GNEP Deployment Studies

FINAL BUSINESS PLAN REPORT, REVISION 3

INTEGRATED USED FUEL MANAGEMENT

A Strategy for the Disposition of the Nation's Used Commercial Nuclear Fuel

September 30, 2009

Prepared by

ENERGYSOLUTIONS
Shaw
Booz | Allen | Hamilton

AJ Dobson
Submitted by Alan Dobson, Project General Manager

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Date

EnergySolutions, LLC
2345 Stevens Dr.
Richland, WA 99354

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Preface

The envisioned business plan elements presented in this report are intended to represent indicative concepts and economics to support early consideration of a regional used (spent) nuclear fuel (UNF) management facility (UFMF) initiative as an initiating step in implementing an evolving national Integrated Used Fuel Management (IUFM) strategy. The report results indicate that workable business frameworks, implementation sequences and positive economic benefits are likely outcomes of this strategy. The concepts discussed in this report represent considerable experience and insights from similar initiatives and projects, including the private fuel storage initiative, at-reactor dry cask storage projects and currently ongoing new nuclear power plant projects. The dollar amounts presented are considered representative based on limited analysis and applying such experience and inputs. A more detailed analysis of projected commercial frameworks and strategy economics is needed to address specific project requirements as the strategy continues to evolve. Initial steps taken toward site development will provide a much better understanding of specific constraints, requirements and opportunities which could significantly modify these concepts. Changes in law, policy and regulation will continue to inform the best path forward and will need to be re-evaluated as they occur. Therefore the details presented in this report, which provide important insights, should be considered indicative rather than prescriptive.

A private industry led regional UFMF initiative, including project development and implementation and subsequent facility operation requires further development of commercial structures that balance a number of challenges including risk management, public outreach, commercial viability, stakeholder requirements, and a host of legal and policy interpretations. The identification of potential volunteer sites with associated stakeholder requirements, evolution of relevant energy policy, and a more detailed accounting of the strategy economics will require continued re-assessment of these concepts to forge an effective commercial framework that can succeed in moving forward with a regional UFMF initiative as part of an evolving national IUFM strategy is a viable commercial venture. It is with this awareness that this report is presented.

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List of Abbreviations

AB .....Administrative Building
AEA .....Atomic Energy Act
AEC .....Atomic Energy Commission
AFCI .....Advanced Fuel Cycle Initiative
AFR.....Away-From-Reactor
ALARA.....As Low As Reasonably Achievable
ANDRA .....Agence Nationale pour la gestion des Dechets Radioactifs
BWR .....Boiling Water Reactor
CA .....Construction Authorization
CEO.....Chief Executive Officer
CFR.....U.S. Code of Federal Regulations
CHB .....Cask Handling Building
CNSC .....Canadian Nuclear Safety Organization
CoC .....Certificate of Compliance
CY .....Calendar Year
D&D.....Decommissioning and Dismantlement
DOE .....U.S. Department of energy
DOE-NE.....DOE Office of Nuclear Energy
DOI .....U.S. Department of Interior
DOJ .....U.S. Department of Justice
DPC.....Dual-Purpose Canister (storage and transport capable)
EA .....Environmental Assessment
EIS.....Environmental Impact Statement
ENRESA.....Empresa Nacional de Reiduos Radiativos SA
ENSI.....Swiss Federal Nuclear Safety Inspectorate
EOI.....Expression of Interest
EOL.....End of Life
EPC .....Engineering, Procurement and Construction
EPRI.....Electric Power Research Institute
ERDO.....European Repository Development Organization
ES .....Energy*Solutions*
ES&H.....Environmental Safety & Health
FCR&D.....Fuel Cycle Research and Development
FEIS .....Final Environmental Impact Statement
FIS.....Federal Interim Storage
FOA.....Funding Opportunity Announcement
FONSI.....Finding Of No Significant Impact
FPL.....Florida Power & Light
FSAR.....Final Safety Analysis Report
FY .....Fiscal Year
GAO.....Government Accounting Office

List of Abbreviations, cont.

GE .....General Electric Company
GNEP .....Global Nuclear Energy Partnership
GTCC.....Greater-Than-Class-C
HAMC.....Host Agreements Management Contract
HLW .....High-Level radioactive Waste
HP .....Health Physics
HR.....Human Resources
HVAC .....Heating, Ventilation and Air Conditioning
INL.....Idaho National Laboratory
ISF.....Interim Storage Facility
ISFSI .....Independent Spent Fuel Storage Installation
IUFM.....Integrated Used Fuel Management
LA .....License Application
LCC.....Life Cycle Cost
LES .....Louisiana Energy Services
LIBOR.....London Interbank Offered Rate
LLC.....Limited Liability Company
LWR.....Light Water Reactor
LWS .....Liquid Radwaste System
MB .....Maintenance Building
MOU .....Memorandum of Understanding
MOX .....Mixed Oxide Fuel
MRS .....Monitored Retrievable Storage
MT.....Metric Tons
MTU.....Metric Tons of Uranium
NAGRA .....National Cooperative for the Disposal of Radioactive Waste
NEI.....Nuclear Energy Institute
NEPA .....National Environmental Policy Act
NMSS.....NRC Office of Nuclear Material Safety and Safeguards
NRC .....U.S. Nuclear Regulatory Commission
NRDC .....Natural Resources Defense Council
NUREG.....NRC Regulatory Guide
NWF.....Nuclear Waste Fund
NWMO .....Nuclear Waste Management Organization
NWPA .....Nuclear Waste Policy Act of 1982, and amended 1987 (a.k.a. the Act)
NWPAA .....Nuclear Waste Policy Amendments Act of 1987 (a.k.a. the amended Act)
NWTRB .....Nuclear Waste Technical Review Board
OCA .....Owner Controlled Area
OCRWM .....DOE's Office of Civilian Radioactive Waste Management
O&M .....Operation and Maintenance
PA .....Protected Area

List of Abbreviations, cont.

PFS.....Private Fuel Storage
PWR.....Pressurized Water Reactor
PG&E.....Pacific Gas & Electric Company
QA.....Quality Assurance
R&D.....Research and Development
ROI.....Return on Investment
RSPC.....Regional Service Provider Contract
RSSF .....Retrievable Surface Storage Facility
SAR.....Safety Analysis Report
SER .....Safety Evaluation Report
SFP.....Spent Fuel Pool
SKB.....Swedish Nuclear Fuel & Waste Management Company
TBD.....To Be Determined
TVA .....Tennessee Valley Authority
U.....Uranium
UNF.....Used Nuclear Fuel (a.k.a. spent nuclear fuel)
UFMF.....Used Fuel Management Facility
U.S. .....United States
WGA.....Western Governors' Association
WIPP.....Waste Isolation Pilot Plant

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Executive Summary

Introduction

The Department of Energy (DOE) is in the process of reviewing current policies and programs for fulfilling its obligations under the Nuclear Waste Policy Act of 1982 (Act) to accept used nuclear fuel (UNF) from US commercial nuclear power plants for final disposition. The current situation necessitates storage of UNF at reactor sites for an indefinite period of time which is not what was intended by the Act. To date, federal commitments made pursuant to that Act remain unfulfilled because of the inability to establish an acceptable site to receive the UNF for disposal once accepted, pursuant to the provisions of the Act.

The foreseeable future for UNF management would appear to be one of either continued storage at reactor sites, or the development of one or more centralized facilities for the management of UNF that would serve as initial UNF receiving locations to begin the waste disposition process while awaiting the final disposal pathway. This latter approach would consolidate the UNF accepted from various reactor sites similar to that of the Monitored Retrievable Storage concept described in the Act and studied by DOE in the 1980's.

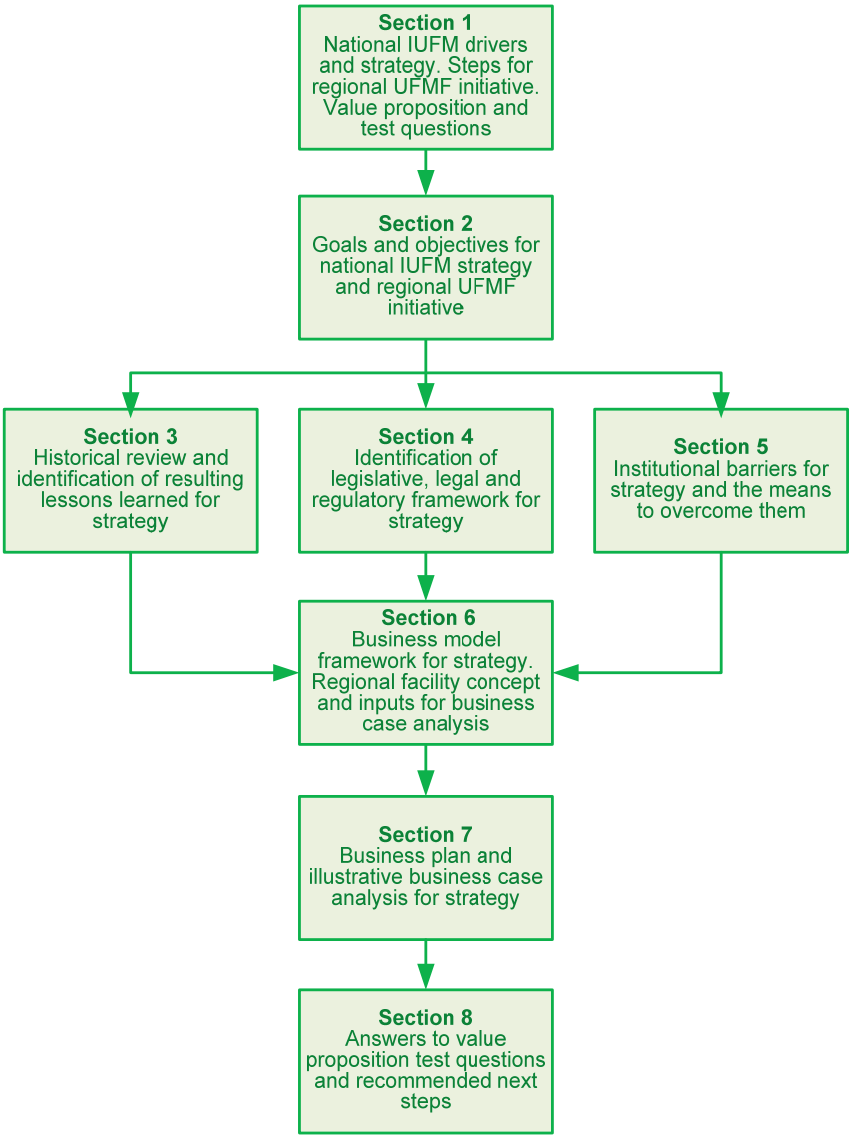
The technology and equipment needed for the removal of UNF from reactor sites, including acceptance by DOE, transportation, and subsequent disposition, is already developed, demonstrated and licensed by the NRC; and is cost effective, proven in use, and readily available. But that means little if there are no acceptable host sites to which the UNF can be moved and received to begin the disposition process. It is apparent, given a review of the related history, that the challenges are not technical or regulatory; rather, they are political and societal.

The Revised Final Business Plan Report presents the comprehensive analysis of a national UNF management strategy constructed around the proposition that private industry, working in partnership with DOE and the respective voluntary regional host entities, can successfully develop multiple Used Fuel Management Facilities (UFMFs) under current federal law and statutes. The Report is intended to be illustrative of the opportunities this approach offers. It is developed around a conceptual strategy that is intended to show commercial feasibility, and provides a framework that should be viewed as indicative and flexible rather than prescriptive.

The Report provides an in depth view and discussion of not just the development of regional, commercial UFMFs, but also the programmatic context for those facilities as part of a national Integrated Used Fuel Management (IUFM) strategy. Regional, commercial UFMFs can play a central role and integrating function in the implementation of a national IUFM system that may change over time. Regional, commercial UFMFs can provide an effective bridge to an evolving national policy for UNF waste acceptance and disposal. It is emphasized that deliberate and measured progress toward a final UNF disposition pathway, by the inclusion of advanced closed fuel-cycle technologies (for example recycling) or direct disposal, is a critical element in the IUFM strategy. The Report seeks to develop a way of moving forward with UNF management in the near term (with a vision for the longer term) that includes an opportunity to develop risk

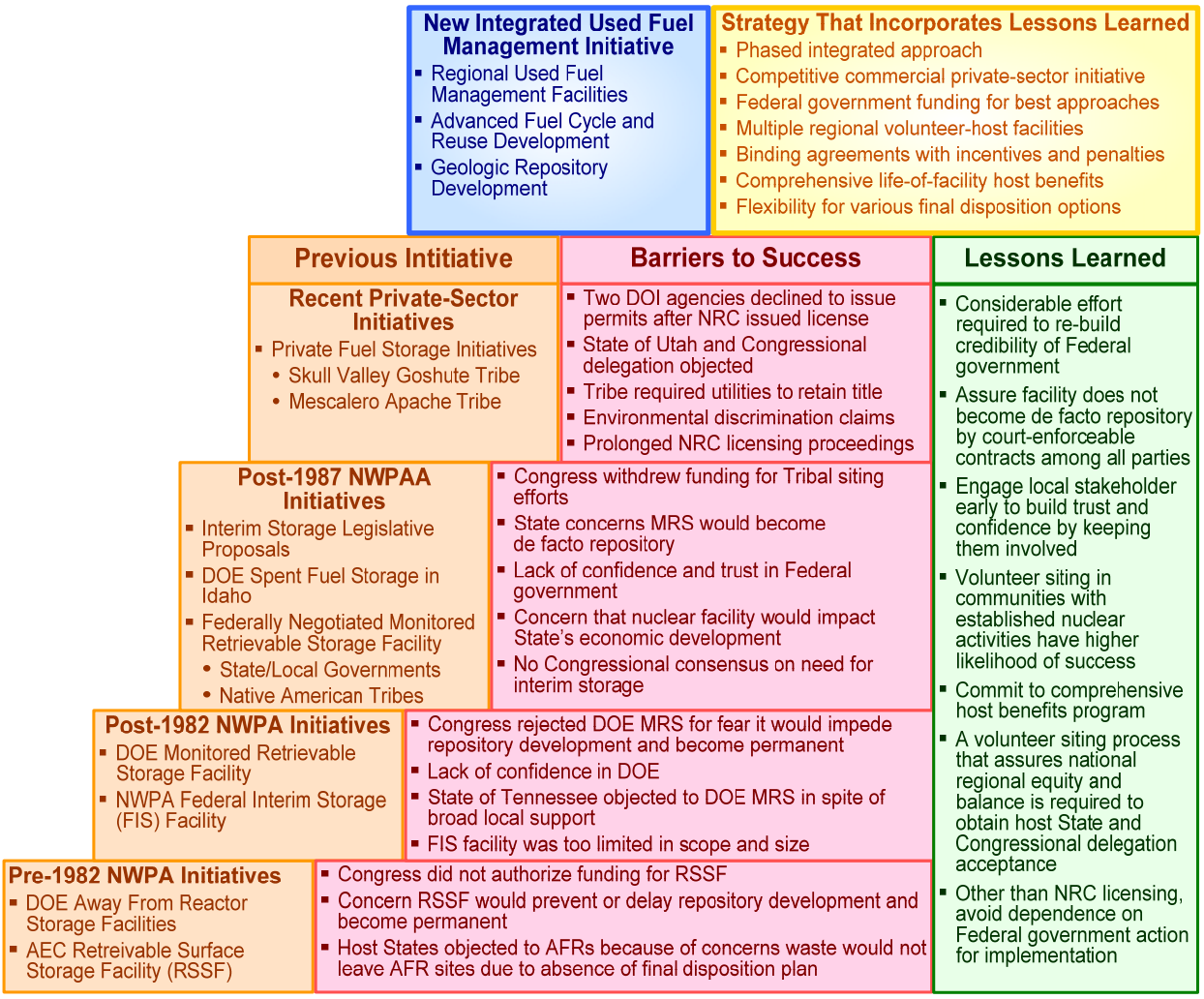
sharing and shared investment opportunities with private industry that are implementable under current federal laws and statutes.

Integrated Used Fuel Management Report Organization.



The Report begins with a discussion of siting, institutional and programmatic issues that are informed by historical lessons learned that will need to be addressed, and then follows with a description of a comprehensive framework for the development of perhaps as many as three geographically regional, commercial UFMFs that can be developed and deployed under current federal laws and statutes (that may be enhanced in the future by legislative amendments in response to policy-maker needs). In this regard, a considerable effort has been made to fully evaluate previous relevant UNF initiatives for the sole purpose of informing and providing data and metrics that can be used to review and validate the plan.

Lessons Learned for a National IUFM Strategy



To test the viability of the regional UFMF initiative as a commercial enterprise, the strategy framework described includes a scenario description and financial analysis of an illustrative business case for a single representative facility. Fixed-based facility and major capital equipment cost estimates are developed based on directly-related past experience and ongoing projects, along with financing, revenue and economic components that together involve significant sharing of risks by private industry (via LLCs dedicated to this purpose).

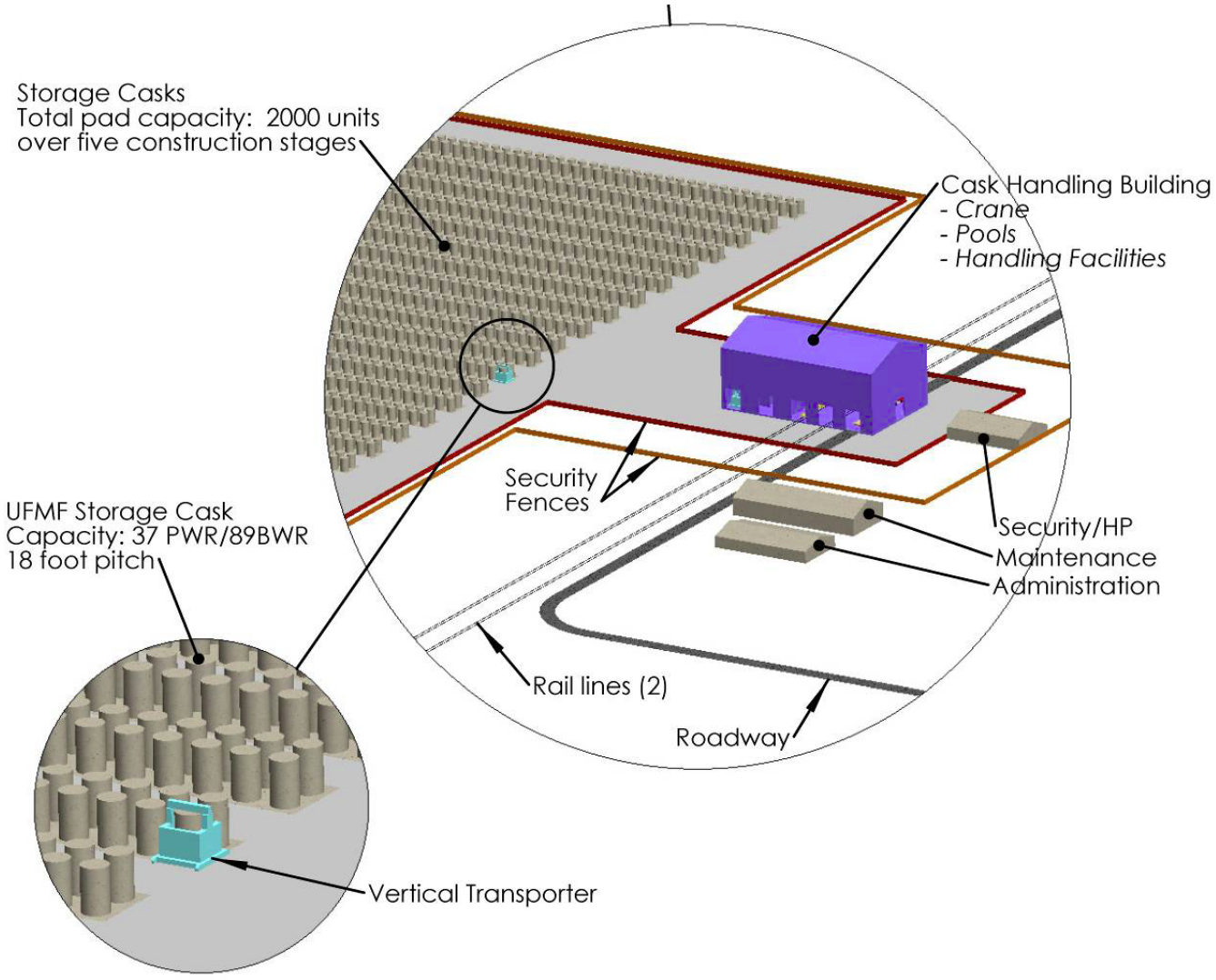
The Report considers a planning scenario whereby construction and operation of a regional UFMF would occur in three stages. Stage 1 provides for a base facility comprising a storage pad with a capacity of 400 dry used fuel storage casks. Stage 2 provides for an expanded facility comprising fuel pools for the receipt of bare fuel and an additional storage pad for a total capacity of 800 casks. Stage 3 provides for continuing expansion of up to three more pads with a capacity of 400 casks each, bringing the total facility capacity up to a total of 2000 casks, or approximately 30,000 metric tons of UNF. The size of each 400 cask storage pad is based upon the maximum footprint size of the storage casks and an optimal cask-to-cask spacing.

The UFMF includes four main buildings and would have a footprint of approximately 400 acres:

- Cask Handling Building (with a fuel pool in the expansion phase)
- Operations and Maintenance Building
- Administrative Office Building
- Security / Health Physics Building

The site would be located in proximity to a rail head and near industrial suppliers in the surrounding region capable of fabricating storage canisters and constructing the concrete casks and pads, and other equipment that will have to be procured for the UFMF. It would also be centrally located between the nuclear power plants that it serves and located near communities that can support housing for workers and provide emergency response personnel. A siting goal will be to locate in proximity to a community that has a substantial nuclear work force, and/or has significant experience with nuclear projects, which would make local acceptance much easier.

Figure 2-3. Used Fuel Management Facility.



An essential feature of the Integrated Used Fuel Management Strategy is that it is designed to be flexible and adaptable to accommodate current and future directions regarding final UNF disposition. Whatever pathway DOE determines to be appropriate in the long term would be enhanced by the implementation of the envisioned framework. The strategy is designed to be enacted and implemented in steps, allowing DOE to make incremental progress at each step, and to reduce its legal risk profile in the process.

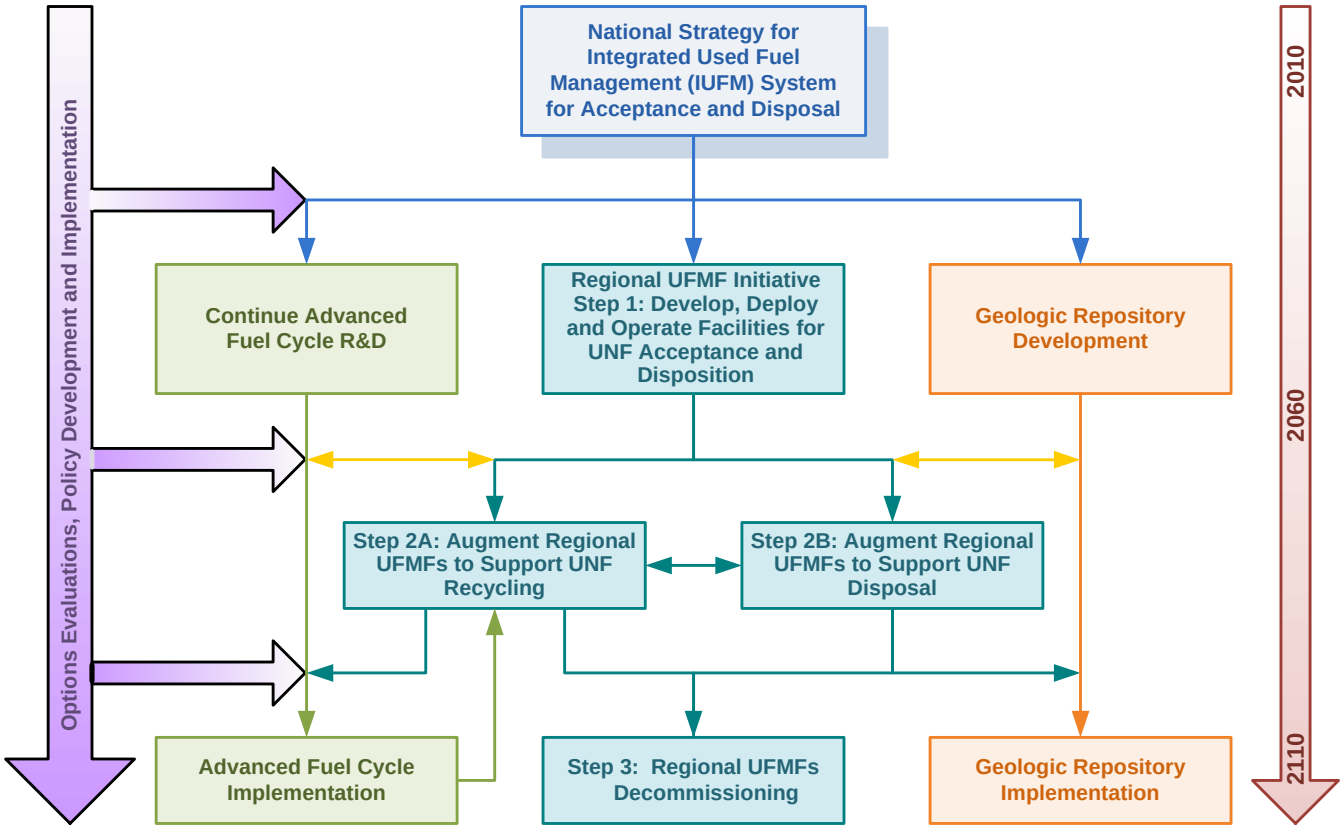
The envisioned federal–private industry–host entity(s)—utility partnership relationship presents opportunities to develop regional UNF management capabilities as part of an evolving national IUFM strategy that have not previously been explored. The framework provides DOE with the means for what is needed today: risk-shared approaches for facility siting, development and deployment that can provide DOE the ability to begin accepting commercial reactor UNF, fulfill contractual obligations, and begin the UNF disposal process sooner than it could otherwise.

The envisioned strategy is flexible and scalable; and incorporates capabilities to provide a broad range of benefits to the Federal government, such as:

- The Act is intentionally prescriptive with respect to the **federal** options it provides DOE (emphasis added) for initiating UNF acceptance and disposal, (due to linkages between a federal MRS and repository), whereas private industry is not subject to the same limited options. The strategy allows DOE with the means to move forward as contemplated by the Act through a private industry-led initiative.
- The acceptance of UNF could be sequenced in accordance with the existing waste acceptance priority ranking established by the existing utility contracts, or might be adjusted by DOE to first remove the UNF from already shutdown reactor sites or for other reasons.
- Some utilities are expected to contract with an LLC directly as commercial customers for the acceptance of their UNF ahead of the federal priority ranking in order to avoid the need for constructing new or additional on-site storage capability, or to address other plant-specific constraints, or in response to local public policy issues.
- The acceptance of bare UNF assemblies from utilities can increase the ability of the LLC to address a broader range of potential utility needs and increase the efficiency of transportation and UNF management. It also supports a broader range of options for final UNF disposition.

Optionally, UNF acceptance could include transfer of title to the UNF from the utility to DOE, to the LLC on behalf of DOE, to the LLC directly, (or the utility could retain title), depending on case-by-case needs, circumstances and conditions.

Integrated Used Fuel Management Strategy.



Programmatic Framework Overview

Since siting is the key, the initiative framework begins with a near-term DOE-NE funding opportunity announcement followed by multiple cooperative agreement grant awards to interested and qualified nuclear industry companies to develop and implement a voluntary UFMF siting process, seeking expressions of interest from potential hosts. It is envisioned that the country would be divided into perhaps three geographic regions. The companies would use grant funds to identify and engage potential hosts (including interested local communities, regions and their State) who want to learn more about the opportunity. This would include discussion of a host-specific, targeted package of benefits, such as economic, educational, public infrastructure-related and industrial development benefits over an extended period of time.

Potential UFMF Regions

Potential volunteer hosts who are willing to move forward through the envisioned siting process, would continue on with the objective of developing negotiated, acceptable host agreements. History informs us that having more than one volunteer host site and facility should help to mitigate national equity and freedom-of-choice concerns, and should greatly increase the ability to find and reach agreement with willing local and state governments. At an appropriate point in this site identification process, this competition among potential host-sponsoring companies would result in the selection of one or more volunteer, candidate hosts in each region to finalize the binding agreements with the respective host.

As binding agreements with a host are being completed, the dedicated UFMF LLCs would be formed, and the LLC's would enter into federal Development Contracts to proceed with obtaining the necessary construction authorizations from NRC to build and operate the facilities.

In the relatively near-term, the regional, commercial UFMF could: 1) begin addressing the removal of UNF from already shutdown reactor sites, 2) be used by DOE to begin acceptance under their contracts with utilities, and 3) be used by utilities to avoid the need for new or expanded on site dry storage or to respond to local public policy constraints. The envisioned UFMF fuel pools would permit utilities to remove UNF directly from their reactor storage pools, thus avoiding altogether the need for on-site dry storage of this UNF.

Prior to the LLC obtaining the necessary NRC construction authorization(s) for the facility, the subsequent construction and operation of the facility would be funded under a federal Regional Service Provider Contract with the LLC (one for each regional LLC service provider). This contract would establish performance payments tied to the first receipt of UNF, plus service fee structures for acceptance, transportation and management of UNF over an operating period of 50 years. In addition to this federal contract, the LLC would enter into subscription contracts with

individual utilities as commercial customers to accept and manage their UNF, both already canistered fuel, and bare fuel assemblies from their reactor storage pools.

Upon signing the host agreement(s), the respective host entities would begin receiving payments for their host benefits program from the LLC, under their host agreements. The host agreements would be funded under a separate federal Host Agreements Management Contract with the LLC, (one for each regional LLC). These annual payments would increase the first year UNF is accepted at the facility, and continue through to decommissioning of the facility.

A conceptual 10 year development and implementation plan for the regional UFMF initiative that defines the initiative phases and performance milestones for each of these contracts is included in the Report. The conceptual plan indicates that based on an FY2010 programmatic start date, facility availability to receive the first already canistered fuel and bare fuel assemblies beginning in 2019 and 2022, respectively, is achievable. As one would expect given the maturity of the available technology, volunteer host site selection and NRC licensing are the critical path activities.

Envisioned volunteer, regional, commercial UFMF initiative federal contracting mechanisms and suggested budgetary funding levels.

Type of Contract	Contract Scope	Funding Type	Timeframe	Suggested Budgetary Funding Level 2009$M
Cooperative Agreement	Siting	Annual Grants	FY2010-FY2012	30 total
Management	Host Agreements and Benefits	Fixed Annual Payments	CY2013-CY2018 CF2019-CY2069	25 per year 50 per year
Performance-Based	Development	Performance Milestones	FY2011-CY2016	50 total
Performance-Based	Services	Performance Milestones Fees for Services	FY2016-CY2021 CY2019-CY2069	250 to 400 total 100 to 150 per year

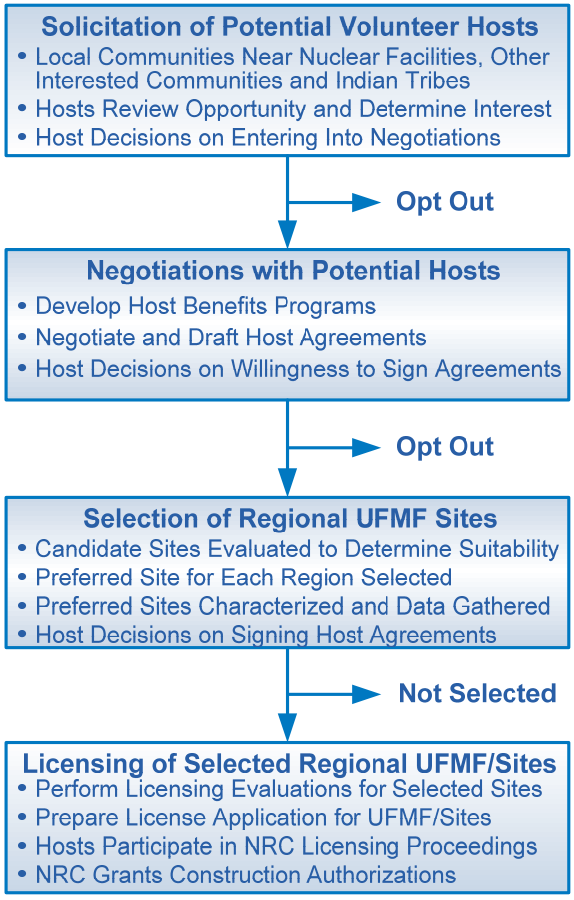
Volunteer Siting Process

The siting process is directed at siting as many as three geographically regional facilities through a competition among participating companies and host sites. The term "host" is informed with the lessons learned from past siting efforts and is used here to refer to the broader network of critical stakeholder interests including local communities, regional institutions, state governmental bodies, and members of Congress. The envisioned volunteer siting process described programmatically above, will be implemented proactively, but with an emphasis on openness and inclusivity, and with appropriate sensitivity and mutual respect.

Regarding host benefits, an emphasis is placed on bringing stable high-skilled employment to the region over the long term through targeted regional industrial development. Benefits are aimed at providing significant direct economic benefits for the purpose of educational, institutional or infrastructure priorities that the host entities may have over the long term. Opportunities for willing hosts interested in fact-finding will be provided early on, aimed at having potential hosts 'see for themselves' that similar modern-day nuclear facilities: 1) routinely operate under a rigorous and compliant safety and quality conscious regiment that is culturally ingrained at all levels of the organization, 2) that incorporate into their daily work practices a high-degree of emphasis on environmental stewardship and public health, and 3) that such organizations are among the best of corporate citizens routinely doing good for the local and regional communities in which they reside. This component of the siting process is aimed at building credibility and confidence in the nuclear industry and that hosting such a facility would not pose an unacceptable risk to their community. Without achieving this, nothing else is possible.

As indicated earlier, the envisioned volunteer siting process led by private industry would begin with the solicitation of expressions of interest from local communities, closely coupled with reaching out to the surrounding region and the State, and offering largely unconditional sub-grants to interested hosts with no-penalty opt out provisions to: 1) prepare an informed evaluation of the benefits and risks, 2) identify other issues and concerns that the local community, surrounding region, and State may have, 3) make a preliminary determination whether there is a potentially acceptable site, and 4) decide under what conditions, if any, the local and State governments would be willing to enter into a binding agreement(s) to host a regional, commercial UFMF. For those local communities and States that agree to enter into discussions with the goal (but not the obligation) of working toward a binding agreement, sub-grants would be made available through the potential host-sponsoring company to establish and fund a joint board to provide input to, and oversight of, the process leading to formalization of a binding agreement(s) signed by the LLC, the host local and state governments, with the DOE as a signatory. This would include developing and negotiating the host benefits program that would be incorporated into the binding host agreements.

Envisioned volunteer regional siting process



A nominally three-year siting process is envisioned (beginning in 2010) with the solicitation and initiation of a dialogue with potentially interested volunteer hosts culminating in negotiated binding agreements with the respective regional UFMF host local and State governments. DOE could provide Fuel Cycle R&D grants for this purpose of approximately $10M per year to each sponsoring company.

UFMF Development and Licensing

At the end of the second year of the planned three-year siting process, DOE would enter into multiple performance-based Development Contracts with the each of the respective potential host-sponsoring LLCs to complete facility and systems engineering, and to prepare the NRC license application, including the environmental report. Under each such contract, it is planned that DOE would make payments tied to the LLC achieving four progressive milestones with NRC including: 1) NRC's docketing of the license application, 2) NRC's issuance of the safety evaluation report, 3) receipt of a NRC construction authorization for the base-capability facility, and 4) receipt an amended NRC construction authorization for the full-capability facility.

The Development Contracts are planned to begin in 2013 and go through 2016, with the milestone payments totaling approximately $50 million over this period. Being performance-based contracts, the LLC would remain at risk for expenses made prior to successful completion of each of the four milestones.

It is assumed for purposes of this illustrative business case example that DOE would fund each Host Benefits Management Contract $25M per year starting in 2013, and continuing until the first shipment of UNF is received. In addition to making the LLC directly responsible for satisfying the terms of the agreements with respective hosts, it allows the opportunity for both the DOE and the private sector to make complementary targeted investments that better serve the hosts and the mission of the facility.

Construction and Receipt of UNF

The cost of construction of a regional UFMF would be financed by commercial loans made to the LLC, which would be repaid through two lump-sum payments from DOE under the Regional Service Provider Contract following initial acceptance of UNF at the base- and full-capability UFMF. This contract would be put in place in late 2015 to facilitate commercial financing approvals and beginning facility construction in early 2016.

This federal contract would be performance-based, with the first payment of approximately $150M due upon the receipt of the first already canistered fuel planned for early 2019 (receipt at the base-capability facility), and a second payment of approximately $150M due with the receipt of the first bare UNF assemblies planned for early 2022 (receipt at the full-capability facility that includes fuel pools). The estimated capital costs for the representative regional UFMF concept chosen for the illustrative business case analysis for the base- and full-capability facility are shown in Table 2-2 and 2-3.

Estimated Capital Costs for Base UFMF

Cost Component	Cost (2009$M)
Startup Costs	82
Engineering and Licensing	35
Base Facility Construction	100
Storage System Transfer Equipment	10
Transportation System Equipment	21
Contingency	17
Total	265

Estimated Capital Costs for UFMF Expansion

Cost Component	Cost (2009$M)
Facility Design, Engineering, and Licensing	14
Facility Construction	23
Storage System Transfer Equipment	9
Transportation System Equipment	33
Contingency	8
Total	87

The commercial loans would be collateralized by the commitments defined by the Regional Service Provider Contract (which would include a 'take-or-pay' provision that would act as a guarantee to reduce the risk profile of the loan and the associated borrowing costs), binding agreements with the host, private equity committed by the LLC, plus any utility commercial customer subscription contracts that can be secured by this timeframe.

For purposes of the illustrative business case, it is assumed (based on historical evidence and recent international experience) that federal funding for each host agreement would increase to approximately $50M per year when the facility receives the first UNF shipment in 2019. To address expected host concerns about the potential permanence of the UFMF as described in the Report, the host agreement is assumed to include a provision to escalate this annual benefits payment by $10M in each successive year, beginning in the 51st year, until all the UNF is removed from the site. It also includes other intermediate one-time incentives and penalties with opt-out provisions under certain conditions as described in the report.

UFMF Operations

For purposes of the illustrative business case example, the regional UFMF is assumed to operate for 50 years. The dry storage capacity of the facility would be expanded every ten years through the first 40 years of operation to accommodate a total of 2,000 storage casks or approximately 30,000 MTU of UNF. At this capacity, the facility would have the capability to receive 80% of all the UNF generated by the plants in a geographic region during this time period, which is approximately one-third of the current fleet of commercial reactors. These expansions would be financed by the receipt unit-cost based fees paid upon receipt of each UNF delivery to the facility. After 50 years of operation, the UFMF would begin decommissioning. In this illustrative business case, the associated decommissioning costs are covered by annual contributions to a trust fund that accrues over the 50 year life of the facility.

Following the two performance payments tied to initial UNF receipt as described above, costs through the facility operations phase would be recovered from DOE and participating utilities on the basis of a set fee structure. For purposes of the illustrative business case, fees under the federal Regional Service Provider Contract and contributions under the Host Agreements Management Contract are estimated to total approximately $175M per year, and annual fees from utility subscription contracts are estimated to total approximately $35M per year.

UFMF Illustrative Business Case Annual Average Fee Payments

Fee	Payee	Annual Fee (2009$M)	Equivalent Unit Fee ($/kgU)
Receipt Fee	Government	54	114
Transportation Fee	Government	34	53
Storage Fee	Government	4	8.30 / yr
Fixed Fee	Government	26	54
Decommissioning Fund	Government	5	N/A
Host Site Benefits Package	Government	50	N/A
Subtotal:	Government	173	N/A
Receipt Fee	Utilities	21	131
Storage Fee	Utilities	2	12.60 / yr
Fixed Fee	Utilities	10	62
Subtotal:	Utilities	33	N/A

The total life cycle cost over the 50 year operating period of a regional UFMF is estimated to be $4.5 billion. For purposes of comparison here, assuming that three regional facilities are developed, the total life cycle cost of $13.5 billion amounts to a small fraction of the total Nuclear Waste Fund value going forward, however it is emphasized that the regional, commercial UFMF initiative does not depend on the Fund, unless so designated by Congressional appropriation.

Based on the illustrative business case analysis results and published industry estimates for on-site dry storage, the comparative unit costs for the facility, (excluding transportation and host benefits costs), are initially higher than those of at-reactor on-site dry storage, but are comparably lower over time due to economies of scale.

Onsite storage vs. regional, commercial UFMF unit life cycle cost comparison

Period (yrs.)	At-Reactor On-site Storage			Regional UFMF		
	LCC ($M)	MTU	LCC/MTU	LCC ($M)	MTU	LCC/MTU ($)
20	$61	350	175	3,457	12,765	271
35	$63	350	180	4,181	22,440	186
50	$63	350	181	4,506	32,115	140

Conclusions

The results of the illustrative business case financial analyses indicate that the regional commercial UFMF initiative, based on a volunteer siting approach, can be a viable commercial enterprise, and as a result, the regional UFMF initiative can be an integral component of a national IUFM strategy. The regional commercial UFMF initiative is the first step in the Federal government's NWPA waste acceptance and disposal disposition pathway for commercial UNF, irrespective of whether the nation decides to continue to pursue direct disposal (the once-through fuel cycle approach) or to adopt a re-use approach (the closed fuel cycle approach).

The regional commercial UFMFs provide the capability for the Federal government, through performance-based contracts with the UFMF LLCs, to start accepting waste from the utility sites (starting with the orphaned shutdown reactor sites) and thereby begin to meet its obligations under the Act and the standard disposal contracts with the utilities. A commercial UFMF would not be limited by the restrictions of the Act that would prevent the creation of a federal UFMF due to statutory linkages with a repository. At the same time, the regional commercial UFMFs satisfy the interests of the nuclear utilities by removing and taking possession of their UNF (constrained by the federal acceptance priority ranking) and, thereby, providing the nuclear utilities the opportunity to satisfy plant-specific constraints, and to focus their resources on the generation and distribution of electrical energy rather than UNF management.

1 Introduction

Background. Previous revisions to the Final Business Plan Report have studied business scenarios for the early deployment of commercial recycling facilities for used nuclear fuel (UNF) in the US. Since the last submittal of this report in January 2009, the landscape for beginning the process of disposing of the wastes from the nuclear fuel cycle has changed significantly, with decisions affecting the status of the geologic repository, and the prioritization of long-term research and development (R&D) into transformational fuel cycle technologies. In light of these changes, and after consultation with US- Department of Energy (DOE), Office of Nuclear Energy (NE), it was determined to be appropriate that a different business approach to used fuel management should be studied, as opposed to updating and revising the previous Business Plan Reports. Those Reports stand as a record of the business approach to the commercial recycling of UNF.

This report describes the conceptual development of a strategy and business plan for the siting, development, deployment and operation of regional, commercial Used Fuel Management Facilities (UFMFs) as part of an Integrated Used Fuel Management (IUFM) strategy for the disposition of the nation's commercial UNF and reactor-related greater than Class C (GTCC) waste[1]. Based on the evaluations documented in this report, it is recommended that a competitive private industry initiative be undertaken in partnership with the Federal government and the nuclear utilities for the development and deployment of multiple regional UFMFs that will enable the removal of commercial used nuclear fuel (UNF) and GTCC waste from reactor sites to begin within ten years of initial development. Doing so will provide the Federal government with the means to begin fulfilling it's obligations under the Nuclear Waste Policy Act (NWPA or the Act) and the 10 CFR Part 961 standard disposal contracts with the utilities by 2020 in accordance with DOE's current baseline schedule[2] for waste acceptance.

As authorized by the Act, the DOE established a standard contract via 10 CFR Part 961[3] that defines the terms and conditions under which the Federal government will accept commercial UNF for disposal. Although the nuclear utility plant owner/operators' primary mission is the production and distribution of electricity, per the 10 CFR Part 961 contract they are obligated to pay fees into the Act's Nuclear Waste Fund (NWF) and to transfer the license for, and ownership of, their UNF to another entity. That entity has primarily been viewed to-date as the Federal government since it has the statutory obligation under the Act for waste acceptance and disposal, and has levied such NWF fees based on the amount of electricity generated and sold. Further,

[1] Per the 10CFR961 standard contract, commercial reactor-related GTCC waste is designated as high level waste (HLW) assuming that it is highly radioactive material that the Commission, consistent with existing law, determines by rule, requires permanent isolation. Thus, like UNF, DOE has an obligation to accept GTCC waste, although its final disposition pathway may or may not be the same as UNF.

[2] U.S. Department of Energy, Office of Civilian Radioactive Waste Management (OCRWM), *Total System Life Cycle Cost Report*, DOE/RW-0591, Washington, DC, July 2008.

[3] Title 10, Code of Federal Regulations (CFR), Part 961, *Standard Contract for Disposal of Spent Nuclear Fuel and/or High Level Radioactive Waste*", April 1983.

the Act intentionally limits the means by which DOE can discharge its waste acceptance and disposal responsibilities under the Act. Private industry, however, is not constrained to only the specific means defined in the Act. Given this, there is an alternative scenario for private industry to lead an initiative to develop regional UFMFs as a means to effect waste acceptance as contemplated by the Act; and to and to hold the NRC license for, and have the capability to take title to, the UNF and GTCC waste on DOE's behalf, as described in this report.

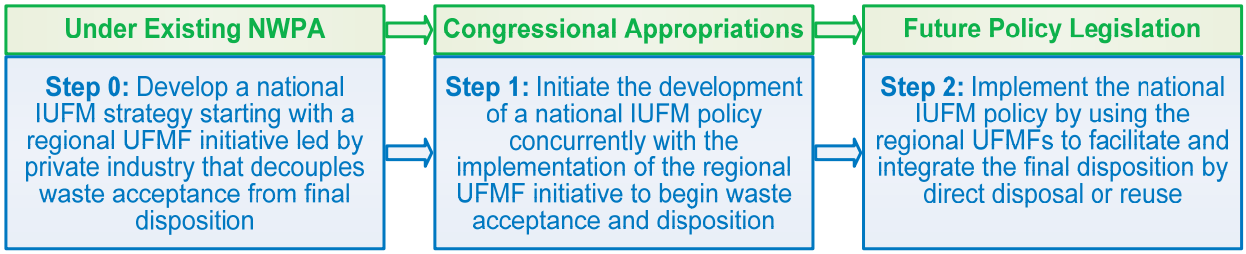
Strategy Drivers. The urgent need for a new national IUFM strategy now is driven by the following factors:

- The Administration has indicated its intent to review the policy options with respect to UNF management and has directed the Secretary to commission a Blue Ribbon Panel to identify and evaluate the range of available options for UNF management going forward.
- The Federal government's policy for waste acceptance and disposal has largely been based on completing the licensing, construction and commissioning of Yucca Mountain, the nation's sole deep geologic repository site for UNF. Should the development of the Yucca Mountain repository not be completed, it would leave the DOE without the means to begin waste acceptance in 2020 as currently planned.
- In addition, the GNEP program to develop and deploy commercially viable UNF recycling facilities to effectively close the fuel cycle in the relatively near-term has been terminated by the Administration and the Congress, deferring indefinitely the deployment of currently available recycling technology and advanced nuclear reactors capable of utilizing recycled fuel. The Secretary has re-directed the effort to the national laboratories for further R&D of more advanced fuel-cycle technologies which will take considerable time to be ready for deployment on a production scale.
- In the absence of a repository for direct disposal or the deployed means for recycling, the Federal government is at risk of being declared by the courts to be in full rather than partial breach of the Act and the standard contracts with the utilities.
- The lawsuit judgments levied by the courts against the Federal government thus far have and will continue to mount in the absence of a credible means to begin waste acceptance and disposal in accordance with the utility standard contracts in the relatively near-term. At present, the cost of building and maintaining on-site dry storage facilities is currently reimbursed by the Federal government through a Department of Justice (DOJ) judgment fund, rather than as part of a well planned cost-effective coordinated policy implementation by the DOE.
- The nation is on a path to deploy new nuclear power plants over the next two decades as part of a balanced, carbon-free national energy portfolio, and the means to maintain adequate base-load generation capability. Successful deployment of these new reactors depends, in part, on confidence in credible waste policy as determined by the NRC.
- In the absence of a new national policy, on-site dry storage at the nation's 73 reactor sites will have to be expanded and maintained indefinitely. The public policy implications and other potential risks posed by such a scenario should be carefully considered, particularly as the

current aging fleet of reactors begins to shutdown in large numbers beginning in about 2030. When this occurs, it will necessitate a step-increase in dry storage capacity for the next 20+ years and, if gone unchecked, will create many more orphaned shutdown reactor sites.

The above drivers make it clear that a credible alternative strategy for the Federal government to begin meeting its moral and legal obligations under the Act is needed to ensure national progress on this important mater. In addition, a strategy that meets the DOE's current baseline schedule to begin waste acceptance by 2020 and remove all the UNF from the current reactor sites by 2066 would be beneficial to ensure the adequacy of the Act's NWF[4] to accomplish its intended purpose.

Strategy Overview. The envisioned national IUFM strategy starting with the regional UFMF initiative will build on past DOE-NE sponsored UNF facility voluntary siting activities and private industry input from the former GNEP and AFCI programs to further develop the concept of a widely supported UNF management solution. The regional commercial UFMF initiative will be volunteer-based and time-phased; it will not require a specific final UNF disposition policy to begin implementation. It neither requires, nor precludes, direct geologic disposal, re-use of the UNF, or any foreseeable disposition options that may be deployed in the future. The envisioned national IUFM strategy is depicted as follows:



The envisioned Integrated Use Fuel Management (IUFM) strategy provides the means for the Federal government to begin making incremental forward progress on waste acceptance and disposition beginning now.

Figure 1-1 graphically depicts how multiple UFMFs can be used to perform an integrating function in a national IUFM system by facilitating the near-term acceptance and disposition of UNF and by supporting two alternatives for the disposition of UNF over the longer term; namely, recycling in one or more advanced fuel-cycle facilities, and disposal in one or more deep geologic repositories. While it is imperative that a national policy with respect to the final disposition of UNF be developed concurrently, the envisioned national IUFM strategy, starting with the implementation of the UFMF initiative, can be implemented independent of future policy directions, as shown in Figure 1-1. An essential feature of the envisioned national IUFM strategy and regional UFMF initiative is it's flexibility to accommodate such future policy

[4] U.S. Department of Energy, Office of Civilian Radioactive Waste Management (OCRWM), *Fee Adequacy Assessment Report*, DOE/RW-0593, Washington, DC, July 2008.

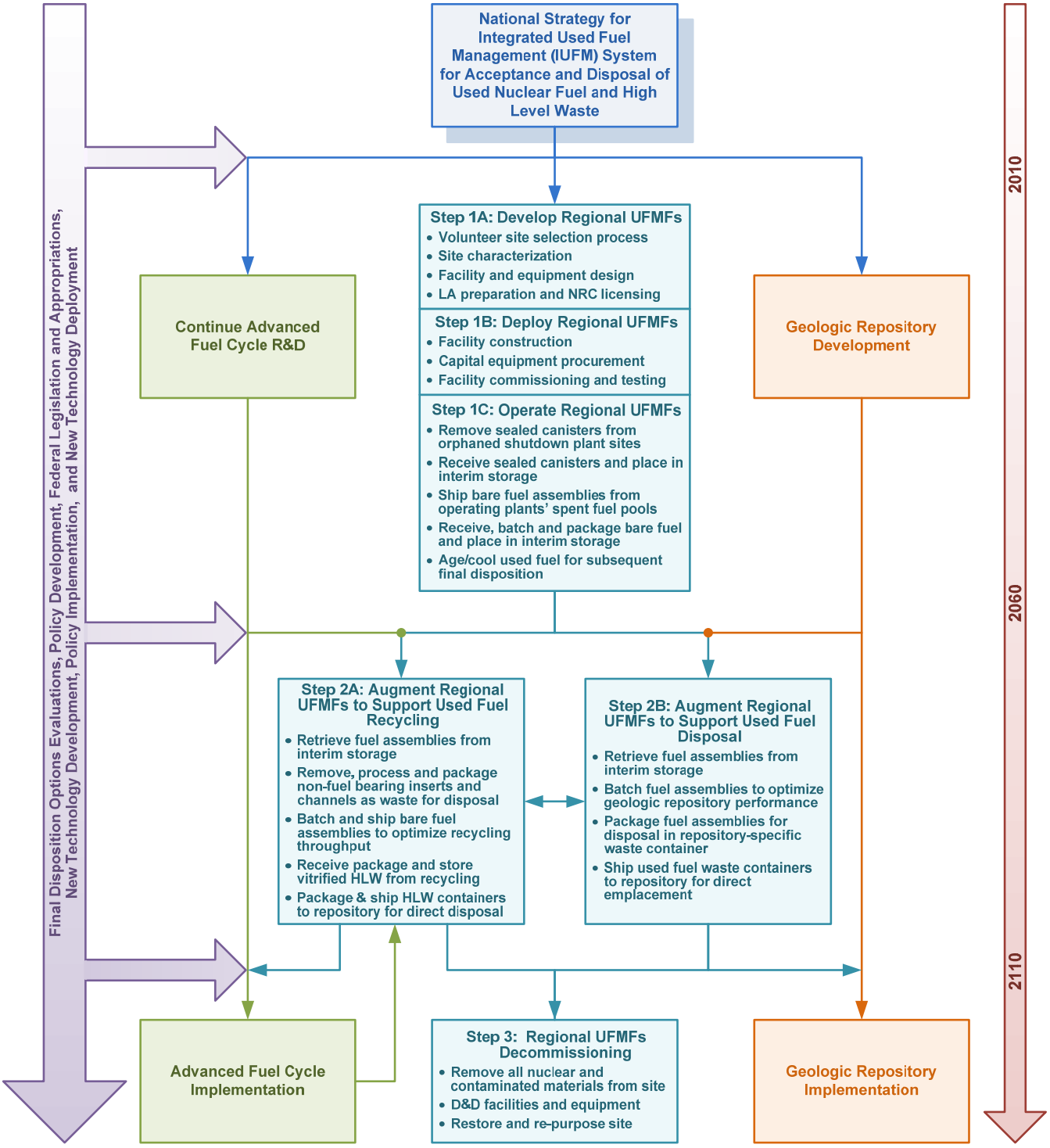


Figure 1-1 – Integrated Used Fuel Management Strategy

The envisioned national IUFM strategy and regional UFMF initiative allows the Federal government to begin fulfilling its NWPA obligations by 2020 and provides flexibility for future policy adjustments and technological innovation.

decisions. Whatever path the Federal government determines to be appropriate in the long-term would be enhanced by the implementation of the strategy.

To this point, beginning waste acceptance and disposition has been linked to the development of a UNF geologic repository and/or a UNF recycling facility, both of which are strategically important but monumental prerequisites. Going forward, the envisioned national IUFM strategy offers the opportunity for a paradigm shift that can allow the Federal government to begin waste acceptance and disposition now, while creating options for both direct disposal of the UNF and GTCC waste in a geologic repository in the future (if the nation continues with the current policy of a once-through fuel cycle), or potential re-use of UNF (if next-generation advanced fuel-cycle technologies are developed as asserted by the Secretary). The strategy also satisfies the foreseeable needs of nuclear utilities by proving the means to remove the UNF from orphaned shutdown reactor sites to facilitate re-purposing of the land, and by supporting the continued operation of nuclear power plants, including license extensions, capacity up-rates and next generation reactors.

