radiological survey
- Remove Tie-Downs on IFTC with Impact Limiter
- Unload IFTC with Impact Limiter from IFTC Transport Vehicle

Preparation of IFTC Transport Vehicle
- Identify Empty IFTC Transport Vehicle
- Conduct Pre-Loading Inspection of Empty IFTC Transport Vehicle
- Position IFTC Transport Vehicle

Transfer of IFTC/M ("IFTC/M" denotes IFTC loaded with modules) Transport Cask onto IFTC Transport Vehicle
- Load IFTC/M Transport Cask and Impact Limiter on IFTC Transport Vehicle
- Attach Tie-Downs to IFTC/M Transport Cask Assembly
- Conduct Post-Loading Inspection
- Conduct Smear Test
- Close Weather Cover on IFTC Transport Vehicle
- Conduct Final inspection of IFTC Transport Vehicle
- Dispatch Loaded IFTC Transport Vehicle

WBS Assumptions:

- Distance from Bruce A/B to DGR site: 1,000 km
- Number of shipments = 12,191
- Approx. 18.3 hr effort per shipment for vehicle prep, loading & unloading (3 person crew)
- Approx. 89 hrs effort per shipment for driving cycle (4 person crew)
- Costs based on average shipment effort. Slight variation in individual shipment effort due to, e.g., pre-loaded trailer swaps.
- Includes fuel and insurance.
- Does not include fleet maintenance - See 661.50.50 (IFTC Transportation Vehicles Maintenance)
- Does not include operation of Emergency Response System - See 661.50.40.10 (IFTC Transportation System Logistics DGR

Emergency Response)
- Does not include operation of Real-Time Tracking System - See 661.50.40.20 (IFTC Transportation System Logistics DGR Real Time Tracking)
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 26 Finish Year: 77 Duration: 52 year(s) WBS Type: Variable

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$103,352,532		$17,348,188	$120,700,720	15%	$138,805,828

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1098

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	17-Feb-2010

WBS Case:	661	ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)
WBS Number:	661.50.30.30	IFTC Transportation Logistics from Pickering to DGR

WBS Description:

The operation of the Transportation System from Pickering to DGR, including:
- Loading of IFTC/M Transport Cask Assembly (filled IFTC Transport Cask and Impact Limiter) onto the IFTC Transport Vehicle Trailers
- Transportation to DGR
- Return empty IFTC Transport Cask Assembly and IFTC Transportation Vehicles to owner Reactor Storage Facility

WBS Deliverable:

IFTC/M delivered at DGR Used Fuel Processing Plant (UFPP)
- Empty IFTC delivered at reactor site

The complete operation includes:

Tractor-Trailer and Escort Vehicle Operation from the DGR to the reactor site and back

Unloading of incoming IFTC Transport Vehicle
- Identify Incoming IFTC Transport Vehicle with empty IFTC with Impact Limiter
- Open Weather Cover on IFTC Transport Vehicle
- Inspect IFTC Transport Vehicle with empty IFTC with Impact Limiter
- Conduct Smear Test, including radiological survey
- Remove Tie-Downs on IFTC with Impact Limiter
- Unload IFTC with Impact Limiter from IFTC Transport Vehicle

Preparation of IFTC Transport Vehicle
- Identify Empty IFTC Transport Vehicle
- Conduct Pre-Loading Inspection of Empty IFTC Transport Vehicle
- Position IFTC Transport Vehicle

Transfer of IFTC/M ("IFTC/M" denotes IFTC loaded with modules) Transport Cask onto IFTC Transport Vehicle
- Load IFTC/M Transport Cask and Impact Limiter on IFTC Transport Vehicle
- Attach Tie-Downs to IFTC/M Transport Cask Assembly
- Conduct Post-Loading Inspection
- Conduct Smear Test
- Close Weather Cover on IFTC Transport Vehicle
- Conduct Final inspection of IFTC Transport Vehicle
- Dispatch Loaded IFTC Transport Vehicle

WBS Assumptions:

- Distance from Pickering A/B to DGR site: 1,000 km
- Number of shipments = 6,440
- Approx. 18.3 hr effort per shipment for vehicle prep, loading & unloading (3 person crew)
- Approx. 89 hrs effort per shipment for driving cycle (4 person crew)
- Costs based on average shipment effort. Slight variation in individual shipment effort due to, e.g., pre-loaded trailer swaps.
- Includes fuel and insurance.
- Does not include fleet maintenance - See 661.50.50 (IFTC Transportation Vehicles Maintenance)
- Does not include operation of Emergency Response System - See 661.50.40.10 (IFTC Transportation System Logistics DGR

Emergency Response)
- Does not include operation of Real-Time Tracking System - See 661.50.40.20 (IFTC Transportation System Logistics DGR Real Time Tracking)
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 26 Finish Year: 66 Duration: 41 year(s) WBS Type: Variable

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$54,596,854		$9,164,320	$63,761,174	15%	$73,325,350

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1099

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 17-Feb-2010

WBS Case: 661 ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)
WBS Number: 661.50.30.40 IFTC Transportation Logistics from Darlington to DGR