Why Private Industry? This report asserts that private industry, in partnership with the Federal government and nuclear utilities, is best equipped to lead, develop, deploy and operate one or more regional UFMFs on a predictable timeline, using private capital and commercial financing, and by employing sound commercial business practices. A primary driver for this assertion is that a private industry led initiative can begin the waste acceptance and disposition processes in the relatively near-term, since a commercial UFMF would not be limited by the restrictions of the Act that would prevent the creation of a federal UFMF due to statutory linkages with a repository. By comparison, a similar a federal initiative would require DOE to satisfy the prescriptive constraints of the existing Act, and would likely require a lengthy process to enact new legislation before substantive progress can be made. Considering the difficulty in passing any legislation involving nuclear waste, it is estimated that 5 to 10 years would lapse relative to the timeline for a private industry led initiative, exposing the Federal government to further damages claims by the utilities.

It is further asserted that private industry is better able to lead a geographically regional and voluntary approach to siting commercial UFMFs that build on the fundamental economic and institutional needs and resources of the nuclear power plant owners, the host State and local governments, and their constituencies, including regional private industries and local small businesses. Such public and private entities will be more willing to engage and enter into a long-term partnership with private industry without the inherent barriers that the Federal government would face, e.g., federal vs. state jurisdictional predispositions. Through a combination of federal and discretionary corporate investments, and targeted economic development initiatives, a commercial UFMF can become a catalyst for economic growth, educational development, a source for stable high-skilled employment, and a means for long-term financial stability in the region by means of a safe and environmentally protective workplace.

For the above reasons, it is asserted that the regional, commercial UFMFs should be owned and operated by private industry, (newly formed, dedicated UFMF LLCs), rather than by the DOE

(or another Federal government entity). Under this business model concept, there would be no need for DOE to prepare new federal NEPA documentation on the management of commercial UNF. Rather, 10 CFR Part 72[5] requires that the UFMF, LLC's license application (LA) for such a commercial facility must be accompanied by an Environmental Report that meets the requirements of 10 CFR Part 51[6]. The NRC would prepare an Environmental Impact Statement to support their licensing action, similar to that for the PFS facility in Utah.

Importantly, the LLCs would not be bound by the federal priority ranking established by the 10 CFR Part 961 standard contracts with utilities. Under the envisioned commercial business model concept, the LLCs can negotiate waste acceptance with any nuclear utility to meet that utility's specific storage needs, regardless of its position in federal priority ranking. In doing so, the commercial viability of the regional UFMF business model concept is enhanced. The regional UFMFs can accept UNF and GTCC waste from the shutdown reactor sites that no longer have operating reactors; and from operating plants that would otherwise need to develop new or expanded on-site storage capacity, or that may have site-specific storage or local public policy constraints.

Commercial, regional UFMFs for commercial UNF will not by themselves eliminate or mitigate the partial breach of contract by the Federal government resulting from the inability of the Federal government to begin waste acceptance by January 31, 1998. However, the acceptance of UNF at a commercial UFMF, with the LLC under contract to serve as a regional service provider to DOE, could be the first step in a national IUFM system that both meets the needs of the nuclear utilities and allows the DOE (through such a contract) to start waste acceptance and thereby begin to meet its obligations under the Act and the disposal contracts with the nuclear utilities. Under this strategy, the commercial, regional UFMFs would provide the means to mitigate some current damages and eliminate some future damages arising from litigation with the nuclear utilities.

Strategy Steps. As depicted in Figure 1-1, a step-wise adaptive strategy for a national IUFM system is envisioned that is informed by the lessons learned from past initiatives undertaken by governmental bodies and private industry worldwide. A strategy that has sufficient flexibility to accommodate and facilitate the future final disposition of UNF by direct disposal, recycling, some combination of both, or by a yet to be developed breakthrough technology. This report attempts to lay out such a national IUFM strategy, starting with the implementation of the regional UFMF initiative in the very near-term, to provide a means to begin restoring the Federal government's credibility in this regard.

Step 1 of the envisioned national IUFM strategy focuses on the establishment of one or more voluntary, stakeholder supported, regional UFMFs for commercial UNF and GTCC waste, for

[5] Title 10 CFR (Code of Federal Regulations) Part 72. Energy: *Licensing Requirements for the Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste, and Reactor-Related Greater Than Class C Waste.*

[6] Title 10 CFR (Code of Federal Regulations) Part 51. *Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions.*

which a conceptual business model has been developed and an illustrative business case has been analyzed. A representative regional UFMF concept is developed for the purposes of the illustrative business case analysis as described in Section 6 and shown in Figure 1-2, that initially has the operational capability to accept already-loaded UNF canisters from reactor sites (with the orphaned shutdown reactor sites as a priority), and to also accept bare fuel from the spent fuel pools of operating plants. The regional UFMF concept presented is scalable and flexible commensurate with future demands and IUFM mission evolution. The assumed UNF inventory for the illustrative business case analysis is provided in Table 1-1.

Table 1-1 – Assumed Regional UFMF Fuel Inventory

Item	Plant Status	Total
Number of Plants	Shutdown	3
	Operating	30
	All	33
Number of Fuel Assemblies	Shutdown	3,600
	Operating	94,000
	All	97,600
MTUs of Fuel	Shutdown	1,050
	Operating	30,315
	All	31,365

The fuel inventory assumed for the illustrative business case is representative of that for a typical region.

Section 6 describes the phased approach for implementing Step 1 which includes siting, design, licensing, construction, procurement, commissioning, operation and end-of-life decommissioning of a representative regional UFMF. Cost estimates are developed for each program phase of the regional UFMF that are benchmarked using past similar efforts for large-scale nuclear facilities.

A conceptual business model for an LLC (as the owner/operator of an UFMF) is described in Section 6 that is underpinned by host benefits and regional service provider contracts with the DOE (or another legal entity that the Congress may create in the future for this purpose), and by contracts with nuclear utilities as commercial customers (and possibly private equity investors). A financial analysis is performed in Section 7 for a representative regional UFMF to test the commercial viability of the conceptual business model. Project financing requirements and other financial assumptions and results are also discussed.

Step 2 of the envisioned national IUFM strategy and regional UFMF mission includes the addition of a future waste packaging facility to support disposal in a geologic repository, (if a decision is made to continue with a once-through fuel cycle policy), or future facilities to support an advanced recycling facility (if a decision is made to implement a closed fuel cycle policy), as shown in Figure 1-1. In the latter case, the UFMF could also store and package the high-level radioactive waste (HLW) resulting from recycling for disposal in a geologic repository. In either scenario, the UFMF will greatly simplify and complement the missions of these future UNF final disposition facilities, which may or may not be located in proximity to the UFMF. For example, the regional UFMF could package the UNF for direct disposal in repository-specific containers, depending on the host geology and location of currently planned and future repository(s). The

augmentation of the regional UFMF's mission to provide a flexible means to integrate final UNF disposition is discussed further in Section 6.6.

Implementation under the Act. With the envisioned national IUFM strategy, some nuclear utilities may want to transfer their licensee responsibilities to a commercial UFMF for purposes of interim storage while retaining the ownership (i.e., title) to the UNF. Other nuclear utilities may want to both transfer the licensee responsibilities and the title for the UNF. Utilities may continue to submit reimbursement claims to the DOJ under their previous 1998 lawsuit settlement agreements to recover the cost of such UNF storage services, depending on the terms of the respective agreements. And, the Federal government may want to begin to meet its legal waste disposal obligations by beginning waste acceptance and starting to perform the "waste disposal activities" specified under the Act, for instance, by exercising its authority in the 10 CFR Part 961 disposal contracts to accord priority for waste acceptance to orphaned shutdown reactors. The envisioned national IUFM strategy has the flexibility to accommodate these and other scenarios.

The Act also envisioned a federal centralized interim storage facility, the Monitored Retrievable Storage (MRS), as part of an integrated nuclear waste management system for commercial UNF. The process laid out in the Act for siting and approval of a **federal** MRS is quite cumbersome and restrictive, however (emphasis added). It is asserted that, if so desired by the Federal government, regional commercial UFMFs, similar in function to an MRS, could be successfully sited through a volunteer approach, designed, licensed, and constructed in a much more expeditious manner, independent of the specific means for final disposition. The key questions in this regard that are addressed by this report are as follows:

- Would the Federal government need to amend the Act to authorize a commercial initiative similar in scope to the MRS, or could such an approach be stipulated in the Congressional appropriations process or legislation other than an amendment to the Act? *It is our view that specific authorization language is not needed now but is desirable in the future. For the near-term, Congressional appropriations language enabling DOE to enter into such commercial arrangements may be sufficient.*

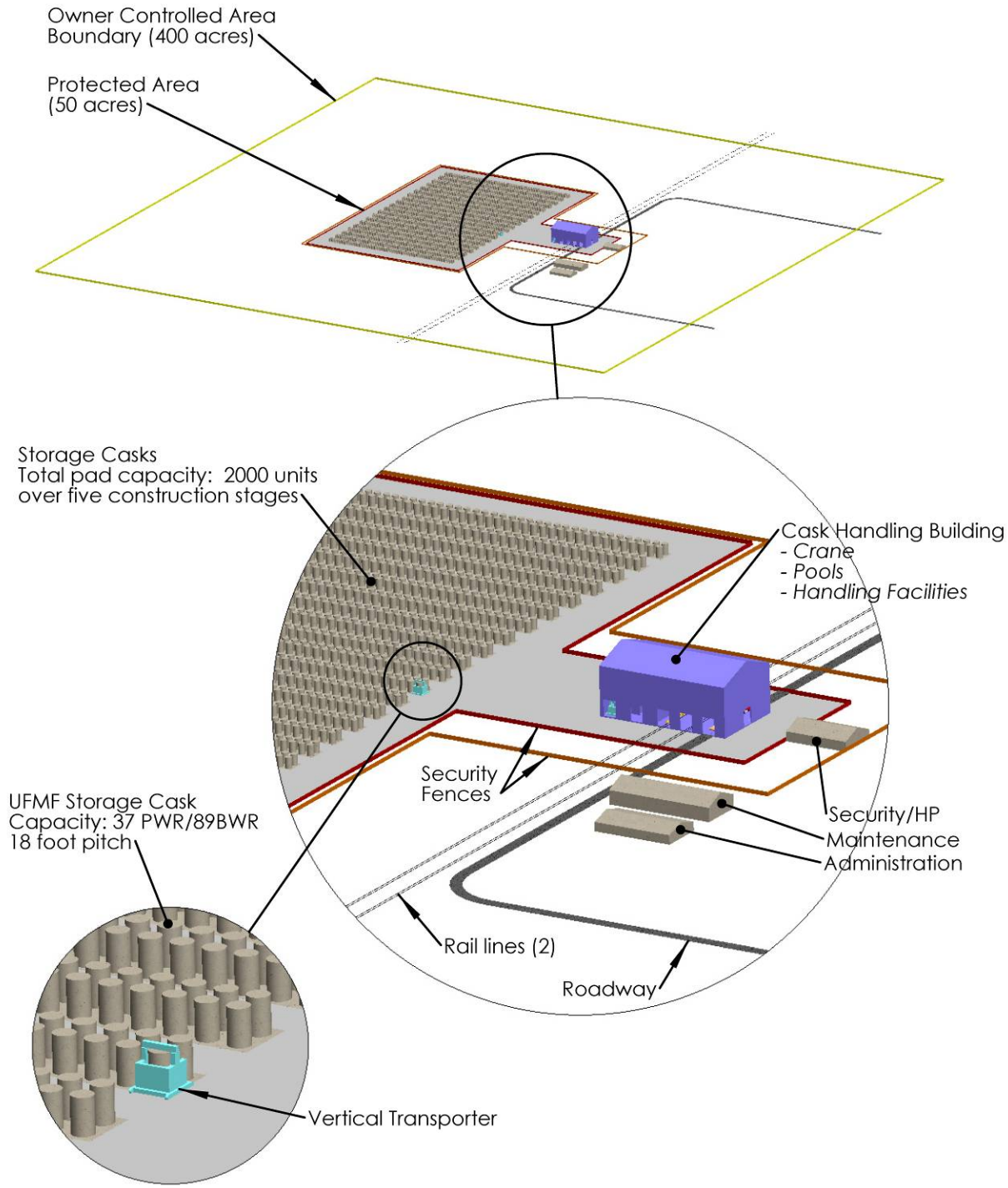


Figure 1-2 – Representative Regional UFMF Concept

The regional UFMF concept is flexible and scalable consistent with demand.

- Can the Secretary take title to commercial UNF without the final disposition means defined, as the Secretary would have done to initiate waste disposal activities using an MRS? *It is our view that the regional UFMFs are the first step in a national IUFM strategy that can support either a direct disposal or a recycle future. As the first step in the disposition process, it would appear that the take-title issue is at the discretion of the Secretary, however, it could also be provided by the Congress in appropriations language.*
- Could these actions be funded from the NWF? The Act, states that in paying the 1.0 mill per kilowatt-hour fee, the entity delivering UNF to the Federal government shall have no further financial obligation to the Federal government for the **long-term storage and permanent disposal** of such UNF (emphasis added). *It is our view that if the Federal government accepts (and therefore takes title to) the UNF destined for a regional UFMF, the Federal government is taking action to fulfill its obligations under the Act for the stated purpose of the NWF. Given this, it would appear that the issue of access to the NWF is at the discretion of the Secretary if so authorized by a Congressional appropriation allocating the NWF for this purpose.*

Economics. Significant portions of this report are dedicated to defining an illustrative business case for a commercial, regional UFMF, and to developing the commercial business model concept, cost estimate and financing plan to site, develop, deploy and operate a representative regional UFMF. A financial analysis is performed to test the viability of such a commercial venture against predefined constructs. The results of the illustrative business case financial analysis indicate that under an equitable performance-based fee for services contract structure, a regional, commercial LLC can provide the Federal government with a viable means to begin waste acceptance and UNF disposition. While the unit costs to the Federal government for a regional UFMF, including transportation and host benefits costs, are higher than that of current at-reactor dry storage as one would expect, they nevertheless provide good value for the Federal government compared with the other alternatives, including the "no-action" scenario and escalating lawsuit damages payments.

Recommendations. This report asserts that the envisioned national IUFM strategy described provides the Federal government with a viable means to begin making forward progress with respect to its obligations under the Act starting now. The concept of a commercial, regional UFMF business model concept is developed and an illustrative business case is presented to illustrate the commercial viability of the strategy, and to identify the range of cost obligations necessary to implement the strategy. The envisioned national IUFM strategy is complementary with other actions being taken by the Secretary to review the nation's policy options with respect to the disposition of UNF, (including but not limited to the forthcoming Blue Ribbon Panel). In addition, the report outlines specific actions that the Federal government can and should take to advance this strategy forward, starting in FY2010, with the development and initiation of the volunteer host siting process for commercial, regional UFMFs which is of critical importance.

In the latter case, the UFMF could also store and package the HLW resulting from recycling for disposal in a geologic repository. In either scenario, the UFMF will greatly simplify and complement the missions of these future UNF final disposition facilities, which may or may not

be located in proximity to the UFMF. For example, the regional UFMF could package the UNF for direct disposal in repository-specific containers, depending on the host geology and location of currently planned and future repository(s). The augmentation of the regional UFMF's mission is discussed further in Section 6.6.

With this two-stepped approach, the regional UFMFs will become an integral part of the nation's future UNF disposition and HLW disposal system that can meet the national need for the next 50 to 100 years. They will provide a flexible platform to incorporate future input from technology R&D programs and policy directions by the Secretary and the Congress that will allow the Federal government to begin making forward progress on UNF acceptance and final disposition much sooner than it could otherwise. For these reasons, the authors recommend that development of the national IUFM strategy and regional UFMF initiative described in this report be continued in FY2010. Expanding upon this national IUFM strategy and regional UFMF concept would be highly beneficial as input to the Secretary's forthcoming Blue-Ribbon Panel and to policy makers who will be tasked with evaluating the path forward for management of the nation's commercial UNF.

1.1 IUFM Strategy Value Proposition and Validation Approach

This report puts forth a value proposition for development and deployment of a new national IUFM strategy and regional UFMF initiative, as shown in Figure 1-3. The central tenet of the strategy is a paradigm shift that incorporates a new way of thinking about the final disposition of UNF that is both necessary and beneficial for the Federal government and the nation. That is, to begin the waste acceptance and disposition process now, while a policy for final disposition of UNF continues to evolve. The middle circle components of the strategy in Figure 1-3 indicate the contractual and financial actions that are required to achieve the necessary paradigm shift. The financial actions include funding provided by the Federal government and the recognition that front-end funding to voluntary hosts will be required. The outer circle indicates the components of a framework necessary to implement the envisioned strategy. The value proposition formulated for this encompasses the following precepts:

- De-coupling the acceptance of UNF from the development of a geologic repository or a UNF recycling center is necessary to allow the Federal government to begin

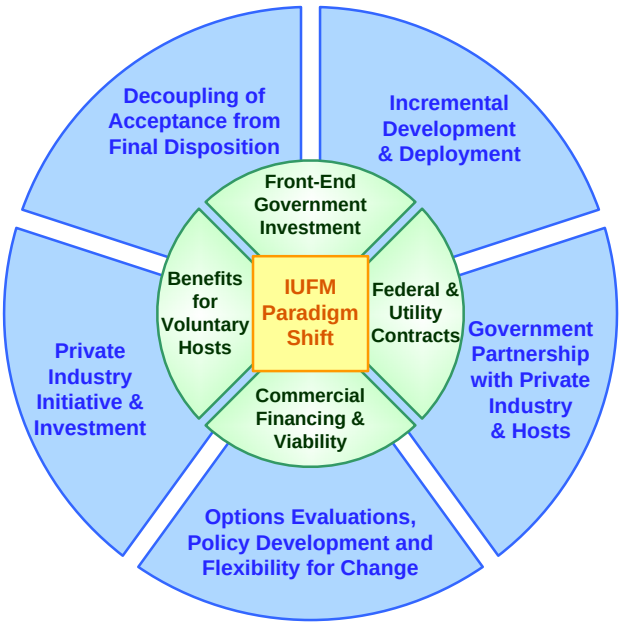


Figure 1-3 – Value Proposition for National IUFM Strategy and Regional UFMF Initiative

The value proposition for the envisioned national IUFM strategy and regional UFMF initiative is compelling.

fulfilling it's obligation under the Act in the near-term.

- De-coupling the acceptance of UNF from the R&D of next generation UNF recycling using advanced fuel-cycle technologies is necessary to provide the time required to demonstrate the viability of such technologies on a production scale prior to deployment.
- An incremental approach to develop and deploy a national IUFM system starting with one or more regional, commercial, multi-purpose UFMFs should be pursued beginning now. The first UFMF will allow the Federal government to make immediate forward progress and provide the flexibility to incorporate changes in policy and new final disposition technologies as they evolve.
- A private industry initiative and partnership with the Federal government and nuclear utilities affords the best opportunity to site, develop and deploy one or more regional UFMFs in the near-term; and to achieve best value for the Federal government, the nuclear utilities, and the host entities.
- Continued effort to further develop the envisioned national IUFM strategy and regional UFMF initiative put forth in this report is warranted in FY2010 to complement and support the ongoing policy review efforts of the Secretary, including but not limited to those of the forthcoming Blue Ribbon panel.

To substantiate and validate the above value proposition as exemplified by a conceptual business model concept and plan, information and data is provided throughout this report, culminating in a financial analysis of an illustrative business case to test the viability of Step 1 of the regional UFMF initiative as a commercial enterprise. For the latter, the following pertinent business model concept constructs are tested:

- **Construct #1:** To site, design and license regional UFMFs (particularly the first one), will require a reasonable front-end investment and a binding contractual commitment by the Federal government to adequately motivate private industry and potential volunteer host State and local governments to build the necessary institutional infrastructure, attract private investment and capital, and to convince the respective hosts that a regional UFMF is in their best interest. ***Test #1:*** *How much front-end Federal government investment is required to site, design and license a regional UFMF and over what time frame?*
- **Construct # 2:** To construct, commission and operate regional UFMFs (particularly the first one), will require a regional service provider contract with the Federal government and mutually beneficial agreements with the respective volunteer host State and local governments, to secure the private investment and capital necessary to finance such a commercial venture. It is also desirable, but not essential to have subscription contracts with as many utility commercial customers committing to use the regional UFMF as possible. ***Test #2****: What are the nature, scope and approximate total value of the contracts and agreements required, and when are they needed to secure the necessary commercial financing to facilitate construction, commissioning and operation of a regional UFMF?*
- **Construct #3:** For a regional UFMF to be a viable on-going commercial enterprise, sufficient revenue must be generated through user fees and service contracts with the Federal

government and its customers to fully offset the associated capital and operating costs (including expenses associated with host benefits), and to generate a reasonable fee and rate of return on equity investment. ***Test #3:*** *How much revenue is needed to make a regional UFMF commercially viable and what is the fee structure necessary to generate this revenue from the Federal government and utility commercial customers?*

- **Construct #4:** For a regional UFMF to be a viable on-going commercial enterprise, the evaluated benefits and cost to the Federal government and utility commercial customers must be equitable and beneficial compared to other alternatives that the Federal government and utility customers may have. ***Test #4:*** *Are the estimated costs and benefits to the Federal government and utility commercial customers for using a regional UFMF equitable and competitive with other available options?*

The answers to the above value proposition and construct test questions for a representative regional, commercial UFMF are provided in Section 8, based on the illustrative business case financial analysis provided in Section 7.

1.2 Context and Roadmap for This Report

The 10-year plan for implementing the envisioned national IUFM strategy, starting with the development and deployment of the regional, commercial UFMFs is summarized in Figure 1-4. Depicted are the contracts needed for strategy implementation, the phases and schedule milestones for the regional, commercial UFMF initiative, and the funding levels and performance milestones. The regional, commercial UFMF initiative steps identified in Figure 1-1 and the phases identified in Figure 1-4 and discussed in the remainder of this report are listed in Table 1-2.

The basic tenets for implementing the envisioned national IUFM strategy starting with a the phased development, deployment and operation of a representative regional UFMF for the

Table 1-2 – Regional Commercial UFMF Initiative Steps and Phases

The strategy steps and programmatic phases for the regional commercial UFMF initiative implementation as part of a national IUFM strategy.

Step No.	Phase No.	Phase Title/Description
1	1	Voluntary Site Development
1	2	Engineering and LLC Business Infrastructure Development
1	3	Licensing and LLC Business Implementation
1	4	Construction and Procurement
1	5	Commissioning and Operations
2	6	UNF Final Disposition
3	7	Decommissioning

disposition of the nation's UNF as described in this report are shown in Figure 1-5 and described as follows:

1. With the otherwise likely long-term delay of UNF acceptance, (if such continues to be tied to geologic repository development and/or the development of an next-generation recycling technology); there is a need for a timely alternative national strategy to begin fulfilling the Federal government's obligations with respect to the Act, to underpin waste acceptance confidence, support the continued operation of existing power reactors, and to facilitate the next generation of nuclear power plants, as described earlier in Section 1.
2. Proceeding with the development and deployment of one or more regional UFMFs is a prudent first step in the evolution of a new national IUFM strategy that can be taken now. The near-term and longer term objectives of regional UFMFs as part of an integrated UNF disposition and HLW management system are discussed further in Section 2.
3. There is an extensive body of past domestic and international experiences that can be exploited to provide valuable lessons learned for the phased development and deployment of volunteer regional UFMFs, and to identify and employ the best Federal government and private industry practices going forward. This historical analysis is described further in Section 3.
4. The current legislative, legal and regulatory framework already empowers private industry in partnership with the Federal government to proceed with siting, design and licensing of one or more volunteer regional UFMFs. While future federal legislation is desirable to facilitate longer term policy, it is not needed to implement the regional UFMF initiative. The landscape of current legislation, laws and regulations; and the means by which the regional UFMF initiative can be implemented under the current framework are described further in Section 4.
5. There are many challenges and intuitional barriers to overcome to successfully site, develop and deploy regional UFMFs. Among these are convincing a volunteer host that both the nuclear industry and the Federal government are trustworthy partners for the long-term, providing a reliable apolitical means to assure that the sustained funding necessary to attract private investment and project financing over the long-term will be available, and convincing a volunteer host that the Federal government and the nuclear industry really do have a viable plan for the ultimate disposition of UNF to mitigate the perception of permanence. These barriers and the strategy to overcome them are discussed further in Section 5.
6. Providing incentives for private industry and host entities in partnership with the Federal government and nuclear utilities to site, develop, deploy and operate regional UFMFs on a predictable timeline and utilizing private investment and commercial financing to provide the best value for the Federal government is in the best interest of the nation, the nuclear utilities, the host states, and the local communities. It is asserted that the phased development and deployment of one or more regional UFMF, including siting, licensing, construction, operation and decommissioning can best be accomplished by private industry. These are discussed further in Section 6, together with the inputs and assumptions utilized for the illustrative business case analysis.

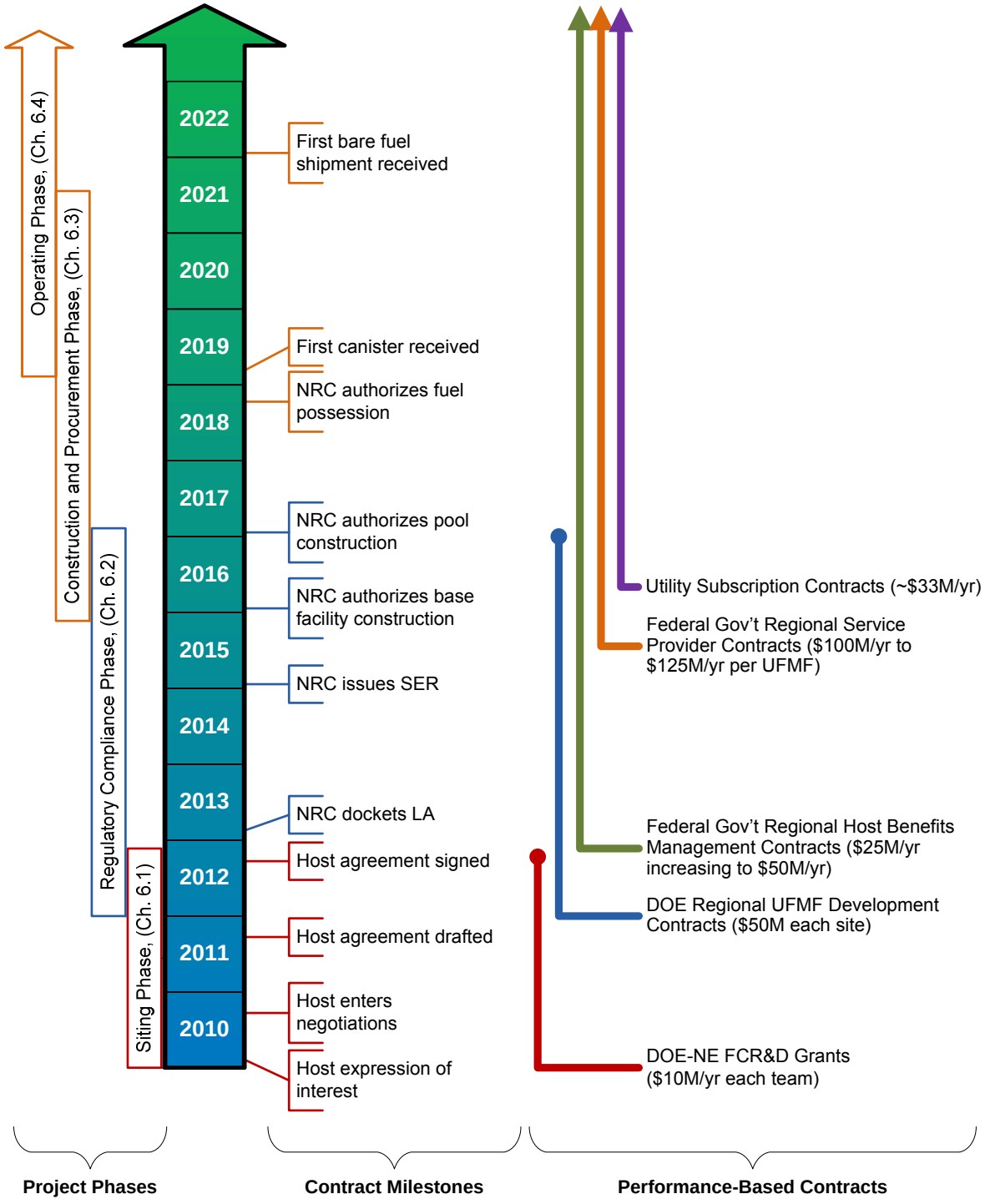


Figure 1-4 – Ten-Year Implementation Plan Overview

The planned approach for the regional commercial UFMF initiative maximizes flexibility and provides a means to achieve incremental progress.

7. To be successful, the commercial business model concept used for development, deployment and operation of regional UFMFs must have sound financial underpinning that includes long-term commitments in the form of fee for goods and services contracts with commercial utility customers and the Federal government. These contracts must generate sufficient revenue to fully offset the capital, operating, and decommissioning costs for the UFMFs, and to generate a reasonable rate of return in order to attract the private capital necessary to finance such a venture. The framework for the envisioned business model concept and its financial underpinning for a representative regional UFMF are described and tested in Section 7, as part of the illustrative business case analysis.
8. There are actions that DOE can and should take in FY2010 to further develop the strategy for the development, deployment and operation of regional UFMFs as part of an integrated national strategy for the disposition of the nation's UNF that are consistent and in concert with the Secretary's ongoing policy review, including but not limited to the efforts of the forthcoming Blue Ribbon panel. These actions and the recommended path forward are discussed further in Section 8 of this report.

The national IUFM strategy described in this report promotes a step-wise vertically integrated plan that is highly flexible and adaptable to accommodate whatever future changes in direction or national policy with respect to UNF deposition that the Secretary or the Congress may wish to pursue going forward. It is believed that framework and business plan described in this report represents the best opportunity for the Federal government and the nation to make real and lasting progress on resolving this longstanding vexing issue in a manner that is fully responsive to the public interests.

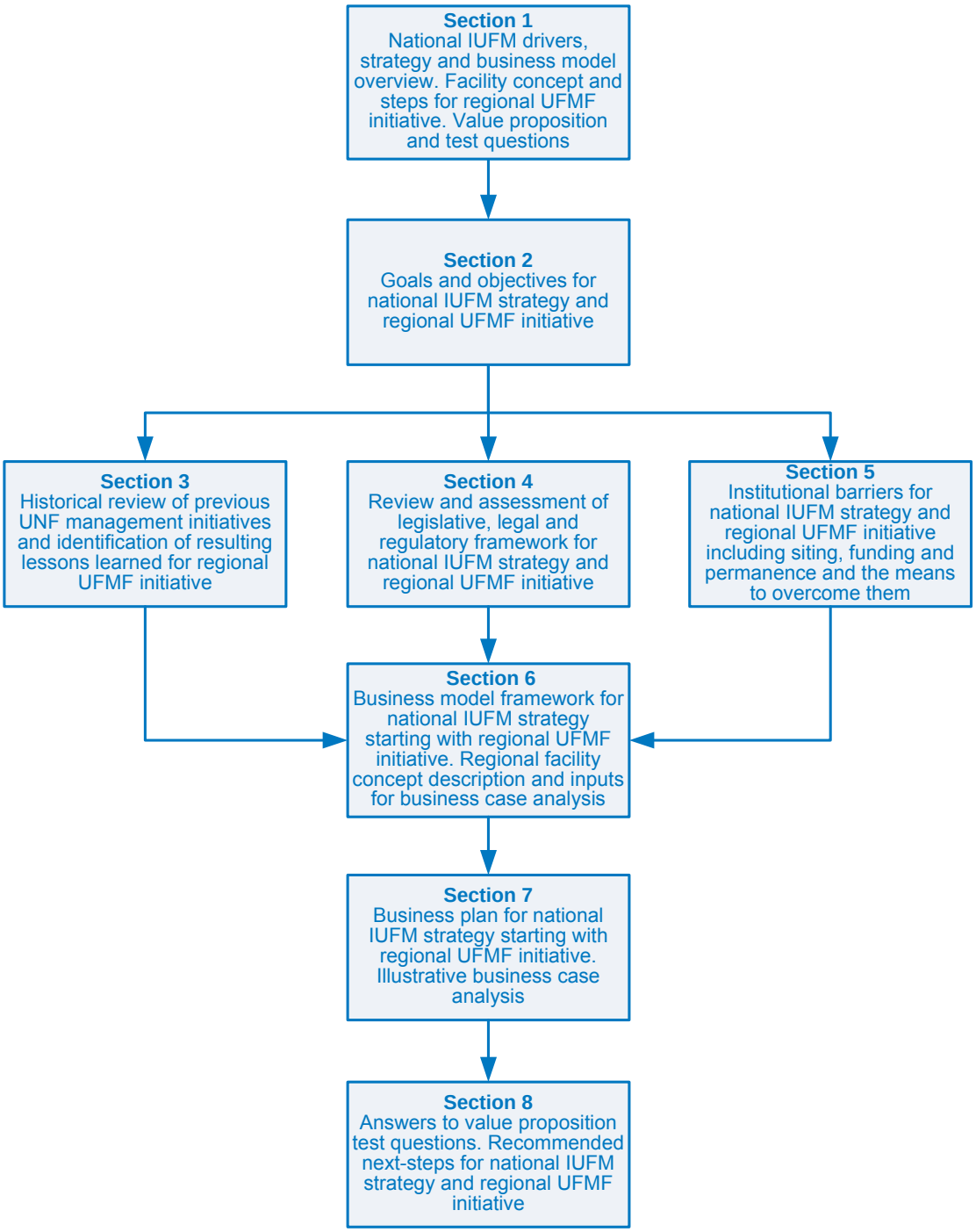


Figure 1-5 – Report Hierarchy for National IUFM Strategy and Regional UFMF Initiative

The supporting components of the report culminate in an illustrative business case for a representative regional UFMF.

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2 Primary Objectives

Under the current UNF management paradigm, a prerequisite for waste acceptance has been development and deployment of the means for final UNF disposition. At this juncture, it would appear advantageous and necessary to develop a new national IUFM strategy that can satisfy the interests of the Federal government and the nuclear utilities. These include beginning waste acceptance without requiring, or precluding, final UNF disposition by either direct disposal in a geologic repository (if the nation continues with the current policy of a once-through fuel cycle) or by re-use (if next-generation advanced technologies are developed in the future to close the fuel cycle).

Accordingly, the envisioned national IUFM strategy described in this report outlines an incremental, flexible and adaptable process for making immediate forward progress on waste acceptance and disposition based on the following precepts:

1. Providing a viable path forward to meet past, present and future UNF disposition obligations by beginning waste acceptance by 2020 at a rate consistent with the Office of Civilian Radioactive Waste Management's (OCRWM's) current baseline DOE/RW-0591 total life cycle cost analysis and its DOE/RW-0593 determination of the Act's NWF fee adequacy.
2. Providing a flexible and adaptable approach that can accommodate future input from important contemporary corollary activities for final UNF disposition, e.g. the Secretary's ongoing policy reviews, including but not limited to the forthcoming Blue Ribbon Panel.
3. Utilizing the best government and private industry practices that incorporate lessons learned from past domestic and international experiences.
4. Providing a vertically integrated approach for facility siting based on volunteerism, regionalism, and equitable interchange at the local, regional, state and federal levels.
5. Implementing the UFMF siting and waste acceptance process based on existing federal statutes under the Congressional appropriations process.
6. Accommodating future changes and directions in federal legislation, Congressional direction and policy decisions.

Going forward, the Federal government's efforts to develop and implement the envisioned national IUFM strategy, of which the regional UFMF initiative is a part, must address the fundamental barriers that have blocked the success of similar efforts over the last four decades. As Section 3 indicates, history shows that the various interests of the many stakeholders in previous UNF disposition initiatives, including local and regional communities, host local and State governments, the Federal government, nuclear utilities, private industry and the rate payers, must be addressed in order for such an initiative to succeed. Failure to involve any one of the stakeholders in the process at the appropriate time, and to be responsive to the varied stakeholders concerns, will make success difficult if not impossible.

It is asserted that the primary objectives of a successful national IUFM strategy, starting with the regional UFMF initiative, must include:

1. Developing a regionalized, balanced and equitable siting process based on volunteerism at the host State, regional and local levels,
2. Delivering a near-term solution for UNF and GTCC waste at orphaned shutdown reactors and a near- and long-term solution for UNF generated at operating reactors that is financially attractive (or at least cost neutral) to utilities and can be implemented under the existing legislative and regulatory framework, and
3. Advancing the development of a national IUFM policy for the disposition of UNF that has the flexibility to accommodate whatever disposition options may evolve; and that facilitates waste confidence, provides support for continued operation of existing power reactors, and for future commercial nuclear power plants as part of a balanced national energy portfolio.

As indicated by primary Objective #1, a successful national IUFM strategy and UFMF initiative must include a regionalized, balanced and equitable siting process. The most obvious reason for this is to attract volunteer local communities and host states by providing a sense of equitable treatment, broad participation in an open process, and freedom of choice. The regionalized approach also has the advantage of locating the UFMFs in closer proximity to the nuclear power plants, thereby localizing the management of UNF within the region benefiting most from the plants, and minimizing the distance the UNF is transported which reduces the overall transportation risks. Strategic siting of multiple UFMFs, each in a location that is in reasonable proximity to the existing commercial nuclear power plants or other nuclear facilities in the region achieves this objective. This is in contrast to the multitude of operating and shutdown plant sites shown in Figure 2-1 that currently store UNF.

A regionalized siting process also provides other opportunities. Starting with several potential UFMF sites within a region and utilizing appropriate and effective milestone-based incentives that are tied to achieving operational status will provide healthy competition between the potential host sites. Identifying interested communities in multiple regions is also essential to maintaining the volunteerism aspect of the envisioned national IUFM strategy, while avoiding the political and societal battle-lines

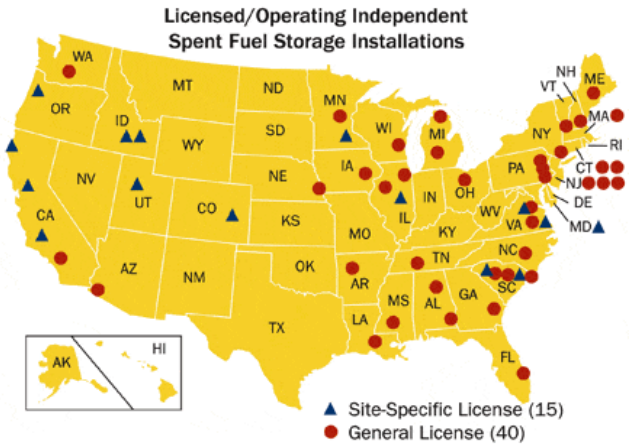

Figure 2-1 – Locations of Current On-site Dry Cask Storage Installations

A successful national IUFM strategy, starting with the UFMF initiative, must be regionalized, balanced and equitable.

that can develop around a single designated site for the entire country when it is perceived to be a forced solution (e.g., the common public perception of the Yucca Mountain siting process, as discussed in Section 3.1.4).

Therefore, volunteerism must be a primary objective of a successful national IUFM strategy. It is important that every UFMF be sited within a local community and surrounding region that volunteers to host the facility. However, communities that volunteer to host an UFMF must also have support from the State governments. As discussed in Sections 3.1 and 5.1, previous efforts to site an interim storage facility or MRS in a volunteer local community that did not have support from the State and the State's Congressional delegation (i.e., the "doughnut effect") were all unsuccessful.

Key to establishing and maintaining local, regional and State support for a volunteer site is effective communications and interaction with the public, local government, regional institutions, and the State government to demonstrate respect, and to build trust and confidence at every stage of the UFMF initiative. If the siting process of a UFMF in a local volunteer community is perceived to be self-serving, secretive or exclusive it will result in distrust and lack of support from members of the public and State government, which will ultimately cause the UFMF initiative to be unsuccessful. It is also important that the local communities, surrounding regions, and the State share in the monetary and non-economic benefits that are provided to host a regional UFMF.

A corollary to primary Objective #2 for a successful national IUFM strategy and regional UFMF initiative must be to establish a clear need for the facilities, both near-term and long-term, that are complimentary to, rather than alternatives to, the final disposition of UNF. In the near-term, consolidation of UNF and GTCC waste currently in dry storage from multiple orphaned shutdown reactor sites, such as that shown in Figure 2-2, to one or more regional UFMFs can mitigate the perceived public risks. Furthermore, removing the orphaned fuel from shutdown reactor sites will allow the land to be used for other purposes, both public and commercial. Longer-term, regional UFMFs are needed to store the UNF from operating reactor spent fuel pools, such as that shown in Figure 2-3, that either are not capable of providing life-of-plant storage or would need to further expand their on-site dry storage facility to facilitate continued plant operation.

Figure 2-2 – UNF at Shutdown Reactor Site

UNF and GTCC waste at orphaned shutdown reactor sites can be consolidated at regional UFMFs to make the land available for other purposes, both public and commercial.

Underlying primary Objective #3 and the need for regional UFMFs must be a clear understanding that their mission is limited to waste acceptance and management in the near-term and to facilitate final disposition and waste disposal in the longer term, and that

such intermediate facilities will not become de-facto permanent due to inaction by the Federal government. Permanence concerns have been a difficult barrier to overcome for such initiatives over the past four decades. History suggests that legally-binding, court-enforceable agreements between the UFMF LLC, the host State and the Federal government that include provisions for substantial penalty payments triggered under certain conditions, such as:

- Lack of measurable progress by the Federal government in the development and implementation of a final UNF disposition policy by certain dates prior to first receipt of fuel, with a discretionary opt-out provision, and
- A binding commitment to the removal of all UNF from the site by a specific date, with annual payments that continue to escalate.

These or similar penalty provisions may be needed to overcome the general distrust of the Federal government among otherwise willing hosts. The envisioned penalty provisions are discussed further in Section 6.2.1

Figure 2-3 – Nuclear Power Plant Spent Fuel Pool

UNF at operating reactor sites can be consolidated at regional UFMFs to avoid on-site dry storage and support the continued operation of existing power plants.

In addition, to begin building the necessary credibility and trust to overcome the perception of permanence, it is essential that the regional UFMF initiative be a component part of a national IUFM policy that is being actively developed and implemented concurrently by the Federal government. To be successful, the regional UFMF initiative can not be an end in itself, and must be part of greater national policy for the final disposition of UNF.

Primary Objective #2 for a successful regional UFMF initiative requires that it must be developed and implemented within the current federal legislative and regulatory framework. A regional UFMF initiative that requires changes to the current legislative and regulatory framework would result in lengthy delays and could not be achieved in a reasonable and predictable timeframe. It is important that the regional UFMF initiative be developed and implemented as quickly as possible in order to be responsive to the strategy drivers identified in Section 1. The envisioned national IUFM strategy and regional UFMF initiative is directly in sync with the Administration's intent to review the policy options for UNF disposition and complements the Secretary's ongoing policy reviews, including but not limited to the efforts of the forthcoming Blue Ribbon Panel. In addition, to maintain private industry support and attract private capital and investment in such a venture, it is essential that the regional UFMF initiative be developed and implemented in a predictable timeframe to a known set of requirements so that

risks can be defined and quantified; this, even though it is recognized that the current NWPA legislative framework is less than ideal and presents challenges, as described in Section 4.

As indicated initially in this section, the specific interests of each stakeholder in a national IUFM strategy, of which a regional UFMF initiative is a part, are variable. Thus, it is useful to recast the primary objects in terms of what it will take to achieve success with each of the stakeholder groups, as shown in Table 2-1. It should also be noted that achieving these objectives from the perspective of each stakeholder is about the longer-term journey, rather than a near-term goal to be reached.

Table 2-1 – IUFM Primary Strategy Objectives

The primary objectives of a national IUFM strategy, of which a regional UFMF initiative is a part, are variable depending on the stakeholder and success must be measured in stakeholder-specific terms.

Stakeholder	Measure of Success
Host Local Communities and Citizenry	• Respect for the concerns and well-being of community • Earned high level of trust and confidence in organizations responsible over time • Opportunities for stable employment in high-skilled jobs long-term in a safe and environmentally protective facility • Enhanced quality of life and increased property values • No adverse impact on health, safety or the environment
Host Local and State Governments	• Fair, balanced and equitable siting process with respect for freedom of choice • Enhanced public institutions and infrastructure • Increased commerce and economic growth with no adverse collateral impact, e.g., decrease in tourism • Facilitate the good stewardship of the environment, natural resources and public lands • Increased revenues with no adverse collateral future liabilities
Host Private Industries	• Opportunities for local small businesses • Opportunities for regional industries • Raise the skill level of the workforce in the region • Facilitate business growth and raise employment levels
Federal Government	• Begin near-term used fuel acceptance while a final used fuel disposition policy is developed • Capable of being developed and implemented under current legislative framework • Opportunity to mitigate future law suit liability payments
Nuclear Utilities	• Removal of used fuel and GTCC waste from orphaned shutdown reactor sites • Removal of used fuel from operating plants to mitigate the need for new, expanded, or prolonged on-site dry storage and to address any plant-specific constraints or public policy concerns (e.g., Indian Point) • Transfer responsibility for the used fuel to the Federal government or the UFMF LLC
Rate Payers	• No adverse impact on electricity rates • No adverse impact on taxes

3 What History Teaches Us

Federal efforts to provide centralized storage facilities for commercial high-level radioactive waste (HLW) and UNF began in 1972 when the Atomic Energy Commission (AEC) proposed a Retrievable Surface Storage Facility (RSSF) for HLW. In 1977, President Carter attempted to provide Away-From-Reactor (AFR) storage facilities for the nuclear utilities' UNF. Both efforts were unsuccessful.

In 1982, the Nuclear Waste Policy Act (NWPA or the Act) was passed by the Congress. The Act gave the Federal government responsibility to provide repositories for permanent disposal of UNF and HLW and gave the nuclear utilities primary responsibility for storage of the waste until it is accepted by the Federal government. The Act also included provisions for interim federal storage facilities - a Federal Interim Storage (FIS) facility and a Monitored Retrievable Storage (MRS) facility. Both of these facilities were complementary to, rather than alternatives to, the development of geologic repositories.

Efforts to site an MRS facility used both federally-directed and negotiated siting processes. Although the efforts identified the existence of potentially willing host communities and Indian tribal governments, the efforts were unsuccessful.

A private-sector centralized interim storage facility, the Private Fuel Storage (PFS) facility in Utah, was licensed by the U.S. Nuclear Regulatory Commission (NRC) in 2006. However, the PFS facility was stopped by actions of the U.S. Department of Interior (DOI). Litigation is currently ongoing.

Recent developments, specifically the ongoing effort by the Secretary to review the policy options for the management of UNF and HLW, (including those of the forthcoming Blue Ribbon Panel); the envisioned NRC changes to the confidence rulemaking findings in 10CFR51.23(a); and a new initiative by the Nuclear Energy Institute (NEI) indicate a renewed attention to at-reactor storage and/or centralized interim storage for as long as 100 years.

Examination of previous federal, private-sector, and international efforts and the reasons for their respective lack of success or their success is, therefore, timely in that the examination reveals a number of key issues that may need to be addressed in any future initiative that includes a centralized interim storage facility, as shown in Figure 3-1. These efforts are identified and discussed further in the sections that follow with the objective of identifying the lessons learned that should be carried forward when developing and implementing new initiatives, such as the envisioned national IUFM strategy described in Section 1.

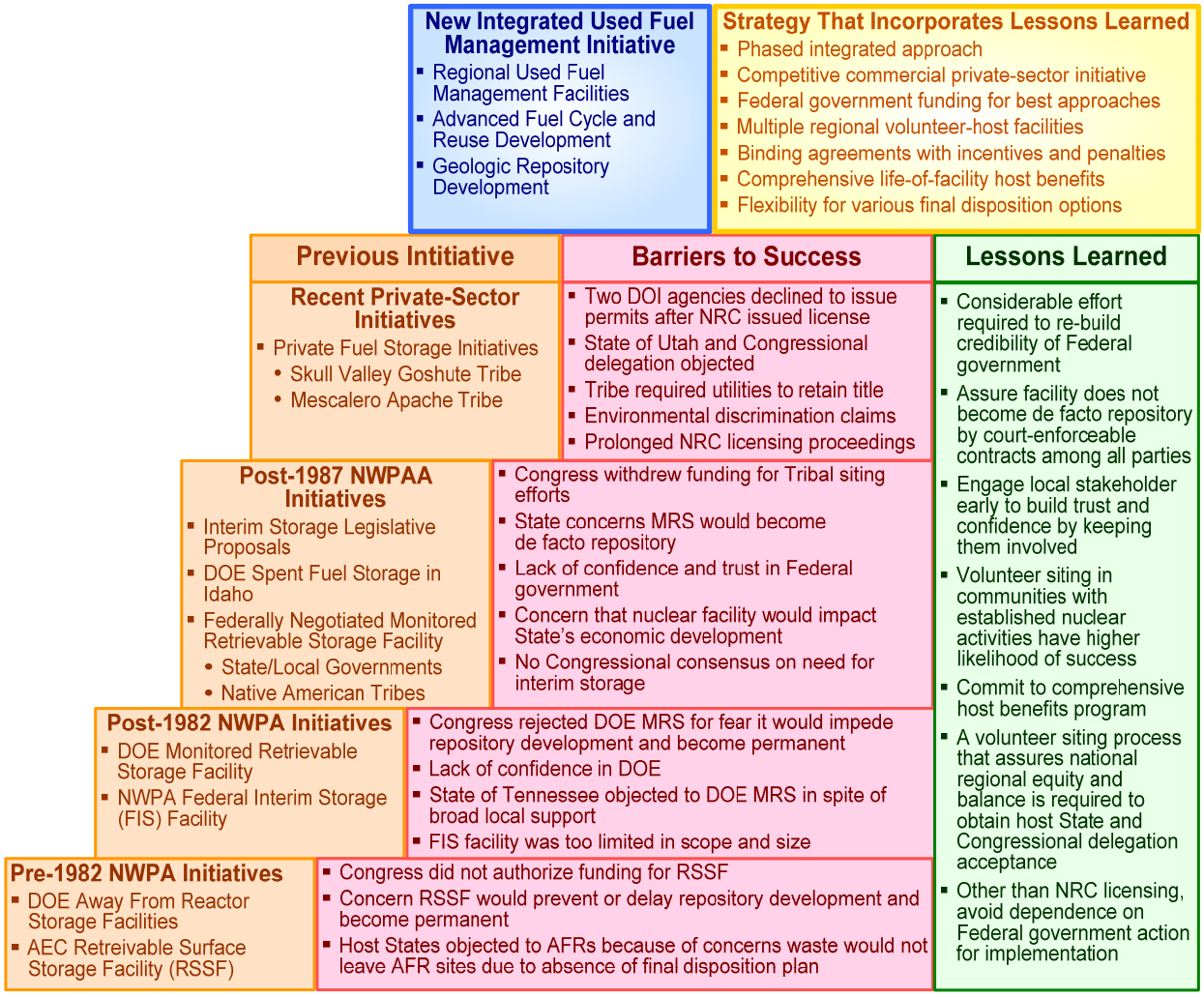

Figure 3-1 – Lessons Learned for a National IUFM Strategy

The previous federal and private sector UNF interim storage initiatives provide a foundation of valuable lessons learned for development and implementation of a national IUFM strategy going forward.

3.1 Previous Used Nuclear Fuel Management Initiatives

Efforts to site a centralized storage facility for commercial UNF and HLW began by the Federal government in 1972. All federal efforts, both before and after passage of the Act, to develop centralized storage facilities for commercial UNF have been unsuccessful.

The following examples provide an abbreviated description of significant efforts to-date. Additional details on these and other previous initiatives, including international initiatives, are provided in Appendix A.

3.1.1 Retrievable Surface Storage Facility (RSSF)

Following the unsuccessful effort by the Atomic Energy Commission (AEC) to locate a geologic repository in salt deposits near Lyons, Kansas, the AEC announced plans to develop an RSSF as an alternative to a geologic repository. The RSSF would provide surface storage for HLW or UNF for as long as several centuries, pending further treatment or disposal. A draft Environmental Impact Statement (EIS) issued in 1974 included an RSSF designed to store for at least 100 years all the commercial HLW to be generated through the year 2000. The proposal was abandoned in 1975 "mainly because of concerns that it could become a permanent storage facility, preventing or delaying development of a geologic repository."[7]

3.1.2 Away-From-Reactor (AFR) Storage Facilities

Following the Carter administration's indefinite deferral of recycling in April 1977, the Federal government offered to accept and take title to UNF delivered by nuclear utilities to government-approved sites for a one-time fee for storage and disposal. AFRs were seen as a way to remove uncertainties about open-ended storage of the UNF at the reactor sites. The policy encouraged use of privately-provided storage under government contract, but DOE would provide the storage, if necessary.[8]

Pursuant to this offer, DOE evaluated use of existing fuel pools at non-operating recycling plants in West Valley, NY, Morris, IL, and Barnwell, SC for AFRs. The effort was strongly opposed by some potential host states in the absence of a realistic plan for permanent disposal, because of concerns that stored fuel would not leave.[9] The effort to gain Congressional authorization was unsuccessful, and, President Reagan withdrew the offer.

3.1.3 Federal Interim Storage (FIS) Facility

Provisions for AFR storage facilities were hotly contested during debates leading up to passage of the Act in 1982.[10] The final legislation provided for one or more FIS for nuclear utilities that were unable to provide sufficient on-site storage to maintain orderly reactor operation. The total

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[7] Monitored Retrievable Storage Review Commission, *Nuclear Waste: Is There a Need for Federal Interim Storage?*, November 1, 1989, p. F-2.

[8] Carter, L. J. (1987) *Nuclear Imperatives and Public Trust: Dealing with Radioactive Waste*. Washington, DC: Resources for the Future, Inc., p. 134.

[9] Colglazier, E. W., "Evidential, Ethical, and Policy Disputes: Admissible Evidence in Radioactive Waste Management," in *Acceptable Evidence: Science and Values in Hazard Management*, edited by Deborah G. Mayo and Rachelle D. Hollander, Oxford University Press, New York, 1991, pp. 137-159 p. 140

[10] Carter, op. cit., p. 206. "The McClure bill, unlike the energy committee bill of the previous Congress, all but embraced the principle that away-from-reactor storage would be only a "last resort." In the end this storage would be defined so narrowly that few utilities could qualify for it, and would promise to be so expensive that probably few would seek to qualify. Nevertheless, the bill's away-from-reactor provision was to be hotly contested. Senators and congressmen from states where an AFR facility seemed most likely to be established wanted no federal AFR program at all."

capacity authorized for storage was strictly limited to 1,900 metric tons. Expansion of the capacity of any FIS at a federal site beyond 300 metric tons was to be considered a major federal action that would require preparation of an EIS, and, expansion of the capacity of any FIS at a non-federal site beyond 300 metric tons was subject to a notice of disapproval, from the State or Indian tribal governing body, that would need to be overridden by Congress.

Emphasis was placed on use of facilities at existing federal sites, and language was included to discourage acquisition or use of the existing private facilities that had been under consideration for AFR facilities.[11] Any FIS was to be fully funded by users through contracts separate from the disposal contracts authorized by the Act.[12] The FIS provisions were intended strictly as a near-term interim measure to handle cases of demonstrated need (certified by the NRC) until a repository was required by the Act to start operations, no later than January 31, 1998. The FIS provisions expired on January 1,1990 with no takers.

3.1.4 DOE Proposal for a Monitored Retrievable Storage (MRS) Facility.

During development of comprehensive legislation leading up to passage of the Act, a federal MRS was initially envisioned as an alternative to a repository, like the RSSF, but was rejected in that form for the same reason the RSSF was rejected.[13] Major environmental groups consistently opposed the interim and long-term storage provisions in the proposed nuclear waste bills on the grounds that storage could delay development of a permanent disposal solution.[14]

[11] Section 135(h), Nuclear Waste Policy Act of 1982.

[12] Section 136, Nuclear Waste Policy Act of 1982.