WBS Description:

The operation of the Transportation System from Darlington to DGR, including:
- Loading of IFTC/M Transport Cask Assembly (filled IFTC Transport Cask and Impact Limiter) onto the IFTC Transport Vehicle Trailers
- Transportation to DGR
- Return empty IFTC Transport Cask Assembly and IFTC Transportation Vehicles to owner Reactor Storage Facility

WBS Deliverable:

- IFTC/M delivered at DGR Used Fuel Processing Plant (UFPP)
- Empty IFTC delivered at reactor site

The complete operation includes:

Tractor-Trailer and Escort Vehicle Operation from the DGR to the reactor site and back

Unloading of incoming IFTC Transport Vehicle
- Identify Incoming IFTC Transport Vehicle with empty IFTC with Impact Limiter
- Open Weather Cover on IFTC Transport Vehicle
- Inspect IFTC Transport Vehicle with empty IFTC with Impact Limiter
- Conduct Smear Test, including radiological survey
- Remove Tie-Downs on IFTC with Impact Limiter
- Unload IFTC with Impact Limiter from IFTC Transport Vehicle

Preparation of IFTC Transport Vehicle
- Identify Empty IFTC Transport Vehicle
- Conduct Pre-Loading Inspection of Empty IFTC Transport Vehicle
- Position IFTC Transport Vehicle

Transfer of IFTC/M ("IFTC/M" denotes IFTC loaded with modules) Transport Cask onto IFTC Transport Vehicle
- Load IFTC/M Transport Cask and Impact Limiter on IFTC Transport Vehicle
- Attach Tie-Downs to IFTC/M Transport Cask Assembly
- Conduct Post-Loading Inspection
- Conduct Smear Test
- Close Weather Cover on IFTC Transport Vehicle
- Conduct Final inspection of IFTC Transport Vehicle
- Dispatch Loaded IFTC Transport Vehicle

WBS Assumptions:

- Distance from Darlington to DGR site: 1,000 km
- Number of shipments = 6,939
- Approx. 18.3 hr effort per shipment for vehicle prep, loading & unloading (3 person crew)
- Approx. 89 hrs effort per shipment for driving cycle (4 person crew)
- Costs based on average shipment effort. Slight variation in individual shipment effort due to, e.g., pre-loaded trailer swaps.
- Includes fuel and insurance.
- Does not include fleet maintenance - See 660.50.50 (IFTC Transportation Vehicles Maintenance)
- Does not include operation of Emergency Response System - See 660.50.40.10 (IFTC Transportation System Logistics DGR

Emergency Response)
- Does not include operation of Real-Time Tracking System - See 660.50.40.20 (IFTC Transportation System Logistics DGR Real Time Tracking)
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 26 Finish Year: 69 Duration: 44 year(s) WBS Type: Variable

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$58,827,275		$9,874,436	$68,701,711	15%	$79,006,967

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1100

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 17-Feb-2010

WBS Case: 661 ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)
WBS Number: 661.50.30.50 IFTC Transportation Logistics from Point LePreau to DGR

WBS Description:

The operation of the Transportation System from Point Lepreau to DGR, including:
- Loading of IFTC/M Transport Cask Assembly (filled IFTC Transport Cask and Impact Limiter) onto the IFTC Transport Vehicle Trailers
- Transportation to DGR
- Return empty IFTC Transport Cask Assembly and IFTC Transportation Vehicles to owner Reactor Storage Facility

WBS Deliverable:

- IFTC/M delivered at DGR Used Fuel Processing Plant (UFPP)
- Empty IFTC delivered at reactor site

The complete operation includes:

Tractor-Trailer and Escort Vehicle Operation from the DGR to the reactor site and back

Unloading of incoming IFTC Transport Vehicle
- Identify Incoming IFTC Transport Vehicle with empty IFTC with Impact Limiter
- Open Weather Cover on IFTC Transport Vehicle
- Inspect IFTC Transport Vehicle with empty IFTC with Impact Limiter
- Conduct Smear Test, including radiological survey
- Remove Tie-Downs on IFTC with Impact Limiter
- Unload IFTC with Impact Limiter from IFTC Transport Vehicle

Preparation of IFTC Transport Vehicle
- Identify Empty IFTC Transport Vehicle
- Conduct Pre-Loading Inspection of Empty IFTC Transport Vehicle
- Position IFTC Transport Vehicle

Transfer of IFTC/M ("IFTC/M" denotes IFTC loaded with modules) Transport Cask onto IFTC Transport Vehicle
- Load IFTC/M Transport Cask and Impact Limiter on IFTC Transport Vehicle
- Attach Tie-Downs to IFTC/M Transport Cask Assembly
- Conduct Post-Loading Inspection
- Conduct Smear Test
- Close Weather Cover on IFTC Transport Vehicle
- Conduct Final inspection of IFTC Transport Vehicle
- Dispatch Loaded IFTC Transport Vehicle

WBS Assumptions:

- Distance from Pt. Lepreau to DGR site: 2,500 km
- Number of shipments = 1486
- Approx. 18.3 hr effort per shipment for vehicle prep, loading & unloading (3 person crew)
- Approx. 162 hr effort per shipment for driving cycle (4 person crew)
- Costs based on average shipment effort. Slight variation in individual shipment effort due to, e.g., pre-loaded trailer swaps.
- Includes fuel and insurance.
- Does not include fleet maintenance - See 660.50.50 (IFTC Transportation Vehicles Maintenance)
- Does not include operation of Emergency Response System - See 660.50.40.10 (IFTC Transportation System Logistics DGR

Emergency Response)
- Does not include operation of Real-Time Tracking System - See 660.50.40.20 (IFTC Transportation System Logistics DGR Real Time Tracking)
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 41 Finish Year: 74 Duration: 34 year(s) WBS Type: Variable

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$21,168,816		$5,286,558	$26,455,374	15%	$30,423,680

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1101

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	17-Feb-2010

WBS Case: 661 ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)

WBS Number: 661.50.30.60 IFTC Transportation Logistics from Chalk River to DGR

WBS Description:

The operation of the Transportation System from Chalk River to DGR, including:
- Loading of IFTC/M Transport Cask Assembly (filled IFTC Transport Cask and Impact Limiter) onto the IFTC Transport Vehicle Trailers
- Transportation to DGR
- Return empty IFTC Transport Cask Assembly and IFTC Transportation Vehicles to owner Reactor Storage Facility

WBS Deliverable:

- IFTC/M delivered at DGR Used Fuel Processing Plant (UFPP)
- Empty IFTC delivered at reactor site

The complete operation includes:

Tractor-Trailer and Escort Vehicle Operation from the DGR to the reactor site and back

Unloading of incoming IFTC Transport Vehicle
- Identify Incoming IFTC Transport Vehicle with empty IFTC with Impact Limiter
- Open Weather Cover on IFTC Transport Vehicle
- Inspect IFTC Transport Vehicle with empty IFTC with Impact Limiter
- Conduct Smear Test, including radiological survey
- Remove Tie-Downs on IFTC with Impact Limiter
- Unload IFTC with Impact Limiter from IFTC Transport Vehicle

Preparation of IFTC Transport Vehicle
- Identify Empty IFTC Transport Vehicle
- Conduct Pre-Loading Inspection of Empty IFTC Transport Vehicle
- Position IFTC Transport Vehicle

Transfer of IFTC/M ("IFTC/M" denotes IFTC loaded with modules) Transport Cask onto IFTC Transport Vehicle
- Load IFTC/M Transport Cask and Impact Limiter on IFTC Transport Vehicle
- Attach Tie-Downs to IFTC/M Transport Cask Assembly
- Conduct Post-Loading Inspection
- Conduct Smear Test
- Close Weather Cover on IFTC Transport Vehicle
- Conduct Final inspection of IFTC Transport Vehicle
- Dispatch Loaded IFTC Transport Vehicle

WBS Assumptions:

- Distance from Chalk River to DGR site: 1,000 km
- Number of shipments = 27
- Approx. 18.3 hr effort per shipment for vehicle prep, loading & unloading (3 person crew)
- Approx. 89 hrs effort per shipment for driving cycle (4 person crew)
- Costs based on average shipment effort. Slight variation in individual shipment effort due to, e.g., pre-loaded trailer swaps.
- Includes fuel and insurance.
- Does not include fleet maintenance - See 660.50.50 (IFTC Transportation Vehicles Maintenance)
- Does not include operation of Emergency Response System - See 660.50.40.10 (IFTC Transportation System Logistics DGR

Emergency Response)
- Does not include operation of Real-Time Tracking System - See 660.50.40.20 (IFTC Transportation System Logistics DGR Real Time Tracking)
- Also subject to overall UFTS assumptions.

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 51 Finish Year: 55 Duration: 5 year(s) WBS Type: Variable

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$228,900		$38,420	$267,320	15%	$307,418

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1102

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	17-Feb-2010

WBS Case: 661 ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)

WBS Number: 661.50.30.70 IFTC Transportation Logistics from Gentilly 1 to DGR

WBS Description:

The operation of the Transportation System from Gentilly 1 to DGR, including:
- Loading of IFTC/M Transport Cask Assembly (filled IFTC Transport Cask and Impact Limiter) onto the IFTC Transport Vehicle Trailers
- Transportation to DGR
- Return empty IFTC Transport Cask Assembly and IFTC Transportation Vehicles to owner Reactor Storage Facility

WBS Deliverable:

- IFTC/M delivered at DGR Used Fuel Processing Plant (UFPP)
- Empty IFTC delivered at reactor site

The complete operation includes:

Tractor-Trailer and Escort Vehicle Operation from the DGR to the reactor site and back

Unloading of incoming IFTC Transport Vehicle
- Identify Incoming IFTC Transport Vehicle with empty IFTC with Impact Limiter
- Open Weather Cover on IFTC Transport Vehicle
- Inspect IFTC Transport Vehicle with empty IFTC with Impact Limiter
- Conduct Smear Test, including radiological survey
- Remove Tie-Downs on IFTC with Impact Limiter
- Unload IFTC with Impact Limiter from IFTC Transport Vehicle