[13] Carter, op. cit., p. 204. "The environmental and anti-nuclear groups were totally opposed to long-term retrievable storage, believing that for this generation to burden future generations with its wastes would be unethical and unsafe."

[14] See testimony in a joint hearing on high level waste legislation held on October 6, 1981 by the Senate Committee on Energy and Natural Resources and the Subcommittee on Nuclear Regulation of the Committee on Environment and Public Works. (Joint Hearings before the Committee on Energy and Natural Resources and the Subcommittee on Nuclear Regulation of the Committee on Environment and Public Works of the United States Senate on S. 637 and S. 1662. October 5 and 6, 1981. Energy Committee Publication No. 97-62, Environment Committee Publication No. 97-H40.) David Berick, the Washington Representative of the Environmental Policy Center, stated "The availability of long-term storage need not and should not serve as an excuse for an inadequate geologic disposal program……. (p. 385). Eric Van Loon, the Executive Director of the Union of Concerned Scientists, warned that the emphasis in the bills under consideration on short-term and long-term spent fuel storage carried "a high risk of harming rather than assisting the development of a successful federal program for the safe, permanent disposal of high-level nuclear waste. (p. 395). The same point was made by Renee Parsons, the Legislative Representative of Friends of the Earth, in a June 1981 hearing before a subcommittee of the House Committee on Interior and Insular Affairs (Hearings before the House Subcommittee on Energy and the Environment of the House Committee on Interior and Insular Affairs on H.R. 3809, Title I and Other Bills Relating to Disposal of Nuclear Waste, June 23, 1981): "While we support the establishment of a permanent geologic repository program for the storage of high level radioactive waste, we do have serious reservations about those types of facilities that are "interim" or "short-term." Such temporary facilities…. merely serve to detract efforts from the goal of a permanent repository program." (p. 559)

The Act incorporated a compromise requiring DOE to submit a site-specific proposal for an MRS facility as a complement to the repository program, with a provision that construction of such a facility should not affect disposal of HLW and UNF in a repository. DOE proposed the site of the Clinch River breeder reactor project, shown in Figure 3-2, in the Roane County portion of Oak Ridge and two alternative sites. All three sites were located in Tennessee and were considered attractive, in part, because they were either owned by DOE or had already been approved by the NRC for another nuclear facility.[15]

Figure 3-2 – Cancelled Clinch River Plant Site

Clinch River and other sites in Tennessee considered for DOE's MRS met with opposition by the State.

The DOE provided a grant of $1.4 million to the State of Tennessee to conduct an independent evaluation of the MRS, with part of the funding going to support an examination of the MRS proposal by a joint task force formed by the City of Oak Ridge and Roane County.[16] The task force concluded that the envisioned facility could be safely built and operated, but that it would not generally be perceived as safe unless a number of specific recommendations were implemented in the MRS authorizing legislation.[17]

The specific concerns of the task force and some of the mitigation measures they recommended are indications of the kinds of conditions that might be imposed for any future centralized interim storage facility by even a favorably disposed community that is familiar with nuclear activities. They included:

- *"Without diligent adherence to rules, regulations, and safety procedures, the MRS could adversely impact the surrounding population and the local environment."* To mitigate this concern, the task force proposed a citizen MRS Environment, Safety, and Health Review Board to oversee operations and even be able to suspend operations in the event of releases at the MRS above agreed-to levels. They also proposed a number of other measures, including specifying highway routes and standards for rail lines.
- *"The proposed facility could delay construction of the geologic repository and become a de facto site for permanent spent fuel storage."* To mitigate this concern, the task force

[15] Easterling, D., Kunreuther, H. (1995). *The Dilemma of Siting a High-Level Nuclear Waste Repository*. Boston: Kluwer Academic Publishers. p. 70

[16] Colglazier, op. cit., p. 146.

[17] Clinch River MRS Task Force, "Position on the Proposed Monitored Retrievable Storage Facility," October 10, 1985.

recommended that authorizing legislation: 1) limit receipt to 300 metric tons until the repository received a construction authorization, 2) limit receipt to 10,000 metric tons until out-shipments to the permanent repository begin, 3) require that any expansion above 15,000 metric tons be subject to the same review and notice of disapproval procedures that applied to the initial authorization, and 4) provide for a significant "overdue-removal penalty" for any UNF stored at the MRS longer than 15 years.

- *"The MRS facility could hinder the communities' efforts to diversify and expand their commercial/industrial base."* To address this concern, the task force recommended a range of measures including payments-equivalent-to-taxes, relocation of the management of the MRS and transportation for the entire civilian radioactive waste management system to Oak Ridge, use of private facilities for MRS activities to the greatest extent possible, proximity to Oak Ridge as a major factor in procurements related to the MRS, and commitment by MRS contractors to diversification of the communities' economic base by bringing non-DOE business into the communities.
- *"Public trust in DOE has seriously eroded." Citing historical experiences that "leave many skeptical that DOE's assurances regarding the MRS will be fulfilled."* The task force specified measures enhancing local authority, such as: 1) consultation and cooperation agreements directly between DOE and units of local government as well as between DOE and the State; 2) preferred status for local governments in interactions with the State, DOE, and NRC regarding the MRS; and 3) a legislative requirement that DOE comply with the task forces' recommendations.
- *"The MRS may be perceived as a 'nuclear waste dump'."* While the task force recognized that "the 'waste dump' label already given to the proposed MRS by many throughout the State can be proven erroneous," they specified mitigation measures including a significant DOE-funded pre-operational public education program, exhibits in the local Museum of Science explaining the MRS and its role in the waste management system, and a visitor center at the facility.

Despite local support for the envisioned MRS (conditional on the recommendations discussed above), Tennessee Governor Lamar Alexander announced in 1986 that he opposed the MRS, even though he agreed that it could be operated safely[18]. His reasons included lack of a convincing demonstration of need for the facility and concern that fears about nuclear waste and the "stigma" of a waste facility would hinder growth in the Oak Ridge area[19]. Tennessee officials also shared the concern of the local task force members that the facility might become a

[18] Colglazier, op. cit., p. 146

[19] Easterling and Kunreuther, op. cit., p. 71.

de facto permanent storage facility[20]. The State sued to block submission of the facility and succeeded in delaying that submission until 1987, by which time the national civilian radioactive waste management program was encountering major political difficulties resulting from decisions and actions concerning siting of the first and second repositories. Those difficulties led to passage of the Nuclear Waste Policy Amendments Act of 1987 (NWPAA or the amended Act) that substantially altered both the repository and the MRS provisions of the Act of 1982.

3.1.5 Federally Negotiated MRS Siting

The amended Act went in several directions with respect to an MRS. On the one hand, it authorized a MRS and allowed DOE to select a site, subject to a State veto and Congressional override procedures like those that applied to the repository, and to design and obtain a license for the facility. At the same time, it nullified the Clinch River site designation, forbid an MRS located in Nevada, and added tight linkages for an MRS to the repository that were more stringent than those specified by the Oak Ridge/Roane County task force. Specifically, construction of an MRS could not begin until a repository received a construction authorization, and, the capacity of the MRS was limited to 15,000 metric tons with no provision for expansion (other than amendment of the amended Act to remove the limit).

The amended Act also established a MRS Review Commission to report on the need for an MRS and created an Office of Nuclear Waste Negotiator (the Negotiator) to seek a volunteer site for the MRS.[21] The amended Act encouraged that the DOE-directed MRS siting process be conducted in parallel with the MRS siting efforts of the Negotiator.

No limitations were placed on the terms and conditions of a proposed siting agreement arranged by the Negotiator, but, the agreement would have to be submitted to Congress for consideration and any necessary statutory authorization. It was hoped that a negotiated agreement might be achieved that would loosen or remove the linkages to a repository that were imposed in the amended Act.

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[20] Vandenbosch, Robert and Vandenbosch, Susanne, *Nuclear Waste Stalemate: Political and Scientific Controversies*, Salt Lake City: University of Utah Press, 2007, p. 77-78. "Senator Albert Gore Jr. (D-TN) questioned the need for an MRS facility. He said: 'We cannot accept a justification of the need of the MRS based on DOE's inability to meet the Act's deadlines for completion of a permanent repository. This road leads to a de facto permanent repository in Oak Ridge, Tennessee. I will do everything possible to stop DOE's effort to turn the MRS into a quick fix political solution to the real problem of final nuclear waste storage."

[21] Not everyone applauded the creation of a voluntary siting process. It was opposed by national and regional environmental and anti-nuclear groups who opposed national nuclear policy in general and the MRS facility in particular. Twelve of these groups opposed appointment of a new Negotiator after the change of administration following the 1992 election. Peele, Elizabeth. "Voluntary vs. Directed Siting – or Somewhere In-Between?", Proceedings of the Fifth Annual International Conference on High-Level Radioactive Waste Management, Las Vegas, Nevada, May 22-26, 1994,Vol. 1, pp. 201-212, p. 204.

Importantly, the amended Act required the Negotiator to seek an agreement with a State or Indian tribe. While local governments would play a role in the voluntary process, any agreement had to be approved by the state government or the governing body of the Indian tribe.

To add an incentive for accepting a repository or an MRS, the amended Act provided for a "benefits agreement" with the State or Indian tribe, in which the host would receive specified payments before and during the operation of the facility, provided the State or Indian tribe waived its right to veto the selection of the site. The benefit payment allowed for an MRS was $5 million per year prior to first receipt of UNF at the MRS and $10 million per year until closure of the MRS. (This approach was criticized as a "bribe" by the national press before it was even formally adopted in law.[22])

A Review Panel would also be established with advisory powers (but without the extent of local authority recommended by the Oak Ridge/Roane County task force). No state showed interest in the benefits agreement.

State/Local Government Efforts. Implementing the amended Act's focus on state governments, the first Negotiator (David Leroy, former Attorney General of Idaho) established a process requiring explicit approval by the governor of a state for negotiations with the state or any local government in the state. States and communities were offered phased study grants to investigate the risks and benefits of hosting an MRS, with no implication of a commitment to negotiating an agreement. No governors responded to the Negotiator's call for expressions of interest, but, elected officials in four counties submitted applications for Phase 1 grants. Three counties were funded (Grant County, ND, Fremont County, WY, and San Juan County, UT). (Four others showed interest but were blocked by their governors.) All three efforts were subsequently terminated. Voters in Grant County recalled all three county commissioners who had supported the application. Statewide opposition in Wyoming and Utah led the governors to reverse their initial approval and block local exploratory efforts from proceeding. [23, 24]

One evaluation of voluntary siting processes[25] concluded that the lack of a well-defined process for public participation in the MRS siting process contributed to "confusion and intense conflict at the local level" in Fremont County and Grant County. The evaluation noted that in both cases "zealous local initiators organized [public participation] that omitted certain stakeholders." The analysis pointed out that applicants for information grants were expected to devise a public participation process, but were given few requirements and little guidance, leading to a variety of *ad hoc* plans that were rarely representative and sometimes did not even try to be.

[22] "Big Spending for a Spent Fuel Bribe," New York Times, October 4, 1987, http://www.nytimes.com/1987/10/04/opinion/big-spending-for-a-spent-fuel-bribe.html

[23] Gouda, M. V. Rajeev & Easterling, Doug, "Nuclear Waste and Native America: The MRS Siting Exercise," *Risk: Health, Safety & Environment* 229 [Summer 1998], pp. 229-258.

[24] See also Easterling and Kunreuther, pp. 72-73.

[25] Peelle, op. cit., p. 204.

The analysis opined that "Without a credible effort to create a representative local task force…to examine the issues and concern about a possible MRS siting, local officials and citizen [task forces] were immediately subject to withering attack by other local interests as well as outside anti-nuclear opponents. In the absence of appropriate [public participation] guidelines, the [voluntary siting] process was driven by an unfortunate mix of zealous local proponents and opponents. Very little balanced local stakeholder consideration of issues and impacts can take place in this atmosphere." A further complication resulted from the fact that "each nuclear facility siting becomes a battleground for anti-nuclear policy struggles."

Several key questions about public involvement raised by the volunteer process were identified: "Are local residents who volunteer the only stakeholders or the primary stakeholders to be considered? What role should non-local stakeholders such as national anti-nuclear and pro-nuclear organizations to have? And, how should the boundaries for a volunteer area be determined?" The analysis went on to conclude that the requirement of the MRS voluntary process that local volunteer bodies involve and inform other interested parties as well as the State "was an unrealistic requirement beyond the capabilities of most local entities" that would be preoccupied with demands of information gathering and public participation with their own constituencies. [26]

In rejecting the request from the Fremont County commissioners for approval of receipt of a Phase II study grant from the Negotiator, Wyoming Governor Mike Sullivan raised a number of key concerns that have been consistently encountered in other efforts to site UNF storage facilities:[27]

- *Concern that the facility is not needed.* "If the storage of the waste is as safe and as benign as represented, does it not make better sense to leave it where it is or, if it is to be moved temporarily, to place it at or near the location of the permanent repository?"
- *Concern that the facility will become a de facto permanent storage facility.* "Can we and are we willing to trust the Federal government's assurances that the MRS site will be temporary? Can we be paid enough or place enough in trust to accept a permanent repository that was intended to be temporary? It is my belief we cannot."
- *Concern about assurances of safe operation.* "Can we be assured of continuing control or oversight of such a facility? Last month the House of Representatives voted to exempt Yucca Mountain from state environmental permitting because DOE contended Nevada was not cooperative. Unless the supremacy clause of the U.S. Constitution is changed, Congress, for fiscal reasons or preemptive reasons, can mandate new terms and new controls as it deems expedient or simply not accept the terms initially negotiated."
- *Lack of trust that citizens' interests would be protected.* The Governor cited a long history of the state having to fight to retain assurances that had previously been given by the Federal

[26] Peelle, op. cit., p. 205.

[27] Letter from Governor Mike Sullivan to the Fremont County Commissioners, August 21, 1992.

government "because of a change in circumstances (fiscal or otherwise) or a change in the attitudes in Congress." He asked "Are we willing to ignore the experience history would provide us for the siren song of promised economic benefits and a policy that is clearly a moving target? As Governor, I am not."

- *Concern that acceptance of nuclear waste would adversely affect economic development in the state.* "Who can assure us what risks we would accept that new businesses may choose not to locate in Wyoming or what the alteration of our image as a state, our environment or our tourist industry may be from our willingness to embrace this nuclear waste?"
- *Concern about the continued commitment of the Federal government to the MRS policy.* The Governor cited GAO reports and Congressional committee statements questioning the need for the MRS as evidence of "the tenuous nature of the MRS strategy and the difficulty of relying upon the current policy of the Federal government."

The Governor summarized his concerns bluntly: "I am absolutely unpersuaded that Wyoming can rely on the assurances we receive from the Federal government. Even granting the personal integrity and sincerity of the individuals currently speaking for the Federal government, there can be no guarantees or even assurances that the Federal government's attitudes or policies will be the same one, five, ten or 50 years from now." He concluded "I simply do not endorse the wisdom of the policy adopted by the Federal government nor do I trust the Federal government or the nuclear industry to assure our interests as a state are protected."

Native American Tribal Efforts. [28] The Negotiator considered requests only from the elected officials of Indian tribes. A total of 24 Indian tribes applied for study grants, but only four — the Mescalero Apache (New Mexico), the Skull Valley Goshute (Utah), the Fort McDermitt Tribe (Oregon and Nevada), and the Tonkawa (Oklahoma) — stayed in the process beyond the initial phases. The Mescalero Apaches and the Skull Valley Goshutes applied for "Phase II-B" grants indicating serious interest, but, this aroused strong opposition in the surrounding states. That opposition led to Congressional cancellation of the program for study grants in 1993.

An analysis of the specific experience of the Tribal efforts for MRS siting identified a number of important issues:

- *Environmental justice.* The question of "environmental justice" arises when unwanted facilities such as waste disposal facilities are disproportionately located in poor and/or racial minority communities. An analysis of the Negotiator's efforts to find a Native American community willing to host an MRS noted that even though the concerns about environmental injustice usually arise with involuntary siting processes, the MRS voluntary siting process was nonetheless criticized by some on environmental justice grounds. From this perspective,

[28] This section draws heavily on a detailed assessment of the MRS volunteer siting process as it related to Native American communities by Gouda, M. V. Rajeev & Easterling, Doug, "Nuclear Waste and Native America: The MRS Siting Exercise," *Risk: Health, Safety & Environment* 229 [Summer 1998], pp. 229-258.

the analysis concludes that "a 'voluntary' siting process cannot be truly voluntary as long as the facility represents the only economic hope for poor communities." [29]

- *Lack of trust in the ability and willingness of the Federal government to manage the facility safely*. This lack of trust in the Federal government added to the perceptions of the risk associated with the MRS facility. It should be noted that "a significant feature affecting Mescaleros' support for the MRS siting exercise was their trust in their tribal government's ability to manage its ventures effectively," and, their trust in their tribal government was based on the tribe's track record of establishing profitable enterprises that have benefited the tribe. This trust in the tribal government offset the lack of trust in the Federal government.
- *Lack of trust that the Federal government would ensure that the MRS would remain a temporary facility*. As discussed below, in subsequent negotiations with Northern States Power to host a private storage facility, the Mescaleros included provisions designed to ensure that the interim facility remained interim.

The tribal efforts at MRS siting also raised concerns about the inclusiveness of the decision process. In the case of the Sac and Fox tribe, although the application for a study grant was submitted by the legitimate elected officials of the tribe, some members of the tribe were concerned that participation in the siting process had not been discussed openly to gain broad consent. This ultimately led to a petition for a tribal meeting and adoption of a resolution to withdraw from the siting process. A more inclusive approach was used by the Mescalero Apaches, with the tribal council sponsoring a referendum to gain support for participation in the MRS siting process. While the initial proposal was defeated, supporters petitioned for a new vote and the tribal government conducted an education campaign "to counter what it alleged was misinformation about the proposal spread by non-Native environmental activists." In the new referendum, the proposal to host the MRS passed by a large majority.

The tribal efforts at MRS siting also resulted in opposition by the surrounding communities and state. Because of tribal sovereignty, the surrounding states do not have control over what the tribes choose to do on their own territory, and therefore, the surrounding states were unable to block tribal participation in the negotiated MRS siting process. When the Mescaleros applied for the substantial Phase II grant that would have required them to enter into discussions with the Negotiator, members of the New Mexico Congressional delegation introduced legislative language that would have blocked DOE from awarding a grant to a tribe without an agreement with local officials in the neighborhood of the facility.[30]

Ultimately, Congress adopted a provision in the Fiscal Year 1994 appropriations bill that blocked use of the Nuclear Waste Fund for Phase II studies of the feasibility of siting an MRS. Also, Congress did not provide any funds for study grants from general revenues under the defense nuclear waste disposal provisions of the appropriations bill. These actions had the effect of

[29] Gowda & Easterling, op. cit., p. 248.

[30] Vandenbosch and Vandenbosch, op. cit., p. 98.

ending the study grant program. While the Negotiator was still able to look for volunteers and develop proposed negotiated agreements, the lack of study grants increased the difficulty significantly,[31] and the new Negotiator appointed by President Clinton, Richard Stallings, did not succeed in reaching any agreements with potential hosts.

While the efforts of the Negotiator to work with Native American tribes were blocked by Congress at the point where it appeared possible or even likely that the efforts would succeed, the positive lesson from the experience is that two tribes – the Mescalero Apaches and the Skull Valley Goshutes – did conclude, like the citizens of the Oak Ridge/Roane County area in Tennessee, that under the appropriate conditions a centralized interim storage facility would be a net benefit.

An analyses of the MRS siting process involving the tribes observed that the Mescalero tribal council concluded that "whatever risks the facility might pose to current and future generations, they would be outweighed by economic opportunities, in the form of direct payments to the tribe and jobs for skilled tribal members," and that "the MRS facility was even expected to serve tribal interests better than the casino and ski resort [that the tribe had successfully developed] by providing the types of high-technology jobs that would attract technically-trained Mescalero Apache back to the tribe for employment." According to this analysis, these expected benefits were key factors in offsetting negative risk perceptions among members of the tribe.[32]

Authority for the Office of the Nuclear Waste Negotiator expired on January 1, 1995, without achievement of a single proposed siting agreement.

3.1.6 Interim Storage Legislative Proposals

There were repeated unsuccessful efforts in the 1990s to pass legislation authorizing a central interim storage facility unlinked to the repository. Beginning in the 103rd Congress, a number of legislative efforts were made to provide interim storage facilities unlinked to the repository at Yucca Mountain, NV. A comprehensive study of repository siting observed that, in the 1994 time frame, "The current sentiment among DOE, Congress, and the proponents of monitored retrievable storage is that the facility should be built at a federally owned site, either a defense installation, a national laboratory, or a nuclear weapons facility…" [33] Several bills sought to provide storage at sites other than Nevada, specifically including existing federal sites.[34] These went nowhere after they were introduced.

[31] Easterling and Kunreuther, op. cit, p. 74.

[32] Gowda & Easterling, op. cit., p. 240, 242.

[33] Easterling and Kunreuther, op. cit., p. 76

[34] H.R. 5057 in the 103rd Congress, and S. 443 and H.R. 1924 in the 104th Congress.

The only bills that were given substantial consideration in committee were those that directed development of a storage facility at or near the Yucca Mountain site in Nevada.[35] The cited study observed that this siting approach had two key advantages from a Congressional standpoint: it would be the least politically painful choice, since the decision to locate the repository in Nevada had already alienated the state so that the marginal cost of putting another waste facility there would be low, and, it would demonstrate federal resolve to put waste in Nevada and thereby add momentum to the repository effort.[36]

These legislative efforts were successfully opposed by the Clinton administration on the grounds that constructing a storage facility near Yucca Mountain would prejudice the repository site suitability determination. Most legislative efforts were not acted on by either the House of Representatives or the Senate, and, none gained approval in both.

Also, during the course of consideration of these bills, the U.S. Nuclear Waste Technical Review Board (NWTRB) issued a report[37] that once again raised the concern that storage efforts could jeopardize the repository program "… by: 1) competing with the disposal program for resources, 2) causing a real or perceived prejudicing of a future decision about the suitability of the Yucca Mountain site, and 3) eroding the impetus and political support for repository development." The NWTRB found no compelling need to move commercial UNF to interim storage in the near-term, but concluded that interim storage would be needed in the future to allow flexibility in the waste management system and (beginning around 2010) to allow removal of UNF from the pools of reactors that are being shut down.

A bill that would allow waste to be stored at Yucca Mountain after the site had been found suitable for a repository (S. 1287) was passed in 2000, but was vetoed by President Clinton on the grounds it would undermine public confidence in the repository. An earlier provision of the bill allowing DOE to take title to UNF at reactor sites was removed before passage due to state concerns that DOE might keep the UNF at the reactor sites indefinitely.[38]

3.1.7 DOE Used Nuclear Fuel Storage in Idaho

In 1994, DOE sought to increase the amount of DOE and U.S. Navy UNF stored at the Idaho National Laboratory (INL). The State of Idaho sued the Federal government to block the proposed increase. A legally-binding, court-enforceable agreement (the "Batt Agreement," named after Idaho Governor Batt) was then negotiated between the State of Idaho, the DOE, and the Navy allowing additional storage in return for commitments to remove the UNF by a specific

[35] e.g. S. 167, H.R. 1020, S. 1271, and S. 1936 in the 105th Congress, and S. 104, H.R. 1270, H.R. 45, and S. 608 in the 106th Congress.

[36] Easterling and Kunreuther, op. cit., p. 77.

[37] Nuclear Waste Technical Review Board, *Disposal and Storage of Spent Nuclear Fuel — Finding the Right Balance*, March 1996

[38] Congressional Record – Senate, February 10, 2000, Page S564

future date (2035), pay overdue removal penalties, and clean up radioactive contamination at INL. This agreement was renewed and revised in 2008 to allow storage of an additional amount of Navy UNF after 2035.

3.1.8 Private-Sector Centralized Interim Storage Efforts

The most recent attempts to site a centralized interim storage facility have involved private-sector initiatives.

Private Fuel Storage Initiative. Following the termination of the Waste Negotiator program, the Mescalero Apaches and Skull Valley Goshutes entered into discussions about hosting a private storage facility with a consortium of nuclear utilities, (know as the PFS initiative,) headed by Northern States Power Company.[39]

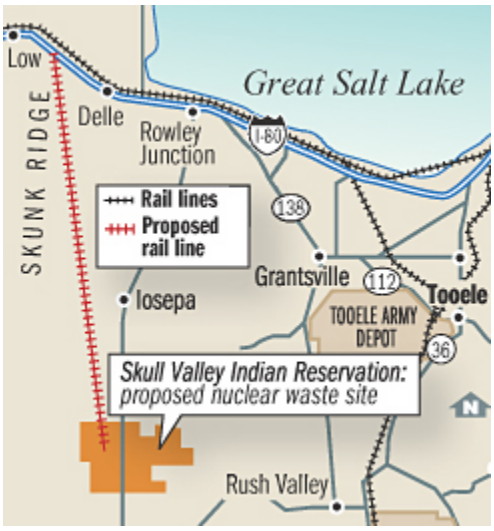

Figure 3-3 – Location of Proposed PFS Facility in Utah

PFS site, although licensed by the NRC, was blocked by the DOI.

Mescalero Apaches. The proposed agreement provided for storage for 40 years, in return for direct payments on the order of $50 million per year for 20 years plus jobs associated with the project.[40] The tribe sought to ensure that the facility would remain temporary and would not become the sole storage site by default by specifying that it would receive only a fraction of the nuclear utilities' UNF. The tribe also required that the title to the UNF would remain with the nuclear utility that generated it so that the nuclear utility retained liability.[41] The tribe ultimately withdrew from the negotiations because it found the financial terms proposed by the consortium to be unacceptable.[42]

Skull Valley Goshutes. The PFS consortium continued discussions with the Skull Valley Goshutes in Utah, leading to an agreement with the Goshutes to host a private interim storage facility for up to 40,000 metric tons of UNF, located as shown in Figure 3-3. This effort was strongly opposed by the State of Utah, which established and funded an Office of High-Level Nuclear Waste Opposition to block the initiative.[43] The State also enacted a number of laws to block the facility, but the U.S. 10th Circuit Court of Appeals concluded that these laws conflicted with (and were superseded by) federal law.[44]

[39] Vandenbosch and Vandenbosch, op. cit., p. 99.

[40] Easterling and Kunreuther, op. cit., p. 75.

[41] Gowda and Easterling, op. cit., p. 244.

[42] Vandenbosch and Vandenbosch, op. cit., p. 99.

[43] Vandenbosch and Vandenbosch, op. cit., 100.

[44] Vandenbosch and Vandenbosch, op. cit., , p. 101.

The PFS facility received a license from the NRC in 2006 allowing storage of 40,000 metric tons for 20 years. However, construction of the PFS facility was blocked by the action of two agencies of the DOI. The Bureau of Indian Affairs disapproved the lease of Goshute land for the facility, citing risk that the facility would become a de facto permanent storage facility, while the Bureau of Land Management refused to grant a right-of-way across public land for transportation of UNF to the site.[45]

Utah press gave credit to the Utah Congressional delegation for blocking the facility. Opposition by the Church of Jesus Christ of Latter-day Saints (Mormon), which argued against requiring a single state to store the entire nation's UNF, was also credited.[46] PFS has challenged the DOI rulings in a federal district court lawsuit, but, no final decision on the lawsuit has been reached.[47]

Recognizing that the PFS facility had been granted an NRC license, the Western Governors' Association (WGA) adopted a resolution in 2006 related to private storage and transportation of commercial UNF.[48] Noting that "Without an available permanent disposal site, there is no guarantee that a private interim storage site will be temporary," the WGA implicitly questioned the need for such a facility, pointing out that "most reactor sites are believed to have the capacity for additional on-site storage" if a repository is delayed. They stated that "No interim storage facility, whether publicly or privately owned, shall be located within the geographic boundaries of a Western state without the written consent of the governor." Finding "that the creation of privately-owned interim storage sites is a direct result of the Federal government's failure to begin accepting spent fuel on schedule," the WGA said that "it is the Federal government's responsibility to ensure adequate preparation for shipments to these facilities, coordination with states, and provision of adequate funding to reimburse the states for costs associated with shipments to any interim storage facility, whether publicly or privately owned," using the Nuclear Waste Fund for these activities if needed. That is, the WGA insisted that even with a private storage facility, the Federal government must play a major role in transportation of UNF to the facility.

Nuclear Energy Institute Initiative. The Nuclear Energy Institute (NEI) supports an integrated UNF management strategy that includes centralized UNF storage at volunteer sites.[49] To promote that policy, the NEI has undertaken an effort to find communities willing to host interim storage facilities. Press reports indicate that some of the communities involved in discussions

[45] Stewart, Richard B. , "U.S. Nuclear Waste Law and Policy: Fixing a Bankrupt System," N.Y.U. Environmental Law Journal [Volume 17 2008], 783-825, p. 799

[46] Vandenbosch and Vandenbosch, op. cit., p. 102

[47] U.S. NRC, Annual Report On Court Litigation (Calendar Year 2008), SECY-09-0020, February 4, 2009, http://www.nrc.gov/reading-rm/doc-collections/commission/secys/2009/secy2009-0020/2009-0020scy.pdf

[48] Western Governors' Association, Policy Resolution 06-7, "Private Storage and Transportation of Commercial Spent Nuclear Fuel," , June 13, 2006 Sedona, Arizona, http://www.westgov.org/wga/policy/06/private-nuke.pdf.

[49] http://www.nei.org/keyissues/nuclearwastedisposal/policybriefs/integratedusedfuelmanagementstrategy/

were among the eleven sites that had expressed willingness to host a recycling facility under the Bush administration's Global Nuclear Energy Partnership (GNEP) initiative.[50] Details of those discussions are not public.

3.1.9 International Siting Efforts

A brief synopsis of international siting efforts, mostly European, is presented in Appendix A. A significant number of these siting efforts have been successful in identifying sites for interim storage facilities and/or geologic repositories, and as such, they provide valuable insights into key aspects of successful siting programs.

In Sweden, the nuclear utilities formed a new company, SKB (Swedish Nuclear Fuel & Waste Management Company), to manage and dispose of all Swedish UNF. Eight locations were selected, and, two of the eight communities voted by large majorities to be candidate sites. Both of the candidate sites are located near existing nuclear facilities.

The interim storage facility (and an encapsulation facility to prepare the UNF for geologic disposal) is located near Oskarshamn. This interim storage facility, the Clab facility, will provide pool storage in water basins for 30 to 40 years. The Forsmark facility, located near Osthammar, will provide direct disposal in a licensed geologic repository constructed in crystalline bedrock.

In Finland, two nuclear utilities formed a new company, Posiva Oy, to manage and dispose of all Finnish UNF. Six sites were originally selected; however, not all of the envisioned sites were located near existing nuclear facilities. Also, the local community was given veto authority over the final selection of the location for the geologic repository.

The UNF is stored in an interim storage facility at each of the nuclear power plants (with the Olkiluoto Island nuclear power plant near Eurajoki accumulating the largest volume of UNF for storage until the geologic repository begins operations). Construction of the geologic repository for direct disposal of Finnish UNF at Olkiluoto Island is underway, with emplacement of UNF scheduled for 2020. This geologic repository will be the world's first geologic repository for the disposal of UNF.

In Switzerland, four nuclear utilities formed a new company, Zwilag, for the interim storage of UNF until such time as NAGRA (National Cooperative for the Disposal of Radioactive Waste) identifies a site and develops a geologic repository for direct disposal of the UNF (under the once-through fuel cycle option) or HLW (under the recycling option). The interim storage facilities, including an existing interim storage facility at the Beznau nuclear power plant, are located near existing nuclear facilities.

[50] "Nuke industry seeks storage sites; Yucca uncertainty prompts campaign," Las Vegas Review-Journal, Feb. 23, 2008, http://www.lvrj.com/news/15901672.html

In Spain, ENRESA (Empresa Nacional de Reiduos Radiativos SA) has the responsibility for the management and disposal of UNF. The Spanish government will call for bids from local authorities to host a centralized, interim storage facility for UNF. To enhance a location to volunteer, ENRESA has closely coupled a technology center with the interim storage facility for UNF.

In France, which has a national policy for the recycling of UNF, ANDRA (Agence Nationale pour la gestion des Dechets Radioactifs) was responsible to select two sites for the retrievable storage, for up to 100 years, of HLW resulting from the recycling of UNF. The Bure site is being investigated, and an "energy enterprise park" is coupled with the retrievable storage facility.

These successful international siting efforts have several distinct characteristics in common. These common characteristics include:

- A national recognition of the need for facilities to manage and dispose of UNF and/or HLW – both in countries pursuing a direct disposal approach and countries pursuing a recycling approach,
- The identification of multiple sites, often through a volunteerism approach, in order to share the responsibility for interim storage and/or geologic disposal of UNF,
- The location of potential sites in proximity to existing nuclear facilities,
- The creation of a new private company or governmental entity with the responsibility for the management and disposal of the UNF,
- The co-location of other high-technology enterprises to enhance volunteerism.

These common characteristics have provided valuable insight in the development of the envisoned volunteerism approach presented in Section 6.2 of this report.

3.2 Lesson Learned – What worked and what didn't?

Efforts under the Act to site an MRS, using both federal-directed and negotiated siting processes, were unsuccessful despite the existence of potentially willing host communities and Indian tribal governments. Strong opposition came from citizens in other (often more populous) communities in the state and outside parties who objected to interim storage on policy grounds (e.g., concern that availability of centralized federal interim storage facilities would derail the development of a geologic repository for disposal and, as a result, the interim storage facilities would become de facto permanent). In addition, there was considerable opposition from the state governments as well as Congressional interference in the siting process.

The same forces have obstructed subsequent federal legislative initiatives for centralized federal interim storage facilities. Private-sector efforts to develop a commercial interim storage facility, PFS facility in Utah, encountered these same forces, and, subsequent to receiving a license from the NRC, the PFS facility was effectively stopped by actions taken by the DOI (the same federal

agency that killed the Ward Valley low-level radioactive waste disposal facility that had been licensed by the State of California).

The following examples provide a brief summary of issues commonly raised:

3.2.1 Distrust of the Federal Government

The first Nuclear Waste Negotiator, David Leroy, concluded that "The principal barrier to successful siting [of an MRS facility] is the widespread distrust of the Federal government held by the American Public."[51] As the examples discussed above indicate, questions have been raised about whether the Federal government would operate the facility safely, whether it would provide promised benefits, and whether it would have the political will to continue to develop permanent disposal facilities so it will keep commitments to ultimately remove UNF after it is placed in "interim" storage.

Wyoming Governor Sullivan summarized the problem succinctly: "Let us not deceive ourselves – we are being invited through continuing study [of a federal MRS facility] to dance with a 900-pound gorilla." He went on to explain "Unless the supremacy clause of the U.S. Constitution is changed, Congress, for fiscal reasons or preemptive reasons, can mandate new terms and new controls as it deems expedient or simply not accept the terms initially negotiated." In essence, any Congressional commitments made in law can be changed, at will, by a future Congress.

For such reasons, the first Nuclear Waste Negotiator encouraged prospective hosts to consider negotiating provisions that would (1) give the host a role in operations, control and safety issues, (2) establish significant penalties for federal non-compliance, and (3) be enforceable in the federal courts. He also suggested that private, state, or tribal ownership and operation would be negotiable. He observed that "In some instances, approaches of this type have been sufficient to initially address and meet trust concerns."[52] The 1995 Batt agreement concerning storage of federal UNF in Idaho included such court-enforceable provisions.

Unlike the court-enforceable provisions of the Batt Agreement, the State of South Carolina agreed to legislative requirements, in the form of schedules for removal and penalties for overdue removal, as conditions for acceptance by the State of South Carolina of the planned consolidation of surplus defense plutonium from other DOE sites at the Savannah River Site. Section 3182 of H.R.4546, the 'Bob Stump National Defense Authorization Act for Fiscal Year 2003', contained provisions intended to assure South Carolina that "all defense plutonium or defense plutonium materials transferred to the Savannah River Site either be processed or be removed expeditiously." That section includes a requirement for a DOE plan for a facility to

[51] Leroy, David H. "The Negotiator: A Novel Approach for Gaining Public Acceptance," Paper submitted for presentation to the 4th International Conference on Nuclear Waste Management," 5-11/09/1993, Prague, Czech Republic, in Proceedings of the International Conference on Nuclear Waste Management and Environmental Remediation.

[52] Leroy, op. cit.

convert plutonium into mixed oxide fuel (MOX) to be used in commercial reactors and to achieve specified target dates and rates for the conversion. It also provides that if certain deadlines are not met, DOE must pay South Carolina $1,000,000 per day, not to exceed $100,000,000 per year, for economic and impact assistance until specified conditions are fulfilled.

Our Proposed Approach. The envisioned national IUFM strategy, starting with the regional UFMF initiative, presented in this report is based on a private sector solution. In this approach, the private sector will be responsible to site, design, license, construct, operate, monitor, and close multiple regional UFMFs while the Federal government retains the responsibility to implement alternate approaches for the management and ultimate disposal of UNF (the once-through fuel cycle approach) or HLW (the recycling approach). The regional UFMF initiative approach is based on volunteerism, and, the regional UFMF initiative approach provides a meaningful role for involvement of the volunteer local communities, in conjunction with the surrounding region and state. The regional UFMF initiative approach emphasizes placing responsibility and control jointly in the hands of the private sector facilities and the local communities – not in the hands of a remote federal agency or the Congress.

The regional UFMF intitative involves the local communities, in conjunction with their surrounding region and state, in the day-to-day activities leading to the site selection, design, operation, monitoring, and closure of the UFMFs, creates a role for the local communities in the oversight (and if necessary the suspension of operation) of the UFMFs, and provides benefit programs for the local communities, surrounding regions, and host states to balance the potential risks and rewards for volunteering.

3.2.2 Permanence Concerns – that a storage facility will become a de facto permanent

The fear that availability of a storage facility would derail efforts to develop a permanent repository, and would therefore make the storage facility a long-term repository by default, has been a perennial source of objections to storage efforts since the RSSF proposal in 1972. It was raised by environmental groups when the Act was being debated, by the MRS Review Commission, by stakeholders in the negotiated MRS siting process, by the NWTRB, and most recently by the Natural Resources Defense Council (NRDC) in comments submitted on the proposed changes by the NRC to the waste confidence rulemaking findings in 10 CFR Part 51.23(a).[53] In addition, the Administration has indicated its confidence in extended dry storage of UNF for as long as 100 years and has announced its intent to review the policy and evaluate options for the final disposition of UNF and HLW. The perception of permanence is discussed further in Section 5.3.

Our Proposed Approach. Under current law and court-enforceable disposal contracts between the Federal government and the nuclear utilities, the Federal government has the ultimate

[53] "NRDC's Nuclear Program Response to the Recommendations of the National Commission on Energy Policy," April 20, 2007, http://docs.nrdc.org/nuclear/files/nuc_07041901a.pdf

responsibility for the disposal of commercial UNF, reactor-related GTCC waste, and HLW resulting from the recycling of UNF in a geologic repository. The Federal government also has the responsibility (and court-enforceable agreements with several states) to dispose of DOE UNF, including Navy UNF, and defense HLW in a geologic repository. It is probable that regional UFMFs would also require court-enforceable disposal contracts with the Federal government, tied to substantial penalty payments, to address potential UFMF host permanence concerns.

The envisioned national IUFM strategy recognizes the current uncertainty in the timing of when, and where, one or more geologic repositories will begin to accept UNF, reactor-related GTCC waste, and HLW for disposal. There is no denying that the UFMFs will operate for several decades or longer. As a result, the UFMFs will become a significant, long-term, inter-generational component of the local communities. Therefore, continued community acceptance, public safety, and well-being are of primary importance. Section 6.1 identifies efforts envisioned to maximize continued community acceptance, public safety, and well-being through joint involvement of the local community in each step of the facility development from site selection through closure.

The envisioned national IUFM strategy is based on the increased recognition by the public of the importance of nuclear energy as a major component of the nation's energy policy, and, the national IUFM strategy incorporates multiple, regional UFMFs to share the potential risks and benefits in an equitable, geographically balanced approach. Further, the regional UFMF initiative places primary emphasis on locating volunteer sites in the vicinity of existing nuclear facilities so that the UFMFs are located, to the extent practical, in areas that benefit most from the generation of electricity by nuclear power plants.

3.2.3 Importance of Early Involvement of Stakeholders at the Local Level

The Oak Ridge/Roane County MRS siting experience suggests that providing funding for an open, inclusive, independent exploration of the risks and benefits of a storage facility by the local community will help build lasting community support for such a venture. Likewise, efforts by the Mescalaro Apaches to explain in an open forum the risks and benefits of a storage facility to tribal members led to a successful referendum on siting the PFS facility.

Cases in which significant portions of the community felt excluded from the process, such as the Negotiator state/local government efforts, led to conflicts. Similar concerns have been raised more recently about the process whereby industrial consortia could propose sites for a DOE nuclear fuel cycle facility as part of the GNEP initiative. A group of organizations from the states involved complained to Congress in 2007 that the process involved no meaningful public information or participation at most of the sites, that in some communities the public did not know that a proposal had been submitted, and that in several sites in which the public knew a proposal effort was underway, they were unable to get involved in the process or even get

information about it. They concluded "Such a closed, secret process will not result in public support for any such major facility in any community."[54]

Our Proposed Approach. The volunteerism approach presented in Section 6.2 will involve the local communities, surrounding regions, and host states from the very start. Early on, with solicitation of expressions of interest, grants will be offered to interested local communities, in conjunction with the surrounding region and state, to evaluate risks and benefits, identify issues of concern, make a preliminary determination that there is a potentially acceptable site, and decide under what conditions the local community and state would agree to enter into a binding agreement. The local community can elect to opt out after this initial participation, and, the grant will not need to be repaid.

Following the confidence building step, for those local communities that agree, along with the state, to enter into discussions, a grant will be awarded to establish a joint board to enter discussions leading, hopefully, to a binding agreement. This includes negotiation of a benefits program that would become part of the binding agreement. As in the initial step, the local community can elect to opt out at the end of the second step, and, the grant will not need to be repaid.

In both instances, the grants would include funding for planning and conducting information exchanges and open forums with the members of the local community, the surrounding region, the state, and the media.

3.2.4 Advantages of Siting Near Communities Familiar with Nuclear Activities

Of the MRS siting experiences considered, the case of the Oak Ridge/Roane County proposal appears to have involved the least internal conflict at the local level. In that case, the members of the local community were very familiar with nuclear technology. This is consistent with a study of repository siting efforts that found that, in cases in which DOE had selected a potential site adjacent to an existing nuclear facility, "the host community had a high level of receptivity, defined in ideological, political, and occupational terms. In contrast, receptivity was much lower (and local opposition much more prevalent) when DOE selected sites where there was no strong nuclear presence. Here, local residents were not at all trustful of the repository technology or the decisions of DOE."[55]

The second Nuclear Waste Negotiator explicitly adopted a siting strategy aimed at communities with pre-existing relationships with nuclear technology – in particular communities with national research laboratories. He believed that state-level elected officials would support siting near

[54] Letter concerning the Global Nuclear Energy Partnership (GNEP) to Senator Byron Dorgan, Senator Pete Domenici, Senator Jeff Bingaman, Congressman Pete Visclosky, Congressman David Hobson, Congressman John Dingell, and Congressman Joe Barton, from 21 citizen groups in NM, OH, IL, KY, TN, ID, OR, WA, NC, GA, and SC, January 25,2007.

[55] Easterling and Kunreuther, op. cit., p. 162.

national laboratories, although the experience in Tennessee on siting an MRS at the former Clinch River breeder reactor site, shown in Figure 3-2, indicated that would not necessarily be the case.[56]

Our Proposed Approach. The experience from prior siting efforts, both domestic and international, show that: 1) local communities with existing nearby nuclear facilities are typically more receptive to hosting additional nuclear facilities, and 2) public support for a new nuclear facility tends to decrease with increasing distance from existing nuclear facilities. The volunteerism approach presented in Section 6.2 will focus on local communities that already have nearby nuclear facilities that are regulated by the State, NRC, or DOE. The volunteerism approach also focuses on the need for, and provides grants for, the local communities to involve, not just inform, their respective surrounding region, State, and Congressional delegation.

3.2.5 Need to Consider a Broad Range of "Benefits" and Concessions

While the monetary payments that can be given to a host for such a facility could be substantial and are an important consideration, they may not be sufficient without other benefits and concessions. As discussed earlier, the offer in the amended Act of large cash payments to an MRS host was stigmatized as a "bribe." For the Mescalero Apaches, the opportunity for "high-tech" jobs, in addition to cash benefits, was important. In the case of the Oak Ridge/Roane County MRS site, the local task force called for a wide range of economic development measures beyond tax-equivalent monetary payments, and in addition required provisions for local oversight and control and strict capacity limitations tied to the development of a geologic repository in order to prevent the storage facility from becoming de facto permanent.

An analysis of potential provisions for a negotiated agreement with an MRS host prepared when the MRS negotiating process was underway suggested a hierarchy of assurances that may need to be provided: (1) assurance that the facility and its operation will not pose a significant risk to the community, (2) assurance that the facility will not hurt them financially or socially, and (3) assurance that the facility will be a positive asset to the community.[57] The first Nuclear Waste Negotiator emphasized the importance of addressing safety concerns before discussing economic benefits. He also emphasized the range of non-economic incentives, such as significant controls over the nature and operation of the facility that could be negotiated.[58]

One social scientist who has studied issues of stigma and public acceptance associated with nuclear waste facilities reported an experiment that indicated a large increase (70 percent) in support for the idea of a repository if it were coupled with a research program on better disposal methods or on future uses for the waste, which he attributed to connecting the waste facility

[56] Easterling and Kunreuther, op. cit., pp. 74-75.
[57] Helvey, E., Kane, D., and Trebules, V., "Helping a Community Control its Future: Potential Negotiating Packages and Benefits for an MRS Host," Proceedings of the Fourth Annual International Conference on High Level Radioactive Waste Management, Las Vegas, Nevada, April 26-30, 1993, pp. 1453- 1458.

[58] Gowda and Easterling, p. 232.

(with its negative connotations) to something positive.[59] Along these lines, the second Nuclear Waste Negotiator tried to reframe the MRS concept in a more positive light by redefining it as a research laboratory or industrial park associated with commercial uses of UNF.[60] However, this effort was ultimately unsuccessful due, in part, to concerns of permanence.

A current example of this approach is found in the volunteer process that is seeking a site for a centralized UNF storage facility in Spain. A Technology Center is closely coupled with the proposal for a central storage facility, and it is seen as one of the major benefits for a community that volunteers to host the storage facility. The Technology Center is expected to receive a large part of the funds invested by ENRESA, the Spanish national radioactive waste management company, in basic and applied research associated with the temporary and final management of UNF and HLW. This would include basic research on technologies for treatment of UNF (separation and transmutation) with the possibility of incorporation of some type of demonstration facility.[61]

Direct provision of benefits by the waste generators (as distinct from the owners/operators of a waste facility) could be considered. In France, the nation's major waste generators have started a program to make investments in the economy in the vicinity of the underground waste laboratory at Bure that is being investigated as a potential repository for HLW. Areva plans to invest 12 million euros in an "energy enterprise park", and, Electricite de France and the Commissariat a l'Energie Atomique are making investments for job creation in the area, particularly in the renewable energy field.[62]

Our Proposed Approach. Early on in the volunteer siting approach presented in Section 6.2, the commercial entity will provide grants to interested local communities, in conjunction with their surrounding region and State, to identify the conditions under which they would consider entering into a binding agreement to host a UFMF. For those interested local communities that agree, in conjunction with their surrounding region and State, to proceed to take the next step (i.e., discussions leading, hopefully, to a binding agreement), the grants in the next step will also provide funds for the negotiation of a benefits program to be included in that binding agreement.

Although this report identifies a wide range and diversity of benefits for potential UFMF hosts (such as additional revenue sources, environmental stewardship, employment and commerce, public infrastructure improvements, and education and training) involvement of the local

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[59] Jenkins-Smith, H., U.S. Nuclear Waste Technical Review Board, Joint Meeting of the Panels on Risk and Performance Analysis, and the Environment and Public Health, Perceptions of Risk and Social and Economic Impacts, Las Vegas, Nevada, May 23, 1995, meeting transcript p.35.

[60] Easterling and Kunreuther, op. cit., p.74.

[61] ENRESA, Dossier De Prensa, La Gestión De Los Residuos Radiactivos: Almacén Temporal Centralizado (ATC) De Combustible Gastado Y Centro Tecnológico Asociado, Madrid, 24 de julio de 2006.

[62] "Andra resumes borehole drilling near underground waste lab at Bure," Nuclear Fuel, 02/11/2008 http://construction.ecnext.com/coms2/summary_0249-272494_ITM_platts

communities, surrounding regions, and host states is essential to ensure that: 1) the facility, including transportation of the UNF to the facility, is safe and does not adversely affect the environment or the quality of life,
2) the benefits programs are matched to the needs, interests, and concerns of those parties, and
3) the public is confident that the UFMFs will be long-term, as well as short-term, assets to the local communities, surrounding regions, and host states.

3.2.6 The Challenge of State Acceptance – the need to address the "doughnut effect"

Past siting experiences show that having support at the local level is necessary, but not sufficient, for a successful siting effort due to the so-called "doughnut effect." This effect occurs in situations in which there is local acceptance of a facility in its immediate vicinity, but opposition from surrounding communities and the rest of the state. This effect was seen with all of the MRS siting efforts under the Act, and, it doomed all of them. For example, in the case of the DOE proposal for an MRS in the Oak Ridge/Roane County area, the DOE sought to address local concerns but was not able to successfully deal with the concerns of state-level officials.[63]

The repeated instances of successful state-level opposition to locally-supported efforts suggests that communications with the public and intergovernmental interactions must begin at the regional and state levels, as well as at the local level, at the initiation of planning for such a nuclear project.

Our Proposed Approach. The volunteerism approach presented in Section 6.2 involves (and provides grants to fund) information exchanges with, and participation by, the local communities, their surrounding regions, and the host states from the very start. The volunteerism approach recognizes that the interests and concerns at each of the three levels must be represented, considered, and successfully addressed, to the extent practicable, from site selection through closure of the facility decades later. The volunteerism approach is focused on developing jointly with the local communities, their respective surrounding region, and the host states a three-tiered benefits program for incorporation into the binding agreement to host an UFMF.

In addition, each binding agreement will be signed by both the local community and the State, and, the binding agreement will require that the local community and State participate, as appropriate, in support of the UFMF during the NRC licensing proceedings, including the public hearings.

3.2.7 Importance of Establishing the Need for the Facility

As stated earlier, the Governors of Tennessee[64] and Wyoming questioned the need for an MRS in their refusal to approve siting efforts by the Negotiator in their states. A published review of

[63] Easterling and Kunreuther, op. cit., p. 71.

[64] Colglazier, op. cit., p. 146

repository siting experiences concluded that "The primary task facing the developer is to convince the public that the proposed facility needs to be built." The review concluded that establishing the need for the repository "…will lend an air of legitimacy to the siting process, which may defuse some of the political opposition normally associated with waste facilities."[65]

Questions about the need for centralized interim storage facilities continue to be raised in national policy discussions. For example, the NRDC objected to a recommendation that DOE develop national or regional storage facilities as "unwise and unnecessary." The NRDC suggested that nuclear utilities can simply transfer UNF into dry casks on site, which would avoid "having to ship the nation's commercial nuclear waste around the country not once, but at least twice (from the reactor site to the "regional" site, and then to a final disposal site)." They also raised the perennial objection that "a regional interim storage site would do away with any real impetus to site and develop a strong, protective repository program."[66]

Experience suggests that it may be easier to establish need for, and acceptance of, storage facilities that are limited to use in specified circumstances. While Congress rejected most storage proposals during debates on the Act, it did ultimately approve limited storage (the FIS) for use by utilities that were unable to provide adequate on-site storage to allow continued orderly operation of their reactors. Similarly, the MRS Review Commission recommended provision of only a limited amount of interim storage, i.e., 2,000 metric tons in a Federal Emergency Storage facility to provide a "safety net" of storage capacity for incidents in which a fuel pool might need to be emptied or to prevent shut down of a reactor and 5,000 metric tons in a User-Funded Interim Storage facility to provide storage for (1) nuclear utilities that might not be able to provide life-of-plant storage, (2) shutdown reactors at sites where a utility no longer operates nuclear power plants, and (3) nuclear utilities that would prefer to ship UNF to this facility rather than retain it on-site.[67] More recently, the NRDC raised no objection to a recommendation that the Secretary of Energy be required to take possession of and/or remove UNF from reactor sites that have been, or are in the process of, being fully decommissioned.

Our Proposed Approach. The volunteerism approach is based on the increased public awareness and acceptance that nuclear power is, and will continue to be, a major component of the nation's energy supply and efforts to establish energy independence. There is a realization that the 104 currently operating nuclear power plants will continue operating for decades and a new generation of nuclear power plants will be added to increase that portion of the nation's electrical supply provided by non-carbon fuels and thereby address environmental and climate change concerns.

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[65] Easterling and Kunreuther, op. cit., p.168. "For a resident to endorse a proposed facility, he or she must believe three things: (1) the problem being addressed by the facility is authentic; (2) the problem belongs to society, not to the person or organization that is attempting to develop the facility; and (3) the facility represents the best approach to the problem."

[66] NRDC, op. cit.

[67] MRS Review Commission, op. cit., pp. 101-102.

Although the UNF from the currently operating and planned nuclear power plants can be safely stored on-site, centralized interim storage has been viewed by many as an attractive alternative to the development and/or continued expansion of on-site storage facilities at nuclear power plants for decades. The attractiveness of centralized interim storage is in large part derived from the concern that the nuclear power plants (and associated on-site dry storage facilities) tend to be located near the growing population centers they serve, as well as, in close proximity to major water bodies and water supplies that the public uses. The proposed UFMFs can offer all the benefits of centralized interim storage, plus the added benefits of being the receiving stations to begin the waste disposal process while awaiting a final disposition path, or even multiple paths.

Initially, the regional UFMFs will address a commonly-held view that a centralized storage facility should be developed for the UNF currently stored at permanently shutdown reactor sites. Shortly thereafter, the UFMFs will provide storage for those nuclear utilities that cannot, or decide they do not want to, develop a new on-site dry storage facility or expand an existing one. In addition, there may be some nuclear utilities that want to remove UNF currently dry stored at a facility on-site. Over time, the UFMFs will provide additional capabilities to prepare the UNF for direct disposal in a geologic repository (if the once-through fuel cycle policy is continued) or to recycle the UNF (if a closed fuel-cycle policy is adopted).

From day-one, the UFMFs provide an opportunity, as the first step in the disposition pathway, for the Federal government, through contracts with the UFMF LLC, to start meeting its long-standing obligations to the nuclear utilities to begin waste acceptance.

3.2.8 Need for Actions by Federal Agencies

The actions taken by the DOI on the PFS facility in Utah (and the Ward Valley facility in California) suggest that any siting initiative should take into consideration whether potential sites require approval (other than a license from the NRC) by federal agencies whose actions might be impacted by political considerations.

Our Proposed Approach. The volunteerism approach presented in Section 6.2 attempts to place the responsibility for site selection, design, licensing, construction, operation, monitoring, and closure of the UFMFs as much as possible jointly in the hands of the commercial entity and the local communities, acting in conjunction with their surrounding region and the host states. This is a conscious effort to minimize the need for approvals by other parties, including agencies of the Federal government other than the NRC, that do not have a direct role in, and/or are not significantly impacted by, the development and operation of regional UFMFs. It is also a conscious effort to adhere to the directive from the Administration that decisions should be based on sound science, not political considerations.

3.2.9 Summary

In summary, these examples suggest that for regional UFMFs (either federal or private-sector facilities) located on non-tribal land, acceptance is needed at the local, regional, state, and federal levels to ensure success, and that to achieve success at all these levels, communication is needed

with the public, local government, state government, and Congressional delegation starting at the initiation of planning for the siting process. Acceptance at only the local level or at just two of the levels has repeatedly been shown to not be workable. The volunteerism approach in Section 6.2 will provide grants to fund the planning and informational exchanges needed to facilitate the first step, the expressions of interest, and the next step, the discussions leading, hopefully, to signed binding agreements between the commercial entity, the local communities, and the host states.

The examples also suggest that the initial stage of the siting process should include an opportunity for the local community to perform an open, inclusive, independent assessment of the need for, safety of, and potential risks and benefits from the envisioned UFMF. The grants in this phase will fund the local community, in conjunction with the surrounding region and the State, to perform this assessment of both the UFMFs and the transportation of UNF to the UFMFs.

In addition, the examples identify a wide variety of potential benefits that can be considered for the local community, including such items as direct payments, safe, environmentally protective employment commitments, job training, expansion of local school curriculum, college scholarships, emergency medical response capability, expansion or establishment of local health services or facilities, improvement of the local transportation system, community re-investment opportunities, and co-location of associated businesses. The volunteerism approach in Section 6.2 recognizes the need to negotiate a benefits program for not only the local community, but also, for the surrounding region and the state. To this end, Section 6.2 identifies a wide variety of potential benefits that can be considered at the regional and state levels, including such items as direct payments, expanded statewide employment opportunities, guaranteed training and contractor preferences to a percentage of state-wide workers and businesses, expanded K-12 math and science education programs, development of regional campuses for state universities or community colleges, siting or expansion of regional hospital or health facilities, improvement of the regional transportation system, and re-location of associated businesses to within the surrounding region or the State. The grants in this phase will fund negotiations of benefits programs that will become part of the signed binding agreements.

Further, the examples suggest that a private-sector approach, rather than an approach that needs approval of the Congress, may provide more flexibility in negotiating both the benefits programs and the binding agreements for the regional UFMFs. The volunteerism approach includes the formation of a joint board between the commercial entity and the local community, in conjunction with the surrounding region and the State, to address the interests and concerns of each party, negotiate a benefits program, and hopefully reach a binding agreement. The volunteerism approach does not require, or expect, that the negotiated benefits programs and/or binding agreements will necessarily be the same for all of the regional UFMFs. Rather, the volunteerism approach is based on the desire to negotiate benefits programs and binding agreements that best satisfy the needs, interests, and concerns of the commercial entity, the local communities, their surrounding regions, and the host states. In this manner, equity is achieved by the mutual agreement of the parties rather than by comparison of the dollar values.

The examples also suggest that the local community and State should insist that any negotiated agreement for interim storage of UNF (whether with the Federal government or with a commercial entity) be court-enforceable and should include both a binding schedule for receipt, storage, and removal (whether for direct disposal or for recycling) of the UNF and a guarantee of payment of substantial penalties for failure to comply with that schedule. The volunteerism approach embraces those points as requirements; however, the volunteerism approach recognizes that, in exchange, the commercial entity needs a binding commitment from the local community and State of continuing, earned support throughout the siting, licensing, construction, operation, and closure of the UFMF.

Finally, the PFS example points out the need to separate the responsibility for waste acceptance from the responsibility of the Federal government to ultimately dispose of the UNF. For PFS, the title to the UNF remained with the nuclear utilities in part to ensure that the UNF could be returned to the nuclear utilities, and the on-site dry storage facility would not become de facto permanent. The regional UFMF initiative, however, recognizes the desire of the nuclear utilities to transfer the ownership and title (and future obligation) for the UNF to another entity. In the envisioned national IUFM strategy, the ownership of the UNF can be transferred to the UFMF (while the responsibility for disposal by the Federal government remains unchanged) irrespective of whether the approach (direct disposal, re-use, or parallel paths) selected for final disposition.

NRC regulations and the disposal contracts between the nuclear utilities and the Federal government provide that the ownership and title of the UNF may be transferred to either the Federal government or the UFMF LLC. The transfer to either entity would occur when the UNF is accepted from the nuclear utility for transport to the UFMF. In addition, the Federal government may, at some subsequent time, take ownership and title to any UNF initially accepted by the UFMF LLC. As a result, the regional UFMF initiative allows several options by which the Federal government, through contracts with the UFMF LLC, can start to meet its waste acceptance obligations to the nuclear utilities irrespective of a final decision, or the ability, to direct dispose or recycle the UNF.

3.3 Incorporating Lessons Learned Going Forward

Going forward, it is clear from the above lessons learned that for the development and implementation of a national IUFM strategy that includes regional UFMFs to be successful, the strategy should incorporate the following principles, as illustrated in Figure 3-4:

- It must be based on a strong functional partnership between the Federal government, private industry, the volunteer host State, and the local communities surrounding the region that is codified by enforceable binding agreements. Such a business model concept is described further in Section 6.1.
- To secure a volunteer site for the first regional UFMF will require that the Federal government to embark on a comprehensive national IUFM strategy that demonstrates a tangible long-term commitment to the simultaneous development of both regional UFMFs and a final UNF disposition policy. Each effort must be tied to measurable benchmarks of

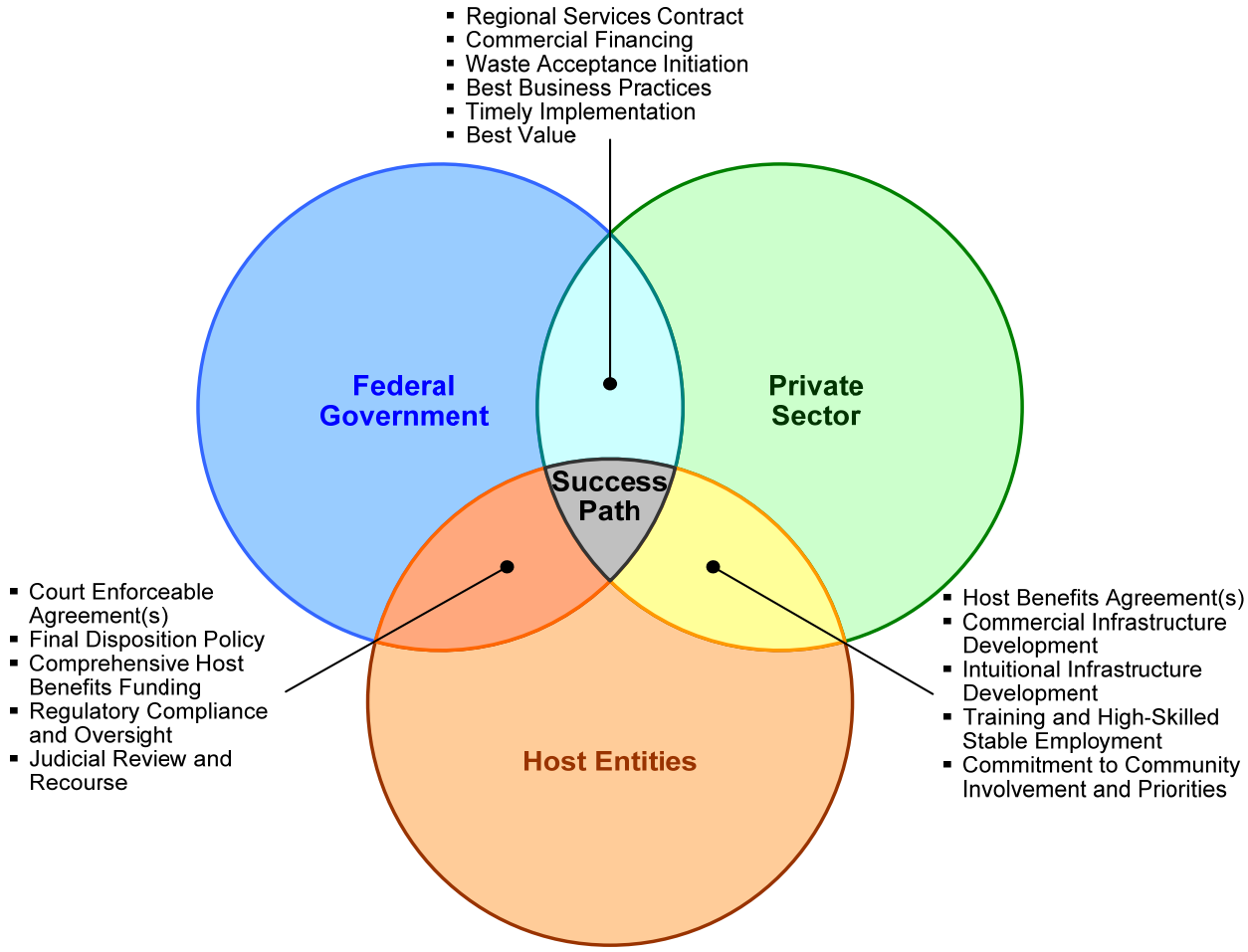

Figure 3-4 – Regional UFMF Initiative Partnership

The lessons learned from previous initiatives indicate that successful development and implementation of regional UFMFs will require strong functional partnerships.

progress that are not subject to political manipulation. Siting of the regional UFMFs is discussed further in Sections 5.1 and 6.2.

- From the PFS initiative and the other lessons learned discussed above, it is evident that the national IUFM strategy should be based on the recognition that private industry is better able to deliver regional UFMFs while the Federal government focuses on the concurrent development of a final UNF disposition policy. These roles and responsibilities are discussed further in Section 6.1.

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4 Legislative, Legal and Regulatory Landscape for Regional, Commercial UFMFs

As Section 3 indicates, the decades of unsuccessful attempts by the Federal government to implement an interim storage facility for commercial UNF are replete with challenges, not the least of which is the tenuous legislative, legal and regulatory landscape that encumbers such an initiative. While this landscape appears to present a significant barrier to the development and implementation of a federal UFMF, (short of new federal legislation), there appears to be a viable path through the existing legislative, legal and regulatory landscape for a commercial UFMF that is owned and operated by private industry, (such as a UFMF, LLC), to be successful, as described in this section.

At present, the NWPA (the Act) provides the DOE exercisable authority to accept UNF from nuclear utilities for interim storage at an MRS (as the first step in disposition of the UNF) and for disposal in the geologic repository at Yucca Mountain, as described in Section 4.1[68]. Although the Act is unclear whether DOE has exercisable authority to accept UNF from the nuclear utilities for interim storage at a commercial UFMF, it is believed that DOE has that exercisable authority but has lacked a facility to which it can move the UNF after waste acceptance.

Development and implementation of a federal UFMF would likely require DOE to deviate from this prescriptive legislative framework. Thus, such a federal action would likely require new legislation. That legislation would need to authorize a federal UFMF, provide a funding mechanism for the federal UFMF, and address any contractual issues that may arise from the existing disposal contracts with the nuclear utilities. In addition, unless specifically pre-empted in such new legislation, the decision to develop a federal UFMF may be considered a major federal action that would require the DOE to prepare new National Environmental Policy Act (NEPA) documentation, including possibly a new Environmental Impact Statement (EIS)[69]. These legislative and regulatory barriers to a federally-led action all appear to reinforce the strategy for a regional, commercial UFMF initiative that is led by the private sector.

Development of regional, commercial UFMFs that are owned and operated by private industry, using a volunteer siting approach, has very clear legislative, regulatory, and legal advantages when compared with continued attempts by DOE to develop a federal interim storage facility for commercial UNF, as shown in Figure 4-1. Importantly, the development of regional, commercial UFMFs in proximity to nuclear reactor sites will meet the objectives of regional balance and geographical equity that were originally embodied in the Act, as described in Section 6.2. No single local community, surrounding region, or State will accept all of the risks, or receive all of the benefits, for providing storage facility for the management of UNF.

[68] Nuclear Waste Policy Act of 1982. 42 U.S.C. 10101 et seq.

[69] National Environmental Policy Act of 1969. 42 U.S.C. 4321 et seq.

The licensing of the PFS facility in Utah, described in Section 3.1.8, demonstrates that no new federal legislation is needed for regional, commercial UFMFs. Also, the regulatory framework already exists, with the packaging and transportation of UNF from nuclear utility sites to the regional, commercial UFMFs regulated under 10 CFR Part 71[70]. Similarly, the licensing of the regional, commercial UFMFs, including approval of storage casks and an environmental review process that fully complies with NEPA, is regulated under 10 CFR Part 72[71]. In fact, the NRC has recently licensed such a facility (the PFS facility in Utah), under this regulatory framework.

The development and implementation of regional, commercial UFMFs does not constitute a federal action, although the regional commercial UFMFs can facilitate the development and implementation of a national IUFM strategy by the Federal government. As such, there is no need for DOE to prepare new NEPA documentation as would be needed to alleviate this regulatory barrier for any federal UFMF.

In addition, the development of regional, commercial UFMFs would have no direct impact on the contractual issues and on-going litigation between the Federal government and the nuclear utilities arising from their disposal contracts. However, the commercial UFMFs provide a means by which the DOE, under contract with a commercial entity (the UFMF, LLC), can initiate waste acceptance and thereby begin to meet its obligations under the disposal contracts with the nuclear utilities. For example, the base facility for regional, commercial UFMFs envisioned in Section 6 provides DOE with the capability to exercise its authority under the Act and the disposal contracts to accord priority for waste acceptance to the UNF from orphaned shutdown nuclear reactors.

It is important to note, however, that unlike a federal UFMF, the commercial UFMFs are not bound by the federal acceptance priority ranking established by the 10 CFR Part 961 disposal contracts with the nuclear utilities. Therefore, the commercial UFMFs can contract with any nuclear utility, irrespective of its position in the federal acceptance priority ranking, to satisfy the interests of that nuclear utility, including taking title to the UNF.

These advantages can reasonably be expected to translate into significant cost and schedule advantages for development and implementation of regional, commercial UFMFs that can serve, similar to an MRS, as the first step in the disposition of UNF without requiring, or precluding, either direct disposal of the UNF in a geologic repository (if the nation continues with the current policy of a once-through fuel cycle) or potential re-use of that UNF (if next-generation advanced fuel-cycle technologies are developed).

The current fleet of 104 operating nuclear power plants generates approximately 2,000 metric tons (MTUs) of UNF each year, as described in Appendix B.1. The nuclear power plants are

[70] Title 10 CFR (Code of Federal Regulations) Part 71. Energy: *Packaging and Transportation of Radioactive Material.*

[71] Title 10 CFR (Code of Federal Regulations) Part 72. Energy: *Licensing Requirements for the Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste, and Reactor-Related Greater Than Class C Waste.*

very nearly at the managed capacity of their spent fuel pools. With the continued delay in waste acceptance by the Federal government, the nuclear utilities will expand the capacity of their existing on-site dry storage facilities, develop new ones, or look for a third party, such as the UFMF, LLC, to provide the storage capacity necessary to facilitate continued plant operations.

4.1 Current Legislative, Legal, and Regulatory Framework for Federal vs. Commercial Regional UFMFs

Legislative Framework. The Atomic Energy Act (AEA) gave the Atomic Energy Commission (AEC) and its successor agencies, including the DOE, limited authority to accept and store UNF as needed for the agency to further any of its purposes, including international cooperation and nuclear non-proliferation, support of research and development in nuclear power, management of U.S. nuclear defense programs, and abatement of a public health risk in an emergency[72]. With passage of the Act in 1982, DOE's authority under the AEA to accept commercial UNF was further limited to instances of certain circumstances determined to be exceptions authorized in the AEA.

DOE has exercised that limited authority to accept (1) small amounts of commercial UNF for research and development purposes (e.g., fuel debris from the damaged reactor at Three Mile Island Unit 2 and other commercial UNF currently stored in an NRC-licensed on-site dry storage facility at Idaho National Laboratory) and (2) commercial UNF from contracts with nuclear utilities that pre-date the NWPA of 1982 (e.g., Fort St. Vrain UNF currently stored in an NRC-licensed on-site dry storage facility in Colorado).

The Act, as amended in 1987, permits DOE to accept commercial UNF for interim storage in only two instances – Section 135 (Title I, Subtitle B, Interim Storage Program), and Section 141 (Title I, Subtitle C, Monitored Retrievable Storage)[73]. The federal Interim Storage (FIS) provisions in Subtitle B expired on January 1, 1990, and, the construction and operation of the Monitored Retrievable Storage (MRS) facility is firmly linked to progress in the development of a geologic repository at Yucca Mountain, Nevada (Section 148(d), Licensing conditions). These licensing conditions are codified in 10 CFR Part 72.44(g).

In a recent report, entitled "Report to Congress on the Demonstration of the Interim Storage of Spent Nuclear Fuel from Decommissioned Nuclear Power Reactor Sites," DOE posited that new legislation would be required to permit DOE to accept, on an expedited basis, commercial UNF from decommissioned nuclear power reactors for interim storage[74].

[72] Atomic Energy Act of 1954. 42 U.S.C. 2011 et seq.

[73] Nuclear Waste Policy Act of 1987. 42 U.S.C. 10101 et seq.

[74] U.S. Department of Energy, Report to Congress on the Demonstration of the Interim Storage of Spent Nuclear Fuel from Decommissioned Nuclear Power Reactor Sites, DOE/RW-0596, December 2008.

In sharp contrast to a federal UFMF, the licensing of the PFS facility in Utah demonstrates that no new federal legislation is needed for development and operation of regional, commercial UFMFs that are owned and operated by private industry. It is desirable, however, that Congress provide language in the Congressional appropriations process supporting such a commercial initiative, similar to an MRS, as the first step in an IUFM strategy for the disposition, including re-use or direct disposal, of commercial UNF. That language should also provide recognition that acceptance of UNF by the Federal government from the permanently shutdown reactors, under its authority in 10 CFR Part 961, Article VI, Section B.1.(b)), is the first step in performing "waste disposal activities" specified under Section 303(d) of the Act[75]. Thus from a legislative perspective, a commercial vs. federal UFMF has clear advantages, as shown in Figure 4-1.

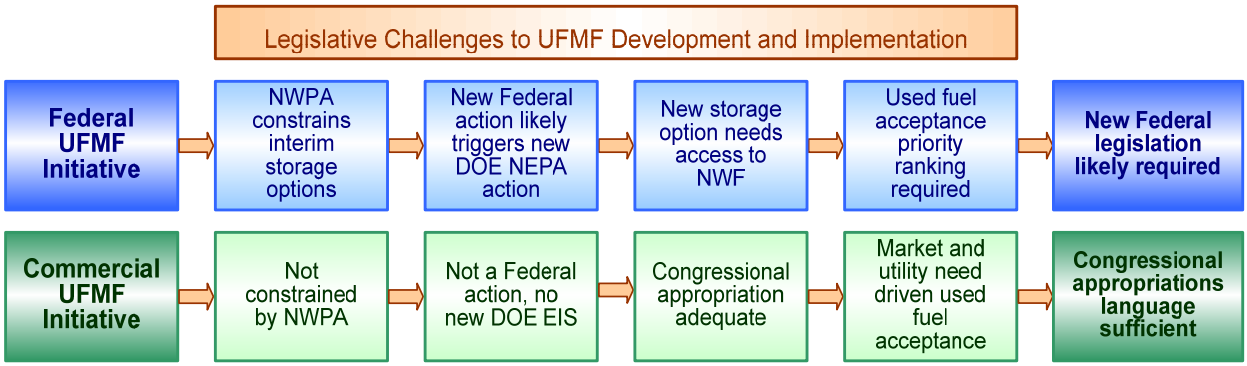

Figure 4-1 – Comparison of Federal vs. Commercial Legislative Challenges

Legal Framework. As authorized in Title III, Section 302(a) of the Act, DOE established a Standard Contract for Disposal of Spent Nuclear Fuel and High-Level Radioactive Wastes (10 CFR Part 961) in 1983 that defines the terms and conditions under which the Federal government will accept commercial UNF for disposal in a geologic repository[75]. Based on the Standard Contract, DOE entered into disposal contracts with the individual nuclear utilities. The Act effectively made entry into such contracts mandatory for the nuclear utilities by prohibiting the NRC from issuing licenses to any operator under 10 CFR Part 50 who has not entered into a contract with DOE or who is not actively and in good faith negotiating with the DOE for a contract (Section 302(b)(1)(A)[76].

The individual disposal contracts with the nuclear utilities stipulate that DOE shall:

1. Take title to the commercial used nuclear following commencement of operation of a repository,

[75] 10 CFR (Code of Federal Regulations) Part 961. Energy: *Standard Contract for Disposal of Spent Nuclear Fuel and/or high-Level Radioactive Waste*

[76] 10 CFR (Code of Federal Regulations) Part 50. Energy: *Domestic Licensing of Production and Utilization Facilities*

2. Begin, in return for payment of fees, to dispose of the UNF not later than January 31, 1998,
3. Require that standard fuel have a out-of-reactor minimum cooling time of five years before waste acceptance, and
4. Base the federal acceptance priority ranking on the principle of "oldest fuel first".

DOE was not able to begin accepting commercial UNF for disposal by January 31, 1998, and as a result, 71 lawsuits have been filed against the Federal government. Federal circuit courts found DOE to be in partial breach of contract and found that the utilities are entitled to recover damages from the Federal government for that partial breach[7778]. There has been no consolidation of the lawsuits – each is being handled separately in different federal circuit courts (and federal appellate courts) and, as a result, the judgments against the Federal government (and claims by the nuclear utilities) can differ. The Federal government has spent over $150 million to-date defending against the lawsuits from the nuclear utilities[79].

On August 10, 2004, the U.S. Department of Justice (DOJ) and Exelon reached an agreement under which the Federal government would reimburse Exelon for costs associated with storage of UNF from Exelon's nuclear power plants. The settlement reportedly paid $80 million immediately for costs already incurred and provided that further amounts will be paid each year until DOE takes title to Exelon's UNF. That settlement has served as a model for settlements with other nuclear utilities; however, each settlement is handled separately and the terms in the agreements can differ. The Federal government continues to be supportive of reaching settlements with the nuclear utilities.

As of May 2009, the status of the 71 lawsuits was as follows[80]:

- 10 lawsuits, representing 36% of the nuclear industry, have been settled ($586 million has been paid to-date and additional claims will be submitted annually to allow for recovery of continuing utility costs due to DOE's delay)
  - Exelon (4 cases): $297 million has been paid through June 30, 2008
  - South Carolina Gas & Electric: $9 million has been paid through 2008
  - Omaha Public Power District: $21 million has been paid through 2007 (and $1.1 million is under review)

[77] *Northern States Power Co. v. U.S.*, 224 F.3d 1361 (Fed. Cir. 2000)

[78] *Maine Yankee Atomic Power Company v. United States*, 225 F.3d 1336 (Fed. Cir. 2000)

[79] Hertz, Michael. Department of Justice, Civil Division, Statement concerning "Budgeting for nuclear waste Management" before the Committee on the Budget, U.S. House of Representatives, July 16, 2009

[80] Cawley, Kim, Congressional Budget Office, Testimony on the Federal Government's Responsibilities and Liabilities under the Nuclear Waste Policy Act before the Committee on the Budget, U.S. House of Representatives, July 16, 2009

- Duke Energy: $69 million has been paid through July 31, 2007 (and $5.4 million has been recommended for payment)
- Florida Power & Light (FPL) (3 cases): $124 million has been paid through 2007 (and $35 million is currently under review)
- TVA has not signed a settlement agreement but a claim for $10 million covering October 2004 through September 2005 has been paid and claims for $3.7 million (through September 2006) and $9.8 million (through September 2007) are under review

- 6 lawsuits have been dismissed (5 voluntarily and 1 with prejudice)
- 4 lawsuits have been tried in federal circuit court and the judgments have been affirmed ($35 million has been paid to-date)
- 51 cases remain pending, including:
  - 13 cases that resulted in judgments (with a combined total of $565 million in damages) and are currently subject to post-trial motions, appeals, or remands
  - 5 cases that resulted in judgments and, subsequently, claims have been filed by utilities to recover damages.
  - 7 cases where the trial is completed and parties are awaiting judgments
  - 25 cases where lawsuits have not yet been tried

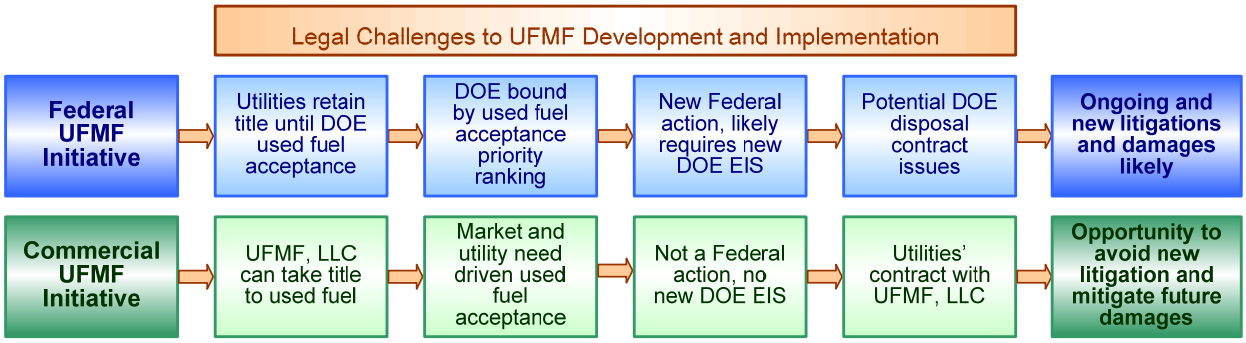

Figure 4-2 – Comparison of Federal vs. Commercial Legal Challenges

The development and implementation of regional, commercial UFMFs for commercial UNF will likely not eliminate the legacy partial breach of contract by the Federal government, and, the utility on-site storage costs, including the legacy costs associated with loading the storage casks, purchasing the storage casks, and storing the UNF will continue to be recoverable as damages under the lawsuits. However, it is plausible that DOE and/or the nuclear utilities could contract with the LLC to accept already canistered used fuel from the orphaned shutdown reactor sites and bare fuel assemblies from the operating nuclear power plants and, as a result, mitigate the incremental damages going forward by an amount equal to the avoided cost of on-site dry

storage of this used fuel that would otherwise continue if no action is taken. Thus from a legal perspective, a commercial vs. federal UFMF has clear advantages, as shown in Figure 4-2.

Regulatory Framework. Pursuant to Section 202 of the Energy Reorganization Act of 1972, any federal interim storage facility for commercial UNF must be licensed by the NRC under 10 CFR Part 72, Licensing Requirements for the Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste, and Reactor-Related Greater Than Class C Waste[81]. Any commercial interim storage facility, including the UFMFs, must also be licensed by the NRC under 10 CFR Part 72. The NRC does not allow agreement states to license storage of UNF (10 CFR Part 72.8), and, the NRC has retained this authority.

In 1980, DOE completed the Final Environmental Impact Statement (FEIS) on Management of Commercially-Generated Radioactive Waste[82]. The FEIS considered interim storage of commercial UNF for an indefinite period of time as the No-Action Alternative. The action proposed in the FEIS was to adopt a national strategy to develop conventionally-mined geologic repositories for the disposal of commercially-generated HLW.

With respect to the No-Action Alternative, DOE stated that:

> "The no-action alternative would leave spent fuel or reprocessing wastes at the sites generating the waste or possibly at other surface or near-surface storage facilities for an indefinite time. In this alternative, existing storage is known to be temporary and no consideration has been given to the need for additional temporary storage when facilities in use have exceeded their design lifetime. There seems to be no question but that at some point in time wastes will require disposal and that considerable time and effort will be required to settle upon an adequate means of disposal. It seems clear that development of acceptable means of disposal of wastes is sufficiently complex and of sufficiently broad national importance that coordination of research and development, construction, operation, and regulation at the federal level is required and that the no-action alternative is unacceptable. Indeed, adoption of a no-action alternative by the Department of Energy could be construed as not permissible under the responsibility mandated to the Department by law."

The current Administration has indicated its intent to evaluate the policy options for the management of commercial UNF. The Blue-Ribbon Panel tasked to identify direction will consider a wide range of alternative approaches, including but not limited to the preferred action (development of a geologic repository for disposal of commercial UNF) and the no-action alternative (at-reactor storage for an indefinite time) in the FEIS. Given the age of the FEIS (nearly 30 years old) and the possibility that the new direction may not be supported by the FEIS or Record of Decision, it is reasonable to anticipate that the DOE will need to prepare new

[81] Energy Reorganization Act of 1972.

[82] U.S. Department of Energy, Final Environmental Impact Statement (FEIS) on Management of Commercially-Generated Radioactive Wastes, DOE/FEIS-0046F, October 1980.

NEPA documentation (including possibly a new EIS) to implement any new federally-led direction for used fuel management.

In 1984, in response to the concerns raised by the U.S. Court of Appeals for the District of Columbia Circuit, the NRC completed a generic determination on the environmental impacts of storage of UNF at, or away from, reactor sites after expiration of reactor operating licenses[83]. This generic rulemaking proceeding, known as the Waste Confidence Proceeding, concluded that UNF can be stored safely and without significant environmental impacts past the expiration of any reactor's operating license until such time as off-site disposal or storage is available.

In 1990, the NRC re-assessed its degree of confidence in the findings from the Waste Confidence Proceeding[84]. This new proceeding reviewed the findings that the NRC had made in 1984. Two of the Waste Confidence findings form the current bases for the NRC's generic determination of no significant environmental impact from temporary storage of UNF after cessation of reactor operation in 10 CFR Part 51.23(a)[85]. Those two findings are:

1. The Commission finds reasonable assurance that, if necessary, UNF generated in any reactor can be stored safely and without significant environmental impact s for at least 30 years beyond the licensed life for operation (which may include the term of a revised or renewed license) of that reactor at its UNF storage basin, or at either on-site or off-site dry storage facilities, and,
2. The Commission finds reasonable assurance that safe independent on-site UNF storage of off-site UNF storage will be made available if such storage capacity is needed.

In 1999, the NRC again reviewed its Waste Confidence findings and concluded that experience and developments after 1990 had confirmed the earlier findings and, therefore, made a comprehensive re-evaluation of the findings unnecessary[86].

In 2008, the NRC proposed to update and revise its generic determination of the environmental impacts of interim storage of UNF at, or away from, reactor sites after expiration of reactor operating licenses[87]. The NRC concluded that the update has strengthened its confidence in the safety and security of UNF storage, both in water pools and in on-site dry storage facilities, and stated that:

> "In sum, the characteristics of spent fuel storage facilities, the studies of the safety and security of spent fuel storage, NRC's extensive experience in regulating spent fuel storage

[83] *State of Minnesota v. NRC*, 602 F.2d 412 (1979)

[84] *Federal Register*. (55 FR 38474; September 18.1990)

[85] 10 CFR (Code of Federal Regulations) Part 51. Energy: Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions.

[86] *Federal Register*. (64 FR 68005; December 6, 1999)

[87] *Federal Register*. (73 FR 59547; October 9, 2008)

and ISFSIs and in certifying dry cask storage systems, and NRC's actions in approving 40-year license renewals for two ISFSIs (meaning that the safety of dry storage after licensed operation at these ISFSIs has been approved for at least a 60-year period) confirm the Commission's confidence that spent fuel storage is safe and secure over long periods of time."

Also, the NRC proposed in a Waste Confidence Decision Update that, if necessary, UNF generated in any reactor can be stored safely and without significant environmental impacts beyond the licensed life for operation (which may include the term of a revised or renewed license) of that reactor at its used fuel storage basin or at either an on-site or off-site dry storage facilities (for as long as 100 years) until a disposal facility can reasonably be expected to be available[88].

Many comments, including the Natural Resources Defense Council (NRDC), challenged the NRC on the need for the NRC to prepare new NEPA documentation to support its proposed changes to the Waste Confidence findings[89]. The NRDC argued that the revised generic determination of environmental impacts in the Waste Confidence Decision Update acts, in essence, as a finding of no significant impact (FONSI) for storage of UNF for as long as 100 years. The NRDC asserted that the proposed changes fail to comply with the procedural requirements of NEPA, stating that although the NRC considers the environmental impacts of storage for as long as 100 years to be so insignificant as to not warrant preparation of an EIS, the NRC must (1) show that it has taken a "hard look" at the environmental impacts posed by UNF storage for as long as 100 years, and (2) comply with the procedural requirements for an environmental assessment under 10 CFR Part 51.30.

The NRC has considered the comments received on the two October 9, 2008 Federal Register Notices, and on June 25, 2009, the NRC published both its final rule amending 10 CFR Part 51.23(a) and its update and revision to the Waste Confidence findings[90]. With respect to the Waste Confidence findings, the NRC revised Findings 2 and 4 as follows:

Finding 2: The Commission finds reasonable assurance that mined geologic repository capacity will be available within 50-60 years beyond the licensed life for operation (which may include the term of a revised or renewed license) of any reactor to dispose of the commercial HLW and spent fuel originating in such reactor and generated up to that time.

Finding 4: The Commission finds reasonable assurance that, if necessary, spent fuel generated in any reactor can be stored safely and without significant environmental impacts for at least 60 years beyond the licensed life for operation (which may include the term of a

[88] *Federal Register*. (73 FR 59551; October 9, 2008)

[89] Pettus, Geoffrey H., Natural Resources Defense Council, letter to Annette L. Vietti-Cook, U. S. Nuclear Regulatory Commission, "Natural Resources Defense Council Comments on the Proposed Waste Confidence Rule and the Proposed Temporary Storage Rule (Docket IDs 2008-0482, 2008-0404)", February 6, 2009.

[90] U.S. Nuclear Regulatory Commission, Final Update of the Commission's Waste Confidence Decision, SECY-09-0090, June 15, 2009.

revised or renewed license) of that reactor in a combination of storage in its spent fuel storage basin and either on-site or offsite independent spent fuel storage installations.

As indicated in Section 6.3, 10 CFR Part 72 provides that the specific license for an independent spent fuel storage installation (ISFSI) (and for UFMFs) will have a license term not to exceed 20 years. The revision to Waste Confidence Finding 4 provides the regulatory basis for an extension or renewal of the license of an existing dry storage facility and a longer license term for a new dry storage facility or UFMF. Should an existing dry storage facility not receive an extension or renewal of its license, that nuclear utility would need to look at alternatives, including the UFMFs, for continued storage of their UNF.

In sum, continued attempts by the DOE to develop federal UFMFs for commercial UNF will most likely be fraught with significant barriers which, even if ultimately successful, will take decades to overcome. Among these barriers is the need for new legislation authorizing DOE to develop an interim storage facility, addressing any contractual issues that may arise from the disposal contracts with the nuclear utilities, and providing a funding mechanism for any federal interim storage program. Also, any decision to pursue a new federally-led direction for the management of commercial UNF will likely require DOE to prepare new NEPA documentation, including possibly a new EIS.

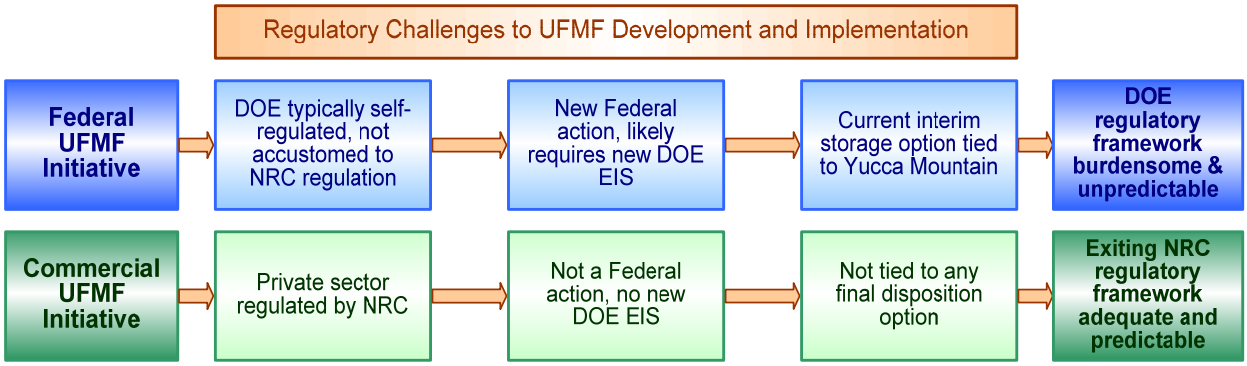

Figure 4-3 – Comparison of Federal vs. Commercial Regulatory Challenges

In contrast, no federal legislation is needed for regional, commercial UFMFs. The NRC has recently expressed confidence in UNF storage for as long as 100 years, and, the regulatory framework for regional, commercial UFMFs is currently in place and has been used in the successful licensing of the PFS facility in Utah, as described in Section 3.1.8. Since the regional, commercial UFMFs would not be federal facilities, there would be no need for DOE to prepare any NEPA documentation. Rather, 10 CFR Part 72.34 requires that the license application (LA) for any commercial UFMF must be accompanied by an Environmental Report that meets the requirements of 10 CFR Part 51, Subpart A. The NRC is required to prepare appropriate NEPA documentation to support their licensing action. Thus from a regulatory perspective, a commercial vs. federal UFMF has clear advantages, as shown in Figure 4-3.

4.2 Commercial UFMF Implementation Strategy under Current Legislative, Legal and Regulatory Framework

Commercial UFMF Framework. Building on the lessons learned from previous initiatives, the time appears to be right for the private sector to begin solving the used fuel management issue by developing, through a volunteerism approach, regionally-located commercial UFMFs as the first step in a national IUFM strategy for the disposition of UNF and reactor-related GTCC waste, as described in Section 1.

The regulatory framework currently exists for packaging and transportation of UNF from utility reactor and storage sites to regional, commercial UFMFs (10 CFR Part 71) and for the licensing of regional, commercial UFMFs, including approval of storage casks (10 CFR Part 72). As indicated in Section 3.1.8, the previous PFS initiative has already demonstrated the viability of this regulatory compliance approach.

The development of regional, commercial UFMFs will not be tied to the geologic repository at Yucca Mountain, as is the MRS, and neither requires, nor precludes, future options that may be proposed for direct disposal in geologic repositories or re-use of commercial UNF.

The regional, commercial UFMFs are not bound by the federal acceptance priority ranking established by the 10 CFR Part 961 standard disposal contracts. As a result, the UFMFs are more able to meet the interests of the individual nuclear utilities, including taking title to the UNF. By taking title to the UNF, the UFMF will assume all rights and responsibilities that the utilities have for the UNF under the 10 CFR Part 961 standard contracts and DOE remains responsible for the final disposition of the UNF. In addition, development of regional, commercial UFMFs will provide an opportunity for DOE, through contracts with the LLC, to start waste acceptance and thereby begin to meet its obligations under the disposal contracts with the nuclear utilities.

As such, the regional, commercial UFMFs are UNF management facilities that can meet the needs of both the nuclear utilities and the DOE. Both the nuclear utilities and the DOE will be able to contract with the regional, commercial UFMFs as the first step in the disposition path regardless of whether the nation decides to continue with direct disposal in geologic repositories (as part of the once-through fuel cycle) or, instead, decides to develop next-generation advanced fuel-cycle technologies for the re-use of the UNF (to close the fuel cycle).

Take-Title Framework. It is considered that nuclear utilities prefer to focus their attention and resources on the production and distribution of electrical energy rather than on UNF management. As such, it is preferable to transfer the license for, and ownership of (i.e., title to), their UNF to another entity. That entity has primarily been viewed to-date as the Federal government because the Federal government has the statutory obligation under the Act for waste acceptance and eventual geologic disposal.

For federal interim storage, the Act explicitly authorized the DOE to enter into contracts with nuclear utilities under which the Federal government would take title to commercial UNF when

accepted for the Interim Storage Program (Title I, Subtitle B) 136(a)). Although not explicitly authorized in the Act, DOE also would take title to the UNF when accepted for monitored retrievable storage (Title I, Subtitle C). As in the case of the MRS, it is believed that DOE has the authority to accept commercial UNF from the nuclear utilities for management at the UFMFs but has lacked such a facility to which it can move the UNF after waste acceptance.

In the regional, commercial UFMF initiative, there are three waste acceptance scenarios, as shown in Figure 4-4. In Scenario 1, DOE would contract with the LLC for managing commercial UNF at the regional, commercial UFMFs. DOE would accept already canistered UNF from permanently shutdown nuclear reactor sites, already-canistered UNF from utility on-site dry storage facilities, and bare UNF assemblies from the UNF pools at operating nuclear power plants. DOE would take title to the commercial UNF at the time of waste acceptance. Although DOE would hold the title to the UNF, the commercial entity (the UFMF, LLC) would be licensed to provide management and other UNF disposition functions.

The nuclear utilities, however, could opt to contract directly with the LLC to provide UNF management services, especially since the commercial UFMFs are not bound by the federal acceptance priority ranking established by the DOE disposal contracts. Some nuclear utilities may prefer contracts with the LLC that transfer the license but retain the title to the UNF (Scenario 2). Other nuclear utilities, however, may prefer contracts with the LLC that transfer both the license and the title to the UNF (Scenario 3). Although it is unclear when DOE would take title to the UNF accepted by the LLC under Scenarios 2 and 3, DOE would not need to take title until such time as it accepts the UNF that resides at the UFMFs for final disposition.

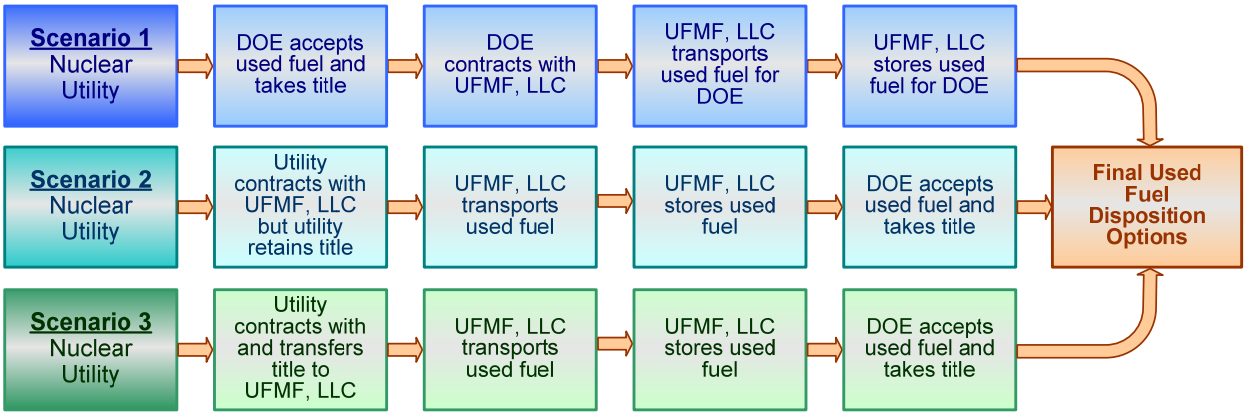

Figure 4-4 – Commercial UFMF Contracting Scenarios

The commercial UFMF has multiple contracting scenarios to suit the Federal government's and the utility customer's needs.

The regional, commercial UFMF initiative described in this report has the flexibility to accommodate all three of these waste acceptance scenarios.

To demonstrate this flexibility, the NRC will allow, pursuant to 10 CFR Part 50.80, the transfer of a license for commercial UNF, **with or without a transfer of title to the UNF**, from a reactor operator to an entity owning and operating a commercial UFMF (emphasis added). For example, the NRC indicated February 2, 2009, that it would approve the transfer of the license for the UNF at the permanently shutdown Zion Nuclear Power Station, Units 1 and 2, from Exelon to Zion*Solutions* as part of the decommissioning, and then at the completion of the decommissioning, the transfer of the license for the UNF back from Zion*Solutions* to Exelon[91].

Also, the Standard Contract, developed pursuant to Section 302 of the Act, allows for a third-party (e.g., a private sector entity owning and operating a regional, commercial UFMF) to take title to the UNF for purposes of management of the UNF. The disposal contract provides that the rights and duties of the owners and/or generators in the contract may be assignable with the transfer of the title to the UNF to a new owner, provided that notice of any such transfer of title to a new owner shall be made to DOE within ninety (90) days of transfer (10 CFR Part 961, Article XIV; see also Section 302(b)(3) of the Act). Section 302(a) of the Act also stipulates that in paying the one mill per kilowatt hour fee for services to be provided by the DOE, the person delivering UNF to the Federal government shall have no further financial obligation to the Federal government for the **long-term storage and permanent disposal** of such UNF (emphasis added).

In the case of the PFS facility in Utah, however, the eight nuclear utilities in the consortium retained the title to the UNF as a condition of the agreement reached with the Skull Valley Goshutes to host the facility on tribal land. This same approach could be used for regional, commercial UFMFs on a case-by-case basis, depending on the prevailing conditions and preferences of the local communities and host states.

UFMF, LLC Business Framework. As described in Section 6.0, regional, commercial UFMFs have tremendous potential market value because the UFMF, LLC has: 1) the ability to possess UNF under NRC license, 2) the option to take title to UNF from the nuclear utilities and, as its owner, enter into a disposal contract with the DOE, and 3) upon taking title to the UNF, the rights and duties of any nuclear utility for its UNF under that utility's existing disposal contract with the DOE. The events leading up to PFS indicate that the nuclear utilities' preference would be to transfer the license for, and ownership of (i.e., title to), the UNF to another entity.

Importantly, the LLC is not bound by the federal acceptance priority ranking, and as a result, the LLC can negotiate acceptance with any nuclear utility, regardless of its position in the federal acceptance priority ranking, to meet that utility's specific storage needs.

As described in Section 6, there are several different strategies that the LLC could employ in contracting with the nuclear utilities. For example, the LLC could opt to negotiate individual

[91] U.S. Nuclear Regulatory Commission, Transfer of the Licenses for the Permanently Shutdown Zion Nuclear Power Station, Units 1 and 2, From Exelon Generation Company, LLC to ZionSolutions, SECY-09-0019, February 2, 2009.

contracts with one or more nuclear utilities based on the specific needs of those utilities. Alternatively, the LLC could opt to form a consortium with one or more nuclear utilities somewhat similar to the approach taken by the eight-member consortium for the PFS facility in Utah.

In either case, the LLC would need to decide whether to take title to the UNF. If the LLC takes title to the UNF, then the LLC can either negotiate a new disposal contract with the DOE, or more likely, opt to be assigned the rights and duties of the individual nuclear utility's existing disposal contract with the DOE. If assigned those rights and duties, the LLC could revisit whether to continue with any on-going litigation or negotiate a settlement with the Federal government to mitigate future damages for the respective quantity of UNF.

In addition to entering into contracts directly with the nuclear utilities, the LLC could enter into contracts or a public/private partnership with the DOE. As a service provider to both the nuclear utilities and the DOE, the acceptance of UNF at the regional, commercial UFMFs would be the first step in a national IUFM strategy that both meets the needs of the nuclear utilities and allows the DOE to initiate waste acceptance and begin to meet its obligations under the disposal contracts with the nuclear utilities.

Significantly, the nuclear utility does not receive any payment for the UNF when it is accepted by the Federal government. In essence, under the Standard Contract (which is predicated on a once-through fuel cycle), the commercial UNF is treated as if it has no value. The LLC could adopt that same posture in acquiring (and taking title to) the UNF from the nuclear utilities, regardless of whether the future disposition of the UNF could include re-use instead of direct disposal in a geologic repository.

Based on the judgments from litigation or the terms of settlements reached with the Federal government, the nuclear utilities are reimbursed their storage costs, once reviewed and approved, by the Federal government. The reimbursable storage costs vary from lawsuit to lawsuit, and, they may (or may not) include (1) storage costs paid by the nuclear utilities to the regional, commercial UFMFs, (2) the costs for transporting the bare or canistered UNF assemblies from the reactor sites to the regional, commercial UFMFs, including the cost of the transportation casks, (3) the costs of unloading the bare UNF assemblies from the transportation casks and then loading the bare UNF assemblies into storage casks, and (4) the costs for purchase of storage casks, storage modules, and concrete storage overpacks.

As Section 6.1 indicates, there are a number of additional potential sources of revenue from the involved nuclear utilities for the regional, commercial UFMFs, such as:

1. Payments for costs that may not be reimbursable under the litigation or settlements between the involved nuclear utilities and the Federal government,
2. Payments in recognition of the avoided costs of developing a new on-site dry storage facility or expanding an existing, capacity-limited on-site dry storage facility,
3. Payments in recognition that the decommissioned sites will become releasable for other uses after removal of the UNF from the sites, and,

4. Payments for taking title to the UNF, thereby removing the involved nuclear utilities from all future obligations for the UNF.

In addition, there may also be additional sources of direct payments to regional, commercial UFMFs as well as to the local communities and host states, as described in Section 6.1. Examples of such potential sources of direct payments include payments from States in which the permanently shutdown reactors are located, such as:

1. Payments from the decontamination and decommissioning trust fund for the removal of the UNF and any reactor-related GTCC waste,
2. Payments in recognition of their avoided future costs of regulation and oversight of used nuclear storage sites after removal of stored UNF, and,
3. Payments in a similar manner that individual states were willing to pay another State to host and provide access to an interstate compact low-level radioactive waste disposal facility.

Also, there could be revenues from other industrial facilities co-located at the regional, commercial UFMFs, such as facilities for the manufacture of transportation and/or storage casks. Indeed, the regional, commercial UFMFs could, with appropriate approvals from the local communities and state governments, become the host sites for development of future advanced fuel-cycle technology facilities that would make re-use of the UNF achievable.

It is important to note that the involved nuclear utilities will need to transfer to the Federal government all fees, including accrued interest, collected by the utilities from ratepayers but not yet paid into the Act's NWF.

Although the federal courts have ruled that the Federal government must pay damages to the nuclear utilities for incurred storage costs, the length of time required to pursue the utility claims in federal trial court (and federal appeals court, if needed) has resulted in several attempts to fund interim UNF storage for shutdown nuclear power reactor sites from their respective decommissioning trusts.

For example, on February 24, 2005, the Public Utilities Commission of the State of California approved a request from Pacific Gas & Electric Company (PG&E) to disburse $35.9 million from its Humboldt Bay Power Plant Unit 3 Nuclear Decommissioning Master Trusts (the Trust) for a dry cask storage system in an on-site dry storage facility[92]. Although the Office of Ratepayer Advocates filed a timely protest objecting to the disbursement of funds from the Trust arguing that PG&E should attempt to recover funds from the Federal government to cover the cost of the on-site dry storage facility, the Public Utilities Commission denied the protest because (1) waiting for recovery of such costs from the Federal government before starting the

[92] Public Utilities Commission of the State of California, Energy Division. Resolution E-3912, "Pacific Gas and Electric Company requests authority to disburse $35.9 million from the Humboldt Bay Power Plant Unit 3 Nuclear Decommissioning Master Trusts for a dry cask storage system to enable 2009 decommissioning work", February 24, 2005.

project could delay the project potentially for many years, (2) the facility is a prerequisite for early decommissioning already approved by the Public Utilities Commission, and (3) the Public Utilities Commission had previously approved disbursement of $10.5 million for initial facility related activities under PG&E's 1999 General Rate Case (D. 00-04-026) and Resolution E-3737.

Also, on February 2, 2009, the NRC announced approval of the proposed transfer of the operating licenses and decommissioning trust fund for the permanently shutdown Zion Nuclear Power Station Units 1 and 2 from Excelon to Zion*Solutions*[91]. As part of that transfer, Zion*Solutions* will use the decommissioning trust fund to pay for development of an on-site dry storage facility as well as for off-site disposal of low-level radioactive wastes generated during the decommissioning.

In addition, although Entergy Nuclear Operations (Entergy) has indicated that it is seeking renewal of the operating license for the Vermont Yankee Nuclear Power Station, the current operating license expires in 2012. Pursuant to 10 CFR Part 50.54(bb), Entergy submitted its UNF management program for Vermont Yankee on March 21, 2007[93]. In that plan, Entergy proposed to use funds from the decommissioning trust fund to cover UNF management costs, including storage in the fuel pool, an existing on-site dry storage facility, and a new on-site dry storage facility. On July 16, 2008, the NRC denied preliminary approval of the UNF management program[94]. The NRC stated that 10 CFR Part 50.75 requires that licensees provide decommissioning funding assurance for decommissioning costs, and, such costs do not include UNF management costs under 10 CFR Part 50.54(bb). Also, the NRC stated that Entergy did not request an exemption, under 10 CFR Part 50.12, from the requirements of 10 CFR Part 50.82(a)(8)(i)(A) to use decommissioning trust funds for UNF management expenses. In addition, the NRC stated that Entergy did not propose to include a financial mechanism to provide reasonable assurance the UNF management withdrawals would not inhibit the ability of the licensee to complete decommissioning. Entergy submitted a revised UNF management plan to the NRC on October 14, 2008. The NRC has not yet responded to that submittal.

In sum, there is little likelihood that the Federal government will provide interim storage for UNF in the foreseeable future. As a result, there is a significant business opportunity for regional, commercial UFMFs, as described in Section 6.1.

[93] Sullivan, Ted A., Entergy Nuclear Operations, Inc., letter to Document Control Desk, U.S. Nuclear Regulatory Commission, Vermont Yankee Nuclear Power Station – Revised Spent Fuel Management Plan Pursuant to 10CFR50.54(bb), Report BVY 08-077, March 21, 2007.

[94] Kim, James, U.S. Nuclear Regulatory Commission, letter to Vice-President, Operations, Entergy Nuclear Operations, Inc. "Vermont Yankee Nuclear Power Station – Review of the Spent Fuel Management Plan (TAC NO. MD8035)", Docket No. 50-271, July 16, 2008.

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5 Overcoming Institutional Barriers for Regional UFMFs

5.1 UFMF Siting

5.1.1 Importance of Regional Approach

As described in Sections 3 and 4, past experience strongly suggests that having multiple UFMFs will greatly increase the ability to find and reach agreements with states and local communities that are willing to host such facilities. In the case of Yucca Mountain, as well as the PFS facility in Utah, the stigma associated with being "the" (one) place in the nation where the UNF is disposed of or stored was a significant barrier to acceptance, particularly on the State level. An additional example is South Carolina, which recently decided to close the Barnwell low-level waste site to out-of-compact States. One of the reasons given for this decision is that having their State being "the nation's dumping ground for low-level waste" would negatively impact the State's image, which in turn would affect tourism, and the willingness of businesses to locate there, etc.. This argument was given weight despite the fact that few people are even aware of the Barnwell disposal site's existence and that the facility generated significant annual revenue for the State by accepting such waste.

Having multiple sites will not eliminate the "stigma" effect, but it should greatly reduce it, since at least some other locations are storing waste as well (which reduces the perception of being singled out). Given this, at least two and perhaps as many as four regional UFMFs should be planned. One good example, illustrated in Figure 5-1, would be to have three sites, one in the Northeast, one in the Southeast, and one in the West, as described in Appendix B.1.

It is acknowledged that there would be a significant cost savings associated with having fewer (or even a single) UFMF. A significant portion of such savings could be used to provide significantly greater benefits to the host State, regional and local community. Whether such increased benefits would be sufficient to offset the opposition due to the "stigma effect" of potentially being the one-and-only site as discussed above is unclear, however, especially given past experience, as discussed in Section 3. Given this history and the associated lessons learned, it is our conviction that regional equity is an essential driver for success and the risks of doing otherwise are too great, as discussed in Section 3. Therefore, a regional approach to the UFMF initiative is assumed as the basis for this report, despite its apparent increased costs. It should, however, also be acknowledged that, given the "stigma effect" it may be necessary to provide a larger package of benefits to the first State, region and local community to step forward and host a regional UFMF, than that provided to subsequent regional volunteers

Figure 5-1 – Three Possible UFMF Regions.

(who will already know that they are not the only site).

5.1.2 Importance of Volunteerism

Past experience also illustrates the importance of having both the State and the local community volunteer to host an interim storage site. The Yucca Mountain example shows the difficulties that result from having the siting dictated by the Federal government. The PFS example described in Section 3.1.8 shows that a volunteer local community is not sufficient without support at the State (and State's Congressional delegation) level as well.