Preparation of IFTC Transport Vehicle
- Identify Empty IFTC Transport Vehicle
- Conduct Pre-Loading Inspection of Empty IFTC Transport Vehicle
- Position IFTC Transport Vehicle

Transfer of IFTC/M ("IFTC/M" denotes IFTC loaded with modules) Transport Cask onto IFTC Transport Vehicle
- Load IFTC/M Transport Cask and Impact Limiter on IFTC Transport Vehicle
- Attach Tie-Downs to IFTC/M Transport Cask Assembly
- Conduct Post-Loading Inspection
- Conduct Smear Test
- Close Weather Cover on IFTC Transport Vehicle
- Conduct Final inspection of IFTC Transport Vehicle
- Dispatch Loaded IFTC Transport Vehicle

WBS Assumptions:

- Distance from Gentilly 1 to DGR site: 1,500 km
- Number of shipments = 18
- Approx. 18.3 hr effort per shipment for vehicle prep, loading & unloading (3 person crew)
- Approx. 112 hr effort per shipment for driving cycle (4 person crew)
- Costs based on average shipment effort. Slight variation in individual shipment effort due to, e.g., pre-loaded trailer swaps.
- Includes fuel and insurance.
- Does not include fleet maintenance - See 660.50.50 (IFTC Transportation Vehicles Maintenance)
- Does not include operation of Emergency Response System - See 660.50.40.10 (IFTC Transportation System Logistics DGR

Emergency Response)
- Does not include operation of Real-Time Tracking System - See 660.50.40.20 (IFTC Transportation System Logistics DGR Real Time Tracking)
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 51 Finish Year: 55 Duration: 5 year(s) WBS Type: Variable

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$185,310		$38,420	$223,730	15%	$257,290

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1103

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 17-Feb-2010

WBS Case: 661 ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)
WBS Number: 661.50.30.80 IFTC Transportation Logistics from Gentilly 2 to DGR

WBS Description:

The operation of the Transportation System from Gentilly 2 to DGR, including:
- Loading of IFTC/M Transport Cask Assembly (filled IFTC Transport Cask and Impact Limiter) onto the IFTC Transport Vehicle Trailers
- Transportation to DGR
- Return empty IFTC Transport Cask Assembly and IFTC Transportation Vehicles to owner Reactor Storage Facility

WBS Deliverable:

- IFTC/M delivered at DGR Used Fuel Processing Plant (UFPP)
- Empty IFTC delivered at reactor site

The complete operation includes:

Tractor-Trailer and Escort Vehicle Operation from the DGR to the reactor site and back

Unloading of incoming IFTC Transport Vehicle
- Identify Incoming IFTC Transport Vehicle with empty IFTC with Impact Limiter
- Open Weather Cover on IFTC Transport Vehicle
- Inspect IFTC Transport Vehicle with empty IFTC with Impact Limiter
- Conduct Smear Test, including radiological survey
- Remove Tie-Downs on IFTC with Impact Limiter
- Unload IFTC with Impact Limiter from IFTC Transport Vehicle

Preparation of IFTC Transport Vehicle
- Identify Empty IFTC Transport Vehicle
- Conduct Pre-Loading Inspection of Empty IFTC Transport Vehicle
- Position IFTC Transport Vehicle

Transfer of IFTC/M ("IFTC/M" denotes IFTC loaded with modules) Transport Cask onto IFTC Transport Vehicle
- Load IFTC/M Transport Cask and Impact Limiter on IFTC Transport Vehicle
- Attach Tie-Downs to IFTC/M Transport Cask Assembly
- Conduct Post-Loading Inspection
- Conduct Smear Test
- Close Weather Cover on IFTC Transport Vehicle
- Conduct Final inspection of IFTC Transport Vehicle
- Dispatch Loaded IFTC Transport Vehicle

WBS Assumptions:

- Distance from Gentilly 2 to DGR site: 1,500 km
- Number of shipments = 1417
- Approx. 18.3 hr effort per shipment for vehicle prep, loading & unloading (3 person crew)
- Approx. 112 hr effort per shipment for driving cycle (4 person crew)
- Costs based on average shipment effort. Slight variation in individual shipment effort due to, e.g., pre-loaded trailer swaps.
- Includes fuel and insurance.
- Does not include fleet maintenance - See 660.50.50 (IFTC Transportation Vehicles Maintenance)
- Does not include operation of Emergency Response System - See 660.50.40.10 (IFTC Transportation System Logistics DGR

Emergency Response)
- Does not include operation of Real-Time Tracking System - See 660.50.40.20 (IFTC Transportation System Logistics DGR Real Time Tracking)
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 41 Finish Year: 72 Duration: 32 year(s) WBS Type: Variable

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$14,588,027		$3,024,672	$17,612,699	15%	$20,254,604