The past efforts described in Sections 3.1 and 3.2 show that local community support has been easier to achieve than support at the State level, which has not been achieved by any previous interim storage initiative to date. This indicates that any siting effort must include a vigorous dialog with, and benefits for, potential host States, from the very beginning. Once a willing State is found, experience suggests that finding a willing community somewhere within that State will be less difficult, and will likely be successful, particularly if there are established "nuclear" communities in the State that already host one or more commercial or governmental nuclear facilities, as discussed in Section 5.1.4.

5.1.3 Site Required Land Area

As described in Section 6.4 and Appendix B.2, the regional UFMF construction and operation occurs in three stages, where Stage 1 provides for a storage pad with a capacity of 400 casks. Stage 2 provides for a continuation of the first pad for a total capacity of 800 casks. Stage 3 provides for up to three more pads with a capacity of 400 casks each. Thus, at the completion of Stage 3, the UFMF includes up to five cask storage pads that each accommodate up to 400 casks for a total capacity of 2000 casks (approximately 30,000 MTU).

The size of each 400 cask storage pad is based upon the maximum footprint size of the storage casks and an optimal cask-to-cask spacing. The 400 cask storage pads each consist of eight rows of 50 casks; therefore, five pads have a total capacity of 2000 storage casks (i.e., 40 rows of 50 casks each).

The UFMF facility also includes the following four main buildings / structures:

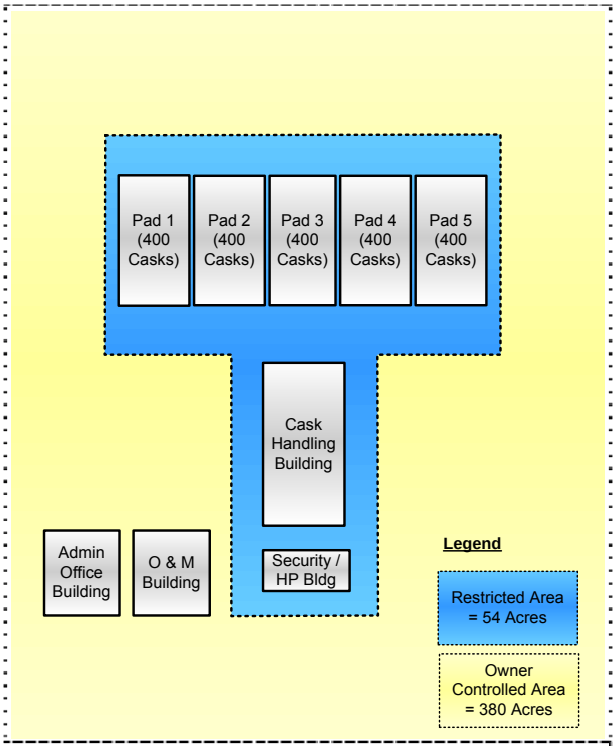

Figure 5-2 – Typical Regional UFMF Site Layout and Required Land Area.

- Cask Handling Building (including fuel pool)
- Operations and Maintenance Building
- Administrative Office Building
- Security / Health Physics Building

As a basis for the land area required for a regional UFMF, a 400-meter buffer zone is included between the storage pad / casks and the Owner Controlled Area (OCA) perimeter. The land area requirement also includes a security fence with a 100-feet wide perimeter zone around the storage pad. Finally, an additional 20-feet wide zone is included between the security fence and the nuisance fence that surrounds the entire restricted area (i.e., the area for the storage pads and the Cask Handling Buildings). Based upon these criteria, an array of 2000 storage casks, and the area as required for the above noted UFMF buildings, the restricted area is approximately 54 acres and the OCA is approximately 380 acres. An illustration of a typical regional UFMF layout and the associated land areas is shown in Figure 5-2.

5.1.4 Site Characteristics

The most important practical consideration for the specific site of the regional UFMF is the ability to meet the siting requirements in 10 CFR Part 72. It is also very important that the site be located in proximity to a rail head, since either building a rail extension, or heavy-hauling all UNF to the site, would both be expensive and difficult. It would also be desirable to locate the facility near industrial suppliers in the surrounding region that would be capable of fabricating the metal storage canisters and constructing the concrete casks and storage pads as shown in Figure 5-3 and Figure 5-4, and other equipment that will have to be procured for the UFMF. Alternatively, industrial space (buildings) where such fabrication operations could take place on-site would be both necessary and an additional benefit to the local community and surrounding region. Shipping the hardware from a remote location is not impossible, but it would be more expensive and less practical than having fabrication shops nearby.

Figure 5-3 – Concrete Cask Construction

Selecting a site that either has or could develop the necessary commercial industrial capability to fabricate components for the UFMF would be advantageous.

It would also be desirable for the site to be somewhat centrally located between the nuclear power plants that it is intended to serve. Finally, it is desirable for the location not to be so remote that housing for workers (within a reasonable distance) is not available, or emergency response (e.g., police or fire) would take an inordinate amount of time. Proximity to a community that has a substantial nuclear work force, and/or has significant experience with nuclear projects,

would make local acceptance far less difficult. Such communities have already experienced the merits of having a nuclear facility in the area first-hand and are generally supportive of its presence, as shown in Figure 5-5.

Another, more specific siting issue is whether the regional UFMF should be located on a virgin site, the site of an existing federal nuclear facility or laboratory, or an existing commercial nuclear facility. The pros and cons of these three options are discussed below.

Siting a regional UFMF on an operating or recently closed federal nuclear facility or laboratory has the following advantages:

- It offers the possibility of continued employment for current or former workers at the nuclear facility; workers who have experience in the nuclear field. This should result in a source of strong political support within the community.
- In addition to the nuclear workers, the general public within such a community is likely to be less fearful and more supportive of the UFMF due to the community's long history with a local nuclear facility. This includes experience with the positive impacts on the local job market and tax base.
- The co-located nuclear facility may have significant infrastructure in place that could be employed, thus reducing project cost.
- The perception that a "pure" Greenfield or non-industrial site would be "blighted" or "contaminated" is reduced, since the area is already an industrial, brownfield site.

Figure 5-4 – Concrete Cask Handling

Large, heavy components such as these are best fabricated in close proximity to where they will be used.

A potential drawback of such a site is that if the previous/existing nuclear facility has had a less than amicable history or relationship with the State or local community (or a significant segment of the community), this could be a significant or insurmountable barrier to acceptance of a regional UFMF, but such instances are rare.

The advantages and disadvantages of siting a regional UFMF on the site of an existing commercial nuclear power plant or fuel cycle facility are similar to those listed above for a federal nuclear facility. The first advantage listed above is somewhat weaker for an operating commercial site, since the existing nuclear workers will continue to be employed at the operating commercial facility, but the other advantages, and disadvantage, would fully apply.

An advantage that a commercial power plant or fuel cycle facility site may have over a federal site is that those facilities routinely perform UNF assembly handling operations that are similar to the operations that will be occurring at regional UFMF. This may result in a larger local supply of workers with applicable training and experience, as well as more potential for useful, and shareable, existing infrastructure.

Figure 5-5 – Supportive Nuclear Workforce

Siting a regional UFMF in a volunteer community with an already established supportive nuclear workforce is desirable.

5.1.5 UFMF Site Stakeholders

As illustrated in Figure 5-6, there are several stakeholder constituencies that will be affected by the siting of a regional UFMF, and will want to be informed of, and participate in, the public inquiry and negotiations associated with the siting.

A primary group is the local community, their representatives, and the surrounding region. This group will be concerned about potential risks and socioeconomic benefits and potential impacts that will result from the presence of the UFMF. The potential risks typically identified by local communities and the surrounding region include potential releases of radioactivity to the environment, potential radiation exposure of workers, potential exposure of members of the public (especially school children) to ionizing radiation (including during transportation of the UNF through the community to the UFMF). Concern about these potential risks can be addressed by improved infrastructure, monitoring programs, improved health care services, and educational programs for first responders and the community.

Positive benefits include local jobs and an increased local tax base, as well as other benefits that will be specifically offered by a regional UFMF, as described in Section 6.2. Potential negative impacts include loss of property values and other economic activity due to the "stigma" of being a UNF storage site.

Another very important group is the State government as well as its (federal) Congressional delegation. For this group the socioeconomic benefits of increased local employment and local tax base are positive, but less important than they are for the local community. On the other hand, the concerns about the stigma's socioeconomic impact, including the potential health risks from nuclear waste storage and transportation within the State are not significantly less. The State may also be concerned about potential long-term financial liabilities that may occur if the Federal government does not live up to its promise of eventual UNF removal, as described in Section 3.2. This is a large part of the reason why lack of State support has caused most previous UNF interim storage efforts to be unsuccessful. With respect to specific benefits

offered by the regional UFMF initiative, the State government and representatives will be more interested in programs that will benefit the entire State (as opposed to just the local area), directly or indirectly. One difficulty is that State-wide benefits will tend to be more expensive because they must impact a larger area and a greater population base.

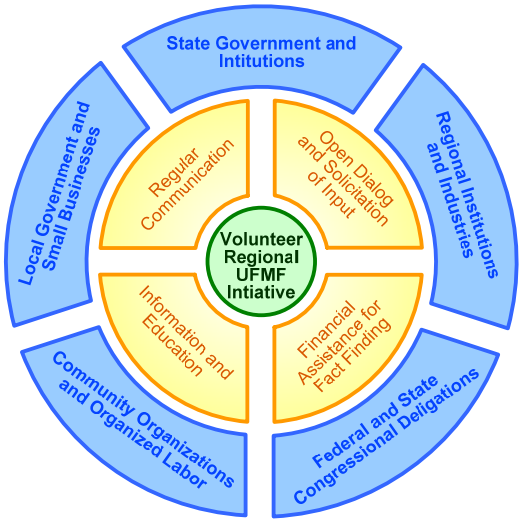

Figure 5-6 – Affected Stakeholder Constituencies

Active stakeholder involvement is the key to successful siting of regional UFMFs.

Another stakeholder group will be the local, regional, and/or State business community. Some industries, most notably tourism, may have some concern related to the stigma effect, but any outright opposition to such an initiative from the business community is expected to be minor. On the other hand, the business community could become a significant source of support for a regional UFMF initiative if they perceive significant benefits and business opportunities will result. Such direct benefits would include contracts for initial facility construction and future expansion, products and services (such as cask fabrication) for local, regional, or in-State companies. Indirect benefits such as purchasing the necessary infrastructure, equipment and supplies to support ongoing business operations would also result. Other institutional benefits, such as improved educational and health programs, could also indirectly benefit the business community.

Another stakeholder group would be any labor unions that are active in the local community, surrounding region, or the State in general. This group will see a benefit from the program in terms of job training, educational opportunities, and new craft and high-skilled jobs. Their interests would include getting agreements for the use of union workers and/or the payment of union wages at the UFMF site, as well as any in-State or local companies that are employed in the providing services or supplies to the project (such as cask fabricators, concrete plants, steel suppliers, and earthmoving companies). Labor could be another source of significant political support if the terms of the project are specified in a way that reflects their interests.

5.1.6 Host Benefits Package

As shown below in Figure 5-8, a wide range of potential benefits can be offered to the local community, surrounding region, and State willing to host a regional UFMF, including additional revenue sources, safe and environmentally protective employment and commerce, public infrastructure improvements, education and training, and industrial and technology development. The specific package that is offered will be tailored to the needs and preferences of the State and community, and the outcome of negotiations with the State, community and other stakeholders, as described in Section 6.2.

Given that most previous interim storage efforts have not succeeded at the State level, the package of benefits that is offered to the host State is of particular importance. Examples of State benefits would be infrastructure improvements (e.g., road, rails, etc.), funding for (nuclear-related) university departments or other education programs, and funding for medical infrastructure, such as a nuclear medicine department at a major hospital. Specific benefits could be given to minority communities in the region, if and where appropriate. Infrastructure improvements would ostensibly be to serve the regional UFMF, but would have general benefits for the State as well. An example of this is the bypass road around Santa Fe that was built as part of the WIPP project as shown in Figure 5-7. In addition to avoiding waste shipments through the center of town, the new road had significant general economic benefits for the community, including expanded development on the West side of town, in the vicinity of the road. A similar situation exists with the other benefits, such as the educational programs. While the immediate purpose of such programs would be to provide an educated workforce for the regional UFMF, the facilities and programs would serve general needs as well.

Figure 5-7 – Waste Isolation Pilot Plant (WIPP)

Waste Isolation Pilot Plant (WIPP) for disposal of defense transuranic wastes in New Mexico.

Another incentive that could be offered to the State would be to create a State office or agency to monitor the UFMF site and operations. The agency would perform environmental monitoring and occupational safety evaluations, and would have one or more personnel on site to monitor operations. This agency would be operated by the State but funded by the regional UFMF initiative. Part of the package could be a training program to provide qualified workers for this State agency. Offering such a program would not only provide additional economic benefits to the State and jobs to the community but such an independent agency and a heighten degree of project accountability would be very helpful in establishing trust between the project and the State and local community.

The regional UFMF will have inherent benefits to the community, including local jobs and a boost to the local tax base. Several additional incentives can be offered, however. The project could agree to procure components, products and services from companies in the local area (or create local industries to do such work). The project could also offer to provide training for local workers so that they can obtain long-term employment at the regional UFMF, or at local suppliers that serve the facility. Funding improvements to the local physical, educational, and medical infrastructure would also generate increased support within the local community.

Another specific benefit that could be offered the local community is to fund improvements to the local area's emergency response infrastructure. This could include improvements to the fire department, emergency evacuation and hazardous material cleanup capabilities, and medical emergency response. These improvements would be offered as a means of ameliorating and offsetting any risks or impacts of facility operations, but they will provide a significant general benefit to the community. In the case of the proposed Ward Valley Low Level Waste site just West of Needles, CA, one of the major desires of the local community was to have a locally-based medical emergency response capability, since the nearest response center at the time was in Las Vegas. The local (Needles) community was initially supportive of the Ward Valley project, but when the State of California refused to provide a few million dollars of funding per year for this local benefit, the local community withdrew its support.

To gain the support of the local business community, the regional UFMF should offer to rely on local businesses for a significant fraction of the components, products and services to support the project (as discussed above). The facility could also offer job training for the local community that could provide workers for project suppliers, as well as other local companies that are not involved with the project. Local companies would also benefit from local infrastructure and emergency response capability improvements. Local labor unions should also be supportive, if the above steps are taken, due to the benefits related to worker training and employment. Also, to attract union support, the project should state that any jobs associated with the regional UFMF to be union jobs that pay union wages.

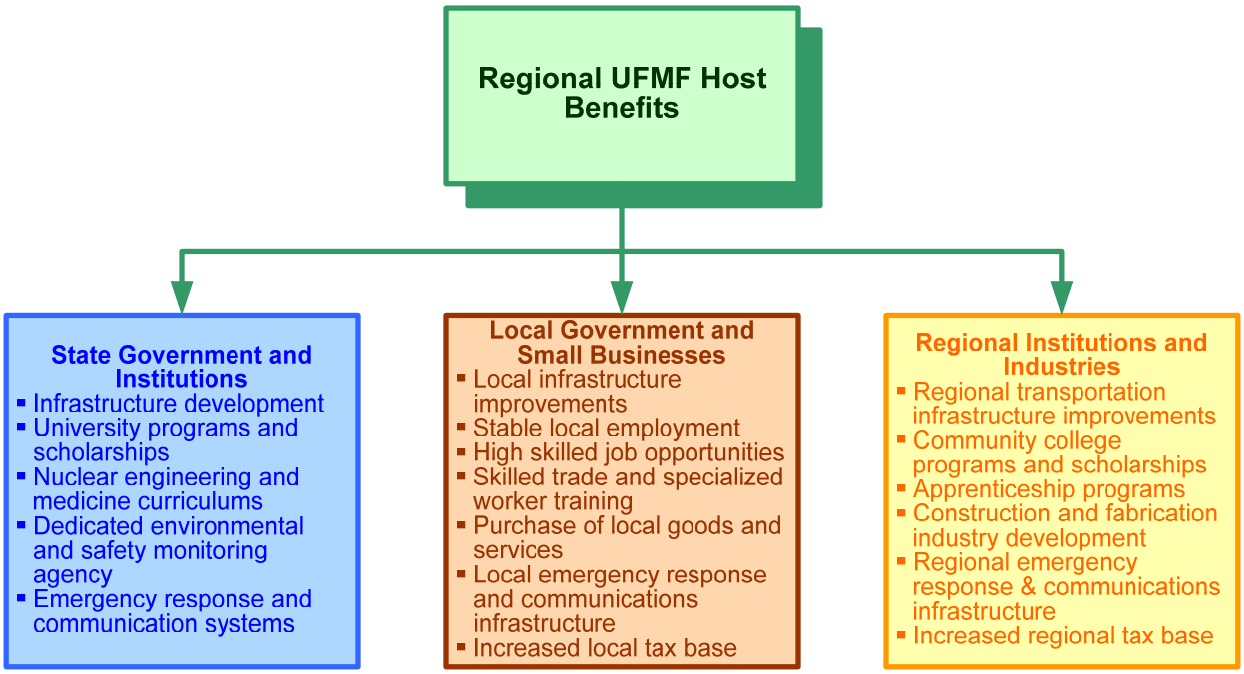

Figure 5-8 – Regional UFMF Host Benefits

The State, regional and local communities will benefit substantially by hosting a regional UFMF.

5.1.7 Cost of Benefit Packages

Given that the specifics of the benefits package will vary widely depending on the needs and preferences of the State and local community, and the results of stakeholder negotiations, it is difficult to directly estimate the cost of a regional UFMF benefits package. Thus, a rough order of magnitude estimate of the overall benefits package cost is determined based on past experience (i.e., past initiatives where the stakeholder negotiations had progressed to a significant degree).

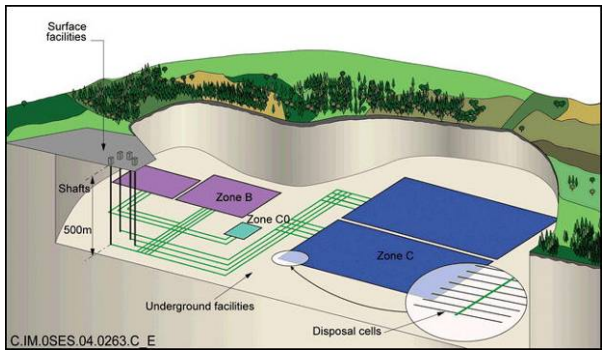

Figure 5-9 – Concept for the French Underground Laboratory at Bure.

As discussed in Section 3.1, when voluntary hosts were being sought in the 1990s for the MRS facility (which is similar to a regional UFMF) no states showed any interest despite the fact that the benefit payment allowed for an MRS was $5 million per year prior to first receipt of UNF at the MRS and $10 million per year until closure of the MRS. Section 3.1 also states that the Mescalero Apache tribe was offered $50 million in annual benefits for hosting an interim storage facility. The tribe ended up supporting the program, but the program was ultimately unsuccessful due to lack of support from the State and its Congressional delegation. An international example, discussed in Section 3.1.9, are AREVA's plans to spent 12 million Euros to fund an "energy enterprise park" in the local area of the Bure underground waste and laboratory site in France as illustrated in Figure 5-9.

Given the above examples, and the fact that inflation (since the 1990s, when these previous initiatives occurred), it is conservatively assumed that the total benefits package required to obtain a voluntary host for siting a regional UFMF (for the local community, surrounding region, and State) will be on the order of $50 million every year, for as long as the facility is on operation and UNF continues to be stored at the facility. Lesser amounts (~$10 million per year) may also be required during the siting process, in order to attract initial interest, and pay for various siting costs such as public meetings and involvement, and to pay for benefits/improvements that may have to be completed before the regional UFMF can be operational.

5.1.8 Overall UFMF Siting Strategy

Federal government initiative to develop a national IUFM strategy will be an important prerequisite for any regional UFMF siting strategy to be successful. The Secretary's ongoing review of the policy options, (including those of the forthcoming Blue Ribbon Panel), is a good first step, but it is imperative that the Federal government follow through with the development of a credible, coherent and actionable policy for the management of UNF, that includes both waste acceptance and final deposition. It's not necessary to decide on what the final disposition method will be now, whether by direct disposal or advanced fuel-cycle recycling, but there needs to be a well conceived criteria, plan, timetable and benchmarks to arrive at such a decision. The

regional UFMF concept can only be successful if it is viewed by potential hosts as being part of a bigger national IUFM strategy put forth and backed by the Federal government. Our strategy for siting regional UFMFs using a voluntary process is described further in Section 6.2.

5.2 Reliable Funding

As discussed in Section 3.2.1, one of the barriers standing in the way of a viable regional UFMF is the general mistrust of the Federal government. Part of this mistrust is due to the fact that Congress can change laws and funding mechanisms that jeopardize long-term agreements with the local communities and host states underpinning the regional UFMF initiative. The potential that actions by Congress or agencies of the Federal government will destabilize future plans and commitments is a fundamental reason why many communities and states, as well as commercial lenders and/or financial investors, are reluctant to consider volunteering to site, or agreeing to finance and/or invest in, such nuclear facilities. As a minimum, it is critical that the siting of a regional UFMF be isolated, as much as possible, from the Congressional approval process.

At the same time, a program that intends to store UNF under contracts with the Federal government and the nuclear utilities for extended periods of time needs the financial security and regulatory approval of the Federal government. Without this type of support, a project will find it difficult to secure the capital resources that will be needed to construct and operate such a facility. Large, complicated projects involving nuclear fuel still require the backing of the Federal government because of the perceived liabilities associated with nuclear energy.

In the past, as far as the final disposition of UNF is concerned, Congress has insisted on a tight leash attached to the support the Federal government provides. These constraints have not been productive for the implementation of final UNF disposition, regardless of the means.

As the history of the Yucca Mountain repository has shown, when project funding is contingent on annual appropriations, Congress, by default, controls the pace of development without regard to technical, regulatory, economic or legal incentives, as shown in Figure 5-10. For Yucca Mountain, this was the case, despite the fact that utility fees had already been collected and were 'technically' available to fund the project and partial breach of contracts with the utilities have imposed, and will continue for decades to impose, financial obligations on the nation's taxpayers. For a long-term project like a national repository or a

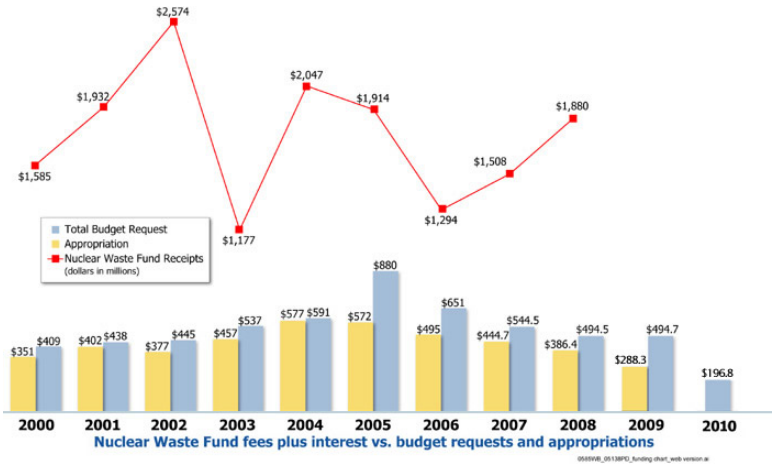

Figure 5-10 – Historical Yucca Mountain Appropriations and Budget

UFMF, Congressional control of funding prohibits the implementing agency from exercising its project plan and technical knowledge as it sees fit. The project becomes, in effect, a political process, divorced from the programmatic and technical bases that should be driving it.

Project financing depends on the ability of private industry developers to identify the risks associated with a project and establishing mechanisms to either control, minimize or offset known risks. Commercial lenders are more apt to fund projects where the risks have been identified and can be managed, then another where the risks are poorly defined or a program is not in place to address the risks. A proven method for controlling risk is to obtain long-term, binding agreements for delivery of services. Long-term agreements provide some assurance of the return on invested equity and the ability to pay off loans. If the Federal government is the entity that will own and operate a regional UFMF, or will subcontract the facility, then as currently configured, the funding of that operation is at the discretion of Congressional budgeting. Many of the problems encountered for Yucca Mountain can be traced back to Congress limiting the level of annual funding for the project. If this were to continue for regional UFMFs, then continuation of the project could be held hostage to the will of Congress, without any recourse to the courts. This is a serious problem that must be resolved.

It is unlikely that a regional UFMF will obtain private financing without a guarantee of reliable funding. Investors will look for an assurance that can realize a reasonable and secure return on their investment, commensurate with the level of risk. Similarly, private banks will set the interest rate based on the perceived risks of the project. Projects without a secure source of future revenue will be deemed a high risk and may not be able obtain financing, except at a high premium. A regional UFMF project will likely be deemed a high risk and will require a reliable source of income to secure the financing that will be required.

Initial, direct Federal government funding will be required for the preliminary work identifying and securing a site, conducting preliminary engineering and licensing, and funding host benefits programs with the local community, surrounding region, and host State. These are short duration activities that precede the long-term commitments of the major amounts of capital that will be required to construct the transportation infrastructure and facilities for a regional UFMF. It is appropriate that the initial phase of the regional UFMF initiative for development leading up to the start of UNF acceptance be funded directly by the government out of DOE-NE FCR&D budgets, or other programs that may evolve based on future recommendations of the Secretary's ongoing policy review, (including the forthcoming Blue Ribbon Panel), on managing UNF. Since nearly 40% of operating reactor sites in the U.S. already have dry storage facilities in place, as indicated in Appendix B.1, with more in the planning stages, there are few opportunities for a private entity to secure backing from a large enough pool of utilities to fund the initial phase. Instead, if regional UFMFs are going to be a part of the solution to the fuel disposition question, then DOE will likely have to support the initial efforts – even if the regional UFMF is a commercial facility.

It is estimated that the initial phase of the program will require approximately $10 million per year for each participating firm to reach volunteer siting agreements, characterize the sites, and develop a preliminary design for the facility. The DOE funding could be in the form of grants,

as is currently done under the GNEP program, performance-based contracts where the fee is tied to NRC granting construction authorization, or Congressional appropriations. This initial funding will lay the groundwork for a reliable project going forward.

Once a private firm has a license to construct and operate a regional UFMF, it can then begin to look for the capital required to complete the detailed engineering and construct the facility. There are two sources of financing – either private equity or commercial loan. Both will require assurance of future revenues to collateralize the investments. The revenue will ultimately come from the utility rate payers. In the most likely scenario, funds would be made available through Congressional appropriations or at the direction of the Secretary. As indicated in Section 3.2, although Congressional direction would be desirable, the Secretary appears have sufficient discretion to take the necessary actions.

5.3 Perception of Permanence

As discussed in Sections 3.1 and 3.2, the perception of permanence was one of the largest factors preventing state and local public acceptance of previously proposed interim storage facilities. For any such project to be successful, it will have to develop a means of reducing or ameliorating this perception. In addition, the underpinning for a successful regional UFMF must be a vigorous Federal government initiative to develop and implement a national IUFM policy concurrently, as described in Section 5.1.8.

Two general approaches to addressing the perception of permanence issue are as follows:

- Agree to penalty payment provisions that have specified triggering events, such as committing to remove the UNF by a certain date, and develop binding agreements that act to ensure that the requirement is met.
- Agree to provide ongoing, long-term benefits to the community that stay in effect as long as UNF remains on the site.

The details and merits of the above two approaches are discussed in this section.

5.3.1 Assured Removal Date Approach

The date when a geologic repository or recycling facility will open is known to be very uncertain. Thus, without a national IUFM policy, it will be well understood, by all parties, that there is very little basis for making any kind of promises or commitments with respect to a specific date when the UNF will be removed from the regional UFMF. This is particularly true in light of recent changes in direction by the Federal government. Thus, commitments to remove the UNF by a given date, by themselves, are unlikely to eliminate or significantly reduce the perception of permanence.

Previous cases (e.g., the Wyoming example discussed in Section 3.1.5) illustrate the problems associated with promising a specific removal date for the UNF. The problem is particularly acute if the promise is coming from the Federal government, due to a general lack of trust in the

Federal government, as well as the relative lack of enforceability of any promises made by the government (due to their ability to change the laws in the future, if and when conditions change). In the Batt agreement discussed in Section 3.1.7 (one of the few cases where a State or local community agreed to accept UNF from another location), the State and Federal government agencies accepted legally-binding commitments to remove the waste by a certain date, to pay financial penalties for overdue removal, and to pay for benefits to the local area (i.e., cleaning up the INL site). The agreement was written so that it would be difficult (although perhaps not impossible) for the Federal government to change the law to relieve itself of its commitments.

A promise of a specific UNF removal date, with financial penalties for overdue removal, would be more enforceable for a private UFMF operator, than it would be for the Federal government, because a private entity can not write or change laws to relieve itself of legally-binding commitments it makes in a contract with the State and local community. Thus, the local community would have more reason to trust such a contract.

On the other hand, a private operator does not have any control over the factors that will govern when the fuel will finally be removed. Thus, it would be difficult for any such operator to agree to pay the community compensation, out of its own pocket, for a delay in fuel removal. Also, unless the Federal government has a financial motivation (such as overdue removal penalties) to implement a final disposition policy for the UNF (i.e., a repository or recycling center), it may not do so in the foreseeable future. Indeed, as discussed in many of the Section 3.1 historical cases, the presence of interim storage facilities may remove some of the impetus to develop a repository. Thus, any such agreement between the community and a private UFMF operator would still have to involve the Federal government, as opposed to the operator, paying financial penalties for late UNF removal.

The PFS facility in Utah used an alternative approach to addressing the permanence issue. In their approach, the UNF would be shipped back to the utilities after a specified closure date of the interim storage facility. With this approach, the utilities would retain title to the UNF while it is being stored at the facility. This approach has the benefit of maintaining utility pressure, on the Federal government, to move forward with UNF final disposition.

Should the development of the geologic repository at Yucca Mountain not be completed (which was intended to disposition the UNF by direct disposal starting in 2020), the PFS approach could be very problematic from the utilities' point of view. If the UNF had to be sent back, virtually all of the benefits to the utility from their participation in the program would be lost. They

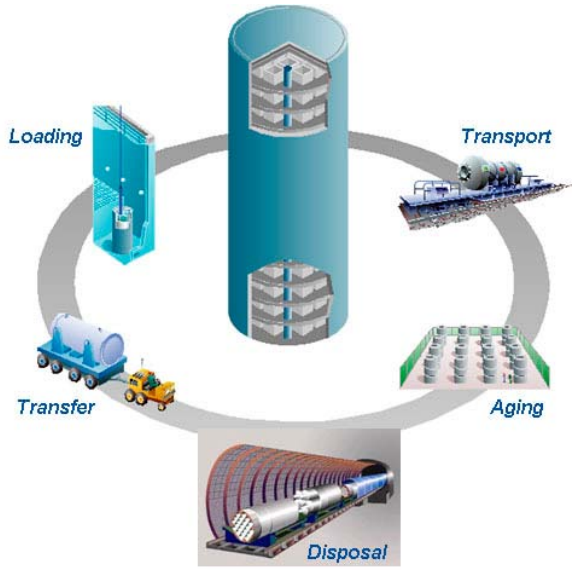

Figure 5-11 – UNF Disposition by Direct Disposal.

would have to dry store the UNF on their sites (the main thing they were trying to avoid). If the reactors spent fuel pool is still operating at the time, the UNF would have to be shipped back and loaded into dry-fuel storage canisters at the plant site. If their pool is no longer operating, the UNF would have to be re-packaged into dual-purpose canisters (DPCs) at the UFMF and sent back to the plant for on-site dry storage. In either case, an orphaned on-site storage facility would then remain at the plant site after plant decommissioning, which carries political costs, and prevents the land being put to other uses. For these reasons, the utilities would likely not be interested in expending resources to send their UNF to a regional UFMF, if there is any risk that they would have to take the UNF back at some time in the future. Thus, it is unlikely that a regional UFMF initiative could rely on a "send the fuel back" approach, as a way to address perception of permanence, and thus is not discussed further here.

Nevertheless, there are a number of possible approaches for obtaining Federal government compensation, to the host State and local community, for a delay in fuel removal due to the lack of an actionable UNF final disposition policy. One approach would be to have the Federal government agree, as a third party to the LLC agreement with the host entities, to pay the overdue removal penalties. A penalty fund could be established in a trust that is accrued over the life of the project that the LLC via the Federal government make regular payments to in accordance with a predetermined payment. The penalty fund would act as a kind of performance bond that would be due and payable to the host State and local community should certain events occur, such as failure to remove the UNF by a certain date. In this example, if the Federal government meets its obligations to remove the UNF from the site, and then the penalty fund would be returned to the Federal government. Should breach of the agreement occur, penalty payments to the host State and local community would not absolve the Federal government of its UNF disposition obligations, it would merely compensate the hosts for the breach without having to resort to a court-imposed judgment.

Another approach would be for the LLC to take title to the UNF from the nuclear utilities, as indicated in Section 4.2. That gives UFMF LLC, all of the rights of the 10 CFR Part 961 utility disposal contract – including the Federal government guarantee to ultimately dispose of the UNF and the ability of LLC to sue if the Federal government doesn't dispose. The LLCs agreement with the host State and local community would bind the LLC to compensate the hosts via the damage payments received from the Federal government per the court judgment. The advantage of this approach is that the LLC are compelled to act together to recover their respective damages from the Federal government. Either approach has the added advantage that there is little chance that an independent court would decide that the Federal government does not owe damages for delayed fuel removal, which would deter the Federal government from backing out of commitments it makes as part of the three-party agreement or the standard utility disposal contract.

A third and less desirable alternative would be for the host State and local communities to sue the Federal government for damages directly in the event of a delay in removing the fuel from the regional UFMF. The penalty payments to the community would be included in the damages, along with the costs of extended facility operation. This approach is similar to that being pursued now by utilities seeking awards from DOE to cover the costs of on-site dry fuel storage,

due to the lack of fuel removal by 1998, and is not discussed further here since it is the least desirable and sellable approach.

5.3.2 Ongoing Benefits Approach

An entirely different approach to addressing the perception of permanence is to accept that period of storage will be indefinite, and to convince a host State and local community that a regional UFMF will be to their benefit despite this fact. Given the pending review of UNF management policy, as well as frequent, open discussion of storing fuel for 100 years or more, it is likely that even if a UNF removal date were specified, it would be very far in the future. Thus, from the perspective of the host State and local community, the period of storage is indefinite, for all intents and purposes, anyway.

The primary feature of such an approach would be to offer the State and local community a package of on-going host benefits that would apply as long as UNF continues to be stored at the site. The benefits would cease once the last of the UNF is removed from the UFMF site. Such a host benefits package could also be combined with penalty payments for late removal of the UNF (which would be paid in addition to the ongoing host benefits, as long as the fuel remains). Having benefits that keep accruing as long as the facility is still in operation, as opposed to having a one-time or short-term benefit, will greatly reduce any perception that the net impact on the community would turn negative after some period of time. This will reduce any political impetus to try to shut the facility down before its scheduled closure date, which in turn will reduce the overall risk of the project. Also, from the community's perspective, the on-going payment of host benefits provides assurance that the Federal government will have some financial incentive to remove the UNF to avoid escalating penalty payments.

As discussed in Section 6.2, benefits to the host State and local community can take many forms, including direct payments, the creation of well-paying local high-skilled jobs, development of local industries directly or indirectly related to the project, upgrades to the transportation, medical and/or emergency response infrastructures, or the creation of academic or research centers. The funding of on-going host benefits would be included in the fees received by the by the LLC from the Federal government via a host agreements management contract as described in Section 6.1. Some of the above benefits, such as transportation infrastructure upgrades, are more up-front (as opposed to ongoing) in nature, and would therefore provide less benefit in terms of the perception of permanence issue. The funding of ongoing host programs and/or permanent facilities would continue until the UNF is removed.

As discussed in Section 5.1, any discussion of benefits will have to involve the host State's government and Congressional delegation, as well as the local community, from the very beginning of the process. Thus far, the State has proved to be the primary barrier to acceptance of an interim storage facility. Therefore, any successful host benefits package will either have to include programs that benefit the entire State, or the benefits to the local community must be so substantial that they attract the State's interest on their own. If the population of the local community is very small, however, it may be true that no degree of local benefit, by itself, will be sufficient to attract the State's interest.

5.3.3 Strategy for Addressing Perception of Permanence

Given that the date of final UNF removal from a UFMF is highly uncertain, but likely to be in the distant future, the strategy for addressing the perception of permanence will primarily focus on providing significant benefits to both the host State and local community, that will continue as long as UNF remains at the facility. The discussion of host benefits (as well as the project in general) will include all stakeholders from the beginning, particularly the State and its Congressional delegation. These ongoing host benefits will be funded by the Federal government via a host agreements management contract with the LLC as described in Section 6.1. As discussed earlier in this section, developing and funding a package of host State benefits that is sufficient to attract a volunteer State will be a primary challenge for the regional UFMF initiative.

Although the ongoing host benefits are the primary mechanism for ameliorating the perception of permanence, establishing a specified UNF removal date, and agreeing to pay substantial financial penalties for overdue fuel removal that continue to escalate with time will also help, and should be included. While the UNF remains at the facility, past the specified removal date, these penalties will be paid in addition to payment of the ongoing benefits to the host State and local community. Once all the UNF is removed, both of those payments will cease.

6 Recommended Framework for UFMF Implementation

This section provides the framework for a business model concept and the basis for an illustrative business case analysis of a representative regional UFMF that is presented in Section 7. As described in Section 1, the waste acceptance and disposition functions provided by regional UFMFs are the first step in the waste disposal process for UNF and GTCC waste, irrespective of whether the final disposition path is direct disposal, recycling, or a combination. As such, the regional UFMF business model concept and facility concept is designed to be flexible, scalable and adaptable to evolve with the development of a national IUFM policy by the Federal government over time.

Current Market for UFMF Services. The commercial nuclear power plants and UNF demographic data that will drive the regional UFMF initiative are provided in Appendix B.1. As the data indicates, there are currently 104 operating nuclear power plants in the U.S. producing approximately 21% of the nation's electrical energy. These power plants produce approximately 78% of the electricity that comes from non-carbon sources. Most, if not all, of the operating nuclear power plants will be granted power upratings and/or 20-year operating license extensions from the NRC. There is a growing recognition that nuclear power will need to be a key component of the nation's base-load generating capability to meet future electricity needs in a non-carbon emitting future. Accordingly, the nuclear utilities have announced plans to build as many as 26 new nuclear power plants in the next decade. In addition, there have been calls to build as many as 100 new nuclear power plants over the next 20 years. The Federal government has, and will continue to have, the responsibility for the final disposition of the UNF from shutdown nuclear reactors, the currently operating nuclear power plants, and the next generation of nuclear power plants.

As the data in Appendix B.1 indicates, the current fleet of operating commercial nuclear power plants produces nearly 2,000 MTUs of UNF each year. To-date, forty-four (44) nuclear reactor sites have approximately 11,700 MTUs of UNF already in dry storage, and, twenty (20) nuclear reactor sites have announced plans to develop new dry storage facilities between 2009 and 2018. Starting in about 2030, the current fleet of operating plants will begin reaching the end of their operating life, (even with current license extensions), and will begin shutting down in large numbers, at the rate of two to three reactors per year. By 2050, nearly all of the current fleet of operating plants will be shutdown, creating a growing population of newly shutdown plants with filled spent fuel pools needing to remove the UNF and GTCC waste from their sites to facilitate plant decommissioning.

In addition, there are currently the nine (9) orphaned shutdown reactor sites with no other operating reactor on the site that are owned and operated by the utilities. Two such sites, (LaCrosse in Wisconsin and Zion in Illinois) are currently wet storing their UNF in fuel pools while they develop on-site dry storage facilities. The other seven shutdown reactor sites (Big Rock Point in Michigan, Haddam Neck in Connecticut, Humboldt Bay in California, Maine Yankee in Maine, Rancho Seco in California, Trojan in Oregon, and Yankee Rowe in

Massachusetts) have already placed their UNF and GTCC waste in dry storage in facilities constructed on the decommissioned plant sites. These sites would otherwise be free of contaminated and nuclear materials and available for other uses, both public and commercial. Collectively, orphaned shutdown reactor sites store 2,857 MTUs of UNF. One additional such site, Fort St. Varian, is already owned and operated by DOE.

As the data in Appendix B.1 indicates, current projections for storage of the commercial UNF for the current fleet of 104 operating reactors and the nine orphaned shutdown reactor sites are tabulated as follows:

Type of Storage	MTUs of Used Fuel		
	2010	2014	2018
Pool	50,978	53,101	54,314
Dry	13,417	19,993	27,104

These figures (particularly the decline in the rate of increase for storage in pools) clearly illustrate that, collectively, the nuclear power plants are nearly at the managed capacity of their spent fuel pools. Only eight reactor sites will have a significant increase in pool storage between 2014 and 2018. Collectively, the rate of increase for dry storage at the other operating commercial nuclear power plants is approaching the annual rate of nearly 2,000 MTUs of UNF.

Unlike in 1996, when the consortium of utilities that formed the PFS initiative had an incentive to finance the up-front costs to license an interim storage facility, nearly half of the operating plant sites today have dry storage facilities in place, as described in Appendix B.1.1. Thirteen years ago, the potential for a substantial savings through economies-of-scale from a centralized interim storage facility was available, even with including transportation and host benefits costs. With nearly all plants expected to install dry storage within the next 10 years, most utilities will have already sunk costs for dry storage facilities, significantly reducing the potential for savings through shared utility resources and costs. Thus, the pool of utilities that have a need to use a UFMF facility is expected to be much smaller. Without the pooled resources of interested utilities, the risks involved in securing a site and obtaining an NRC license are too great to secure private sector funding without significant Federal government funding and long-term commitments.

Projected Market Growth for UFMF Services. With the continued delay in waste acceptance by the Federal government, the nuclear utilities will expand the capacity of their existing on-site dry storage facilities, develop new storage facilities on-site, or look for a third party, such as the LLC, to provide new off-site storage capacity. In addition, the regional, commercial UFMFs will provide off-site storage capacity for nuclear utilities that are required to eliminate or restrict the size of existing on-site storage facilities for logistical or local public policy reasons.

Implementation of the regional UFMF initiative by private industry will be accomplished in partnership with the Federal government, the nuclear utilities, and the respective host State and local governments using a phased approach, and the business model concept described in this

section. The basic approach and resources required for voluntary UFMF siting, design development, obtaining the necessary NRC licenses and construction authorizations, facility construction and major capital equipment procurement, facility commissioning, operation and facility decommissioning are also described. The cost estimate bases used to develop the Section 7 illustrative business case for the various phases of a representative regional, commercial UFMF are provided in this section. The financial analysis of the illustrative business case using the business model concept and inputs described is provided in Section 7.

6.1 Regional UFMF Business Model

Fundamental to the successful implementation of a regional UFMF as a commercial enterprise and the financial viability of such a venture is the structure of the business model concept for a commercial UFMF. These include how the UFMF business enterprise will be organized and managed, how it will be financed, the nature of its contractual relationships with the Federal government and commercial utility customers, how revenue and a return on investment will be generated, and how the commercial business will be operated. Successful implementation of the commercial UFMF initiative, particularly in the first ten years, will require a highly interactive partnership and clear definition of responsibilities between private industry, the nuclear utilities, the Federal government, and the volunteer host entities, as shown in Figure 6-1. These are discussed further in the sub-sections that follow.

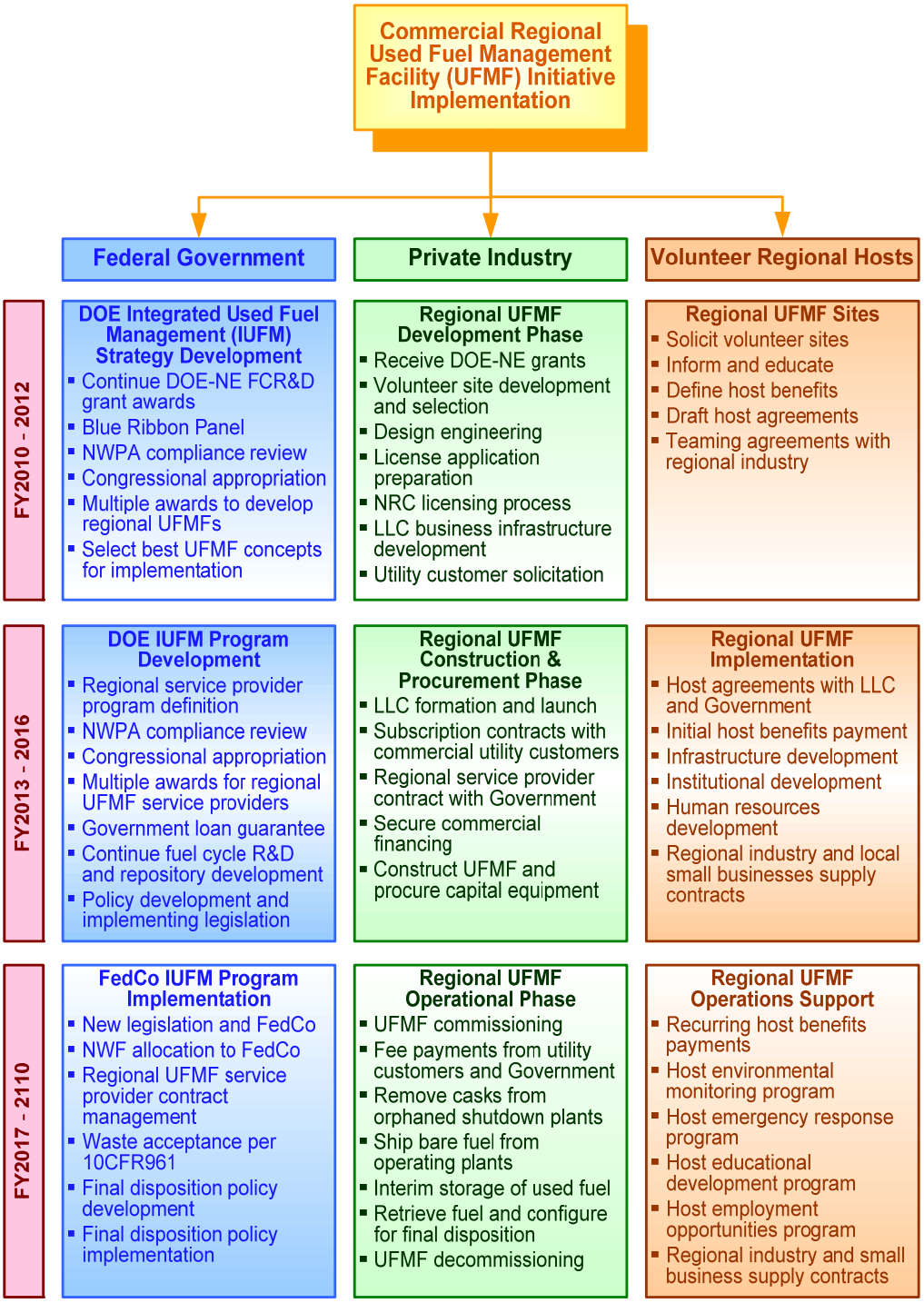

Figure 6-1– Commercial Regional UFMF Initiative Implementation

Successful implementation of a national IUFM strategy and the regional UFMF initiative will require a well-defined Federal government, private industry and host partnership.

6.1.1 Organization and Management

It is anticipated that the early phases of the regional UFMF initiative, particularly for the first commercial UFMF, including site development, design engineering and NRC licensing will be performed by experienced nuclear facility and service provider contractors under grants and performance-based development contracts with the DOE. DOE-NE FCR&D contracts are well suited for voluntary site development in the FY2010-2012 timeframe. A Congressional appropriation and suitable language permitting the associated funding for engineering and NRC licensing in the FY2011-CY2017 timeframe will likely be needed given the magnitude and duration of these efforts, however, new federal nuclear waste legislation is not considered necessary, as discussed in Section 4.2. Multiple DOE performance-based development contracts with payments tied to completion of predetermined milestones that require risk-sharing are appropriate for these phases. In addition to design engineering and NRC licensing, the regional LLC will be formed and launched during this timeframe. From this point on, the LLC will be a self sustaining commercial business entity with sufficient resources and infrastructure to hold the NRC licenses, construct, own and operate a regional UFMF.

While there are many possible start-up business models, it is envisioned that the LLC will likely be a new dedicated company derived from a joint-venture (JV) formed by experienced nuclear industry companies with business components and resources taken from the JV parent companies that are necessary to manage and operate such a commercial venture. Over the period of CY2013 through CY2016, the JV parent companies will make equity investments to facilitate the formation and initial operation of the LLC, including but not limited to:

- LLC business infrastructure development including business management systems, finance and accounting systems, QA program and procedure development, environmental safety and health (ES&H) program and procedure development, HR policies and practices systems, employee benefits program development costs, etc.
- LLC formation including all the incorporation, business licensing and permitting, SEC filings, banking accounts and a line of credit, business insurance, payroll systems, management recruiting and relocation, leasing and furnishing of temporary office space, etc.
- LLC discretionary corporate development programs for host benefits, including mentoring local small businesses, developing regional industry capabilities as UFMF suppliers, education and scholarship programs, etc.

Given the passage of time since the PFS initiative in the mid-1990s and the tenuous history of UNF and HLW management in the U.S. as described in Section 3, it is highly doubtful that any private company, group of investors or financial intuitions would step forward to capitalize such a risky indeterminate venture on their own. Therefore, under the current conditions, it is judged that DOE funding in the form of grants and development contracts will be necessary to "seed" the early phases of the regional UFMF initiative implementation to an extent that risks can be defined, quantified and mitigated; and commercial financing can be secured to move forward. For their part, it is suggested that the companies participating in the early DOE grant phase and development contracts of the initiative meet certain experience and resource qualifications and have the full intention of becoming a regional UFMF owner/operator and advancing their UFMF

concept through construction and operation as a commercial venture once an NRC construction authorization is granted.

Like the early phases of the GNEP project, it is envisioned that there be multiple phased grant awards for further concept development and discussions with interested communities in multiple regions, as described in Section 5.1 and Appendix B.1. A competition could be established by DOE-NE based on certain predetermined criteria to refine potential business concept(s) and to continue discussions with and ultimately select between interested potential host parties for each region, including preliminary siting and host development work in much the same way it was initiated previously for the GNEP project. DOE-NE could finalize volunteer host selections in subsequent phases and award development contracts to advance the best candidate sites and facility concepts through the site selection, detailed design and NRC licensing process for one or more regional UFMFs. Performance milestones would be established to provide a means of risk-sharing and an incentive for the development contract recipients to successfully complete each stage of initial development in a predetermined timeframe to be qualified to continue forward to the next phase. Incentives could be provided for successfully developing the first regional UFMF since it will be the most challenging. The output of the grant and development contracts would include the following:

- A binding agreement(s) with the volunteer host State and local governments and institutions; and teaming agreements with regional industries.
- A package of “shovel ready” drawings and specifications.
- NRC authorization to construct the facility; and the permits and approval required by any other governmental entities having jurisdiction.

As described above, in parallel with these DOE funded grants and development contracts, private industry would move forward and expend its own resources to develop a dedicated business entity, (probably a Limited Liability Company (LLC)), that may be solely owned or more likely emanating from a joint-venture agreement), for the purpose of owning and operating one or more regional commercial UFMFs. The necessary business infrastructure and management organization would need to be developed to demonstrate that the LLC has the financial resources, qualified management personnel and management systems necessary to own and operate a regional UFMF in accordance with NRC regulatory requirements. A five-year business plan for the LLC would be developed which would detail all aspects of the UFMF business as a commercial enterprise. A Board of Directors and an independent management oversight board would be established. An LLC specific Quality Assurance Program, Security Plan, Environmental Monitoring Plan and an Emergency Response Plan would be developed. It is preferred that the LLC would be sufficiently well established so that the NRC construction authorization for the UFMF would be granted to the LLC as the license holder. The LLC should have in place by the end of the DOE grant and development contracts all necessary infrastructure needed to move forward with UFMF construction and operation, and to enter into host agreements with the respective host entities.

6.1.2 Funding and Financing

It is envisioned that funding for each regional UFMF will primarily be provided by the following Federal government contracting mechanisms at the indicated funding levels (in current year dollars), which are the same or bound those resulting from the Section 7 illustrative business case financial analysis for budgeting purposes:

Type of Contract	Contract Scope	Funding Type	Timeframe	Suggested BudgetaryFunding Level (2009$M)
Cooperative Agreement	Siting	Annual Grants	FY2010-FY2012	30 total
Management	Host Agreements and Benefits	Fixed Annual Payments	CY2013-CY2018 CF2019-CY2069	25 per year 50 per year
Performance-Based	Development	Performance Milestones	FY2011-CY2016	50 total
Performance-Based	Services	Performance Milestones plus Fees for Services	FY2016-CY2021 CY2019-CY2069	250 to 400 total 100 to 150 per year

Regional UFMF initiative funding would also be obtained by private industry equity investments in the LLC and through subscription contracts with utilities as commercial customers; primarily those that have a need to accelerate the 10 CFR Part 961 federal acceptance priority rankings. Financing of the regional UFMF initiative using these funding mechanisms is described in the paragraphs that follow.

The initial development phase of the regional UFMF initiative would be funded by DOE under a grant program similar to that used for the GNEP program by DOE-NE. It is highly suggested that DOE-NE proceed to issue a funding opportunity announcement (FOA) for this purpose, to facilitate multiple FCR&D cooperative agreement awards in early CY2010 to further develop the regional, commercial UFMF concept described in this report and to initiate the early siting process, as described in Section 6.2. This would include further development of a voluntary siting plan, engaging with potential host State, regional and local governmental entities, members of the public and regional industry. It would also include developing a conceptual design of the UFMF and a more detailed cost estimate and schedule for the next phase of the initiative.

It is assumed for this estimate that each participating private industry team would be funded to approximately $10 million for three successive years, in order to continue making meaningful forward progress to advance the regional UFMF initiative. Some private industry contributions may also be possible depending on circumstances and under certain conditions. Such contributions would later be reimbursed by DOE if agreements are signed with the host entities for a site. Funding for the DOE's Fuel Cycle R&D program and the Administration's FY2010 budget request submitted to Congress that includes direction for DOE-NE to evaluate alternative

means of commercial UNF management appears to already contain sufficient funding that could be utilized for this purpose at DOE's discretion.

Beginning in FY2011 and continuing through CY2016 a new Congressional appropriation request is likely necessary to advance the regional, commercial UFMF initiative through the next phase including voluntary site selection, detailed design, preparation of an NRC license application, and obtaining the necessary regulatory approvals, as described in Section 6.3. A new Congressional appropriation request will most likely be supported if the path recommended by the Secretary's ongoing policy review, (including the forthcoming Blue Ribbon Panel), calls for development of centralized interim storage, or if the affected states' Governors are able to influence the Administration or the Congress to act, or if the courts find DOE in full breach of the standard contract. DOE development contracts would be awarded preferably to the LLCs to advance the best regional UFMF concepts through this phase.

For budgetary purposes, a funding level for the development contract of approximately $50 million is assumed, (consistent with that in the illustrative business case financial model), which should be adequate to advance the first UFMF concept through completion of the NRC licensing process. Advancing the subsequent UFMF concepts through licensing is expected to cost less. The funding for this phase of regional UFMF implementation should be provided by a new Congressional appropriation that spans multiple consecutive budget years. It is strongly suggested that this be accomplished in a single Congressional appropriation and DOE contracting action to assure a stable reliable source of funding for this effort, as described in Section 5.2.

Also during this timeframe, host agreements contracts would be negotiated between the LLC and the host State and local governmental entities and institutions to establish the terms of these court-enforceable binding agreement(s), perhaps similar to the tri-party Idaho agreement, as discussed in Section 3.1.7. These agreements may take the form of a three-party agreement between the hosts, the LLC and the Federal government. These contracts will be funded by the Federal government in a separate contracting action, and managed and administered by the LLC for maximum effectiveness. This framework puts the LLC rather than the Federal government squarely in the middle and accountable for trust and relationship building with the host entities over the long-term which is essential for success, as described in Sections 3.2 and 6.2. Once the host agreements are signed, Federal government funding will commence via a Host Agreements Management Contract (HAMC) with the LLC. Success-based host benefits funding tied to the UFMF reaching certain key milestones is suggested.