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1104

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 17-Feb-2010

WBS Case: 661 ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)
WBS Number: 661.50.30.90 IFTC Transportation Logistics from Douglas Point to DGR

WBS Description:

The operation of the Transportation System from Douglas Point to DGR, including:
- Loading of IFTC/M Transport Cask Assembly (filled IFTC Transport Cask and Impact Limiter) onto the IFTC Transport Vehicle Trailers
- Transportation to DGR
- Return empty IFTC Transport Cask Assembly and IFTC Transportation Vehicles to owner Reactor Storage Facility

WBS Deliverable:

- IFTC/M delivered at DGR Used Fuel Processing Plant (UFPP)
- Empty IFTC delivered at reactor site

The complete operation includes:

Tractor-Trailer and Escort Vehicle Operation from the DGR to the reactor site and back

Unloading of incoming IFTC Transport Vehicle
- Identify Incoming IFTC Transport Vehicle with empty IFTC with Impact Limiter
- Open Weather Cover on IFTC Transport Vehicle
- Inspect IFTC Transport Vehicle with empty IFTC with Impact Limiter
- Conduct Smear Test, including radiological survey
- Remove Tie-Downs on IFTC with Impact Limiter
- Unload IFTC with Impact Limiter from IFTC Transport Vehicle

Preparation of IFTC Transport Vehicle
- Identify Empty IFTC Transport Vehicle
- Conduct Pre-Loading Inspection of Empty IFTC Transport Vehicle
- Position IFTC Transport Vehicle

Transfer of IFTC/M ("IFTC/M" denotes IFTC loaded with modules) Transport Cask onto IFTC Transport Vehicle
- Load IFTC/M Transport Cask and Impact Limiter on IFTC Transport Vehicle
- Attach Tie-Downs to IFTC/M Transport Cask Assembly
- Conduct Post-Loading Inspection
- Conduct Smear Test
- Close Weather Cover on IFTC Transport Vehicle
- Conduct Final inspection of IFTC Transport Vehicle
- Dispatch Loaded IFTC Transport Vehicle

WBS Assumptions:

- Distance from Douglas Point to DGR site: 1,000 km
- Number of shipments = 124
- Approx. 18.3 hr effort per shipment for vehicle prep, loading & unloading (3 person crew)
- Approx. 89 hrs effort per shipment for driving cycle (4 person crew)
- Costs based on average shipment effort. Slight variation in individual shipment effort due to, e.g., pre-loaded trailer swaps.
- Includes fuel and insurance.
- Does not include fleet maintenance - See 660.50.50 (IFTC Transportation Vehicles Maintenance)
- Does not include operation of Emergency Response System - See 660.50.40.10 (IFTC Transportation System Logistics DGR

Emergency Response)
- Does not include operation of Real-Time Tracking System - See 660.50.40.20 (IFTC Transportation System Logistics DGR Real Time Tracking)
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 41 Finish Year: 51 Duration: 11 year(s) WBS Type: Variable

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$1,051,241		$176,451	$1,227,692	15%	$1,411,845

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

29-Apr-2010 4:58:54 PM WEDS ID # 1125

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 29-Apr-2010

WBS Case: 661 ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)
WBS Number: 661.50.30.100 IFTC Transportation Logistics from New Build A

WBS Description:

Loading of IFTC/M Transport Cask Assembly (IFTC Transport Cask and Impact Limiter) onto the IFTC Transport Vehicle Trailers and transportation to DGR
Return empty IFTC Transport Cask Assembly and IFTC Transportation Vehicles to owners Reactor Storage Facilities

WBS Deliverable:

Complete operation of placing the IFTC/M Transport Cask Assembly (IFTC Transport Cask and Impact Limiter) onto IFTC

Transport Vehicle Trailer and Transport to DGR and back

Preparation of IFTC Transport Vehicle

- Incoming Empty IFTC Transport Vehicle
- Pre-Loading Inspection of Empty IFTC Transport Vehicle
- Position IFTC Transport Vehicle

Transfer of Filled IFTC/M Transport Cask onto IFTC Transport Vehicle

- Load IFTC/M Transport Cask and Impact Limiter on IFTC Transport Vehicle
- Attach Tie-Downs to IFTC/M Transport Cask Assembly
- Post-Loading Inspection
- Smear Test
- Close Weather Cover on IFTC Transport Vehicle
- Final inspection IFTC Transport Vehicle
- Loaded IFTC Transport Vehicle ready for Deployment

WBS Assumptions:

Distance from New Build A to DGR site: 1,000 km
- Number of shipments = 4,208
- Approx. 18.3 hr effort per shipment for vehicle prep, loading & unloading (3 person crew)
- Approx. 89 hrs effort per shipment for driving cycle (4 person crew)
- Costs based on average shipment effort. Slight variation in individual shipment effort due to, e.g., pre-loaded trailer swaps.
- Includes fuel and insurance.
- Does not include fleet maintenance - See 661.50.50 (IFTC Transportation Vehicles Maintenance)
- Does not include operation of Emergency Response System - See 661.50.40.10 (IFTC Transportation System Logistics DGR Emergency Response)
- Does not include operation of Real-Time Tracking System - See 661.50.40.20 (IFTC Transportation System Logistics DGR Real Time Tracking)
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 67 Finish Year: 85 Duration: 19 year(s) WBS Type: Variable