Based on historical data and recent international experience, as described in Section 5.1, the order-of-magnitude funding levels for host benefits are estimated for budgetary purposes to be, (consistent with those assumed in the illustrative business case financial model):

- $10 million incentive bonus for being the first UFMF to receive an NRC construction authorization
- $25 million annually prior to receipt of the first UNF. In addition to initiating the agreed

upon infrastructure and institutional investments, this funding will allow the State and local governmental entities to actively monitor the site characterization and NRC licensing process, as described in Section 6.3. The first annual payment would include the reimbursement of any contributions made by private industry during the site development phase under the cooperative agreement grants in recognition of a successful outcome. No reimbursement would be owed if the site development phase does not have a successful outcome.

- $10 million penalty payment if the Federal government has not made measurable progress (against pre determined metrics defined in the binding host agreements) on the development and implementation of a final UNF disposition policy that is triggered by the NRC construction authorization for the facility is granted but before facility construction begins, estimated to be 2016. An additional $10 million penalty payment tied to measurable final UNF disposition policy progress that is triggered following commissioning of the facility but prior to the first receipt of UNF, estimated to be 2019. These penalties would also include an opt-out provision that could be exercised by the hosts at their discretion following a triggering event.
- $50 million annually following receipt of the first UNF, for the next 50 years, or until all nuclear materials are removed from the site, whichever comes first. This funding will facilitate full implementation of the continued infrastructure, institutional and socioeconomic investments defined in the host agreements, as described in Section 6.2.
- $50 million annually, escalating by $10 million every year after 50 years, until all nuclear materials are removed from the site. As described in Section 5.3, this escalating penalty payment funding is intended be onerous to assure that there is sufficient financial motivation to commence and complete the final disposition of the UNF and GTCC waste as committed in the binding court-enforceable agreement with the host State. The penalty payment will trigger automatically, and should not require a court action to invoke.

The penalty provisions in the host agreements are intended to be punitive and mitigate the perception of permanence concerns that potential hosts will certainly have, as described in Sections 3.2.2 and 5.3. A penalty provision trust fund that accrues over the life of the project is envisioned, as described in Section 5.3.1.

In parallel, the UFMF would enter into teaming agreements with local small businesses and regional industries to develop these private industry firms as suppliers for the regional UFMF, as described in Section 6.2. Discretionary private sector investments and targeted corporate development and endowments aimed at local and regional industrial and educational development would be made to facilitate these objectives.

After the LLC obtains NRC authorization to construct the regional UFMF and the dedicated LLC is fully operational as described above, construction of the facility and procurement of capital equipment will be financed by private means through a combination of equity investors and commercial lending institutions. To collateralize the necessary private financing will require that the LLC have a long-term Regional Service Provider Contract (RSPC) in place with the Federal

government that would include a take-or-pay provision and/or a loan guarantee to reduce the risk profile of the loan and the associated borrowing costs). Such a commitment by the Federal government will be necessary to obtain reasonable and cost-effective commercial loan terms. In addition to possible loan guarantees to reduce commercial borrowing costs, DOE may wish to consider the additional use of federal schedule risk insurance for unseen regulatory or litigation delays. This could be similar to 10 CFR Part 950[95] provisions for new reactor construction projects. In addition during this timeframe, obtaining subscription contracts from utilities as commercial customers would be desirable, but difficult until the UFMF is licensed and constructed. Once the regional UFMF is constructed and operational, some utility subscription contacts are more likely over the longer term, based on plant-specific needs. The illustrative business case assumptions in this regard are described in Section 7.

The scope of the LLC's RSPC with the Federal government will include providing UNF and GTCC waste acceptance and final disposition services for a specified region, group of plant sites, and an amount of UNF and GTCC waste to be removed from each site over a specified period of time. As described in Section 4.2, title for the UNF could be retained by the utility, transferred to the Federal government or transferred to the LLC under certain conditions. For the latter, the RSPC with the LLC would provide a mechanism for the Federal government to begin fulfilling its obligations to the utilities under the 10 CFR Part 961 contracts to begin mitigating future damages. Such service provider contracts could be authorized and funded under a Congressional appropriation that may or may not be linked to the Act and funded from future NWF receipts if the Congress so designates. As discussed in Section 4, it is asserted that new legislation is not a prerequisite to construct one or more UFMFs and to enter into a RSPC to begin the waste acceptance process. Since the LLC will not yet have the installed capability to provide the contracted services until the facility is constructed and is operational, the RSPC will have to be some form of "bankable" paper, e.g., a "take-or-pay" contract and/or loan guarantee from the Federal government so that it can obtain commercial financing. It is strongly recommended that the RSPC be accomplished in a single Congressional appropriation and Federal government contracting action to assure a stable reliable source of funding for this effort, as described in Section 5.2.

The LLC's contracts with utilities as commercial customers will take the form of a subscription contract that will include a commitment to transport, canisterize, and store a specified inventory of UNF and/or GTCC waste utilizing the regional UFMF. Such utility contracts will likely not be achievable by the LLC until the facility is constructed and operational, however, efforts to solicit early subscribers to use the UFMF should be initiated in parallel with the NRC licensing process. Incentives to early subscribers will likely be necessary that may include LLC management oversight board participation, equity ownership and/or a preferential fee structure. Early subscribers will primarily include those utilities that have a need or demand to accelerate the 10CF961 federal acceptance priority, as described in Section 4.2.

[95] Code of Federal Regulations, Title 10, *Energy*, Chapter III, *Department of Energy*, Part 950, *Standby Support for Certain Nuclear Plant Delays.*

For any orphaned shutdown plants that desire to accelerate the removal of the remaining nuclear materials, the scope of the LLC's contract with the respective utility will be to remove all the already canistered UNF and GTCC waste from the site. For operating plants, the scope of the LLC's contract with the respective utility will be to remove a specified amount of bare UNF assemblies from the plant's spent fuel pool at regular intervals that the utility would otherwise need to place in dry cask storage in an on-site facility, newly constructed or existing. If requested by a utility, the contract could also include removal of UNF already canistered in the plant's spent fuel pool prior to shipment, or taken from the plant's on-site dry storage facility. If not retained by the utility or transferred to the Federal government, these LLC contracts with the utility may include a provision to transfer title of the UNF to the LLC under certain conditions, as described in Section 4.2.

The commitments provided by Federal government via the RSPC as discussed above, the HAMC with the Federal government, and any early utility commercial customer subscription contracts that can be obtained, together with the LLC's business plan and equity investments for the regional UFMF will be used to secure financing for the construction of the UFMF from commercial sources. These contracts will need to be investment grade instruments that a commercial lending institution or a group of private equity investors can independently valuate and determine the viability of the commercial venture before the necessary financing can be secured. The terms of such a lending agreement are likely to include a parent company guarantee(s), an equity position in the LLC by the lending institution, and LLC board participation. Project financing will need to be sufficient to complete site improvements, facility construction and the procurement of major capital equipment for the regional UFMF as described in Section 6.4, and to operations cover cash-flow for at least the first year of UFMF operations. Beyond the first year of operations, the LLC will establish a line a credit to cover cash-flow as necessary. The total value of these contracts is estimated to be between $250 and $400 million to provide the necessary collateral for commercial financing of these activities. A loan amortization schedule of not longer than five years is highly desirable if not required. Illustrative business case assumptions for the amount of financing required is provided in Section 7.

Also, under Section 180c of the Act, DOE is responsible providing technical and financial assistance for training of local public safety officials to States and Tribes through whose jurisdictions the DOE plans to transport UNF and HLW. Where a transportation route crosses more than one jurisdiction or the route constitutes a border between two jurisdictions, all jurisdictions will be eligible for grants. The technical assistance will consist of non-financial assistance, such as access to qualified personnel with the knowledge and experience to assist in providing the training. The training will cover procedures required for both safe routine transportation and for dealing with emergency response situations. The financial assistance will take the form of two grants - assessment and planning grants, and training grants. The assessment and planning grants will be issued approximately four years prior to commencement of shipments in order to support assessing the need for, and planning for, the training. The training grants will have two parts: a base portion and a variable portion determined by formula (including factors such as population along the route, length of the route, number of shipments,

and shipping sites). For purposes of Section 7 illustrative business case, it is assumed that the DOE will be responsible for implementing the requirements of Section 180c of the Act. Thus, these costs have not been included in the associated financial analysis or considered further.

6.1.3 Fees and Revenue

Following UFMF construction and commissioning beginning in the CY2016 and continuing through CY2020, operation of the UFMF will commence as described in Section 6.5. As described above, contracts will already be in place with the Federal government and utility commercial customers to provide a reliable and predictable revenue stream for the UFMF commercial enterprise. At this juncture, new nuclear waste policy legislation would be desirable to clarify that the envisioned national IUFM strategy and regional UFMF is a legitimate alternative means for the Federal government to meet its waste acceptance and disposition obligations under the Act. Such legislation should consider a provision to allow direct utilization of the NWF for this purpose that does not require an annual appropriations action, and that the Secretary has the authority to allocate. This is particularly true, given the magnitude and the longevity of the funding commitments for HAMCs and the RSPCs. New nuclear waste policy legislation in this timeframe may also desirable to initiate the Federal government's national IUFM strategy to develop and implement the policy for final UNF disposition and disposal, based on the outcome of the Secretary's ongoing policy review, (including the forthcoming Blue Ribbon Panel), and other policy setting initiatives.

It is envisioned that the fee structure under the RSPC will include: 1) two one-time milestone-based lump-sum fee payments, 2) unit-rate-based lump-sum UNF receipt fees for services provided, 3) recurring unit-rate-based annual service fees, 4) recurring fixed annual fees, and 5) cost-based fees for any extraordinary site- or region-specific transportation services provided by the LLC, as summarized in Table 6-2. The fees attributable to the Federal government are for providing all goods and services that are not the responsibility of the utilities under the 10 CFR Part 961 contract, (which are limited in scope to those services that are necessary on the plant site to ready the UNF and GTCC waste for shipment). The fees under the RSPC include all fees associated with waste acceptance, transportation from the reactor sites to the UFMF, packaging and interim disposition, and accrual of a decommissioning fund for the UFMF.

As described above, the RSPC will be performance-based as a means of risk-sharing by tying payments to completion of one-time or recurring pre-determined performance milestones. These will include two significant lump-sum milestone payments for the first receipt of already canistered UNF from an orphaned shutdown plant in 2019, and a second for the first receipt of bare UNF assemblies from an operating plant in 2022. The order-of-magnitude funding levels needed for these two one-time payments are estimated for budgetary purposes to be in the range of $125 to $175 million each. The illustrative business case revenue assumptions and estimates of the amount of these fees and payments are provided in Section 7. Prior to these milestones, it is envisioned that no payments will be received by the LLC under the performance-based RSPC.

Under the RSPC, a recurring fixed annual fee will be necessary to offset the cost for providing the essential goods and services that are required to meet the obligations of the NRC 10 CFR

Part 72 storage and 10 CFR Part 71 transport licenses, and that are largely independent of the amount of UNF managed by LLC, (including the fixed facility, equipment, material and labor costs necessary to meet the minimum requirements of the NRC licenses). Beyond that, it is envisioned that unit-rate-based receipt and annual fees for services per kgU of UNF will be charged under the RSPC for waste acceptance and interim disposition, including packaging, transportation, receipt, off-loading, canisterizing as required, and dry cask storage, as described in Table 6-2. The order-of-magnitude annual funding levels needed for services provided under the RSPC, (excluding those associated with host benefits), are estimated for budgetary purposes to be in the range of $100 to 150 million per UFMF per year. This conservatively assuming no utility contributions, but otherwise includes all the receipt fees and annual fees described above and in Table 6-2. The illustrative business case assumptions for the amount of revenue generated from these fees are provided in Section 7. The cost-based fees for any extraordinary site- or region-specific transportation services are not estimated since they are by definition variable. In addition, fees associated with UNF title transfer to the LLC have not been estimated at this time.

Separately, payments to LLC under its HAMC with the Federal government to fund, manage and administer the host benefits programs in accordance with the binding, court-enforceable agreements with voluntary host State and local governments will be made on an ongoing basis as described in Section 6.1.2.

It is envisioned that the user fees charged to utility commercial customers under the subscription contracts will include unit-rate-based lump-sum UNF receipt fees for services provided, recurring unit-rate-based annual service fees, and cost-based fees for customer-specific services provided, as summarized in Table 6-3. As indicated in Section 6.1.2, utility subscribers are expected to be limited to those plant sites that have a need or demand to accelerate the 10 CFR Part 961 federal acceptance priority, since by 2019 timeframe; most all plants will already have the capability for on-site dry storage. For shutdown plants, the user fees will include the necessary services to remove already sealed transportable canisters from the plant site, placement of the canisters in storage overpacks at the UFMF, and maintaining the UNF in dry cask storage. For operating plants, the user fees will include the necessary services to prepare a transport cask loaded with bare fuel assemblies in the plant's spent fuel pool[96], offloading the fuel assemblies in the UFMF fuel pool, loading the fuel assemblies into storage canisters, placing the canisters in storage overpacks and maintaining the UNF in dry cask storage. For operating plants that contract for removal of already canisterized fuel, the user fees will be similar to those for the shutdown plants. The illustrative business case assumptions for the amount of revenue generated from these fees are provided in Section 7. In addition, fees associated with UNF title transfer to the LLC have not been estimated at this time.

[96] Typically, the utility's licensed fuel handlers will perform cask fuel loading operations, and their trained crane operators will perform cask handling operations in the plant's spent fuel pool building. The UFMF, LLC on-site services will typically be limited to moving the transport cask on and off site, and preparing the cask for fuel loading and shipment.

6.1.4 Flexibility for Future Change

In order to successfully serve the Federal government and its commercial customers, and to provide a wide range of benefits to the host local, regional, and State communities in which it resides over the long-term, the regional UFMF must be designed and managed to adapt to a broad range of potential business scenarios and UNF and GTCC waste final disposition solution scenarios. The envisioned regional LLC business model concept will need to incorporate the highest degree of flexibility into the envisioned UFMF design (both dry canister and wet UNF assembly transfer), the widest possible acceptance of UNF and HLW, and the greatest number of options for final disposition by direct disposal or reuse on the back-end.

As an example of the flexibility that UFMFs should provide by design, it is highly beneficial for the facility and the UFMF business model concept to include the capability for accepting both already canistered UNF and bare UNF assemblies, rather than limiting acceptance to UNF that has already been canistered at the reactor site, (as was the case for the PFS facility described in Section 3.1.8). The drivers for having the capability to accept bare UNF assemblies at a UFMF are as follows:

- Given the pre-existing constraints of the 10 CFR Part 961 standard contracts with the utilities, it will be much easier for the regional commercial UFMFs to enable DOE to discharge its responsibilities in accordance with the terms of the existing contracts by being able to accept bare UNF assemblies, making UFMFs a much more attractive option for the Federal government. Such capability provides the ability to accept varied quantities of UNF assemblies (rather than entire canisters), as specified in the standard contract priority ranking, and where ownership of the plant, (and individual plant units on multiple reactor sites) is now very different than that specified by the standard contract priority ranking.
- The ability for utilities to ship bare fuel directly from the plants' spent fuel pools, rather than having to first load dual-purpose transportable canisters (which are more expensive compared with store-only canisters) is logistically and financially much more attractive to utility commercial customers.
- The shipment of bare versus already canistered UNF assemblies allows greater quantities of thermally hotter fuel per transport cask and train shipment which reduces the number of transport evolutions per MTU of fuel and lowers transportation costs and risks.
- It enables the use of higher capacity, store-only canisters for storage at a UFMF, (which are more economical than dual-purpose transportable canisters), rather than being limited to storing only what can be transported in an already canistered configuration, (which is much more restrictive thermally). Also, having a fuel pool at the regional UFMF to handle bare UNF assemblies wet rather than dry, (using a shielded transfer system), alleviates problematic fuel cladding oxidation concerns.
- It provides maximum flexibility for final USF disposition, i.e., the ability to selectively configure, batch, and package UNF assemblies for optimal final disposition, as described

in Section 6.6.

In addition, starting in about year 2030, there is a bow-wave of currently operating plants that are scheduled to reach End Of Life, (even with current license extensions), that will start to shutdown at the rate of about three to five plants per year. By 2050, all but a handful of the 104 are scheduled to shutdown. In this circumstance, offloading the plant's entire spent fuel pool by shipping UNF bare to the regional UFMF would be an enormous advantage.

The envisioned regional LLC business model concept incorporates revenue streams and fee structures based on fixed milestone payments, fixed annual fees, standard services fee rates, subscription fees, cost-based site-specific fees, annual services fee rates, and, (optionally depending on circumstances and conditions), UNF title transfer fees. This tiered contract and revenue structure (both from the Federal government and utility commercial customers) allows LLC business model concept to evolve as the national IUFM policy continues to evolve and circumstances change.

Table 6-1 – UFMF Initiative Implementation Phases, Funding and Financing Plan (4 pages)

Project Phase and Scope	Timeframe, Funding Mechanism and Outputs	
Initiation Phase (current phase) • Develop phased integrated concept for national UNF acceptance and disposition strategy • Develop concept for Step 1 regional UNF management • Develop concept for future Step 2 UNF final deposition options	**FY2008-09.** Current DOE-NE FCR&D contract • Briefing on integrated UNF management approach (completed) • Recycling facility business concept development (completed) • Regional UNF management facility (UFMF) business concept development (this report)	
Phase 1 **Voluntary Site Development** • Continue national IUFM strategy and regional UFMF initiative planning • Regional volunteer siting process plan development • Regional volunteer siting process implementation • Volunteer host benefits package development • Develop NRC licensing plan • Develop LLC business and operational plan • Begin regional marketing and utility commercial customer development	**FY2010** UFMF regional site development authorized and funded under DOE-NE FCR&D cooperative agreement grants • Funding opportunity announcement (FOA) issued by DOE-NE • Private industry and other entities respond to FOA • DOE-NE makes grant awards to multiple private industry teams • Each team is funded $10M, plus private industry contributions if any • Grant process provides catalyst for a competitive “bake-off” to develop the best regional concepts • Multiple volunteer host entities (local, State and regional) are solicited • Each team initiates dialog with interested host sites and develops facility concept for one or more regions • Hosts who are willing to enter into negotiations are identified • Programmatic and technical development are continued	**FY2011-12** Continued UFMF site development authorized and funded under DOE-NE FCR&D cooperative agreement grants • Down select and continue development of promising regional concepts • Continue to fund each of best regional concepts an additonal $10M/yr., plus private industry contributions if any • Solicit active utility participation, including NEI and EPRI • Enter into negotiations with candidate regional volunteer host(s), (State, local and regional) • Draft host agreements and sign MOU(s) • Develop implementation plan for region • Select best regional concept(s) for implementation phase • Sign host agreements with regional hosts
Phase 2 **Engineering and LLC Business Infrastructure Development** • Select volunteer regional sites and characterize each site • Design facility and equipment • Prepare SAR, environmental plan, security plan, emergency plan, and management plan • Prepare NRC license application (LA)	**FY2011-12** UFMF engineering and LLC business infrastructure development authorized and funded under new Congressional appropriation and new DOE development contracts • A new Congressional appropriation beyond normal DOE annual budget will likely be needed to fund this phase given its magnitude, assuming there are multiple UFMFs • New DOE competitive procurement for advancing the best regional UFMF concept(s) through design and licensing	

Table 6-1 – UFMF Initiative Implementation Phases, Funding and Financing Plan (4 pages)

Project Phase and Scope	Timeframe, Funding Mechanism and Outputs
• Negotiate host agreements management contract (HAMC) with Federal government • DOE develops regional service provider management and operations plan(s) and policy framework • Private industry begins LLC business infrastructure development • Solicit regional utility commercial customers who may be willing to use the facility if licensed and constructed	• Award new DOE development contract(s) to fund design and licensing of each selected regional UFMF concept(s) with estimated budgets of $50M each • Performance based development contract(s) to share risks with payments tied to successful completion of scope milestones, e.g., NRC docketing of the LA • Draft model HAMC developed with the Federal government • Private industry develops new LLC formation, organization and business infrastructure implementation plan • Private industry prepares business and operational plan for new LLC(s) • Continue commercial customer business development and identify potential early subscribers
Phase 3 **Licensing and LLC Business Implementation** • Submit 10 CFR Part 72 LA to NRC • Review of SAR, environmental plan, security plan, emergency plan, and management plan by NRC • 10 CFR Part 72 NEPA process, public notice period and judicial review • Legal formation of regional LLC to own and operate facility • LLC negotiates regional service provider contract (RSPC) with Federal government • LLC enters into HAMC with Federal government • Private industry develops new LLC organization and business infrastructure • Obtain NRC 10 CFR Part 72 authorization to construct base facility for already canistered fuel • Obtain NRC 10 CFR Part 72 authorization to construct pool facility for bare fuel • Obtain NRC 10 CFR Part 72 license to possess and store UNF and GTCC waste, including fuel title transfer provision • LLC negotiates draft subscription contracts with interested regional utility commercial customers who will commit to use the facility if constructed, and obtains early subscriber signed MOUs • Negotiate subscription contracts with regional utility commercial customers willing to use the facility if constructed	**FY2013-16** UFMF Licensing and UFMF, LLC implementation authorized and funded under same or additional Congressional appropriation and same DOE development contracts • Continue on with same DOE development contract(s) to fund NRC licensing of each selected regional facility • Performance based development contract(s) to share risks with payments tied to successful completion of scope milestones, e.g., obtaining NRC construction authorization • An additonal Congressional appropriation in this timeframe probably necessary to fund HAMC and subsequent RSPCs given their magnitude and longevity • Initiate host benefits program implementation and investments at $25M/yr. per site, plus $10M incentive bonus for being first site to receive NRC CA. Facilitate host involvement in licensing process • Draft model RSPC developed with the Federal government • Federal government selects lead/1st regional UFMF for construction and demonstration • Federal government selects other regional UFMF for construction • Private industry makes equity investment in LLC and discretionary corporate development programs, including regional industry development • LLC business and management infrastructure that is necessary to hold NRC license(s) in place • Develop draft model contracts with utility commercial customers and obtain early subscriber signed MOUs • Host evaluates Federal government's progress on final fuel disposition policy and determines if $10 million penalty payment is owed and whether to opt-out prior to initiation of facility construction

Table 6-1 – UFMF Initiative Implementation Phases, Funding and Financing Plan (4 pages)

Project Phase and Scope	Timeframe, Funding Mechanism and Outputs
Phase 4 **Construction and Procurement** • Enter into RSPC with Federal government with necessary financing collateralization provisions • Enter into contracts with willing regional utility commercial customers/early subscribers • Secure commercial financing • Construct facility and procure capital equipment with sufficient capacity to support 1st five years of operations • Construct base operating capability facility for receipt and storage of canisters, primarily from isolated shutdown plants • Procure components and equipment for base operating capability facility • Construct full operating capability facility for receipt of bare fuel, primarily from existing operating plant pools • Procure equipment for full operating capability facility • Negotiate subscription contracts with other commercial customers willing to use the facility if it becomes operational • Update regional LLC business and operational plan	**FY2016-2021** Construction and procurement of lead/1st regional UFMF and other regional UFMFs authorized and funded under new Congressional appropriation • Continue host benefits program implementation and investments at $25M/yr • Federal government commitment to fund RSPCs and collateralize UFMF construction and procurement loan • Obtain financing for facility construction and procurement based on HAMC and RSPC with Federal government loan collateralization; and utility subscription contracts. • LLC awards contracts to construct facility, supply capital equipment and fabricate components, with preference for local small businesses and regional industries • Develop draft model contracts with other commercial customers and obtain signed MOUs • Host evaluates Federal government's progress on final fuel disposition policy and determines if additional $10 million penalty payment is owed and whether to opt-out prior to 1st fuel receipt
Phase 5 **Commissioning and Operations** • Implementation of LLC business and operating plan • Continue implementation of HAMC with Federal government • Preoperational demonstration and commissioning • Implement RSPC with Federal government • Implement commercial customer subscription contracts • Negotiate and enter into additional subscription contracts with other commercial and governmental customers • Procure additonal components for initial capability facility operations, i.e., storage overpacks, for fuel and GTCC waste canisters, primarily from orphaned shutdown plants • Retrieve, transport, receive, transfer and place already sealed shutdown plant canisters in storage	**FY2019-2021** Commissioning and operation of lead/1st regional UFMF and other regional UFMFs authorized and funded under same Congressional legislation and appropriation • Same authorizing legislation and funding source as previous phase • New legislation helpful for LLC to take title to fuel on DOE's behalf to allow DOE to fufill their 10 CFR Part 961 contract obligations in this manner, (may not be needed if DOE takes and retains title to fuel, further legal review needed) • Continue host benefits program implementation and investments at $25M/yr, increased to $50M/yr after receipt of 1st fuel • Facility construction/procurement costs, operating costs, and accrual for facility decommissioning recovered primarily by RSPC fees including two onetime payments upon receipt of 1st fuel, and onetime fee upon fuel receipt and annual fees (see Federal government fee structure, Table 6-2) • Base operating capability facility costs also covered by utility subscription contract user fees, primarily from orphaned shutdown plants with need to accelerate removal schedule, including onetime fee upon canister receipt and annual fees for

Table 6-1 – UFMF Initiative Implementation Phases, Funding and Financing Plan (4 pages)

Project Phase and Scope	Timeframe, Funding Mechanism and Outputs
• Procure components for full capability facility operations, i.e., storage canisters and overpacks, for bare fuel, primarily from existing operating plant pools • Transport, receive and unload operating plant bare fuel; and load, seal, transfer and place canisters in storage • Batch and age UNF for waste disposal by direct disposal or recycling	storage (see Commercial Customer fee structure, Table 6-3) • Full capability facility operating costs also covered by utility subscription contract user fees, primarily from operating plants with need to accelerate removal schedule, including onetime fee upon receipt of fuel and annual fees for storage (see Commercial Customer fee structure, Table 6-3)
Phase 6 **Future Expansion and Operations** • Continue implementation of LLC business and operating plan • Continue implementation of Federal government HAMC and RSPC • Continue implementation of commercial customer subscription contracts • Implement additonal subscription contracts with commercial and governmental customers • Amend 10 CFR Part 72 license as required • Construct additional storage pad space consistent with demand. Procure additional components consistent with demand	**FY2021-69** Regional UFMF expansion and continued operations authorized and funded under same or amended Congressional legislation and appropriation • Same authorizing legislation and funding source as previous phases • Continue host benefits program implementation and investments at $50M/yr. • Facility expansion construction/ procurement costs, ongoing operating costs, and accrual for facility decommissioning covered primarily by RSPC fees including onetime fee upon fuel receipt and annual fees (see Federal government fee structure, Table 6-2) • Ongoing facility operating costs also covered by commercial user fees, primarily from operating plants, including onetime fee upon receipt of fuel and annual fees for storage (see Commercial Customer fee structure, Table 6-3)
Phase 7 **Fuel Removal and EOL Decommissioning** • Canister retrieval from storage, fuel unloading and packaging for subsequent Step 2 final disposition by recycling and/or disposal • D&D facility, prepare land for re-purposing, and cease regional LLC business operations	**FY2070-EOL** Fuel removal and UFMF decommissioning authorized and funded under same or amended Congressional legislation and appropriation • Same authorizing legislation and funding source as previous phases • Continue host benefits program implementation and investments at $50M/yr. for 50 years, escalating by $10M/yr. until all fuel is removed • Facility ongoing operating costs, and accrual for facility decommissioning covered primarily by RSPC fees including annual fees (see Federal government fee structure, Table 6-2) • Ongoing facility operating costs also covered by commercial user fees, primarily from operating plants, including annual fees for storage (see Commercial Customer fee structure, Table 6-3) • Facility D&D funded by LLC accrual over operating life of facility per condition of 10 CFR Part 72 license • Authorization and funding source for Step 2 final disposition TBD

Table 6-2 –Conceptual UFMF Fee Structure Basis for Federal Government[97,98] (4 pages)

Scope of Services	One-Time Fees	Recurring Fees
Host Agreements Management Contract (HAMC)		
Implementation of host agreements with local and State governments	First year fixed annual fee paid to LLC to fund, manage and administer and initiate the implementation of the host benefits program in accordance with the host agreements: • $25M upon both local and State governments signing host agreements ☒ • $10M incentive bonus for being the first site to receive an NRC construction authorization ☒ • $10M penalty tied to lack of Federal government progress on final fuel disposition policy by 2016 with opt-out provision before facility construction begins ☒ • $10M penalty tied to lack of Federal government progress on final fuel disposition policy by 2019 with opt-out provision before 1st fuel received ☒	Fixed annual fee paid to LLC to fund, manage and administer the ongoing implementation of the host benefits program in accordance with the host agreements: • $25M/yr. prior to 1st receipt of fuel ☒ • $50M/yr. after 1st receipt of fuel for 50 years ☒, or removal of all fuel and GTCC waste, whichever comes first • $50M/yr. after 1st receipt of fuel ☒, increasing by $10M/yr. after 50 years ☒ until all fuel and GTCC waste is removed from site.
Regional Service Provider Contract (RSPC)		
Regional transportation system development	Cost-based fee for development and implementation of a regional transportation system including the necessary regional infrastructure improvements; and development of a transportation plan for each reactor site to be serviced ☒	
Transport and receive 1st already canistered fuel and GTCC waste primarily from orphaned shutdown plants and 1st bare fuel from operating plant spent fuel pools	Performance-based fixed fee paid to LLC in two lump-sum payments for partial amortization of the associated facility construction and procurement commercial loans upon ☒: • Receipt of 1st shutdown plant	Fixed annual fee paid to LLC after 1st receipt of fuel to cover ongoing ☒: • Fixed operating costs[99] • Accrual for facility and equipment D&D

[97] It is estimated that the vast majority of UFMF costs will need to be recovered from the Federal government through the host benefits management contract payments and regional service provider contract fees shown in this table for the UFMF, LLC business model to be viable. The balance of UFMF costs, estimated to be a small fraction of total costs, will be recovered from commercial customers through user fees as shown in Table 6-3, primarily from plants that have a need to accelerate the standard contract queue priority.

[98] ☒ indicates fee is included in the Section 7 illustrative business case analysis. ☒ indicates fee is not included in the Section 7 illustrative business case analysis.

Table 6-2 –Conceptual UFMF Fee Structure Basis for Federal Government[97,98] (4 pages)

Scope of Services	One-Time Fees	Recurring Fees
	canister • Receipt of 1st bare fuel assembly	
Already Canistered Fuel:		
Fuel and GTCC Waste that Is Already Canistered and in On-site Dry Storage, Primarily from Orphaned Shutdown Plants • This fuel will be accepted in accordance with 10 CFR Part 961 priority ranking, unless otherwise specified by the RSPC	Services fees to retrieve, transport, receive, transfer and place an already sealed dual-purpose canister in storage at the facility including: • Cost-based incremental fee per canister for on-site services to retrieve and package canister for shipment based on site-specific conditions[100] ☒ • Unit-rate transport fee per kgU of fuel for transportation of 3-5 cask consist train ≤ 500 miles on mainline railroads gate-to-gate ☒ • Cost-based incremental transport fee per cask of fuel for extraordinary services to transport from site to mainline railroad based on need for intermodal transport or use of secondary regional or local railroads or longer distances ☒ • Unit-rate storage fee per kgU of fuel for procurement of storage overpack for dual-purpose canister and receipt and processing of canister at facility ☒ • Unit-rate incremental fee per fuel assembly if title transfers from utility to Federal government via LLC ☒	Annual fee for storage of canister at the facility from receipt until removal from storage for final disposition • Unit-rate annual storage fee per kgU of fuel ☒
Bare Fuel:		
Bare Fuel that Has Not Yet Been Canistered, Primarily	Services fees to support loading and to transport, receive and unload bare fuel;	Annual fee for storage at the facility from receipt until

[99] Certain basic fixed O&M costs including the cost for security and regulatory compliance personnel, facility and equipment are required as a condition of the NRC 10CFR72 storage and 10CFR71 transportation licenses that are independent of the amount of UNF that is transported and stored, i.e., whether only one or hundreds of casks are transported and stored. These recurring baseline costs are referred to as the fixed operating costs for facility, equipment and labor necessary to meet the minimum requirements of the NRC licenses.

[100] Cost for this service is the responsibility of the utility under the 10CFR961 contract (see Table 6-3).

Table 6-2 –Conceptual UFMF Fee Structure Basis for Federal Government[97,98] (4 pages)

Scope of Services	One-Time Fees	Recurring Fees
from Existing Operating Plant Pools (assume no GTCC waste until plant is shutdown) • This fuel will be accepted in accordance with 10 CFR Part 961 queue priority, unless otherwise specified by the RSPC	and load, transfer and place store-only canister in storage at the facility including: • Cost-based incremental fee per bare fuel assembly for on-site services to retrieve and package fuel in transport cask for shipment based on site-specific condition[101] ☒ • Unit-rate transport fee per kgU of fuel for transportation of 3-5 cask consist train ≤ 500 miles on mainline railroads gate-to-gate ⛢ • Tiered incremental unit-rate transport fee per fuel assembly for services to transport fuel with varied fuel-specific conditions: o No premium for 24 PWR or 56 BWR intact assemblies with low to moderate burnups and longer cooling times ⛢ o Premium for 21 PWR or 44 BWR intact assemblies with high burnups or shorter cooling times ☒ o Premium for damaged fuel assemblies or fuel fragments that require individual canning ☒ • Cost-based incremental transport fee per cask of fuel for extraordinary services to transport from site to mainline railroad siding based on need for intermodal transport or use of secondary regional or local railroads or longer distances ☒ • Unit-cost storage fee per kgU of fuel for procurement of store-only canister and overpack; and to receive and unload bare fuel; and load, transfer and place canisters in storage at facility ⛢ • Tiered incremental unit-rate storage fee per fuel assembly for services to store fuel with varied fuel-specific conditions:	removal from storage for final disposition • Unit-rate annual storage fee per kgU of fuel ⛢

[101] See footnote for this on-site service under canistered fuel above.

Table 6-2 –Conceptual UFMF Fee Structure Basis for Federal Government[97,98] (4 pages)

Scope of Services	One-Time Fees	Recurring Fees
	o No premium for 37 PWR or 87 BWR intact assemblies with lower burnups and longer cooling times ☑ o Premium for 32 PWR or 68 BWR intact assemblies with moderate burnups and cooling times ☒ o Premium for 24 PWR or 56 BWR intact assemblies with high burnups or short cooling times ☒ o Premium for damaged fuel assemblies or fuel fragments that require individual canning ☒ • Unit-rate incremental fee per fuel assembly if title transfers from utility to Federal government via LLC ☒	

Table 6-3 – Conceptual UFMF Fee Structure Basis for Commercial Customers[102,103] (4 pages)

Scope of Services	One-Time Fees	Recurring Fees
Subscription Contract		
Utility subscribers that commit to use facility to enhance commercial financing of construction and procurement[104] • Early subscribers that commit to use facility if licensed and constructed • Subscribers that commit to use the facility after it's licensed but before construction is completed • Later subscribers that commit to use the facility after it's constructed and operational	Negotiated amount based on timeframe of subscription, level of commitment and total amount of fuel included ☒	
Already Canistered Fuel:		
Fuel and GTCC Waste that Is Already Canistered and in On-site Dry Storage, Primarily from Orphaned Shutdown Plants • These utility customers are expected to be primarily those that have a need to accelerate the 10 CFR Part 961 priority	Services fees to retrieve, transport, receive, transfer and place an already sealed dual-purpose canister in storage at the facility including: • Cost-based incremental fee per canister for on-site services to	Annual fee for storage of canister at the facility from receipt until removal from storage for final disposition

[102] It is estimated that the vast majority of UFMF costs will need to be recovered from the Federal government through host benefits management contract payments and regional service provider contract fees shown in Table 6-2 for the UFMF, LLC business model to be viable. The balance of UFMF costs, estimated to be a small fraction of total costs, will be recovered from commercial customers through the user fees shown in this table, primarily from plants that have a need to accelerate the standard contract queue priority.

[103] ☑ indicates fee is included in the Section 7 illustrative business case analysis. ☒ indicates fee is not included in the Section 7 illustrative business case analysis.

[104] Commercial customers who subscribe before the NRC license is granted and the facility is constructed may have an equity position in the LLC and will be eligible for preferential priority and user fees. Early subscribers may also be eligible for LLC board of directors and/or executive management oversight board participation.

[105] Cost for this on-site service is the responsibility of the utility under the 10CFR961 standard contract.

[106] Costs for transport services will need to be recovered from the Federal government per Table 6-2 for UFMF, LLC to remain commercially competitive since transportation is not part of utility's 10CFR961 standard contract obligations.

[107] See footnote for transport services above.

[108] For orphaned shutdown plants, the storage fees paid by commercial customer for this service should be proportional to current cost to utility for performing the same scope at the dry storage facility on-site so that using LLC facility is competitive with leaving casks in dry storage on-site. Some premium above this cost is warranted since fuel is being removed and utility's obligation is ended.

Table 6-3 – Conceptual UFMF Fee Structure Basis for Commercial Customers[102,103] (4 pages)

Scope of Services	One-Time Fees	Recurring Fees
ranking, e.g., previously shutdown plants and plants with on-site dry storage constraints	retrieve and package canister for shipment based on site-specific conditions[105] ☒ • Unit-rate transport fee per kgU of fuel for transportation of 3-5 cask consist train ≤ 500 miles on mainline railroads gate-to-gate[106] ☒ • Cost-based incremental transport fee per cask of fuel for extraordinary services to transport from site to mainline railroad based on need for intermodal transport or use of secondary regional or local railroads or longer distances[107] ☒ • Unit-rate storage fee per kgU of fuel for procurement of storage overpack for dual-purpose canister and receipt and processing of canister at facility[108] ☐ • Unit-rate incremental fee per fuel assembly if title transfers from utility to Federal government via LLC or to LLC ☒	• Unit-rate annual storage fee per kgU of fuel[109] ☐
Bare Fuel:		
Bare Fuel that Has Not Yet Been Canistered, Primarily from Existing Operating Plant Pools (assume no GTCC waste until plant is shutdown) • These utility customers are expected to be primarily those that have a need to accelerate the 10 CFR Part 961 priority ranking, e.g., plants with either wet or dry on-site storage constraints and newly shutdown reactors that need to off-load their spent fuel pools to decommission the plant	Services fees to support loading and to transport, receive and unload bare fuel; and load, transfer and place store-only canister in storage at the facility including: • Cost-based incremental fee per bare fuel assembly for on-site services to retrieve and package fuel in transport cask for shipment based on site-specific condition[110] ☒ • Unit-rate transport fee per kgU of fuel for transportation of 3-5 cask	Annual fee for storage at the facility from receipt until removal from storage for final disposition • Unit-rate annual storage fee per kgU of fuel ☐[116]

[109] See footnote for orphaned shutdown plant storage fees above.

[110] See footnote for this on-site service under canistered fuel above.

Table 6-3 – Conceptual UFMF Fee Structure Basis for Commercial Customers[102,103] (4 pages)

Scope of Services	One-Time Fees	Recurring Fees
	consist train ≤ 500 miles on mainline railroads gate-to-gate[111] ☒ • Tiered incremental unit-rate transport fee per fuel assembly for services to transport fuel with varied fuel-specific conditions[112] ☒: o No premium for 24 PWR or 56 BWR intact assemblies with low to moderate burnups and longer cooling times o Premium for 21 PWR or 44 BWR intact assemblies with high burnups or shorter cooling times o Premium for damaged fuel assemblies or fuel fragments that require individual canning • Cost-based incremental transport fee per cask of fuel for extraordinary services to transport from site to mainline railroad siding based on need for intermodal transport or use of secondary regional or local railroads or longer distances[113] ☒ • Unit-rate storage fee per kgU of fuel for procurement of store-only canister and overpack; and to receive and unload bare fuel; and load, transfer and place canisters in	

[111] See footnote for transport services above.

[112] See footnote for transport services above.

[113] See footnote for transport services above.

[114] For operating plants, the storage fees paid by commercial customer for this service should be proportional to avoided cost to utility for performing the same scope on the plant site so that using the facility is competitive with storing the fuel on-site. Some premium above this cost is warranted since fuel is being removed and utility's obligation is ended.

[115] See footnote for operating plant storage fees above.

[116] See footnote for operating plant storage fees above.

Table 6-3 – Conceptual UFMF Fee Structure Basis for Commercial Customers[102,103] (4 pages)

Scope of Services	One-Time Fees	Recurring Fees
	storage at facility[114] ☒ • Tiered incremental unit-rate storage fee per fuel assembly for services to store fuel with varied fuel-specific conditions[115]: o No premium for 37 PWR or 87 BWR intact assemblies with lower burnups and longer cooling times ☒ o Premium for 32 PWR or 68 BWR intact assemblies with moderate burnups and cooling times ☒ o Premium for 24 PWR or 56 BWR intact assemblies with high burnups or short cooling times ☒ o Premium for damaged fuel assemblies or fuel fragments that require individual canning ☒ • Unit-rate incremental fee per fuel assembly if title transfers from utility to Federal government via LLC or to LLC ☒	

6.2 Regional Volunteer Siting Process

Based on the experience gained and lessons learned in previous attempts to site centralized interim storage facilities, as described in Section 3, as well as experience gained in GNEP siting studies, this section presents the concept for a novel siting process that will serve as the starting point for development of a more detailed regional volunteer siting process plan in FY2010 and also to begin soliciting interested voluntary host sites for a regional UFMF in FY2010, as described in Section 8.2.

6.2.1 Regional Volunteer Siting Process

It is envisioned that the siting of the regional, commercial UFMFs will be based on a volunteerism approach, as shown in Figure 6-2. The volunteerism approach is informed by the previous attempts by the Federal government and, to a much lesser extent, the private sector as summarized in Section 3 of this report.

Key aspects of the volunteerism approach, based on "lessons learned" from those previous attempts, include:

1. The regional UFMFs will be commercial facilities. This will provide a closer and more balanced relationship between each UFMF and the local community, surrounding region, and host State. It should also provide a more responsive environment for interaction with the local community to promote the effective operation of the UFMF. In addition, it should facilitate development of a comprehensive and effective host benefits program tailored specifically to the needs and interests of the local community, surrounding region, and host State.
2. The development of multiple UFMFs will provide regional balance and geographic equity. The regional UFMFs will be in proximity to the nuclear power reactors that produce the UNF, and, transportation distances will generally be less than 500 miles. No one local community, surrounding region, and host State will assume all of the potential risk or gain all of the possible benefit.
3. The focus of the volunteerism approach will be on local communities that already have nearby nuclear facilities (such as nuclear power plants, uranium enrichment facilities, national laboratories, commercial radioactive waste disposal facilities, nuclear fuel fabrication facilities, and DOE field sites) that are regulated by the State, NRC, or DOE. These local communities already have a skilled workforce, a focus on nuclear quality assurance and safety, a well-developed nuclear culture, and a history of successfully working under government regulation. These local communities also have a demonstrated commitment to minimizing the potential risks associated with operating nuclear facilities, protecting the environment, and maintaining the quality of life in the community and surrounding region. Parallel efforts will also focus on local communities and Indian tribal governments that, although they do not have a nearby nuclear facility, express an interest.

4. The volunteerism approach will provide a balance between the interests of the local community, surrounding region, and the State. The binding agreement put forth and negotiated with the UFMF, LLC (with the concurrence of the Federal government as a signatory), will require the approval of both the local community and the State. In the case of a volunteer Indian tribal government, the LLC will work with the Indian tribal government and the State to reach a binding agreement. The binding agreements will, to the extent possible, be court-enforceable and legally binding on all parties, (similar to the Idaho tri-party agreement discussed in Section 3.1.7).
5. Although the responsibility for safe and environmentally acceptable management of the UNF and GTCC waste that will reside with the LLC as the licensee, each local community, through a joint board with the LLC, will be actively involved, not just informed, in all phases of the siting, licensing, construction, operation, and decommissioning of the UFMF. The structure, membership, role, and responsibilities of each joint board will be negotiated with the local community. Each joint board may also include representatives from the surrounding region and State.
6. The joint board will have the responsibility to assess any safety issues that may arise, and, the joint board will have the authority, under certain agreed upon conditions, to suspend receipt of UNF and/or the affected operations at the facility while a safety or environmental issue is investigated and remedied by the LLC.
7. Benefits programs will be negotiated with each local community and the State. The type and value of the host benefits will evolve with each successive phase in the

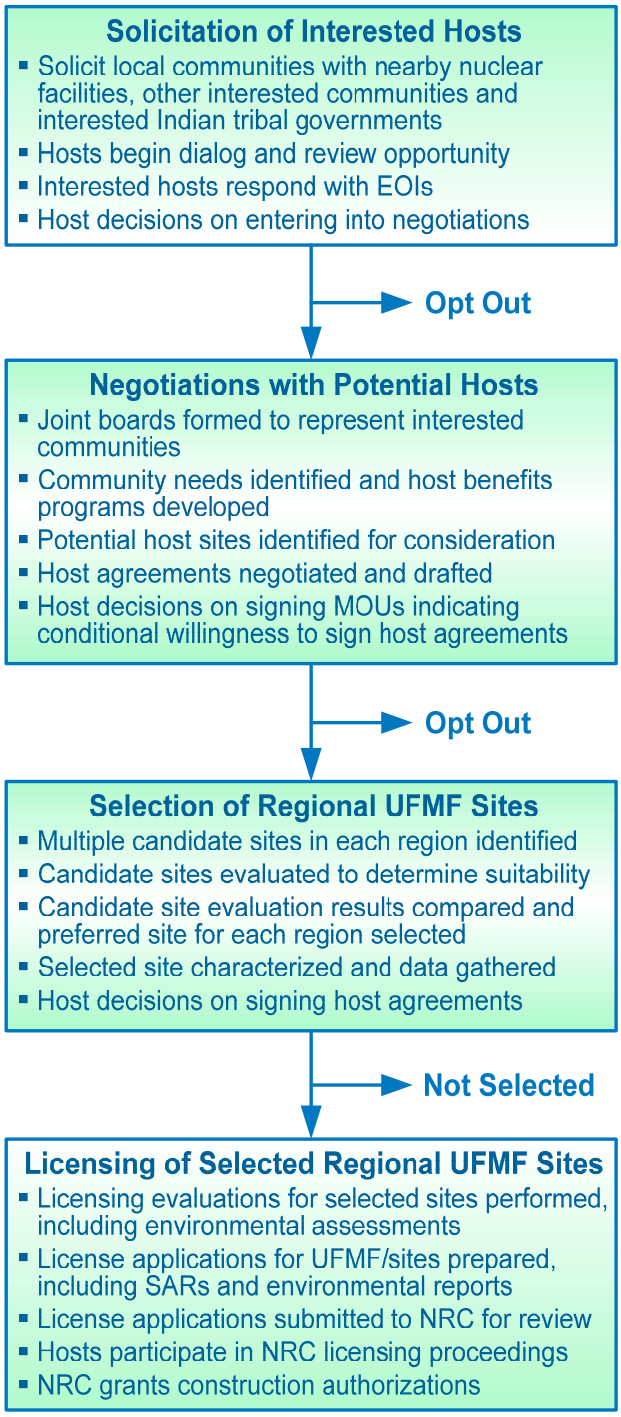

Figure 6-2 – Regional Volunteer Siting Process Concept

History indicates that a private industry led regional volunteer siting process has the best chance of success.

siting, licensing, construction, operation, and decommissioning of the UFMF, as described in Section 6.1.2. The host benefits program will continue to provide benefits until all UNF and GTCC waste has been removed from the site.

8. The benefits program will be extended to the surrounding regions and states, particularly those along transportation corridors, via Section 180(c) of the Act, as described in Section 6.1.2.

The list of potential benefits that could be considered when negotiating a benefits package with a potential host for inclusion in the host agreements is quite long and widely diverse. The range of potential host benefits include but are not limited to:

1. Additional Revenue Sources
   a. Increased property tax base
   b. Increased sales tax base
   c. Increased corporate tax base
   d. Increased income tax base
   e. Increased payroll tax base
   f. Direct payments for services
   g. Surcharges/license fees
2. Employment and Commerce
   a. Human resources development
   b. Safe, environmentally protective high-tech and skilled-trade jobs
   c. Local and regional hiring
   d. Source of stable long-term employment
   e. Procurement of goods and services from local small businesses
   f. Procurement of fabricated components, equipment, construction materials and construction services from regional industries
   g. Relocation of UFMF, LLC corporate management to the local community
   h. Relocation of manufacturing facilities to region
   i. New business start-up, technology transfer and mentoring
3. Public Infrastructure Improvements
   a. Roads/intersections
   b. Railroads
   c. Water/sewer
   d. Fire protection
   e. Law enforcement
   f. Emergency response facilities/ hospital expansion
   g. Environmental monitoring
   h. Recreational facilities
   i. Communication systems
   j. Internet connectivity

4. Education/Training
   a. Scholarship programs
   b. New curricula for science/energy
   c. Expansion of extra-curricular programs
   d. Research grants
   e. School construction
   f. Extension programs to establish local colleges
   g. Job training/vocational training
   h. Internships and skilled trade certifications
5. Technology Center/Research & Development/Industrial Development
   a. Improved transportation casks/fabrication/testing
   b. Transportation rolling stock
   c. Transportation logistics
   d. Improved storage casks/fabrication
   e. Waste package design/fabrication
   f. Radiation monitoring equipment
   g. Advanced fuel-cycle technologies for recycling

The volunteerism approach will consist of seven steps that are led by private industry, from solicitation of expressions of interest in 2010 to decommissioning of the UFMFs as much as 50 years later. The host agreements with the host entities will be developed, implemented, managed and administered by the LLC as the owner/operator under its HAMC with the Federal government, as described in Section 6.1.2. The first three steps in the process will be funded by DOE-NE under FCR&D grants, and the remaining steps will be funded by the Federal government via the HAMC with the LLC. The seven steps in the regional volunteer siting process are:

1. **Solicitation of expressions of interest from interested local communities**. It is planned that the private industry will issue a formal solicitation to potential host entities in 2010. The solicitation will describe the opportunity and identify the range of benefits and the potential risks associated with voluntarily hosting a regional UFMF. Local communities that have an interest in considering the opportunity will respond with an expression of interest (EOI).

   Those responding with an EOI will be eligible for a sub-grant to fund local communities, (along with the surrounding region and the State), to: 1) better understand the opportunity, 2) prepare a balanced evaluation of the benefits and risks, 3) identify other issues and concerns that the local community, surrounding region, and State may have, including any legislative or regulatory constraints, 4) make a preliminary determination whether there is a potentially acceptable site or sites for further consideration, and 5) decide under what conditions, if any, the local and State governments would be willing to enter into a binding agreement with the LLC to host a regional UFMF. It is recommended that Step 1 be completed in late 2010, as

described in Section 8.2. The sub-grant for Step 1 will not need to be repaid if the local or State government decides to opt out of the siting process at the end of this step.

2. **Formation and funding of a joint board with the local communities.** It is planned that local communities that agree, along with the State, to enter into discussions with the goal of moving forward to negotiate and formalize a host agreement(s)[117], will be eligible for an additional sub-grant in 2011. A joint board will be established with participating members from the respective host entities and private industry. Its activities will be funded by the sponsoring nuclear company via the DOE grant program and the sub-grant. During the site development phase of the regional UFMF initiative, the joint board will be led by individuals designated by the respective host entities.

   At this juncture, the primary function of the joint board will be to provide input to, and oversight of, the process leading to the development and negotiation of mutually acceptable host agreements. The joint board will identify those individuals that have the authority to develop and conduct negotiations on behalf of the host entities. In addition, the joint board will, (with the help of the sponsoring nuclear company,) will identify one or more potential sites that warrant further evaluation. It will also develop and negotiate the respective host benefits programs that will be incorporated into the host agreements, if the local community and State agree to go forward. The joint board will also participate in information exchanges with the local community, surrounding region, State, and media.

   It is planned that host agreements will be negotiated with the local and State governments, including the respective host benefits programs, with terms that are mutually acceptable to all parties in 2011. The resulting host agreements will be drafted in late 2011 and a memorandum of understanding (MOU) will be signed that identifies the conditions that must to be satisfied before the host local and State governments will sign the host agreements. It is further planned that the draft host agreements and MOU will initiate the negotiations of the HAMC between the LLC and the Federal government, which planned for completion in early 2012. The sub-grant for Step 2 will not need to be repaid if the local community or State decides to opt out of the siting process at the end of this step.

3. **Site selection.** For those local communities that, together with the State, successfully negotiate and develop draft host agreements to host a regional UFMF and sign an MOU, the respective joint board(s) will be eligible to receive additonal sub-grants in 2012. They will continue to be involved in the evaluation of the candidate sites and selection of the preferred site in that geographic region. It is planned that the host agreements designating the preferred site will be signed by the signatories making them binding in late 2012. It is further planned that the signed host agreements will serve as the basis for the HAMC between the

[117] A single of separate host agreements with the local government and the State government may be necessary depending on the needs and requirements of the respective hosts. The jurisdictional hierarchy established by the host agreement(s) will be the State government followed by the local government.

LLC and the Federal government will be completed concurrently in late 2012 and signed by the end of that same year.

Once the signed host agreements are in place, the role of joint board, (chartered and funded by the host agreements), will be as a management oversight board that will report directly to the UFMF,LLC CEO and will hold a voting membership on the LLC Board of Directors. The joint board will assist in the compilation of site data needed for preparation of the NRC license application to demonstrate the suitability of the preferred site, as described in Section 6.2.2, and to compare volunteer candidate sites, if there is more than one candidate site, in that geographical region. The joint boards will also review the results of the evaluation process for the preferred site in that geographical region to independently confirm that it has been thorough, unbiased, transparent, and well-documented. The joint board will review and confirm the record of decision for the selected site for which the NRC license application will be prepared. The joint board will continue, in this and subsequent phases, to interface with the local community, surrounding region, state, and media.

4. **Licensing.** The joint board for the selected regional site will review the site environmental studies needed to prepare the NRC license application and design the facility. The joint board will also provide input to the facility design process to assure that the UFMF is compatible with local community needs, including identification of any preferences or design features for consideration by the design team. The joint board will also review the plans to construct, operate, monitor, and decommission the facility in order to provide input on any concerns that need to be addressed or potential adverse impacts that need to be avoided or mitigated.

   In addition, the joint boards will have the opportunity to review the NRC license application prior to submittal, including the safety analysis report, the environmental report, and certain plans, such as the emergency plan, the decommissioning plan, and the surety funding plan, to be submitted with the license application. As a condition of the host agreements, the joint board members and local and State government officials designated by the joint board will also participate, as appropriate and as stipulated by the NRC regulations, in support of the UFMF during the NRC licensing proceedings, including the public hearing. Other government officials and members of the public, whether for or against, will also have the opportunity to participate.

5. **Construction.** The joint board will have the opportunity to monitor construction of the UFMF, including providing oversight of the contractor's ES&H program implementation and the measures being taken to protect the environment in accordance with the applicable requirements. The joint board will also provide oversight to ensure that appropriate steps are taken to realize the negotiated benefits for the local community and surrounding region, such as those listed above, which will include, (but are not limited to): 1) training and guaranteed hiring of local and regional construction workers, 2) procurement of construction materials, goods and services from local and regional suppliers, 3) completion of agreed-upon infrastructure improvements, and 4) implementation of the agreed-upon taxation structure.

6. **Operation.** The joint board will have the opportunity to monitor operation of the UFMF, including monitoring the implementation of LLC's ES&H program, QA program, site environmental monitoring program, radiological monitoring program, and corrective action program. The joint board will also have the opportunity to review on-site and off-site environmental and radiological monitoring data, including along transportation routes in the community, to ensure that there are no releases of radioactivity or significant off-site exposures of the public to ionizing radiation during transportation of the UNF to the UFMF and/or during operation of the facility. In addition, the joint boards will be informed and regularly consulted on any reportable incidents or accidents that resulted in injury or significant exposure to workers or the public in order to solicit input on the appropriate pre-emptive and/or corrective actions needed to preclude or prevent future occurrences. As indicated previously, the joint board will have the authority, under certain agreed upon conditions, to suspend receipt of UNF and/or the affected operations at the facility while a safety or environmental issue is investigated and remedied.

   In addition, the joint board will have primary responsibility for stewardship of the host benefits program to assure that all the benefits initiatives outlined in the host agreements are well planned, effectively implement and that the respective funding is well spent for its intended purposes. It will also have the responsibility to assure compliance with the non-economic provisions of the host agreements, such as monitoring the Federal government's progress towards development and implementation of a UNF final disposition policy.

7. **Decommissioning.** The joint board will continue to provide the same oversight as during the operation phase until all UNF and GTCC waste is removed from the site, the facility, components and equipment are decommissioned and closed, and the site is remediated as stipulated in the host agreements so that the site can be re-purposed for other uses, whether public or commercial at the host's discretion.

As described in Section 6.1, although the host benefits program will be managed and administered by the LLC, all costs for the regional UFMF volunteer siting process and the host benefits will be born by the Federal government, other than the discretionary corporate investments made in the region through endowments and other corporate development programs.

6.2.2 Site Evaluation Process

The UFMF site evaluation process must consider whether the facility will be constructed on a greenfield site or a previously existing nuclear site. The construction of a facility on a greenfield site requires significantly more characterization effort compared to making use of an established nuclear site. An environmental impact report would be required for the greenfield site including information on geology, soils, hydrology, seismology, and other environmental conditions. Hazardous conditions would have to be evaluated including natural disasters, such as floods, earthquakes, meteorological and climatological conditions, and extreme temperatures, as well as man-made hazards, such as flight paths, other nearby facilities, and roads or rail lines. The greenfield site's proximity to existing rail lines must also be considered to ensure adequate

transportation access. The cost of developing the site also plays a significant part in the determination of where to site a UFMF.

The previous considerations are the most significant with respect to hazards that could pose a threat to nuclear safety at the facility. Other considerations are those associated with the local, regional, and state populace in proximity to a site. Environmental justice, as discussed in Section 3, can be a consideration, depending on where the facility is sited. The volunteer siting process described above should alleviate facility cost and construction schedule impacts caused by a general unwillingness of the state or local communities to cooperate with licensing of the facility, and by intervention and contention in the public hearing process.

Each site must be characterized with respect to seismology, flooding potential, and environmental impacts on air quality, local flora and fauna, etc. The time required to characterize a site will vary significantly from site to site, but can be significantly reduced by selection of a site where characterization has already occurred and whose environmental impacts have already been evaluated. Siting the facility near an existing nuclear site significantly reduces the overall effort required for licensing. Impacts of the facility on the surrounding environment would have already been examined as well as potential hazards that could threaten safe operation of the facility, both environmental and man-made. An important consideration for selecting the site of an existing nuclear facility is the space available for the UFMF. As described in Section 5.1.3, the UFMF requires substantial space for cask storage and support facilities, approximately 54 acres for the restricted area, with a total of about 380 acres required for the entire site.

It is desirable to have more than one acceptable site for the UFMF in each of the three regions evaluated. With several viable sites in a region, the factors used for determining the optimal site are primarily the development cost, the relative acceptability of the UFMF by local, regional, and state populations and governments, proximity of the site and access to rail lines, and space available at the potential sites.

Additional information for UFMF site characterization and evaluation are provided in Appendix B.2.1. Additional information on UFMF siting that forms the basis for the illustrative business case analysis is provided in Section 7.

6.3 Regulatory Compliance Process

The regulatory framework for licensing regional, commercial UFMFs already exists and has been used successfully. The expertise and experience needed to site, design, license, and construct both wet and dry storage facilities, storage casks, and transportation casks also already exists, both in private industry and at the NRC. A licensing strategy has been developed that can accomplish the NRC licensing of a regional UFMF within the existing regulatory framework in an expeditious, cost-effective manner.

6.3.1 Licensing process

The U.S. Nuclear Regulatory Commission (NRC) will license any independent UNF storage facility under 10 CFR Part 72. Certificates of compliance for storage casks will be issued under 10 CFR Part 72, and, certificates of compliance for transportation casks will be issued under 10 CFR Part 71. The NRC has not delegated authority to license such a facility or issue certificates of compliance for storage casks and transportation casks to the Agreement States.

The NRC has existing regulatory guidance to assist the applicant in the preparation and review of the license application. Regulatory Guide 3.53 describes the applicability of existing regulatory guides, including those related to reactor spent fuel pools, to the design and operation of a independent UNF storage facility. Regulatory Guide 3.50 is the standard format and content guide for the safety analysis report for such a facility, and, Regulatory Guide 3.48 is the standard format and content guide for the license application to store UNF and HLW[118]. In addition, NUREG-1567 is the standard review plan for spent fuel dry storage facilities.

The NRC has successfully licensed independent UNF storage facilities, both located at and located away from operating nuclear reactors, under 10 CFR Part 72. There are currently 44 such licensed facilities at operating nuclear reactor sites and seven at orphaned shutdown nuclear reactor sites. Examples of NRC-licensed UNF storage facilities located away from operating nuclear reactor sites include a pool facility (the GE-Morris facility in Illinois) and dry facilities (the DOE-managed facility at Idaho National Laboratory and the as-yet un-built PFS facility in Utah).

The license for an independent UNF storage facility not located at an operating reactor site requires a stand-alone specific license in accordance with 10 CFR Part 72 rather than a general license which is tied to a 10 CFR Part 50 operating license. The license for such a facility located at an operating reactor site is a general license. Although it is possible that the volunteer siting process envisioned for the regional, commercial UFMFs may result in one or more volunteer site(s) located in the immediate vicinity of an operating nuclear reactor, the regional UFMFs will not be owned by a party operating a nuclear reactor under a 10 CFR Part 50 license and, therefore, each regional, commercial UFMF will require a site-specific license. Issuance of a site-specific license typically requires significantly more time and effort on the part of both the applicant and the NRC than issuance of a general license.

A specific license for a UFMF will have a license term not to exceed 20 years. That license can be renewed to lengthen the operating life of the UFMF, and, the NRC has recently finalized a rulemaking in which the Commission found reasonable assurance that, if necessary, UNF generated in any reactor can be stored safely and without significant environmental impacts for at least 60 years beyond the license life for operation (which may include the term of a revised or

[118] Regulatory Guide 3.48, U.S. NRC, Standard Format and Content for the Safety Analysis Report for an Independent Spent Fuel Storage Installation or Monitored Retrievable Storage Installation (Dry Storage), Rev. 1, August 1989.

renewed license) of that reactor in a combination of storage in its spent fuel pool and either on-site or offsite dry storage installations.

The facility infrastructure needed for a regional, commercial UFMF that must be licensed in accordance with 10 CFR Part 72 is described in Appendix B.2.1. For purposes of the UFMF illustrative business case presented in Section 7, it is assumed that a new stand-alone site-specific 10 CFR Part 72 license will be needed for a regional, commercial UFMF. As stipulated in 10 CFR Part 170.31, the license application fee for each regional UFMF is based on full cost recovery by the NRC.

A two-step licensing process is envisioned. In this two-step process, the UFMF LLC will submit a license application (LA) for both base capability and full capability UFMF to the NRC simultaneously, and request that the NRC proceed with the review of the LA and the hearing proceedings on two separate, but parallel, paths. The first path will be the base capability facility to receive already canistered fuel. The second path will be the full capability facility to receive, handle, and canister bare fuel assemblies. By separating the licensing review and hearing proceedings into two separate, but parallel, paths, it is anticipated that, based on the extensive experience with dry storage, the NRC authorization to construct the facility for receiving already canistered fuel can be obtained as much as a year earlier. The NRC authorization to complete the construction of the facility for receiving bare fuel is expected to follow shortly thereafter.

The transportation infrastructure needed for a regional, commercial UFMF that must be licensed in accordance with 10 CFR Part 71 is discussed in Appendix B.2.3. As stipulated in 10 CFR Part 171, the LA fees for the transportation casks will be paid by the cask vendors. For the shipment of loaded canisters from shutdown plants, it is assumed that the cask vendor's already licensed transportation cask for the associated dual-purpose cask system will be used. For the shipment of bare fuel from the operating plant's spent fuel pools, a transportation cask suitable for bare fuel will be needed. For purposes of the UFMF illustrative business case presented in Section 7, it is assumed that a certificate of compliance (CoC) will be obtained for one new large rail transportation cask that can accommodate bare PWR or BWR fuel, and that the regional UFMF will be the NRC 10 CFR Part Part 71 certificate holder[119]. The NRC fee for review of each application for a CoC is based on the full recovery of costs and it is assumed that these LA fees will be paid by the regional UFMF.

The storage casks needed for a regional, commercial UFMF that must be licensed in accordance with 10 CFR Part 72 is discussed in Appendix B.2.2. For the storage of loaded canisters from shutdown plants, it is assumed that the cask vendor's already licensed storage overpack will be used. For the storage of bare fuel from the operating plant's spent fuel pools, a large capacity economical store-only canister, (rather than a transportable canister), and storage overpack will be needed. For purposes of the UFMF illustrative business case presented in Section 7, it is

[119] There are existing dual-purpose metal storage and transport casks currently in use at a few plants sites, e.g., Peach Bottom, that could be adapted for this purpose. However, for the sake of the regional UFMF business case presented in Section 7, these casks are conservatively assumed to be unavailable.

assumed that a CoC will be obtained for one new large capacity storage cask that can accommodate bare PWR or BWR fuel, and that the regional UFMF will be the NRC 10 CFR Part 72 certificate holder[120]. The LA fees for the storage casks to be used at the regional UFMFs are based on full cost recovery by the NRC and it is assumed that these LA fees will be paid by the regional UFMF.

As stipulated in 10 CFR Part 171.15(c)(1), the annual fee for each regional UFMF can be expected to be on the order of $135,000 (the FY2007 annual fee was $159,000 and the FY2008 annual fee was $135,000). This annual fee covers the certificates of compliance for the transportation casks and the storage casks used for the regional UFMFs.

6.3.2 License Application

For planning purposes, the regional volunteer site selection, the site characterization of the volunteer sites, the design of the UFMF facilities and equipment, and the preparation of the LA are assumed to take place in FY2011-CY2016. This timeline should be achievable for several reasons. The volunteer site selection may be expected to identify volunteer sites that are in proximity to other NRC-licensed facilities (e.g., nuclear reactor sites, fuel fabrication facilities, and existing independent UNF storage facilities), state-regulated nuclear facilities (e.g. WIPP and commercial low-level radioactive waste disposal facilities), and DOE sites. Selection of volunteer sites in such proximity should reduce the time and cost needed for site characterization and should provide early-on the site data, developed under a rigorous quality assurance program, needed for facility design, the safety analyses, and the identification of potential environmental impacts needed for the LA.

Likewise, reliance on equipment and facility designs that have previously been reviewed and licensed by the NRC (e.g., the dry storage facilities at the PFS facility in Utah and spent fuel pools at new reactors currently being reviewed by NRC) should reduce both the time and cost needed for the design of the UFMFs and preparation of the 10 CFR Part 72 license application.

The contents of the LA are specified in 10 CFR Part 72, and, regulatory guidance and the standard review plan are provided by the NRC. The LA must include a SAR, Environmental Report, Emergency Plan, Technical Specifications, Physical Protection (Security) Plan, and QA Program for the independent UNF storage facility. The contents include but are not limited to addressing the following:

[120] There are existing dual-purpose canister-based concrete storage systems that are currently licensed that could be adapted for this purpose. However, for the sake of the regional UFMF business case presented in Section 7, a UFMF-specific storage cask is conservatively assumed to be used.

- General and financial information
- Technical qualifications of applicant
- Quality assurance
- Facility design
- Conformity to NRC general design criteria
- Safety evaluation report
- Operating procedures
- Operator training
- Radionuclide inventory and records requirements
- Physical protection plan
- Financial assurance and decommissioning plan
- Emergency plan
- Environmental report

These documents may reference storage cask vendor FSARs which have been previously reviewed by the NRC.

The regional UFMF license application must contain the technical information described in 10 CFR Part 72.24. NUREG-1567[121], provides detailed guidance as to information that needs to be included in the independent UNF storage facility SAR. Specifically it identifies topics that the NRC's reviewers will evaluate. NUREG-1571[122], summarizes some of the requirements for a site-specific license that are reviewed by the NRC as follows:

- Siting Evaluation Factors (Subpart E) — the site characteristics, including external, natural, and manmade events, that may directly affect the safety or the environmental impact of the facility.
- General Design Criteria (Subpart F) — applies to the design, fabrication, construction, testing, maintenance, and performance requirements for structures, systems, and components important to safety.
- Quality Assurance (Subpart G) — The planned and systematic actions necessary to provide adequate confidence that a structure, system, or component will perform satisfactorily in service as applied to design, purchase, fabrication, handling, shipping, storing, cleaning, assembly, inspection, testing, operation, maintenance, repair, modification, and decommissioning.
- Physical Protection (Subpart H) — the detailed plans for facility security.

[121] NUREG-1567, U.S. NRC, Standard Review Plan for Spent Fuel Dry Storage Facilities, Final Report, March 2000.

[122] NUREG-1571, U.S. NRC, Information Handbook on Independent Spent Fuel Storage Installations, December 1996.

- Personnel Training (Subpart I) — the program for training, proficiency testing, and certification of facility personnel who operate equipment or controls important to safety.

The NRC will review the site-specific LA and complete an evaluation of potential environmental impacts of the facility in accordance with the National Environmental Policy Act of 1969 (NEPA), generally in the form of an Environmental Assessment (EA) for an independent UNF storage facility located at a reactor site and an Environmental Impact Statement (EIS) for such an away-from-reactor facility. Following its safety review and resolution of comments, the NRC issues a Safety Evaluation Report (SER) and the final EA or EIS. The SER evaluates the licensees SAR and assesses the technical adequacy of the facility and the UNF storage system.

The submittal of the LAs for the regional UFMF to NRC is assumed to take place in January 2013. Figure 6-3 provides a generalized flowchart of the NRC and licensing proceedings.

Upon receipt of each license application, NRC will assign a docket number and cause a notice of docketing to be filed in the Federal Register. The Commission will issue a notice of proposed action and opportunity for a public hearing, or, if the Commission determines that a public hearing is required in the public interest, the Commission will issue a notice of public hearing. It is reasonable to expect that a public hearing will be held for each regional UNF management facility. The public hearings will be held under 10 CFR Part 2, Rules of Practice for Domestic Licensing Proceedings and Issuance of Orders. The NRC review of the LA, preparation of the SER and EA, the informal, oral public hearings, and issuance of a license including a construction authorization (CA) for the base capability facility are assumed to take three years. The issuance of an amendment to the license to obtain the CA for the full capability facility is assumed to take an additional year.

As discussed later in this section, the issuance of certificates of compliance for the transportation casks and the storage casks will occur on a separate, earlier timeframe than the licensing of the UFMF. Issues related to the transportation casks and storage casks will not be admitted as contentions for the public hearings.

6.3.3 Issuance of License

At the conclusion of the public hearings, the Presiding Officer will make findings of fact and conclusions of law on matters put into controversy by the parties and on any matters designated by the Commission to be decided by the Presiding Officer. Assuming successful resolution of these matters by the Presiding Officer, the Director of NMSS will make the requisite findings and issue the license including the CA.

The licensee is required to submit a Final Safety Evaluation Report (FSAR) within 90 days after issuance of the license. The FSAR is to be based on the safety analysis report submitted with the LA and is to reflect any changes or commitments developed during the license approval and/or public hearing process.

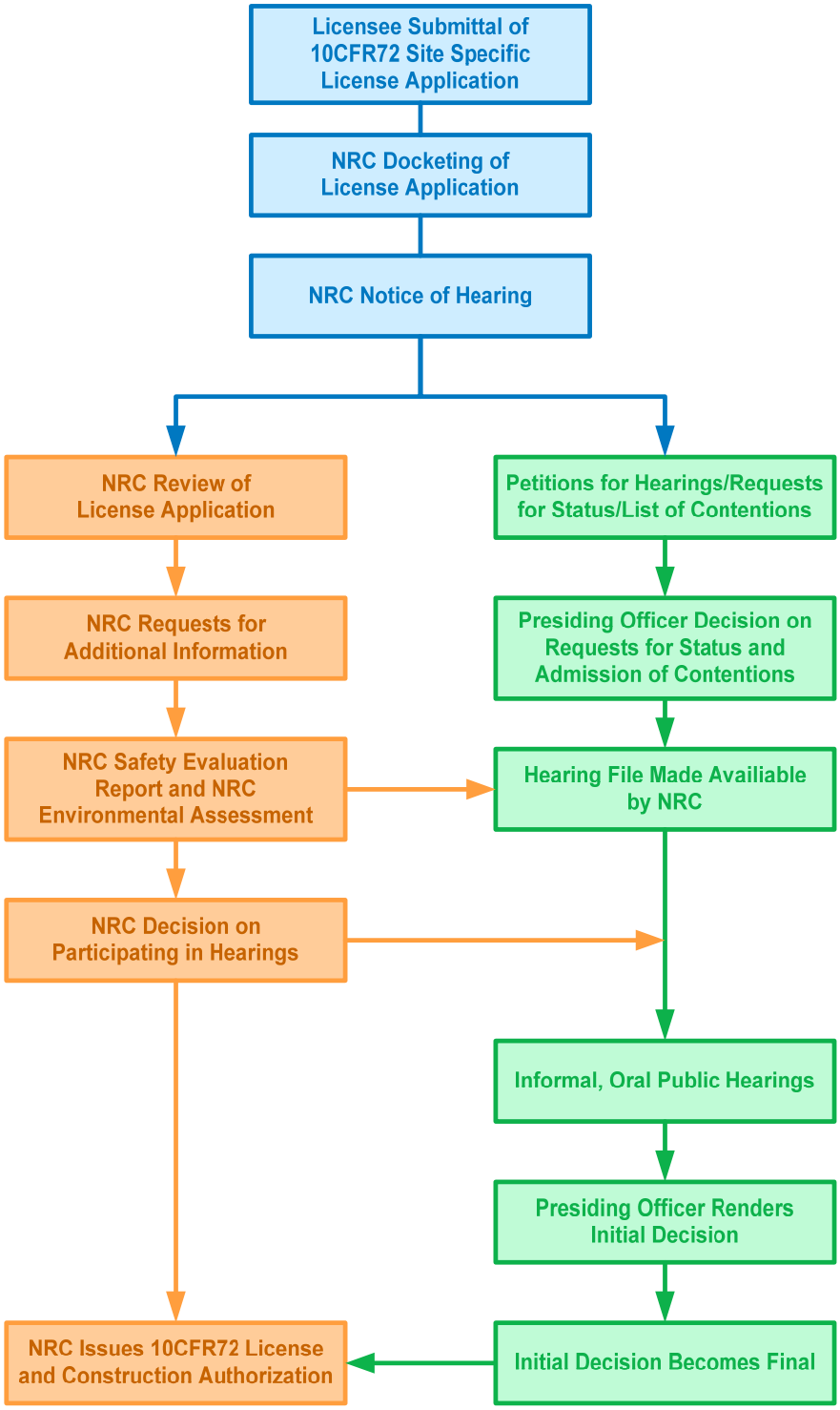

Figure 6-3 – NRC Licensing Process for Regional UFMF

The NRC licensing process for a regional, commercial UFMF is well established.

6.3.4 Licensing Strategy – Storage and Transportation Casks

The design and licensing of the storage casks and transportation casks will proceed in advance of, and on a separate path, from the regional UFMFs. Existing certified storage casks and transportation systems will be used to the extent possible, and in instances where new storage casks and transportation casks are needed, existing cask vendors will be encouraged to revise already-certified designs or develop new designs for submittal to the NRC.

As described in Appendix B.3.2 and B.3.3, the number, types, and time of delivery of the storage casks and transportation casks needed for the regional UFMFs can be identified in advance of selecting the volunteer sites, characterizing those sites, and beginning preparation of the LA. For example, planning can already begin to determine the storage casks and transportation systems needed for base capability facility. During this timeframe, which is estimated to take 3 years, the regional UFMFs will receive only canistered UNF primarily from the orphaned shutdown nuclear reactors for storage on reinforced concrete storage pads. The types of casks that will be transported are already known. Those casks that are certified for transportation (i.e., they are certified dual-purpose casks) are also already known. In addition, those casks that will require certified transportation casks are already known. Further, the cask vendors for the existing casks, both for storage at the nuclear reactor sites and for transportation to the regional UFMFs, are also already known.

Should this information identify the need to develop one or more transportation casks, the appropriate cask vendor can determine the extent to which the transportation casks can be based on modification of existing certified designs. If they can, those design modifications can be made and applications for amendments to the existing certificates of compliance can be submitted to the NRC.

The full capability facility includes the receipt, unloading, and canisterization of bare UNF assemblies in a transfer pool. Even before starting the licensing process for the regional UFMFs, both the transportation casks needed to transport, by heavy-haul truck or rail, the bare UNF assemblies from operating reactor sites and the storage casks needed for dry storage of those fuel assemblies at the regional UFMFs can be identified, designed, reviewed, and certified.

6.3.5 Licensing Strategy – Regional UFMFs

At the start of the licensing process, the LLC as the applicant will request that, for each LA, the NRC form separate hearing boards and set separate hearing schedules for the base capability facility and the full capability facility in anticipation that licensing of the former can be completed more expeditiously. The licensing of the full capability facility can proceed on its own schedule and can be accomplished as an amendment to the already issued license. This licensing approach will accelerate both the removal of the already-canistered UNF from the orphaned shutdown reactor sites and the completion of decommissioning of those sites as a priority.

The level of effort associated with preparation of the site-specific UFMF SAR can be reduced considerably by selection of a storage system that has been reviewed and approved by the NRC (with a CoC having been issued for the storage system), or a storage system that is currently undergoing NRC review. An existing rule eliminates the need for repetitive reviews by the NRC during the site-specific LA review process. In this case, the NRC would focus their review on site-specific issues and storage system/site interface issues. This helps streamline the site-specific licensing process and makes the site-specific licensing process similar to the general licensing process. Should the UFMF elect to utilize a storage system that has not been reviewed and approved by the NRC, the storage system will be license separately as described above rather than as part of the site-specific - for the UFMF.

Also, there is an alternative licensing approach that should be considered based on standardization. The licensing process assumed for the Section 7 illustrative business case is based on the assumption that there will be separate LAs, NRC reviews, and public hearings for each of the three regional UFMFs. With the exception of site-specific information as described in Section 6.2.2, such as the description of site characteristics (e.g., geology, hydrology, seismicity, fauna, flora, population, socioeconomics, etc.) needed for the LAs (e.g., design of the facility, evaluation of pathways for the potential release of radionuclides to the public, evaluation of potential environmental impacts, etc.), the LAs for the regional UFMFs will be essentially the same and the contentions raised before the separate hearing boards will, to a large extent, be the same.

As a result, it may be appropriate in FY2010 to (1) evaluate the possibility and practicality of adopting a standard plant approach and (2) discuss with the NRC the process to implement, if advantageous, a standard plant approach. In that approach, the applicant would submit a generic LA and the NRC would perform a generic review, including one public hearing, of the common aspects of the regional UNF management facilities. At a later date, the applicant would submit site-specific information and analyses for each regional UNF management facility and the NRC would perform separate, limited reviews, and would hold separate, limited public hearings, on the site-specific aspects of each regional UFMF.

This approach, although unknown at this time whether it can be adopted, would allow preparation, submittal, and review of the generic LA, including public hearings, to proceed in parallel with the site selection, site characterization, and design activities in CY2011-12. It would limit the scope of the site-specific LAs, licensing review, and public hearings for each of the regional UFMFs, thereby reducing the time and cost needed by both the applicant and the NRC. It would have the added benefit of providing certainty to the local communities and host states that they are volunteering for a facility that, in the end, can be licensed. Also, it would provide confidence to the nuclear utilities and the DOE that they can enter into viable contracts for the long-term management of UNF.

6.4 Construction Phase

This section presents an overview description of the cost basis for the construction phase of a representative regional UFMF for the illustrative business case presented in Section 7, including

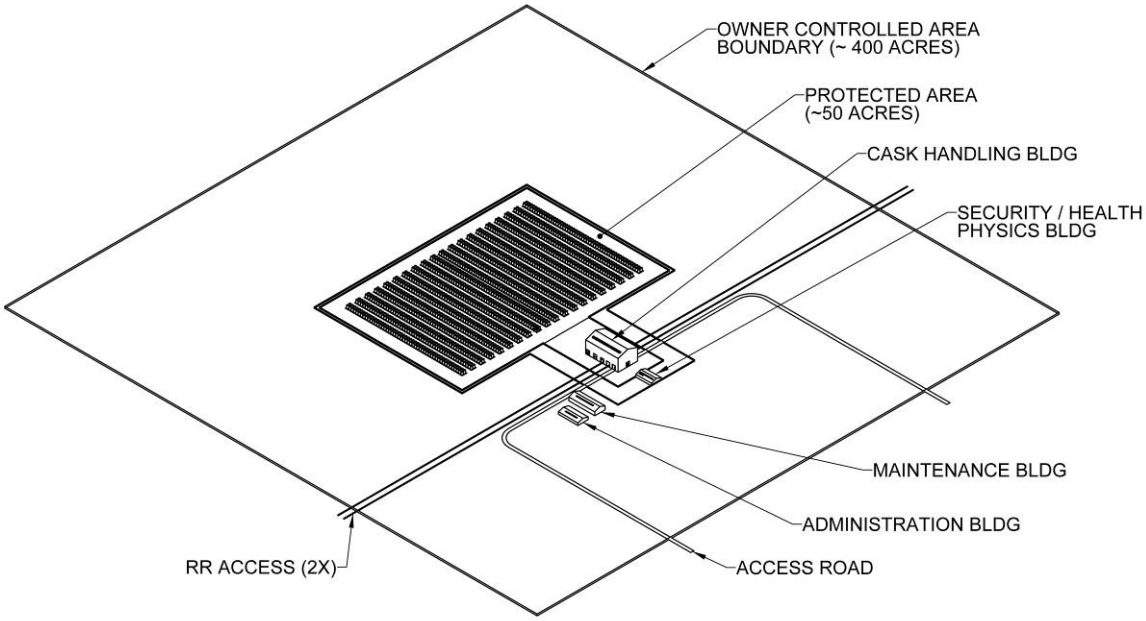

Figure 6-4 – Fully-Configured Regional UFMF

The regional UFMF, when fully configured, occupies about a 400 acre site with a 50 acre protected area.

the assumed key steps occurring during the facility construction phase, and the construction phase funding model. The estimated construction costs for the UFMF infrastructure, including the transportation and storage system components, are detailed in Appendix B.3. The cost basis for the UFMF construction phase is discussed in Section 6.4.1. The financing steps and key revenue assumptions for the construction phase are discussed in Sections 6.4.2 and 6.4.3, respectively.

6.4.1 Construction Phase Cost Basis

The cost basis chosen for the UFMF is a complete fixed-base facility for the acceptance, transfer, and dry cask storage of orphaned DPCs from shutdown reactors and bare fuel from operating reactors, as shown in Figure 6-4. The construction phase extends into the operations phase in a manner that provides for a more representative regional UFMF illustrative business case. This approach allows the UFMF to accept DPCs from shutdown plants (i.e., orphaned DPCs) as early as possible, while spreading out the required capital investment over several years of UFMF operation. In addition, the revenue provided by Phase 1 operations is used to partially fund the continued (Phase 2 and beyond) construction. The major cost elements for the UFMF construction phase are the UFMF facility and transportation system.

6.4.1.1 Regional UFMF Facility

The cost basis for the regional UFMF construction phase is a multipurpose facility that serves the goals listed in Table 6-4. Several UFMF system attributes follow from each goal, and these attributes have been included in developing the cost basis for the illustrative business case analysis in Section 7. The regional UFMF construction is planned in five stages, as shown in Figure 6-6 and outlined below:

- Stage 1: Construct a base capability facility for receiving and storing dual purpose canisters (DPCs)
- Stage 2: Expand the facility to its full capability for receiving, packaging and storing bare fuel assembly receipt and storage operations.
- Stage 3: Construct additional storage pads.
- Stage 4: Construct additional storage pads.
- Stage 5: Construct additional storage pads.

During Stage 1, all facility structures, systems, and components necessary for orphaned DPC receipt, transfer, and storage operations are constructed or procured. The primary UFMF buildings structures and major equipment included in the Stage 1 construction include:

- Cask Handling Building (CHB), including:
  - Building structure and facilities
  - Cask off-loading station with laydown area
  - Canister transfer cells
  - 150-ton single failure proof overhead bridge crane
  - Crawler garage
- Maintenance Building, including:
  - 100 ton non-single failure proof maintenance crane
  - Cleaning / welding / painting equipment
  - Tools as required for cask transfer / handling equipment repair
- Security and Health Physics Building
- Administrative Building
- Storage Pad (capacity of 400 storage casks)

The completion of Stage 1 construction will establish the Owner Controlled Area (OCA) and the Protected Area (PA). The total area of the UFMF is approximately 400 acres and the PA area is approximately 50 acres. Figure 6-5 shows the general layout of the UFMF base facility. The CHB, storage pads, and security and health physics building are located within the PA. The security and health physics building is the security checkpoint and the primary personnel entrance for access into and out of the PA. Four 36-foot wide by 900-foot long storage pads are

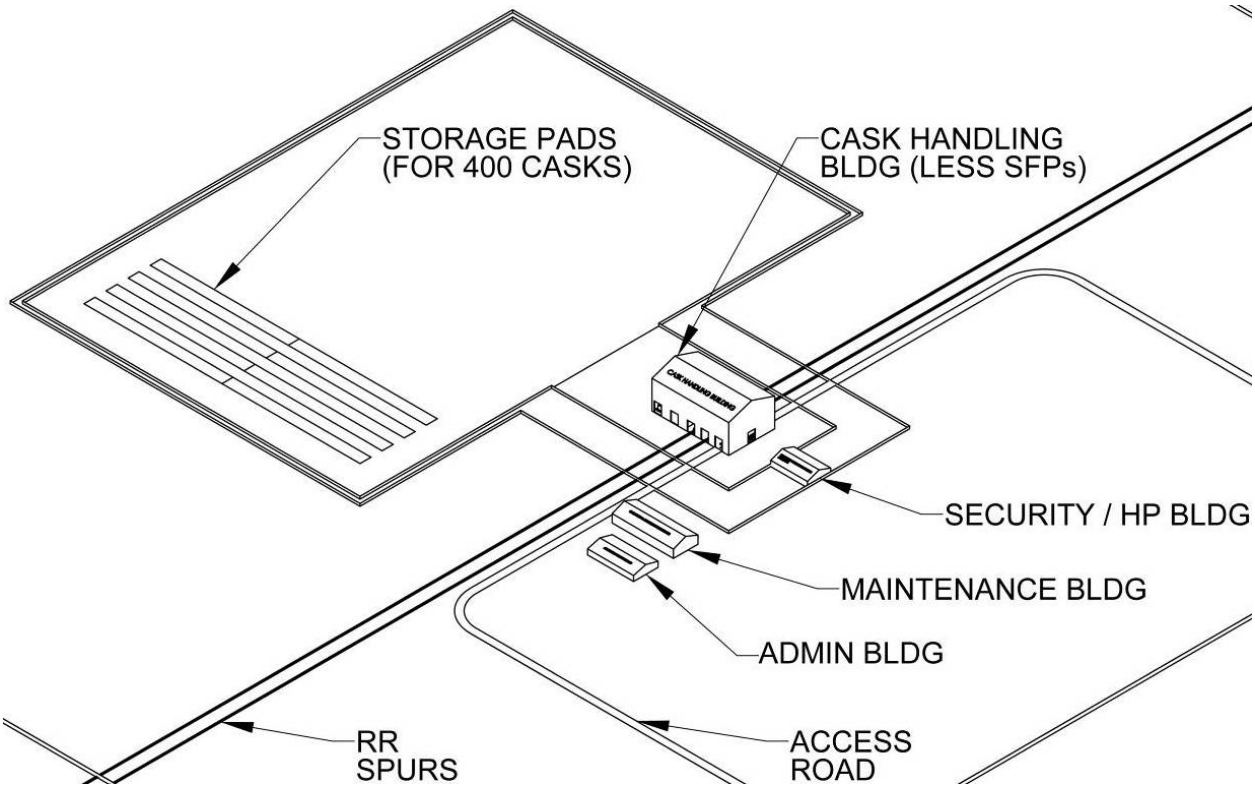

Figure 6-5 – Regional UFMF Base Capability Facility

The UFMF base capability facility includes all structures, systems, and components required for orphaned DPC receipt, handling, and storage

constructed, each with a capacity for 100 vertical storage casks. Storage casks are placed in a 2x50 array on each storage pad at 18-foot center-to-center spacing.

The access roads and railroad spurs to the UFMF are constructed during Stage 1. Inspection of incoming transportation casks prior to entry to the restricted and CHB will take place at the receiving station. A cask receiving station, with rail sidings used to stage railcars, will be constructed outside of the PA to control railcar movement into and out of the PA and CHB. A haul road is constructed within the restricted area from the CHB to the storage pad area to accommodate a fully loaded cask transporter (or "crawler"). Facility roads and parking lots will be constructed as appropriate. Additional information on the CHB, storage pads and related storage equipment / components is included in Appendix B.2.1.

Stage 2 includes construction of four additional storage pads, increasing the total UFMF storage capacity to 800 storage casks, as well as the fuel pool extension to the CHB, including the related equipment needed to facilitate operation of the fuel pools such as the cooling system with its pumps, heat exchangers, demineralizers, and a filtered building exhaust/HVAC system. In the illustrative business case analysis, the fuel pool expansion occurs at the beginning of stage 2, whereas the storage pad expansion occurs prior to the 10th year of operation. Additional information on the fuel pools and associated systems is included in Appendix B.3.1.

Finally, Stages 3 through 5 include construction of additional storage pads as necessary to provide storage space of up to 40 additional casks per year. A total storage space for 2,000 storage casks is assumed for the illustrative business case regional UFMF, as shown in Figure 6-5.

6.4.1.2 Transportation System

The regional UFMF transportation system capital costs for the illustrative business case analysis include procurement of the components and rolling stock. NRC certification costs are included in previous project phases and commissioning costs are included in the operations phase. Conservative assumptions are made regarding the capacity of the transportation casks, consistent with currently available systems.

The primary components of the transportation system are:

- Transportation packages
  - Transportation casks,
  - Skids,
  - Impact limiters
  - Personnel barriers
- Dedicated train systems (railcars, security cars, and buffer cars)

A description of transportation system is provided in Appendices B.3.3.

Table 6-4 - Basis for Illustrative Business Case Regional UFMF Capabilities

Regional UFMF Goal	Attributes
Accept and store all orphaned DPCs from shutdown reactor sites in the postulated region within the first three years of operation.	• Phased/Staged construction approach. • 40 DPCs per year throughput rate. • Assume three orphaned storage sites, using two different vendor storage systems, to be accommodated at UFMF.
Accept and store bare fuel from operating reactor sites in the postulated region wishing to participate. Accept already-canistered used fuel	• Requires pool transfer facility. • Requires fuel canisterization capability. • Pool requires rack space for the purpose of mixing/matching fuel assemblies to be loaded into storage canisters at the UFMF. • Assumed region includes 20 participating PWR plants, 10 participating BWR plants. • Revenue model based on 900 PWR and 1100 BWR assemblies per year. • Peak required throughput assumption (for UFMF infrastructure cost basis) is 125% of that assumed for the revenue forecast. • Total of twenty separate storage pads with 100 cask capacity per pad (2000 canisters total).
Accommodate back-end operations to remove the fuel assemblies from storage and facilitate the final used fuel disposition options.	• Existing facilities could be reconfigured or new facilities could be added at a future date to facilitate used fuel recycling on the same site or a different site. • Fuel could be repackaged into repository-specific waste containers for direct disposal in one or more geologic repositories. • Facility could serve a load balancing function to optimize the operations of either a recycling center or geologic repository, e.g., thermal aging, fuel batching, reconfiguring fuel to remove control inserts and flow channels, etc. • Capability could be added at a future date to temporarily store and package GTCC and other HLWs for disposal.

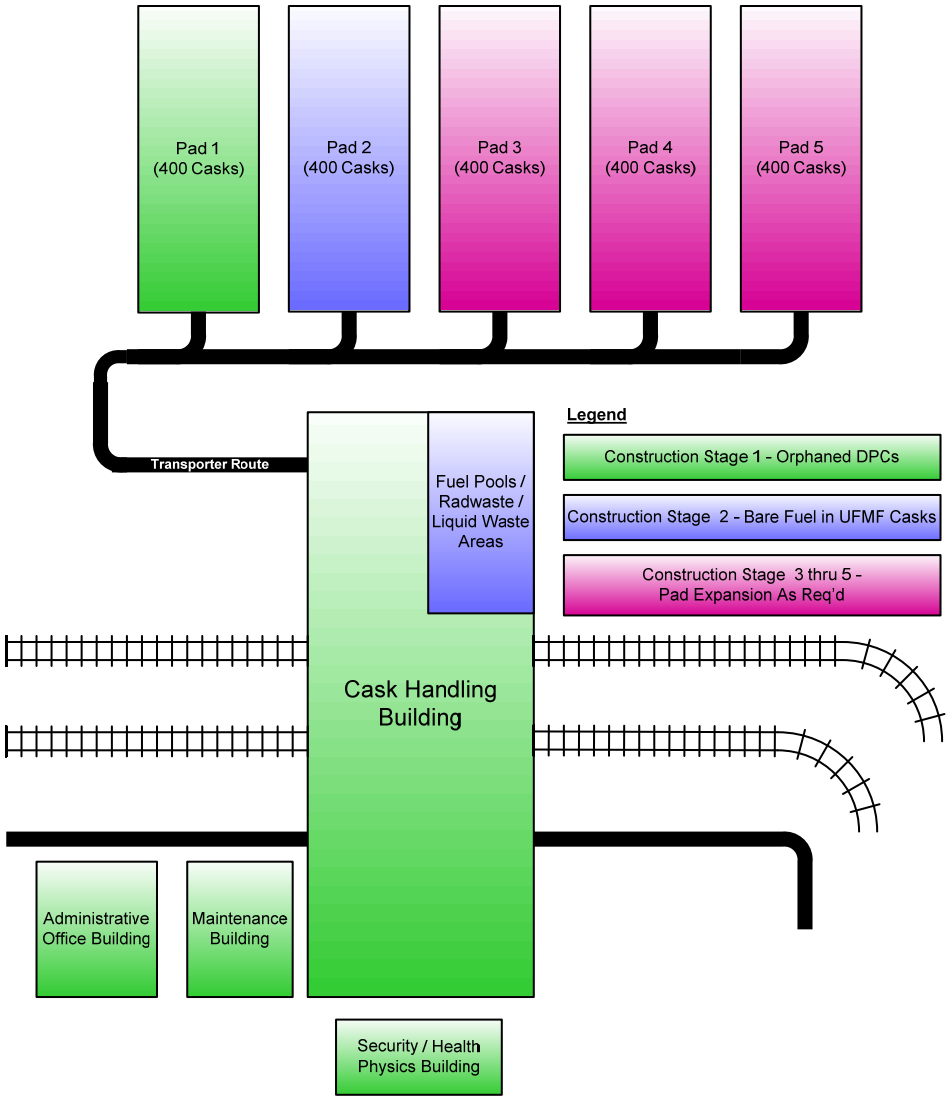

Figure 6-6 – Regional UFMF Staged Construction Approach

The regional UFMF staged construction approach allows rapid deployment of orphaned DPC acceptance, while construction and procurement activities progress to allow bare fuel assembly acceptance and storage.

6.4.2 Construction Phase Financing Steps

The steps for financing the construction phase, as described for the regional UFMF business model concept in Section 6.1 and identified in Table 6-1, are:

- Enter into RSPC with Federal government. A federal loan guarantee would also be helpful to obtain more favorable/less costly commercial loan terms.
- As achievable at this stage, enter into contracts with committed regional commercial customers /early subscribers. Solicit and put memoranda of understanding in place with other uncommitted customers.
- Obtain commercial financing for construction collateralized by the Federal government RSPC and perhaps a loan guarantee, and any commercial customer subscription contracts.
- Construct facility and procure capital equipment with sufficient capacity to support 1st five years of operations.
- Construct initial operating capability facility for receipt and storage of canisters, primarily from orphaned shutdown plants.
- Procure capital equipment for initial operating capability facility.
- Construct full operating capability facility for receipt of bare fuel assemblies, primarily from existing operating plant pools.
- Procure capital equipment for full operating capability facility.

6.4.3 Key Revenue Assumptions

As described in Section 6.1, revenue to amortize the cost of constructing a regional UFMF will be generated by the fees collected from the Federal government and any commercial customers for goods and services associated with using the UFMF.

Revenue from Federal Government. Funding from the Federal government service contracts consists of receipt fees and annual fees. Table 6-5 maps each of these fee categories to the construction phase cost elements. The major cost elements funded by RSPC to facilitate UFMF construction are any payments owed to the host to acquire or lease the site, and for the transportation system procurement.

Revenue from Commercial Customers. Revenue from the commercial utility customers consist of initial subscription fees, fees for canister or UNF removal from the plant sites, UFMF packaging and storage fees, and optionally UNF title transfer fees. Table 6-5 maps each of these fee categories to the UFMF construction phase cost elements.

Table 6-5 – Summary of Construction Amortization Revenue Model

Cost Element	Commercial				Government	
	Subscription	Fuel Pick Up	Annual	Title Transfer	Initial	Recurring
UFMF Facility Construction					✓[1]	✓[1]
Transportation System Procurement					✓[1]	✓[1]
Storage Capital Equipment					✓	✓

Note:
1. Construction financing to be amortized by these fees.

6.5 Operational Phase

The operational phase is the longest time period of the regional UFMF life cycle and thus dominates illustrative business case financial model. Although much of the project's capital equipment and infrastructure are procured or constructed during the previous phase, this phase includes significant O&M costs (facility O&M and transportation), host benefit costs, most of the storage hardware costs, and provides most of the life cycle revenue.

This section presents an overview description of the bases for the financial model costs used for the Section 7 illustrative business case analysis, the assumed key steps occurring during the facility operations phase, and the operational phase revenue model.

6.5.1 Operations Phase Cost Basis

The UFMF operational phase cost basis covers an assumed 50 year operating life beginning with a 3 year canister-only acceptance phase followed by 47 years of bare fuel assembly acceptance.

The key capital and O&M cost elements incurred during the operational phase are:

- Commissioning: Startup costs for the facility, transportation system, and UNF storage system.
- Facility O&M: Facility operations and maintenance costs including management, administrative, security, ES&H, quality assurance, regulatory compliance, and maintenance staff.

- Transportation: Transportation system labor, maintenance and other transportation-related direct costs.
- Storage: Storage system capital equipment (canisters and storage overpacks), labor, and other storage-related direct costs.
- Host Benefits: Costs associated with the ongoing host benefit package during the operational phase.

6.5.1.1 Baseline UFMF Throughput, Lifetime, and Capacity

The Section 7 illustrative business case financial model assumes a representative geographic region with 20 participating active PWR plants, 10 participating active BWR plants, and three decommissioned plants whose fuel is already canistered in dual-purpose (transportable) canisters. This population corresponds to a region comprised of about 1/3 of the total U.S. currently operating commercial nuclear plants, as discussed in Appendix B.1.1 with about 90% participation among the region member plants.

The UFMF is presumed to accept UNF from the orphaned shutdown plant sites first, at a rate of 40 dual-purpose canisters per year, for the first three years of operation. The facility is then assumed to begin accepting bare UNF assemblies in year four, at a rate of 900 PWR and 1100 BWR assemblies (645 MTU) per year, directly from operating plants' spent fuel pools. Because there may not be an economic motivation for operating utilities to ship already canistered fuel to a UFMF, the financial model does not include dual purpose canister receipt after year three. Should utilities desire such a transfer, as might accompany a transfer of title, the envisioned UFMF framework could easily accommodate already canistered fuel transfer at similar costs to those presented herein for orphaned canisters for shutdown plants. The current UNF storage market is discussed in Appendix B.1 and the UFMF fuel acceptance basis is discussed further in Appendix B.2.

The UFMF model is also capable of storing reactor-related GTCC waste, which would have similar costs to the canistered fuel model. For the purpose of the illustrative business case financial analysis, GTCC waste is not addressed separately. It is recognized, however, that accepting GTCC waste is particularly important for orphaned shutdown plants in order to remove all of the remaining nuclear materials from the sites. When UNF canisters are discussed, they should be understood to mean GTCC waste canisters interchangeably.

Operations during this phase will consist of the transfer of canisters from transportation casks to storage casks, the transfer of bare fuel assemblies from a transportation cask to a canister in a transfer cask, or from a transportation cask into the SFP and later from the pool to a canister in a transfer cask. Once the UNF has been loaded into a canister in a transfer cask, canister transfer operations will be conducted to transfer the canister into a storage cask, and the storage cask transported to the UFMF storage pad for long-term storage. The facility will be under security surveillance 24 hours a day, seven days a week until all radioactive material and contaminants have been removed from the UFMF site. Monitoring of site and personnel dose rates will be

done continuously by Health Physics personnel. O&M personnel will maintain all systems to ensure maximum through-put. Administrative personnel will ensure all documentation is controlled and retained in accordance with 10 CFR Part 72.152 and 10 CFR Part 72.4 requirements.

The regional UFMF lifetime, for purposes of the illustrative business case financial analysis, is assumed to be 50 years, after which time a number of scenarios can occur. Because of the flexibility of the regional UFMF concept as part of a national IUFM strategy, as discussed in Section 1, many different scenarios are possible at the back-end and so the business model concept must be flexible enough to evolve as the national waste policies continue to develop.

Although the regional UFMF concept is viable for a range of different facility capacities, specific parameters are selected in order to perform the illustrative business case financial analysis in Section 7. Using the throughput and lifetime described above, and based on the transportation and storage hardware characteristics discussed in the following subsections, the regional UFMF capacity is modeled at 2000 canisters, or approximately 30,000 MTU, over the assumed 50 year storage campaign.

6.5.1.2 Baseline Storage Hardware

The storage system capital equipment is a significant portion of the UFMF lifecycle cost. Conservative assumptions were made regarding the capacity of the UFMF storage casks, compatible with currently available dry storage systems. The detailed descriptions of the storage and transportation systems are provided in Appendices B.3.2 and B.3.3.

The primary storage system components are:

- Storage canisters
- Storage casks
- On-site transfer casks
- On-site cask transporter
- Canister drying/sealing/cutting equipment

6.5.1.3 Baseline O&M Labor

Since most of the capital equipment investment has been made in the construction phase, the regional UFMF operational phase costs are a significant portion of the operating budget. Section B.2.1.2.1 describes the labor plan that forms the basis for the financial model labor costs. For the operational phase, the labor plan includes personnel for:

- Plant management and administrative staff
- Quality, licensing, safety, and engineering staff
- Security staff

- Health physics staff
- Storage and transportation operations staff

Shift work is included in the labor plan assuming one shift for management and administration functions, two-shifts for operations and health physics, and 24/7 security staff.

6.5.2 Key Steps in the Financial Model

The key operational phase steps assumed in the illustrative business case financial model as described in Section 6.1 and identified in Table 6-1 are:

- Implementation of LLC business and operating plan
- Preoperational demonstration and commissioning
- Implement Federal government RSPC and HAMC
- Implement commercial utility customer subscription contracts
- Negotiate and enter into additional subscription contracts with other commercial and governmental customers
- Procure components for initial capability facility operations, i.e., storage overpacks, for receipt and storage of UNF and GTCC waste canisters, primarily from isolated decommissioned plants.
- Retrieve, transport, receive, transfer and place already sealed D&D'd plant canisters in storage
- Procure components for full capability facility operations, i.e., storage canisters and overpacks, for receipt of bare fuel assemblies, primarily from existing operating plant pools
- Load, transport, receive and unload operating plant bare fuel assemblies; and load, seal, transfer and place canisters in storage

The illustrative business case financial model is discussed in detail in Section 7.2 and the illustrative business case analysis results are presented in Section 7.3.

6.5.3 Key Revenue Assumptions

As described in Section 6.1, revenue to cover the cost of operating a regional UFMF will be generated by the fees collected from the Federal government and commercial customers for goods and services associated with using the UFMF.

Revenue from the Federal Government. Revenue from the Federal government RSPC consists of receipt fees and annual fees. Table 6-6 maps each of these fee categories to the operations phase cost elements.

Revenue from Commercial Customers. Revenue from the commercial utility participants consists of initial subscription fees, canister or fuel assembly removal fees, and optionally UNF title transfer fees. Table 6-6 maps each of these fee categories to the operations phase cost elements.

Table 6-6 – Summary of UFMF Operational Revenue Model

Cost Element	Commercial				Government	
	Subscription	Fuel Pick Up	Annual	Title Transfer	Initial	Recurring
UFMF Facility Commissioning					✓	
UFMF O&M		✓	✓	✓[1]	✓[1]	✓
Transportation O&M						✓
Storage Hardware		✓			✓	
Storage O&M		✓	✓			✓
Host Benefits						✓

Note:
1. Title transfer fees for utilities choosing to transfer title (not included in Section 7 illustrative business case).

6.6 Future Final Disposition

The regional UFMF is intended to be a robust and flexible component of a national IUFM system, as described in Section 1. The UFMF serves two primary purposes; near-term, it allows UNF to be removed from shutdown plants and operating reactor sites, but, longer-term, it also forms a valuable asset as a staging facility for the final disposition of the UNF, either by direct disposal or recycle.

The regional UFMF concept described throughout this report can accommodate a wide range of UNF final disposition options, including direct geologic disposal, recycling, other options requiring next-generation advanced fuel-cycle technologies, or any parallel combination. For UNF final disposition by direct disposal in a deep geologic repository, regional UFMF functions may include:

- Batching the UNF assemblies to minimize its reactivity and to minimize its radiological and thermal source terms during disposal in the repository. This would serve to optimize repository performance and enhance public safety. It would also alleviate and simplify the multitude of fuel assembly configurations that the repository must now deal with as presently configured which will simplify the repository safety analysis and licensing process.
- Packaging the UNF in repository-specific waste disposal containers and sealing the disposal packages closed. This would allow the waste disposal package design(s) to be tailored to geology and hydrology of the specific repository(s) site to enhance the total system performance. This would also substantially reduce the surface infrastructure required at a repository and simplify repository operations making it unnecessary to have the capability to handle fuel assemblies.

These regional UFMF repository staging operations would significantly reduce the mission of the repository to simply receiving sealed waste disposal packages that are free of contamination for direct emplacement in one or more geologic repositories. Such a de-scoped geologic repository for UNF would function much the same way as the WIPP facility in New Mexico does today for disposal of pre-packaged transuranic waste, which would make it much easier to site and license one or more geologic repositories in the future.

For final UNF disposition by recycling using advanced fuel-cycle technologies on the same site or a different site, regional UFMF staging operations may include:

- Batching the UNF assemblies to minimize its reactivity and to minimize its radiological and thermal source terms for recycling operations. This would serve to optimize recycling operations and enhance public safety.
- Removing the non-fuel bearing components of the UNF assemblies, including the control rod inserts for PWR assemblies and the flow channels for BWR assemblies. Segmenting, volume reducing and packaging this hardware for disposal as Class B/C waste rather than HLW. This would serve to simplify UNF recycling facility operations and optimize the overall waste stream.
- Transporting the UNF assemblies bare in transportation casks with bolted closures so there are no welded canister opening and canister waste disposal operations at the recycling center.
- Receiving packaging and storing vitrified HLW for the UNF recycling center. Packaging the HLW in repository-specific disposal containers and sealing the disposal packages closed.

These regional UFMF recycling staging operations would reduce the footprint of the recycling center by alleviating the need to have dry lag storage, a large fuel pool and a storage area for vitrified HLW. UNF received at the receiving center would be ready for recycling upon arrival. Vitrified HLW from the UNF recycling center could be directly shipped to the UFMF for storage and staging for disposal.

6.6.1 Potential Final Disposition Missions

Because of the wide range of possible regional UFMF missions during the yet to be defined final disposition phase, financial modeling of this phase is not practical at this time. The illustrative business case financial analysis, therefore, assumes that decommissioning and dismantlement phase occurs immediately after the 50 year storage campaign in order to properly capture the D&D costs.

Table 6-7 – Potential UNF Final Disposition Missions

Disposition Strategy	UFMF Function	UFMF Benefits
Geologic Repository	• Batching and thermal aging as necessary • Repackage fuel into repository-specific disposal packages	• Consolidates repackaging activities to a few sites • Improved transportation logistics
Recycling	• Batching and thermal aging as necessary	• Recycling facility could be distant (eliminates the need for DPCs) or co-located (eliminating transport).

6.6.2 Final Disposition Costs

The future final disposition phase cost elements may include any of the following, (likely other):

- Storage costs for interim canisters awaiting disposition
- O&M costs to unload canisters
- Capital and O&M costs to repackage UNF into disposal canisters
- Prepare and ship canisters or bare UNF assemblies to a final disposition facility

6.6.3 Final Disposition Funding

Costs for the UNF disposition phase are assumed to be funded by a future Federal government services contract and are not considered further.

6.7 Decommissioning and Dismantlement Phase

The decommissioning and dismantlement (D&D) phase begins when all the UNF, GTCC and HLW has been removed from the UFMF site. As discussed in Section 6.6, the UNF disposition phase is not included in the Section 7 illustrative business case financial model due to the range of possible future scenarios. For illustrative business case financial modeling purposes, it is assumed that the D&D phase occurs immediately at the end of the 50 year storage period, expending the D&D fund accrued over that period of time.

6.7.1 D&D Phase Cost Basis

The UFMF D&D phase cost basis includes the steps necessary to retire the facility, storage hardware, and transportation system hardware. It is assumed that host benefits cease at the end of the D&D phase.

The key D&D cost elements are:

- Decontamination- Cleanup of pool, water and air treatment systems, in preparation for dismantling and demolition. Remove activated material from storage casks in preparation for demolition as traditional waste.
- Dismantlement- Dismantlement/deconstruction and salvage of the UFMF facility and equipment.
- Disposal- Disposal of radioactive components and non-radioactive material.
- Operations- Ongoing facility operations and maintenance costs including management, administrative, ES&H, quality assurance, regulatory compliance, and maintenance staff during the D&D phase.
- Host Benefits- Costs associated with the ongoing host benefit package during the D&D phase.

6.7.1.1 Decommissioning Approach and Assumptions

Decommissioning of the regional UFMF will be a condition of the 10 CFR Part 72 site license described in Section 6.3. A preliminary decommissioning plan for the UFMF must be provided in the LA. The final D&D plan will be submitted for NRC review at least 24 months prior to the expiration of the 10 CFR Part 72 license.

The assurance of decommissioning funding may be met, as per 10 CFR Part 72.30, by prepayment, an open-ended surety method or insurance or other guarantee method, or an external sinking fund with annual deposits in combination with a surety method or insurance. With payment for the D&D phase assured, the actual work to be performed for decommissioning must be sufficiently detailed to provide reasonable assurance that the D&D phase of the UFMF will adequately cleanup the site, removing radioactivity to an acceptable level, and provide adequate protection to the health and safety of the public.

The following records must be maintained over the operating life of the UFMF until the site is released for unrestricted use, in accordance with 10 CFR Part 72.30(d), and will be used to plan the actual decommissioning efforts:

- Records of spills or off-normal occurrences involving the spread of contamination,
- As-built drawings and modifications of structures and equipment involved in the use and/or storage of radioactive materials, and locations of possible inaccessible contamination,

- A document, which is updated a minimum of every two years, containing a list of all areas designated at any time as restricted areas, and a list of all areas outside of the restricted areas involved in a spread of contamination, and
- Records of decommissioning cost estimates and the funding method used.