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$35,674,429		$5,988,116	$41,662,545	15%	$47,911,927

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

29-Apr-2010 4:59:35 PM WEDS ID # 1126

Organization Name:	Palladium Product Development & Design		
Prepared by:	R. Scheps	Reviewed by:	R. Scheps
Modified by:		Last Modification Date:	29-Apr-2010

WBS Case: 661 ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)
WBS Number: 661.50.30.110 IFTC Transportation Logistics from New Build B

WBS Description:

Loading of IFTC/M Transport Cask Assembly (IFTC Transport Cask and Impact Limiter) onto the IFTC Transport Vehicle Trailers and transportation to DGR
Return empty IFTC Transport Cask Assembly and IFTC Transportation Vehicles to owners Reactor Storage Facilities

WBS Deliverable:

Complete operation of placing the IFTC/M Transport Cask Assembly (IFTC Transport Cask and Impact Limiter) onto IFTC Transport Vehicle Trailer and Transport to DGR and back

Preparation of IFTC Transport Vehicle

- Incoming Empty IFTC Transport Vehicle
- Pre-Loading Inspection of Empty IFTC Transport Vehicle
- Position IFTC Transport Vehicle

Transfer of Filled IFTC/M Transport Cask onto IFTC Transport Vehicle

- Load IFTC/M Transport Cask and Impact Limiter on IFTC Transport Vehicle
- Attach Tie-Downs to IFTC/M Transport Cask Assembly
- Post-Loading Inspection
- Smear Test
- Close Weather Cover on IFTC Transport Vehicle
- Final inspection IFTC Transport Vehicle
- Loaded IFTC Transport Vehicle ready for Deployment

WBS Assumptions:

Distance from New Build B to DGR site: 1,000 km

- Number of shipments = 4,435

- Approx. 18.3 hr effort per shipment for vehicle prep, loading & unloading (3 person crew)
- Approx. 89 hrs effort per shipment for driving cycle (4 person crew)
- Costs based on average shipment effort. Slight variation in individual shipment effort due to, e.g., pre-loaded trailer swaps.
- Includes fuel and insurance.
- Does not include fleet maintenance - See 661.50.50 (IFTC Transportation Vehicles Maintenance)
- Does not include operation of Emergency Response System - See 661.50.40.10 (IFTC Transportation System Logistics DGR Emergency Response)
- Does not include operation of Real-Time Tracking System - See 661.50.40.20 (IFTC Transportation System Logistics DGR Real Time Tracking)
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 66 Finish Year: 85 Duration: 20 year(s) WBS Type: Variable

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$37,598,963		$6,311,160	$43,910,123	15%	$50,496,641

WBS Specific Supporting Documentation:

Multi Element Supporting Documentation:

RC DETS Alternate Case Final Sept 9, 10.xls

TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1105

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 17-Feb-2010

WBS Case: 661 ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)
WBS Number: 661.50.40.10.10 IFTC Transportation Logistics DGR Emergency Response

WBS Description:

The implementation and maintenance of the Emergency Response System, including communications, operations and documentation for the duration for the UFTS.

WBS Deliverable:

- An on-going Emergency Response System ready to respond to any accident or incident during the operation of the transportation system.

Operation of the Emergency Response System includes:
- Completed emergency response plan with all the necessary documentation (references to applicable regulations, emergency procedures, maps, safety files, Transport Emergency Response Plan (TERP), emergency response assistance plan (ERAP), etc.).
- Staffed emergency system ready to raise alarm, conduct situation analysis, activate response agencies, notify authorities, activate part-time personnel and deploy a recovery system for the transportation package.

When required, core staff will activate emergency response teams, such as:

Command and Decision Team:
- Logistic and technical assistance to Authorities
- Decision on proper technical means to be implemented
- Management of other teams

Technical Analysis Team:
- Estimation of the technical state of the packaging and of associated impacts
- Proposition of technical emergency and assistance solutions

Mobile Command Team:
- Implementation of command, information and expertise near the incident
- First intervention equipment (satellite communication system, radio or chemical protection, equipment, camera, and computers). (This team implements processes to minimize consequences or to bring a solution to the situation)

Communications Team:
- Preparation and development of crisis communication especially dedicated to the media situation
- Provision of a specific communication plan
- Provide incident information to regulator
- Provide information for the press and for other communication entities
- Accept information from the press

WBS Assumptions:

- One annual emergency exercise/year (600 person-hours)
- One actual emergency exercise/year (600 person-hours)
- Two full-time equivalent (FTE) technicians to maintain and operate the recovery equipment and to update the necessary documentation (~3280 hr/yr)
- Minor incidentals, including working area services, consumables, conventional and radiological waste handling, etc., accommodated in "Allowance".

- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 26 Finish Year: 85 Duration: 60 year(s) WBS Type: Variable

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$21,237,888			$21,237,888	15%	$24,423,571

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1106

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 17-Feb-2010

WBS Case: 661 ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)
WBS Number: 661.50.40.10.20 IFTC Transportation Logistics DGR Real Time Tracking

WBS Description:

The implementation and maintenance of the Real Time Tracking System for the duration of the UFTS.

WBS Deliverable:

- Secure, real-time reporting on the current position of transportation system components

Operation of the Real Time Tracking System includes:
- Real time information on IFTC Transport Cask, IFTC Transport Vehicle and Escort locations
- Provision of progress information for transport operations
- Maintaining the security of transmitted information

WBS Assumptions:

- Real Time Tracking System operates 24 hr per day, 7 days a week (8760 hrs/year)
- System uses three shifts of two controllers
- System management requires one full-time-equivalent (FTE) supervisor and one FTE administrative individual
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 26 Finish Year: 85 Duration: 60 year(s) WBS Type: Variable

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$102,115,608			$102,115,608	15%	$117,432,949

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1107

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 17-Feb-2010

WBS Case: 661 ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)
WBS Number: 661.50.50 IFTC Transportation Vehicles Maintenance

WBS Description:

IFTC Transportation Vehicle maintenance.

WBS Deliverable:

Perform preventive maintenance of the Transportation Vehicle Trailers, Tractors and Escorts.

WBS Assumptions:

- The maintenance of the IFTC Transport Vehicles will be contracted to a third party specializing in maintenance of long haul transport vehicles.
-The maintenance cost of Transportation Vehicles is equivalent to 5% of one-time fleet procurement cost per year
-The tire replacement cost for Transportation Vehicles is equivalent to 2% one-time fleet procurement cost per year
- Every 3.5 years a complete overhaul of the IFTC Transport Vehicle Tractor and Trailers is performed
- Incidental maintenance of low-mileage non-fleet vehicles (mock-ups, emergency response fleet) accounted for under "allowance".
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 25 Finish Year: 85 Duration: 61 year(s) WBS Type: Variable

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
		$35,779,800	$35,779,800	15%	$41,146,770

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Feb-2010 3:00:00 PM WEDS ID # 1074

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 17-Feb-2010

WBS Case: 661 ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)
WBS Number: 661.55 ENVIRONMENTAL MANAGEMENT

WBS Description:

The set-up, and monitoring, of transportation aspects within an Environmental Management System (EMS) for NWMO in accordance with ISO 14001, including:
- Auditing of supplier EMSs, and review of proposals.
- Liaison with regulators regarding environmental and other regulatory requirements.
- Assistance with transportation aspects of Environmental Assessment (EA).
- Planning of environmental monitoring activities as needed.
- Ensuring that all environmental requirements are met by transportation system equipment and facilities.

WBS Deliverable:

- Input to NWMO EMS.
- Communications with regulators.
- Plans, audits and reports as required by EMS.

WBS Assumptions:

- Work starts at the time engineering work starts on the transportation system (year 16) and continues throughout operation.
- Approximately two full-time equivalents (FTEs) from commencement of engineering work to start of operations.
- 820 hr/yr labour during Transport Operations.
- Expenses and incidentals included in "Allowance".
- Preparation of material for application for IFTC Transport Cask approval certificate(s) and approvals for Equipment for IFTC Transport Case are included in the cost estimates for those components (WBS 661.40.20).
- Administrative support is covered by Program Management (WBS 661.50.10).
- Also subject to overall UFTS assumptions. Major assumptions table attached as "Multi Element Supporting Documentation".

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 16 Finish Year: 87 Duration: 72 year(s) WBS Type: Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$7,189,301			$7,189,301	30%	$9,346,091

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

29-Apr-2010 4:10:39 PM WEDS ID # 1116

Organization Name: Palladium Product Development & Design
Prepared by: R. Scheps Reviewed by: R. Scheps
Modified by: Last Modification Date: 30-Apr-2010

WBS Case: 661 ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)
WBS Number: 661.60 DECOMMISSIONING

WBS Description:

The development and implementation of plans to decommission the Used Fuel Transportation System (UFTS) and associated loading facilities.

Decommissioning includes:
- Decontaminating related Used Fuel equipment and preparing such for landfill.
- Decommission the UFTS and associated loading facilities.
- Consigning controlled decommissioning waste to a suitable disposal facility

WBS Deliverable:

- A deactivated and decommissioned UFTS

Decommissioning includes:
-An approved plan for decommissioning the Used Fuel Transportation Systems and associated loading facilities
- Decontaminated UF equipment, prepared for landfill
- Dismantled and decommissioned UFTS and associated loading facilities
- Decommissioning waste stored in an owner disposal facility

WBS Assumptions:

- Estimate adapted from Cogema (2003)
- It is assumed that the Used Fuel Transportation System and associated loading facilities do not have any major contamination and have not experienced a major irradiation incident or accident.
- It is assumed that the Used Fuel Transportation System and associated loading facilities have been maintained according to procedures and will be decommissioned without any difficulties.
- Contractor, non-permanent equipment and non-permanent material costs ("Other") of decommissioning is estimated as 10% (approx. $25M) of the capital cost sum for IFTC Transport Casks, Impact Limiters, IFTC Transport Vehicles and Equipment for IFTC Transport Cask Loading (approx. $250M). An allowance for disposal operation cost of decommissioning waste is included in this sum.
- Labour hours are estimated by taking an allowance of 30% of "Other" decom. costs discussed above and dividing this by a nominal hourly rate of approximately $59, resulting in an estimate of approx. 129,000 hr.
- No credit for remaining useful life or salvage value at time of decommissioning.
- Also subject to overall UFTS assumptions.