Detailed information and procedures for decommissioning activities will be provided in a final decommissioning plan. The extent of any required decontamination cannot be quantified at this time as future radioactive levels of components cannot be accurately projected. Efforts will be taken throughout the life of the facility to minimize the potential for any contamination. Actual decontamination efforts and sequences of work will depend on facility operating history. The descriptions that follow provide a conceptual plan for detailed engineering and planning which will occur at the end of facility operations.

It is not anticipated that either the storage overpacks or the storage pads will have residual radioactive contamination once the canisters are removed because: 1) the canisters are sealed by welding that precludes leakage of canisters, and 2) measures are applied at the originating reactors and the UFMF fuel pool when the UNF assemblies are loaded into the canisters to prevent contamination of the canister outer surfaces. Also, neutron flux levels generated by the UNF in some cases may be sufficiently low that significant activation of storage cask and storage pad materials will not occur, with radiation levels, due to activation products, below the applicable NRC criteria for unrestricted release of equipment/materials.

It is anticipated that the fences and peripheral utility structures will not be contaminated and will therefore require no decontamination or special handling, and will be left in place or removed as determined with the landowner.

The final decommissioning plan will address decontamination of the UFMF site, removal of radioactive materials and termination of the facility operating license, and will include a description of the decommissioning organization, staffing, schedule, and procedures, and a description of how the UFMF will continue to protect the public health and the environment during decommissioning. In developing the final decommissioning plan, the NRC regulatory criteria for decommissioning will be reviewed against the existing technical specifications, and modifications, revisions or deletions will be proposed as applicable. Decommissioning activities will be planned using ALARA goals and criteria for protection of personnel from exposure to radiation and radioactive material. The final decommissioning plan will include information on the following:

- Site preparation and organization,
- Procedures and sequences for removal of systems and components,
- Decontamination procedures,
- Design, procurement and testing of any special equipment,
- Identification of outside contractors to be utilized,

- Procedures for removal and disposal of radioactive materials,
- A schedule of activities.

Prior to the commencement of UFMF decommissioning activities, the UNF stored at the UFMF will be repackaged for final disposition as described in Section 6.5 and shipped off-site in licensed transportation casks. The empty storage overpacks will then be surveyed to confirm that no contamination or activation above regulatory limits has occurred. Storage overpacks with activation and contamination levels below the applicable NRC limits for unrestricted release will be disposed of as non-controlled material. Storage overpacks with surface contamination will be decontaminated to the extent practicable using conventional methods. Storage overpacks with shallow-depth activation will be scabbled to the extent practicable using conventional methods. Storage overpacks that have been rendered below the applicable NRC limits for unrestricted release will be disposed of as non-controlled material. Storage overpacks with contamination or activation levels above the applicable NRC limits for unrestricted release will be segmented by saw cutting, with the activated or contaminated portions segregated and disposed of off-site as low level waste. The portions or components of the overpacks that are below the applicable NRC limits for unrestricted release will be disposed of as non-controlled material.

The empty storage canisters will be surveyed to determine the extent of contamination and activation for waste classification purposes. Canisters with light to moderate surface contamination will be decontaminated to the extent practicable using conventional methods. Storage canisters with low to moderate activation will be segmented and/or otherwise volume reduced to segregate the waste by classification for disposal. Storage canisters with extensive activation will be used as disposal containers for activated materials and re-seal welded closed. The portions or components of the canister that are below the applicable NRC limits for unrestricted release will be disposed of as non-controlled material. The remaining portions or components of the canister that exceed unrestricted release limits will be classified as Class A or Class B/C waste and shipped to an appropriate licensed low level waste facility for disposal.

Storage overpack decommissioning may be performed at any time following the removal of the canister. This will allow storage overpack decommissioning efforts to be essentially complete by the end of canister removal operations. Similarly, storage canister decommissioning may be performed at anytime following removal of the UNF, however, it may be advantageous to allow activated materials to decay for some period of time prior to decommissioning. The transportation casks and transfer casks will be similarly decommissioned after they are no longer required for facility operations.

It is anticipated that the stainless steel liners for the fuel pools will largely be contaminated beyond possibility of decontamination by normal means. The stainless steel pool liners will be segmented, volume reduced and packaged in the highly activated storage canisters for disposal as described above, and shipped to an appropriate licensed disposal facility. It is further anticipated that the stainless steel liner will protect the concrete of the fuel pool building structure from contamination. The water in the pool is sufficient to prevent activation of the underlying concrete.

Characterization surveys will be performed to verify the storage pads, building structures, and site areas are free of contamination; with radiation and radioactivity levels below the applicable regulatory limits for unrestricted release. If the characterization surveys identify contamination levels above the applicable limits for unrestricted release, the structures or components will be decontaminated using conventional decontamination techniques that minimize the volume and processing of the resulting radwaste. All low level radioactive waste generated during decontamination efforts and portions of any structures or components which remain contaminated will be shipped off site for disposal at an appropriate licensed facility.

After all nuclear materials have been removed from the UFMF and all storage, transportation and transfer casks decommissioned, a detailed radiation survey will be performed of the Canister Transfer Building, with particular attention focused on any areas of known or historic contamination. Canister Transfer Building equipment or structures which may have contamination levels above the applicable regulatory limits for unrestricted release will be decontaminated to the extent practicable using conventional methods. All radioactive material above the applicable regulatory limits for unrestricted release will be removed from the site and disposed of as low level waste. A final radiation survey will be conducted to assure that all radioactive materials have been removed from the site, following which the 10 CFR Part 72 license will be retired. After all the buildings have been removed, a final declaration will be made to
re-purpose the site for other unrestricted uses.

6.7.2 Key Steps in Financial Model

The key D&D phase steps assumed in the financial model are:

- Accrue a decommissioning fund over the 50 year operating life
- Complete UNF disposition campaign.
- D&D facility.
- Cease host benefits programs.
- Cease regional LLC business operations.

The financial model is discussed in detail in Section 7.2 and an illustrative business case is presented in Section 7.3.

6.7.3 Key Funding Assumptions

As described in Section 6.1, a fraction of the fees collected from the Federal government over the entire operating life of the UFMF will be used accrue a decommissioning fund. The key funding assumptions are as follows:

- Federal government RSPC contract to fund D&D accrual.

- D&D and operations funded by LLC accrual over operating life of facility per condition of 10 CFR Part 72 license
- Costs partially offset by sale of property and salvage revenue.

Table 6-8 maps each of the commercial and government funding fee categories to the D&D phase cost elements.

Table 6-8 – Summary of D&D Phase Funding Accrual Model

Cost Element	Commercial				Government	
	Subscription	Fuel Pick Up	Annual	Title Transfer	Initial	Recurring
D&D Activities					✓	✓
Operations					✓	✓
Host Benefits						✓

7 Used Nuclear Fuel Management Facility Business Plan

As a basis for evaluating the viability and risks involved in managing commercial UNF as a private industry commercial venture, an illustrative business case scenario and cash-flow model for a representative regional UFMF are developed using the business model concept described in Section 6.1. This section describes the basis for the business case scenario, and provides the financial projections for the development and implementation of a regional UFMF, and an estimate of the cash-flows required to make such a commercial business enterprise viable.

It is emphasized that the illustrative business case scenario presented here is based on but one set of assumptions and inputs derived from extensive direct experience and data, and that many other permutations are possible and should be more thoroughly evaluated going forward.

In Section 1.1, four value proposition questions are formulated to test the viability of the envisioned regional, commercial UFMF as follows:

- *Test #1: How much front-end Federal government investment is required and over what timeframe to site, design and license a regional UFMF?*
- *Test #2: What are the nature, scope and approximate total value of the contracts and agreements required, and when are they needed to secure the necessary commercial financing to facilitate construction, commissioning and operation of a regional UFMF?*
- *Test #3: How much revenue is needed to make a regional UFMF commercially viable and what is the fee structure necessary to generate this revenue from the Federal government and utility commercial customers?*
- *Test #4: Are the estimated costs and benefits to the Federal government and utility commercial customers for using a commercial UFMF equitable and competitive with other available options?*

The financial model described in this section is used to derive the data necessary to respond to these value proposition test questions which are provided in Section 8. The financial model is also used to assess the impact that various risks scenarios that a regional UFMF might encounter would have on the overall life cycle cost of the facility. These risk impacts are used to develop a contingency assigned to account for the mitigation of such risks to attempt to envelop the range of potential costs to develop and implement a regional UFMF.

7.1 Basis for Business Case Scenario

The business case scenario selected for economic analysis supports all of the stated missions and objective of the regional UFMF initiative described in Section 1 and defined in Section 2. It is

based on the business model concept described in Section 6.1, and utilizes the inputs provided in the balance of Section 6 and Appendix B.3.

The business case scenario for a regional UFMF assumes that a private commercial firm, the UFMF, LLC, will own and operate the facility, providing services to the Federal government and utilities as commercial customers, either directly, or through a federal Regional Service Provider Contract (RSPC). Title for the fuel may or may not be transferred, as described in Section 4.2. The cost associated with fuel title transfer is not assumed in this illustrative business case scenario.

The business case scenario envisions the regional LLC as a private sector provider of UNF waste acceptance and management services, as contemplated by the Act and described in Section 4.2. As such, it is considered appropriate that DOE initially use appropriated funds under the AEA and shift to funds appropriated under the Act over time. As described in Section 4.2, the Secretary, as directed by the Congress, appears to have the necessary authority to allocate NWPA-appropriated moneys in the NWF for use in implementing regional, commercial UFMFs as part of a national IUFM policy for the final disposition of UNF.

Table 7-1 shows the business case scenario expenditures and funding sources for implementation of a representative regional UFMF over the next ten years. The activities listed in the table fall under one or more of the regional UFMF initiative phases identified in Table 6-1. Similarly, the funding sources identified in Table 7-1 include estimates of the federal funding required for the business case scenario, as well as the private equity commitments, commercial loans and utility contributions that are estimated to site, engineer, license, and construct a representative regional UFMF. These business case scenario funding levels are all enveloped by the suggested budgetary funding levels provided in Section 6.1. As described in Section 6.1.2, it is envisioned that the siting, engineering, licensing and construction of the facility are funded through a combination of DOE-NE FCR&D grants[123] and DOE performance-based contracts.

The following sub-sections summarize the basis for the selected business case scenario; followed by the section that describes associated capital and operating costs for the construction, operation and decommissioning of a representative regional UFMF, based on the assumed business case scenario inputs that follow here. Section 7.3 describes the analysis for the selected business case scenario for a representative regional UFMF. The analysis provides the financial data to address the four value proposition test questions posed at the beginning of this section. The answers to these questions are provided in Section 8.1.

[123] The commercial firms interested in developing a regional UFMF may or may not be willing to make discretionary contributions during the envisioned three-year DOE-NE FCR&D grant program for the site development phase, depending on circumstance and conditions. At the end of this site development phase, it is planned that the host agreements are signed. At that point, it is envisioned that such contributions, if made, would be reimbursed by DOE. No discretionary contributions or reimbursements are included in the business case scenario here.

7.1.1 Site Development Basis for Business Case Scenario

As the process of securing a volunteer host site progresses as envisioned in Section 6.2, the LLC would negotiate and be awarded a separate Host Agreement Management Contract (HAMC) by the Federal government once the host agreements between the LLC and the host local and State governments have been negotiated and signed. Under the HAMC, it is assumed that the LLC would implement, manage and administer the host agreements, (which primarily includes the host benefits program), having assumed annual funding levels of $25 million per year prior to first receipt of fuel, as described in Section 6.1.2. The annual funding is assumed to remain at this level through the engineering and licensing process. The LLC is assumed to continue to manage the host agreements through completion of construction of the UFMF. Continuing on into the operations phase, the LLC would implement and manage host agreements, with annual federal funding levels assumed to increase to $50 million per year for the next 50 years. No host agreement bonus or penalty payments are assumed to occur, as shown in Table 6-2.

Before beginning the licensing process, it is assumed that a private industry firm, the LLC, would be formed as the commercial entity that will hold the NRC license for the regional UFMF, as described in Section 6.1.1. The costs to form the new UFMF Limited Liability Company (LLC) with sufficient businesses infrastructure and resources is a time-consuming and costly effort that is expected to require the tens of millions of current year dollars of investment by private industry. It is a necessary step in the application and issuance of a license to construct and operate the UFMF. The resources expended in forming the LLC are assumed to be credited as the initial investment of private equity in the regional UFMF initiative. The entire cost is assumed to be at risk pending the issuance of a license and completion of construction of an operating facility.

7.1.2 Engineering and Licensing Basis for Business Case Scenario

It is assumed, that the licensing of the regional UFMF will be conducted by the LLC under a performance-based Development Contract with DOE, as described in Section 6.1.2. Firms interested in competing to provide DOE with UNF management services will enter into an agreement with DOE to license the facility. To provide the necessary incentives to the private firms competing in the regional UFMF initiative, it is assumed that the Development Contract would include four performance milestone payments tied to the progress through the licensing process. These milestone payments are shown on Table 7-1.

To finance the engineering and design required for the LA, the UFMF, LLC is assumed to use a combination of private equity or commercial loans (only the loans are assumed for this business case scenario). These interim loans would be required to cover cash-flow expenses pending the payments received from DOE for meeting the associated performance milestones. The cost to prepare, submit and respond to queries concerning the LA is estimated to be $46 million in constant 2009 dollars, which is consistent with the suggested budgetary funding level suggested in Section 6.1.2. It is assumed that the LLC would be reimbursed under four milestone payments when:

- The NRC dockets the LA;
- The NRC issues a Safety Evaluation Report (SER) for the facility;
- The NRC issues a Construction Authorization (CA) for the base facility; and
- The NRC issues an amended SER and CA for the expansion of the facility to add the fuel pools.

7.1.3 Facility Construction Basis for Business Case Scenario

It is envisioned that when the NRC issues the SER for the base facility in 2015 and the LLC receives its second milestone payment under the Development Contract, it would begin negotiating a performance-based RSPC with DOE. The RSPC would be the contract mechanism used by the LLC to construct and operate the facility. As such, it is assumed here that the RSPC would include a "take-or-pay" provision. Under this agreement, the DOE, or another federal entity, would agree to pay the LLC for the receipt and management of UNF once the base capability UFMF is operational, regardless of whether the Federal government provides fuel for the facility or not. With the "take-or-pay" provisions of the RSPC in hand, (which basically constitutes a form of loan guarantee), the LLC can negotiate with commercial banks for the financing needed to raise the capital necessary to construct the facility. The capital requirements needed to construct the facility and procure the major capital equipment are estimated to be $283 million in constant 2009 dollars, which is enveloped by the suggested budgetary funding levels in Section 6.1.2.

Although not modeled in the current business case scenario, the commercial loans used to finance the construction of the regional UFMF could be supplemented with additional private equity contributions and initial subscription fees from utilities. It is assumed that utilities that have a need to remove fuel from their sites ahead the federal priority ranking prescribed by the 10 CFR Part 961 standard contract would have the most incentive to enter into a Subscription Contract with the LLC. It is envisioned that subscriptions would include upfront payments prior to start-up of the facility. These initial subscription fees would be paid directly by the utilities and would be treated as an additional equity contribution, with return on the invested equity paid out for a fixed period.

Under the RSPC, it is envisioned that the LLC would receive two performance milestone payments for the construction of the base and full capability facility. The payments are assumed to coincide with the planned receipt of the first canisters of fuel in 2019 and the first receipt of bare fuel assemblies in 2022. Each milestone payment is assumed to equal 50% of the non-equity capital cost requirement, so that by the time the LLC begins receiving bare fuel, 100% of the outstanding capital debt has been retired. Interest accrued on commercial loans during the licensing and construction phases is assumed to be retired during the first five years of operation out of operating revenue received during that period.

Table 7-1 – UFMF Illustrative Business Case Cash-Flow Model Results Summary

	Estimated Cash Flow for First Twelve Years($M)												
Debits & Credits / Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total
Site Selection Process (G)	(10)	(10)	(10)										(30)
Host Benefits Payments (H)				(25)	(25)	(25)	(25)	(25)	(25)	(50)	(50)	(50)	(300)
LLC Formation Expenses				(5)	(9)	(9)							(23)
Preliminary Design (D)		(5)											(5)
Detailed Design (D)			(15)										(15)
LA Review (D)				(6)	(6)	(6)	(6)	(2)					(26)
Commercial Loan Payments				(9)		(9)	(19)	(9)		(141)		(142)	(329)
Equipment Procurement (R)							(33)	(32)	(31)				(96)
Site & Facility Construction (R)							(36)	(35)	(26)	(17)	(17)		(131)
Equipment Installation (R)								(23)	(11)	(6)	(3)		(43)
Facility/Equipment Testing (R)								(1)	(2)	(0.5)	(1)		(4)
Commissioning (R)								(2)	(5)			(2)	(9)
Total Debits:	(10)	(15)	(25)	(45)	(40)	(49)	(119)	(129)	(100)	(215)	(71)	(194)	
Government Contributions (G)	10	10	10										30
Government Funding (H)				25	25	25	25	25	25	50	50	50	300
Equity Contributions				5	9	9							23
Commercial Loans Funding		5	15	6	6	6	75	95	75	24	21	2	329
Gov. Milestone Payments (D&R)				9		9	19	9		141		142	329
Total Credits:	10	15	25	45	40	49	119	129	100	215	71	194	
Total Net Cash-Flow:	0	0	0	0	0	0	0	0	0	0	0	0	

Federal Government Contract Designation:
(G) = DOE-NE FCR&D cooperative agreement grants
(H) = Host agreements management contract (HAMC)
(D) = Performance-based development contract
(R) = Performance-based regional service provider contract (RSPC)

7.1.4 Facility Operations Basis for Business Case Scenario

Prior to receipt of canisters, the LLC would negotiate a payment schedule for the transport and receipt of DPC canisters with fuel from orphaned shutdown reactor sites. It is assumed that the majority of the payments would be made by the Federal government under the RSPC and fuel from utility sites would be accepted in the order established by DOE under the standard contract priority ranking. However, as a private industry operator, the LLC also has the option of accepting fuel independent of the priority ranking established by DOE, if a utility had a need to accelerate the removal of fuel from its site.

Under this latter scenario, the LLC will negotiate Receipt and annual Fixed and Storage Fees with each utility commercial customer that has a need to 'move up' in the queue, as described in Table 6-3. These fees will be charged directly to the utility as a commercial customer and not to the Federal government through the RSPC. However, it is likely that the annual fees for managing a utility's fuel would be assumed by the Federal government under the RSPC in the year that the utility's fuel would normally have been received, or when DOE takes title, whichever occurs first. Under the first scenario, the LLC will establish a base one-time fee for receipt of fuel and annual charges for recurring management services. These costs will be paid by the Federal government and are the same for all fuel accepted according to the standard contract priority ranking. For the purposes of this business case scenario, it is assumed that 25% of fuel received each year is from utilities that have a need to accelerate fuel removal and would be willing to pay some premium for this service (compared with their on-site dry storage costs).

Regardless of whether the cost to receive and manage the fuel is covered under the RSPC or paid directly by the utility as a commercial customer, all costs associated with the transportation of the fuel from the utility site to the UFMF will be paid for by the Federal government under the RSPC, as shown in Table 6-2. Also covered under the RSPC are annual HAMC payments of $50 million following first receipt of fuel, as described in Section 6.1.2. The LLC will manage the regional host benefits program for the Federal government and will distribute the funds in accordance with the terms of the agreements with host entities.

It is assumed for this business case scenario that at the end of 50 years of operation, the facility will stop accepting fuel. Operation of the facility beyond this point is assumed to be funded through the annual storage and fixed fees. Annual host benefits program payments of $50 million per year will continue for the entire 50 year period. As Section 6.1.2 indicates, it is envisioned that the annual payment will escalate by $10 million per year after 50 years as long as fuel remains on the site. This and other envisioned bonus and penalty payments have not been included in this business case scenario. At some point, fuel will begin to be transferred out of the facility for final disposition to either a repository or recycling center. This phase of the operation is not included in the business case scenario since the timing and scope of the activities are dependent on the final disposition scenario. Likewise, the costs to support the removal of UNF and GTCC waste will be covered by a future Federal government services contract. Decommissioning of the site will be performed as the storage pads are cleared of loaded storage casks. It is assumed that as part of the RSPC, the Federal government will make annual contributions to a decommissioning fund accrued by the LLC. Contributions will continue for as

long as fuel is received at the facility. This fund will be used to finance the decontamination and dismantling (D&D) of the facility and components, and to return the site it to its original condition.

7.2 Business Case Estimated Costs and Financial Assumptions

This section includes the estimated capital and operating costs for the representative regional UFMF included in the business case scenario analysis. The data used to develop the costs are presented in Appendix B. The basis for the estimates follows the frameworks presented in Section 6. Section 7.3 uses these cost projections to develop a business case scenario cash-flow analysis. The analyses in Section 7.3 identify the financing and revenue required to support construction, operation and decommissioning of a representative regional UFMF.

7.2.1 Business Case Estimated Capital Costs

The business case scenario financial analysis of a representative regional UFMF is based on a facility with a nominal throughput capacity of 40 dual-purpose canisters (DPCs) per year for the first three years of operation, followed by 40 UFMF store-only canisters per year for the remaining 47 years of bare fuel operations, as discussed in Appendices B.2.2 and B.2.3. Capital costs have been developed for the transfer and storage facilities (the fixed-based facility) and the transportation system. All costs are in constant 2009 dollars. These costs are escalated and adjusted for inflation for the financial analyses in Section 7.3.

In the business case scenario financial analysis, the canisters and casks are treated as fixed operating costs, i.e. expendable items. The periodic addition of storage pads and replacement of one of the vertical cask transporters, are treated as recurring (every ten years) operating expenditures. These costs are recovered out of the one-time fees paid upon receipt of the fuel at the facility, as described in Table 6-2 and Table 6-3.

The business case scenario financial analysis in Section 7.3, models two major capital cost outlays. The first capital cost expenditure is to design, construct and commission a base UFMF capable of receiving and managing only DPCs, primarily from shutdown reactor sites, as shown in Figure 6-5. The base capability facility includes all of the components and capital equipment for a full-service UFMF with the exception of the fuel pools. The construction of these facilities is deferred in order to expedite the completion of the base facility in order that orphaned DPCs at shutdown reactor sites can be received as soon as possible. It also provides the additional necessary time to complete licensing of the fuel pool facility, as described in Section 6.3, which act to time-phase the amount of initial capital that needs to be raised. In the capital costs presented below, a distinction is made between costs associated with the base capability facility and the full capability facility.

Similarly, storage pad space to accommodate additional storage casks is added every ten years. Space is added to accommodate 400 additional casks in each expansion stage, as shown in Figure 6-6, with the first expansion coming on-line in year ten. Capacity is added until the total capacity of the facility is 2,000 storage casks, (or about 30,000 MTUs of fuel).

7.2.1.1 First Stage Construction and Transportation Capital Costs

The installed overnight cost for the first stage construction of the base capability UFMF, which includes all of the infrastructure, equipment and rolling stock required to receive, transfer, and store up to 40 DPCs per year, is estimated to be $265 million. The capital costs for the base UFMF facility include facility start-up costs, fixed facility construction costs and transportation capital equipment costs, as summarized in Table 7-2 and discussed below. This estimate does not include escalation or inflation adjustments, but does include a 10% contingency. Descriptions of fixed-based facilities and transportation system equipment for the base capability facility, and the associated cost estimates and bases, are described further in Appendix B.3., Table 7-2, and discussed below. Descriptions of fixed facilities and transportation system equipment for the base facility, and the associated cost estimates and bases, are described in detail in Appendix B.3.

Table 7-2 – Estimated Capital Costs for Base UFMF

Cost Component	Cost (2009$M)
Startup Costs	82
Engineering and Licensing	35
Base Facility Construction	100
Storage System Transfer Equipment	10
Transportation System Equipment	21
Contingency	17
Total	265

Facility start-up costs, which are discussed in Section 7.2.2.1, are estimated to total $82 million. Fixed-based facility capital costs, which total $145 million, are comprised of engineering and licensing costs, base capability facility construction costs, and DPC transfer equipment costs. Engineering and licensing costs for the base capability facility are estimated to total $35 million. The base capability facility construction costs total $100 million, which are estimated and broken-out in Table B.3-1. The capital cost of the storage system transfer equipment required for DPC receipt operations (e.g., vertical transporters, transfer casks, and miscellaneous transfer equipment) total $10.0 million, which are estimated and broken out in Table B.3-8. The transportation system capital costs total $21 million which includes the rolling stock used to transport the DPCs from the shutdown reactor sites to the UFMF plus the UFMF rail yard motive equipment, and which are estimated and broken-out in Table B.3-12.

The transportation system costs are distributed differently. The UFMF, LLC will procure the rolling stock and associated equipment to handle and secure the transportation casks as capital equipment, however, the regional railroad operator(s) will be contracted by the LLC to provide the actual transportation of the UFMF-owned rolling stock as an O&M cost. The transportation system capital equipment for DPCs will be procured along with the capital equipment for the fixed-based facility. Additional capital equipment to transport bare fuel assemblies will be procured when needed to commission and start-up that part of the operations.

7.2.1.2 Second Stage Construction and Transportation Capital Costs

Table 7-3 – Estimated Capital Costs for UFMF Expansion

Cost Component	Cost (2009$M)
Facility Design, Engineering, and Licensing	14
Facility Construction	23
Storage System Transfer Equipment	9
Transportation System Equipment	33
Contingency	8
Total	87

After three years of DPC transport and receipt operations, the facility will begin bare fuel assembly transport and receipt operations. Since the pool facility and equipment needed to support bare fuel assembly operations are not required until the fourth year of operation, the engineering, procurement, construction and installation necessary to support this phase of operations are deferred until needed. In this second stage of construction, the facility storage capacity will be expanded and all systems and equipment required for fuel pool operations will be constructed and/or installed. The additional facilities and equipment to transport, receive, transfer, and store the bare fuel assemblies are described in Appendix B.3.

The installed overnight cost for the second stage, including the UFMF transportation system equipment required for bare fuel assembly shipments, is estimated to total $87 million, as shown in Table 7-3. This estimate does not include escalation or inflation adjustments, but does include a 10% contingency. The fixed-based facility costs total $41 million, which consists of $14 million for engineering and licensing, $23 million for construction (Table B.3-2), and $9 million for UFMF storage system transfer equipment (Table B.3-9). The transportation equipment is estimated to be $33 million (Table B.3-13). These costs include all licensing and home-office EPC costs plus material and field labor costs. As discussed in Section 7.2.2.2, the construction cost for the storage pad expansion is included in the facility O&M cost rather than the facility capital cost. The licensing for the fuel pools is assumed to be completed as part of the licensing process for the entire facility.

7.2.1.3 Additional Expansion Capital Costs

The facility will begin operation with sufficient storage capacity for the first ten years of operation (i.e., 400 storage casks). At full capacity, the facility will be designed to contain 50 years worth of fuel generated by approximately one-third of the current fleet of commercial reactors (assumed to be 2,000 storage casks, or about 30,000 MTUs of fuel). The fully expanded storage pad construction will occur in five stages, adding capacity for 400 additional storage casks at 10-year intervals, as shown in Figure 6-6. The engineering and licensing costs of these periodic expansions are accounted as one-time costs included in the engineering and licensing costs for the entire facility. However, the procurement and installation costs associated with the periodic expansions of the storage pad are distributed over the five years preceding completion of each expansion stage.

The installed overnight cost for each storage pad expansion stage is estimated to be $10 million (Table B.3-2). The storage pad for the initial base capability facility will be expanded four times. The first expansion will be completed in the tenth year of operation. The final expansion will occur in the 40th year of operation. At that point the maximum capacity of the facility will be 2,000 storage casks.

Another major capital expenditure will be the replacement of the vertical transporter required to move the full casks from the cask transfer building out to the storage pad. The cost to replace one of the two transporters every ten years is estimated to be $2 million (Table B.3-9). The costs to procure and deliver this equipment are distributed over the two years preceding its replacement.

7.2.2 Business Case Estimated Operating and Maintenance Costs

The Operating and Maintenance (O&M) costs for the operation of a regional UFMF are based on the frameworks described in Section 6 and the data presented in Appendix B. Annual O&M costs for the facility and for the transportation systems are estimated as described in Appendix B.3.1.2.3. One-time start-up costs are also developed and included in the capital costs as described in Section 7.2.1. All costs are in constant 2009 dollars. O&M costs are escalated and adjusted for inflation in the cash-flow analysis in Section 7.3.

7.2.2.1 Business Case Start-up Costs

Start-up costs, which are one-time costs borne by the LLC, are estimated to total $82 million. For purposes of this business case scenario analysis the following start-up costs are included:

- LLC development costs
- Storage cask procurement costs (for one year's operation)
- Project engineering and licensing costs
- Project management/oversight costs during construction
- Spare parts procurement costs

The LLC development costs are the costs expended by the private commercial firm to set up a limited liability company that would submit and hold the NRC license to construct and operate the UFMF, as described in Section 6.1.1. This is a necessary step in the process to establish an independent, private company to provide UNF management services to the Federal government. The costs to establish the LLC are considered to be the initial equity investment into the commercial venture by private industry.

As discussed above, the facility will need a stock of storage casks before it can begin operation. The cost to procure the 40 storage casks required for the first year of DPC receipt operations is included in the start-up costs.

Project costs for engineering and licensing; and for management/oversight are project overhead costs incurred by the LLC that are debited against the project. These costs include the labor charges for LLC employees that will oversee the EPC contractor completing the facility design and LA. During construction, these include in-house management, engineering and field personnel to oversee construction and provide site security.

Spare parts are included as an LLC cost because the selection of what equipment to maintain as spare is discretionary. For this analysis, spare parts are estimated as one percent of the total installed overnight cost of the facility and transportation systems.

7.2.2.2 Business Case Facility O&M Costs

The facility O&M costs associated with the general operation and maintenance of the facility are separated into fixed and variable O&M costs. The total facility O&M costs are estimated to be $51 million per year during DPC receipt operations, increasing to $84 million per year for bare fuel assembly receipt operations. The estimated facility O&M costs for expansion years (for the 5 years preceding every 10th year of operation) are somewhat higher at $86 million per year due to the addition of storage pad expansion construction costs and replacement costs for the vertical transporter. A discussion of the facility O&M cost elements and bases is provided in Appendix B.3.1.2.3.1 and discussed below.

The fixed O&M costs for the facility, which are expected to remain constant regardless of the types and quantities of fuel being managed by the facility, are estimated to be $38M per year. The basis for this cost, which includes facility labor, operations support, training, engineering and legal support, insurance and regulatory fees, property lease, property tax, payments into the decommissioning fund, and facility maintenance. Variable O&M costs for the facility are those costs that vary based on facility operations (e.g., DPC receipt versus bare fuel receipt) and maintenance activities (e.g., routine verses rebuild maintenance). Variable O&M costs also include the annual procurement costs for storage casks and canisters used on the UFMF. These include 40 storage casks per year during DPC receipt operations and 40 storage casks plus 40 storage canisters per year during bare fuel receipt operations. They also include the construction costs for storage pad expansions and periodic replacement of vertical transporters, which occur every 10th year of operation, but whose cost is spread evenly over the 5-year period preceding the expansion year. The total variable O&M cost during DPC receipt operations is estimated to be $14 million per year. During bare fuel receipt operations, the total variable O&M cost is estimated to be $46 million per year for non-expansion years and $48 million per year for expansion years.

Also, the business case scenario cost estimate does not include the costs for implementing Section 180(c) of the Act, which are assumed to be the responsibility of the Federal government, as described in Section 6.1.2.

7.2.2.3 Business Case Transportation O&M Costs

The O&M costs for DPC and bare fuel assembly transportation operations are associated primarily with LLC labor costs and railway shipping fees. Other transportation O&M costs

include training, insurance and regulatory fees, and maintenance of the transport rolling stock. The total transportation O&M costs are estimated to be $20 million per year during DPC receipt operations. This cost increases to $26 million per year for bare fuel receipt operations and $30 million every 10th year (i.e., re-build maintenance years). A discussion of the transportation O&M cost elements and cost bases is provided in Appendix B.3.1.2.3.2 and discussed below.

The transportation O&M costs are separated into fixed costs, which are expected to remain constant for DPC and bare fuel transport operations, and variable O&M costs, which fluctuate based on operations and maintenance activities. Fixed O&M costs for transportation, which include labor, training, insurance and regulatory fees, are estimated to be $5 million per year, as discussed in Appendix B.3.1.2.3.2.

Variable transportation O&M costs include railway shipping fees, which vary based on the transport distance and number of shipments, and maintenance costs, which vary based on the size of the transportation fleet. The variable transportation O&M costs for DPC receipt operations are estimated to total $15 million per year. The variable transportation O&M costs for bare fuel receipt operations increase to an estimated total of $22 million per year and $25 million every 10th year for re-build maintenance of transportation equipment.

7.2.3 Business Case Estimated Decommissioning Costs

The facility, component and equipment decommissioning costs are the estimated costs to return the site to its initial condition. A description of the decommissioning assumptions are provided in Section 6.7 and included in Appendix B.2. The costs to decommission the UFMF are estimated based on costs generated for the decommissioning of a utility on-site dry storage facility and UNF handling facilities. The costs to cover this future expense are accrued into an escrow account during the time period when USF is being received at the facility. The total cost to decommission the UFMF in constant 2009 dollars is estimated to be $210 million. To finance this expense 50 years after start-up of the facility, an annual accrual of $5.5 million into an escrow account is assumed.

It is assumed that the decommissioning fund will be accrued and maintained by the LLC based on annual payments received under the RSPC, as a condition of the NRC license for the facility. For purposes of this business case scenario analysis, it is assumed that the facility, components and equipment have no salvage value and that the returning the site to a condition equivalent or better than it was originally will be required by the agreements with the host entities.

7.2.4 Business Case Financial and Funding Assumptions

A cash-flow model is developed to validate the economics of the commercial UFMF business model concept as part of this business case scenario financial analysis. The model used as inputs the assumed annual regional volumes of fuel received, plus estimates of capital and O&M costs for the facility and transportation. In addition to these costs, the other major influence on the business case scenario financial model results is the assumptions for the primary economic variables such as escalation, inflation and interest rates.

7.2.4.1 Contingency

A 10% contingency is added to the capital and operating costs used in the business case scenario analysis in Section 7.3. This contingency is added to account for uncertainty in the estimating process and based on the range of risk uncertainty identified in Section 7.4.

7.2.4.2 Escalation

Escalation is applied to the business case scenario cost estimates to account for price increases due to factors beyond inflation. These include effects due to high demand or limited supply. The business case scenario cash-flow model applies separate escalation rates for capital costs and O&M costs. For all cases, a capital cost escalation rate of 2% is used. O&M costs are escalated at 0.5%. The decommissioning fund payments and the host site benefits are adjusted for inflation, but not escalated.

7.2.4.3 Inflation

An inflation rate of 2% is applied to all business case scenario costs.

7.2.4.4 Interest Rates

The cash-flow model used to evaluate the business case scenario in Section 7.3 used a commercial bank interest rate. The interest rate used in the model is calculated based on a London Interbank Offered Rate (Libor) of 5.00% plus 2% inflation and a 2% margin, or 9.00%. This rate is close to the 52 week high for the Libor and equal to the current US Prime rate of 5%.

7.2.4.5 Rate of Return, Annual Profit, and Discount Rate

The fuel receipt fee assessed by the UFMF for the business case scenario analysis is set to provide a minimum guaranteed before tax profit and a minimum internal rate of return on the invested private capital. The fee per cask of fuel received at the facility is fixed so that the net cash-flow to the LLC over the lifetime of the facility provides an annual before tax profit of 8% and a minimum rate of return on the equity invested of 11% over the first 25 years of operation.

To calculate the life cycle cost (LCC) for the UFMF, a discount rate of 8% is used. This rate is based on a typical bond rate for utilities. The bond rate represents the value of money for a government-regulated enterprise, like a utility and is considered most similar to the UFMF business operations. This is a nominal discount rate since the cash-flow analyses in Section 7.3 use current year dollars, with the effect of inflation included. The LCC comparison with that for operating an on-site dry storage facility uses a real discount rate of 6% (8% adjusted for inflation.)

7.2.4.6 Taxes

The business case scenario cash-flow model assumes that the LLC would pay state and federal taxes on all net income. For the cash-flow model, a state tax rate of 8% is assumed. The federal tax rate is set at 32%. Taxes are assessed on income after allowances for depreciation of capital.

Capital is depreciated on a straight line basis over the life of the facility. Capital expenditures in the later years for storage pad expansion and replacement of the transportation equipment are treated as operating expenses in the years expended and therefore are not incorporated into the depreciation calculations.

7.2.4.7 One-Time Fuel Receipt Fees, Annual Storage and Fixed Fees and Subscriptions

As discussed below, in the business case scenario financial analysis, the funds to finance the construction of the base capability UFMF are assumed to come from a variety of sources, as discussed in Section 6.1.2. Initially, the DOE is expected to finance the siting activities through a cooperative agreement grant program. The engineering necessary to complete and submit an LA to NRC assumed to be funded through a performance-based federal development contract. The LLC formed to submit the LA is assumed use a combination of bank loans and private funds to perform this effort, with development contract payments received pending successful completion of major project milestones.

It is assumed that the construction of the UFMF will be funded by the LLC using commercial bank loans that are primarily backed by a federal RSPC with a 'take-or-pay' provision. This RSPC provision guarantees payment for the receipt and management of fuel once a facility is operational. The RSPC is also assumed to guarantee milestone payments tied to receipt of the first DPC and the first bare fuel assemblies to cover the cost of financing the base and full capability facility construction, (but not the future storage pad expansions), and procurement of major capital equipment, so that reasonable and equitable terms on construction loans can be obtained.

The construction loans and RSPC milestone payments could be augmented with private equity investments and utility investments through subscription contracts with utilities as commercial customers, as described in Section 6.1.2. Under a subscription contract, the LLC would offer subscriptions to commercial customers who commit to using the regional UFMF. It is envisioned that such subscriptions would be treated as equity investments in the LLC by the utilities. In return for their investments, the commercial customers would receive preferential priority for fuel removal from the reactor site and space in the UFMF; and would also receive a nominal periodic dividend-like interest payment over the time period that their fuel resides at the facility, up to the point when their fuel is removed. The subscription fee would also be a pre-payment on the back-end fee for retrieving their fuel from dry cask storage at the UFMF, and readying it for transfer to the Federal government in accordance with the 10 CFR Part 961 standard contracts.

Once operational, it is envisioned that the LLC would fund operation of the facility from two primary revenue sources: the Federal government RSPC and utility commercial customer subscription contracts. The Federal government would contract with the LLC, through the RSPC, to transport, receive and manage UNF in accordance with the federal priority ranking. Utilities that have a need to accelerate the removal of fuel from their facility ahead of the federal priority ranking could contract independently with the LLC. In this case, the utility would opt out of having the LLC remove fuel from their reactor site on behalf of the Federal government under the RSPC. Instead, the utilities would pay fees to the LLC directly under their

subscription contract with the LLC for fuel receipt and management, as described in Table 6-3. It is assumed that 100% the fuel transportation costs under the RSPC, and 100% of the host benefits program costs under a separate HAMC would be recovered from the Federal government, regardless of the federal or commercial contractual arrangement for fuel receipt and storage, as described in Table 6-2.

It is envisioned that utilities that contract independently with the LLC would pay a one-time fee upon receipt of their fuel at the UFMF, and two annual fees to cover recurring fuel management costs. Under the RSPC with the UFMF, the Federal government would pay a one-time receipt fee upon receipt of fuel at the UFMF, a one-time fuel transportation fee, plus four annual fees. The annual fees received from the Federal government would cover the recurring fuel management costs for fuel received under the RSPC, (plus contributions to the UFMF decommissioning fund), and the recurring cost of funding the host benefits program under the separate HAMC. Table 7-4 summarizes the revenue generating fees paid to the UFMF LLC by both the Federal government and utility commercial customers.

Table 7-4 - UFMF Illustrative Business Case Fee Schedule

Fee	Payee	Frequency	Purpose
Receipt Fee	Government and Utilities	One-time upon receipt of fuel	Covers variable operating costs and profit
Transportation Fee	Government	One-time upon receipt of fuel	Covers all transportation costs
Storage Fee	Government and Utilities	Annual fee assessed based on amount of fuel on UFMF site	Covers fixed costs associated with storage, predominantly security labor
Fixed Fee	Government and Utilities	Annual fee assessed based on amount of fuel on UFMF site	Covers NRC-mandated costs to comply with license, predominantly fixed costs such as lease, labor and fees owed
Decommissioning Fund	Government	Annual fixed fee	Covers fund accrual
Fund Host Benefits Program	Government	Annual fixed fee	Fund host benefits per agreements with regional volunteer host local and State governments

It is assumed that the fuel receipt fee is paid upon receipt of a fuel delivery to the UFMF, either by the Federal government under the RSPC or directly from the utility under a subscription contract. The fee for transporting the fuel is also paid at the time of delivery of the fuel by the Federal government through the RSPC. The storage and fixed fees are assessed annually for each cask of fuel managed at the UFMF. It is envisioned that utilities are responsible for these fees if their fuel is received ahead of the federal priority ranking schedule established by the 10 CFR Part 961 contract. If the Federal government does take title to the fuel after it arrives at the

UFMF, then it would seem that these fees would logically become the responsibility of the Federal government. Such fees would also logically be transferred to the Federal government under the RSPC once the scheduled date for receipt of the fuel occurs per the federal priority ranking. Alternatively, the LLC, under certain circumstances and conditions, may take title to the fuel from the utility on its own behalf, or on the behalf of the Federal government, as described in Section 4.2. The business case scenario analysis does not assume fuel title transfer; as such additional fees are not included in the model.

The receipt fee covers the variable costs associated with handling and preparing the DPC or bare fuel assemblies for dry storage on the UFMF site and recurring costs for storage pad expansion, equipment maintenance / replacement. The receipt fee is also the mechanism used to recover return on investment and profit. The transportation fee is also a one-time fee that covers the direct and variable expenses associated with transporting the fuel.

It is assumed that the storage fee is assessed on unit-rate basis per kgU of fuel stored per year at the facility. It is based on a prorated estimate of the life-cycle costs for the security labor and other expenses. This fee would be paid annually by utilities that accelerated the federal priority ranking until the time when their fuel would normally have been designated for removal, or when the Federal government takes title. If the fuel is received under the RSPC, then the storage fee would be paid by the Federal government.

The business case scenario analysis assumes that a fixed fee is also assessed annually like the storage fee. This fee covers the fixed facility, equipment and labor costs that such a regulated nuclear facility must bear to meet its minimum obligations under the licenses issued by the NRC. In effect, this annual fee covers the fixed operating costs of the facility, excluding the decommissioning fund and host benefits program costs.

It is envisioned that the recurring fees to cover the accrual of the decommissioning fund and fund the host benefits program are the responsibility of the Federal government. The Federal government will make annual contributions to cover both expenses through the RSPC and a separate HAMC, as described in Section 6.1.2.

For the business case scenario analysis, the receipt and transportation fees, along with the storage and fixed fees are distributed over the fifty years of fuel receipt operations. When fuel ceases to be received into the facility after 50 years, then the only source of revenue will be the storage and fixed fees to cover, at a minimum, the security and management of the facility. Host benefit program payments would continue until all fuel is removed from the site.

7.3 Illustrative Business Case Analysis

To assess the economic viability of a regional commercial UFMF, a cash-flow analysis is performed for the illustrative business case to model the financial requirements for the planning, development, construction, operation and decommissioning of a representative 30,000 MTU UFMF. The financial model estimates the fee structure required to provide a reasonable profit on business operations and a minimum return on equity investment for a commercial facility. The model also tracks the cash-flow requirements from public and private entities over the

course of the project's lifetime. All of the phases defined in Section 6.1 and described throughout Section 6 , with the exception of the final fuel disposition phase described in Section 6.6, are included in the model.

The final fuel disposition phase is not included because this activity will be part of the future national IUFM policy implementation by the Federal government under a future services contract for final disposition the UNF. For the present business case analysis, the model assumes that the costs associated with the UNF final disposition phase will be covered by a future program, or programs (repository and / or recycling), and therefore, how the UNF is handled after it leaves the UFMF does not impact the financial viability of the regional UFMF as a commercial business model concept. However, the cost to install equipment to support base and full capability UFMF operations and that is suitable for use in the future for repackaging of UNF for final disposition, is included in the business case scenario analysis. Although the operating costs for preparing the UNF for final disposition are not included in this model, the facility will be designed with the flexibility to manage the UNF to accommodate both repository and recycling scenarios.

7.3.1 Business Case Project Implementation Timeline

Implementation of a regional commercial UFMF will require a phased approach as described in Section 6.1. A total of seven phases are anticipated as defined in Section 1.2 and described throughout Section 6. These include:

- Phase 1 – Site Development
- Phase 2 – Engineering and LLC Business Infrastructure Development
- Phase 3 – Licensing and UFMF, LLC Implementation
- Phase 4 – Construction and Procurement
- Phase 5 – Commissioning and Operations
- Phase 6 – Future Expansion and Operations
- Phase 7 – Fuel Removal and EOL Decommissioning

These phases are primarily funded using four Federal government contract mechanisms including:

- DOE-NE Cooperative Agreement Grants,
- Performance-Based Development Contract,
- Performance-Based Regional Service Provider Contract, and
- Host Agreement Management Contracts for funding Host Benefits Program.

The first two contracting vehicles are relatively short-term agreements and focused on the near-term needs to establish a UFMF in each geographic region. The third contracting mechanism, the RSPC, is a long-term agreement between the Federal government and the UFMC, LLC that

covers the construction and expansion of the facility as part of the overall long-term management of UNF. It is envisioned that multiple nuclear industry firms will be interested in participating in the first two programs, with the RSPC limited only to those firms that have been granted an NRC license and CA for the facility under the second program.

It is envisioned that firms that are successful in obtaining a signed MOU with the volunteer hosts for one or more candidate sites under the first program, as described in Section 6.2, will also be awarded a separate HAMC. Under this federal contract, the LLC would manage the host benefits program which is funded by annual payments under the contract. This contract would initiate upon signing of host agreement with the respective local and State governments and continue until all the fuel is removed form the site.

Figure 7-1 shows the assumed schedule for development and implementation of a representative regional UFMF that is used in the business case scenario analysis, from initiation of the site development phase through the facility construction and operation phase. This schedule assumes that preliminary construction (site prep) and long-lead equipment procurement can begin only after receiving a CA from the NRC. Once the base capability facility is contracted and equipment is procured, this analysis assumes that the UFMF can begin receiving DPCs with fuel. A few years later, the fuel pool equipment for the full capability facility is installed after receiving an amended CA from NRC. After this installation is completed, this analysis assumes that the UFMF can begin receiving bare fuel assemblies. Facility storage pad expansions follow in the out-years.

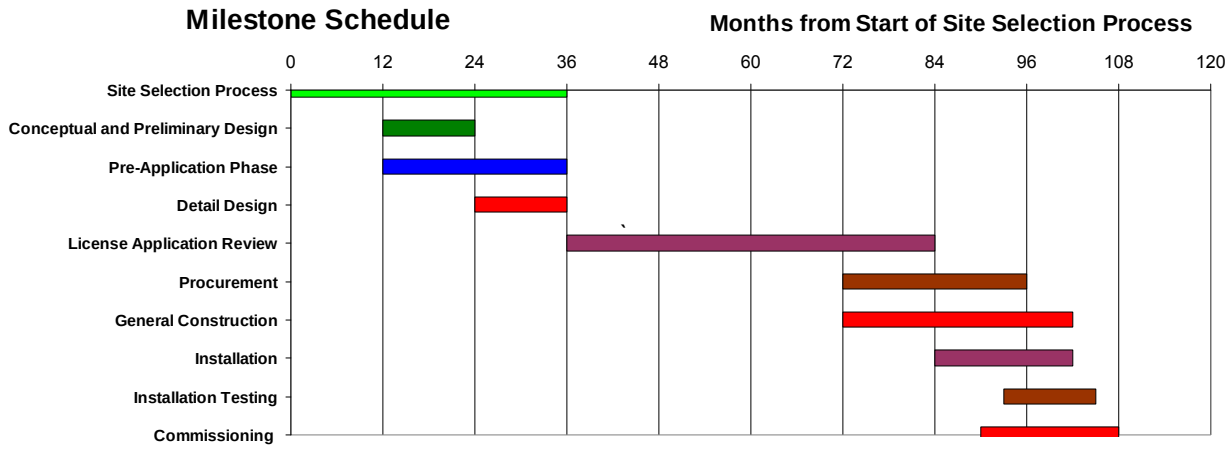

Figure 7-1 – UFMF Illustrative Business Case Milestone Schedule

The schedule assumed for implementation of a regional UFMF for the business case analysis is reasonable and achievable.

The regional UFMF is assumed to continue accepting fuel and operate for 50 years. The storage capacity of the facility is expanded every ten years through the first 40 years of operation to accommodate a maximum capacity of 2,000 storage casks. These expansions are financed out of the receipt fees collected for each fuel delivery to the site. The cash-flow model handles these

expansions, along with replacement of the vertical transporter as essentially interim operating expenses distributed over the five years preceding their use.

After 50 years of operation, the UFMF is assumed be decommissioned. As with the construction, this will be a phased operation, with storage pads taken out of service and dismantled as storage casks are taken out of service. In this analysis, the costs for decommissioning are covered by annual contributions to a decommissioning fund that accrues over the 50 year life for the facility.

7.3.2 Business Case Financial and Cash Flow Analysis

In the business case scenario cash-flow model used to analyze the economics of a regional UFMF, the cooperative agreement grants anticipated to extend from FY 2010 through FY 2012 with a total value of $30 million. The grants are assumed to consist of three annual grants of $10 million each.

It is envisioned that the performance-based development contract would be awarded to those firms able to secure a draft agreement and signed MOU with a prospective host. The development contract would overlap one year with the grant program, extending from FY 2012 and through CY 2016. The total cost of the development contract is estimated to be $46 million, which is comparable to the suggested budgetary funding levels in Section 6.1.2. This is the estimated cost to complete the engineering necessary to prepare, submit and defend a LA for the base and fuel capability UFMF. Since this is a performance-based contract, a line of credit is necessary to cover cash-flow and expenses during this period. The four milestone payments associated with this contract would include: the NRC docketing of the LA ($9 million); the NRC issuing the SER ($9 million); the NRC granting a CA for the base capability facility ($19 million); and the NRC granting an amended CA for the full capability facility ($9 million). These costs are constant 2009 dollars.

Beginning in 2013, firms that have been awarded a development contract will also be awarded a separate federal HAMC. Under this contract the firm would manage a $25 million per year host benefits program for the host site. This contract would continue through NRC licensing and facility construction from CY2013 through CY2018. As shown in the business case scenario schedule in Figure 7-1, this level of host benefits payments continue until the first DCP of fuel is received at the beginning of 2019. The total value of HAMC to this point is estimated to be $150 million in constant 2009 dollars.

The RSPC is envisioned to be a long-term, multi-faceted contract mechanism that will be awarded only to LLCs who's respective regional UFMF and site the NRC has issued a SER and for which a CA for the base capability facility is anticipated. The initial part of this contract will cover the construction and major capital equipment procurement for the base and full capability facility and is estimated to be valued at $283 million in constant 2009 dollars, which is bounded by the suggested budgetary funding levels in Section 6.1.2. Like the development contract, this is envisioned to be a performance based contract with payments made when key milestones are achieved. The key milestones for this part of the RSPC are the receipt of the first DPC with fuel

at the base capability facility ($142 million) in early CY2019, and the receipt of the first bare fuel assemblies at the full capability facility ($141 million) in early CY2022.

Based on this business case scenario analysis, the Federal government would be required to invest at total of approximately $30 million in grants and approximately $46 million for development over 8 years to site, design and license a UFMF, plus an additional $150 million for funding the host benefits program during this period. To secure the commercial loans and private equity needed to construct a regional UFMF, the business case scenario analysis indicates that a performance-based RSPC with a 'take-or-pay' provision having an initial contract value of $283 million would be sufficient for the business case scenario presented herein. The RSPC would be supplemented with subscription contracts from utility commercial customers that commit to send fuel to the UFMF. The construction period costs would be supplemented with additional payments of $150 million for funding the host benefits program during this period.

The estimated business case scenario fee amounts charged by the LLC to operate the facility are summarized in Table 7-5 and Figure 7-2. The fees are expressed in constant 2009 dollars and would be adjusted for inflation based on the year of fuel receipt. The difference in the fees assessed to the Federal government through the RSPC and those assed to utility commercial customers through subscription contracts are based on the assumption that 25% of the fuel received in any year comes from utilities willing to pay a 15% premium to accelerate the federal priority ranking. Overall, the utility commercial customers would cover approximately 15% of the total annual average operating cost of $206 million per year.

Under the envisioned fee structure shown above, for the business case scenario analyzed, the LLC can operate for 50 years at an average annual before tax profit margin of 8%. The private equity invested in the LLC will earn more than 11% internal rate of return under this business case scenario which should be sufficient to attract private investor to assume the commensurate risks.

Table 7-1 and Figure 7-3 show (in current year dollars) the initial projected cash-flows for the business case regional, commercial UFMF. These cash-flows are representative of the initial phases of development and implementation, through construction and procurement.

Based on the business case scenario analysis results, Table 7-6 shows the estimated funding and revenue requirements for the development and operation of a regional UFMF between 2010 and 2035. The first column identifies the funding/revenue source. Column two indicates how the monies are used. The majority of the initial funding comes from the Federal government in the form of grants and performance-based contracts. In the later years, after the facility begins operations, the revenues to keep the facility operating come from a combination of federal services contracts, federal host agreement management contracts and utility commercial customer subscription contracts.

Column three of the table shows the funding/revenue requirements for the development, construction and operation of a single UFMF. As shown in column 4, these are the estimated costs expended over a 26 year period from 2010 through 2035. For a single UFMF, the total estimated cost in constant (non-discounted) 2009 dollars is $5 billion. Over the same period, the

estimated costs would be approximately $15 billion for three regional facilities. Expenditures in the early years could fluctuate depending on the number of firms competing to develop a regional UFMF.

Table 7-5 – UFMF Illustrative Business Case Annual Average Fee Payments

Fee	Payee	Annual Fee (1) (2009$M)	Equivalent Unit Fee ($/kgU)
Receipt Fee	Government	54	114
Transportation Fee	Government	34	53
Storage Fee	Government	4	8.30 / yr
Fixed Fee	Government	26	54
Decommissioning Fund	Government	5	N/A
Host Site Benefits Package	Government	50	N/A
Subtotal:	Government	173	N/A
Receipt Fee	Utilities	21	131
Storage Fee	Utilities	2	12.60 / yr
Fixed Fee	Utilities	10	62
Subtotal:	Utilities	33	N/A

(1) Values shown are one-time receipt fees and recurring annual fees as defined in Table 7-4. The values shown are averaged on an annual basis.

Table 7-6 – UFMF Illustrative Business Case Funding and Revenue for First 20 years

Values shown are in undiscounted constant 2009 dollars.

Funding / Revenue Source	Purpose	2009$M	Years (CY)
DOE-NE FCR&D Grants	Siting/Host Development	30	2010-12
LLC Equity Investment	Business Infrastructure Development	25	2013-15
Development Contract	Engineering & Licensing	50	2012-16
Host Agreements Mgmt. Contract (HAMC)	Host Benefits Package	150	2013-18
Regional Service Provider Contract (RSPC)	Construction & Start-up	300	2016-22
HAMC	Host Benefits Package	850	2019-35
RSPC	Operations	3,000	2019-35
Utility Subscription Contracts	Operations	500	2019-35
	Total:	5,000	