Exclusive of Contingency.

WBS Allowance Basis:

Standard

Start Year: 80 Finish Year: 87 Duration: 8 year(s) WBS Type: Step-Fixed

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$8,724,495		$25,266,320	$33,990,815	15%	$39,089,438

WBS Specific Supporting Documentation:
Multi Element Supporting Documentation:
RC DETS Alternate Case Final Sept 9, 10.xls
TM1 - Assumptions Appendix 3.pdf

Work Element Definition Sheet

17-Sep-2010 2:28:28 PM WEDS ID # 9007

Organization Name: NWMO - Nuclear Waste Management Organization
Prepared by: U. Stahmer Reviewed by:
Modified by: Last Modification Date:

WBS Case: 661 ALL ROAD TRANSPORT SYSTEM (based on 7.2M fuel bundles)
WBS Number: 661.90 PROGRAM MANAGEMENT

WBS Description:

Organizational structure to support / manage transportation program.

WBS Deliverable:

- Siting (Y01 to Y09)
- Project schedule
- Project business plan inputs on a yearly basis
- Program definition required to achieve implementation objectives
- Resourcing plan
- Regulatory work regulatory review to identify applicable regulations and assess impact of regulatory changes

- Site Licensing Phase (Y10 to Y15)
- Program definition required to achieve implementation objectives
- Resourcing plan
- Support to EA

- Manufacturing (Y16 to Y25)
- Oversight of Project Management team
- Project schedule
- Program business plan inputs on a yearly basis
- objectives
- Resourcing plan
- Certificate for Transport Package Design (Y20) recertification (Y24)
- Licence to Transport Category II Nuclear Material

- Operations (Y26 to Y54)
- Manage resources, facilities and infrastructures required for operating and maintaining the Used Fuel Transportation System
- Organizational structure to support / manage transportation program
- Operate, manage and administer the Used Fuel Transportation System.
- Project schedule
- Project business plan inputs on a yearly basis
- Program definition required to achieve implementation objectives
- Resourcing plan

WBS Assumptions:

- Regulatory work includes recertification of active transport certificates (transfer of IFTC ownership from OPG to NWMO is anticipated by Y03, certificate renewal is required in Y04), keeping abreast of current regulatory issues and determining impact of regulatory changes (IAEA, CNSC, TDG, provincial transport regulations)
- Travel assumption is 1 trip to regulator every 2 years (Y04, Y06 and Y08) at $1,500 per trip.
- Work on Route development (660.55) during EA (Y13, Y14 and Y15) is anticipated to be minimal and is assumed to be captured under this WEDS.
- Travel assumption is 1 trip to regulator every 2 years (Y10, Y12 and Y14) at $1,500 per trip.
- The Program Management includes 2 FTE persons during the entire period of Used Fuel transportation package manufacturing assumed to span 10 years and includes:
  - One program director,
  - One program administrator,

- Travel assumption: 10 trips annually to DGR site and manufacturing facilities at $1,500 per trip
- Lump sum allocation for new Production Package Certificate application(s) $24,000 in Year Y19.
- Lump sum allocation for Package Design Certificate recertification(s) in Y24 at $1,000.
- Licence to Transport in Y24 and renewals as required by the regulator
- The team to manage the Used Fuel Transportation System includes a staffed team of 14 FTE persons during the entire period of Used Fuel transportation assumed to span 31 years and includes:
  - One transport manager,
  - One maintenance supervisor,
  - Three engineers (one design/regulatory responsible, one package maintenance engineer and one equipment maintenance engineer)
  - Four Transportation Officers (one per main storage site (3) and one at the UFPP),
  - One scheduler,
  - One secretary,
  - Two forwarding technicians,
  - One Quality Assurance and Inspection technician,
- Travel assumption: 10 trips annually between UFPP and sites at $1,500 per trip.
- Certificate recertifications (7) every 4 years at $1,000 per recertification

Exclusive of Contingency.

WBS Allowance Basis:

Start Year: 4 Finish Year: 85 Duration: 82 year(s) WBS Type: Variable

Labour Costs	Material Costs	Other Costs	Subtotal	Allowance	Total Cost
$194,347,583		$1,189,000	$195,536,583	0%	$195,536,583

WBS Specific Supporting Documentation:
SNC APM Master Estimate 660 D1 Rev. 10 Program Management.xlsx
Multi Element Supporting Documentation: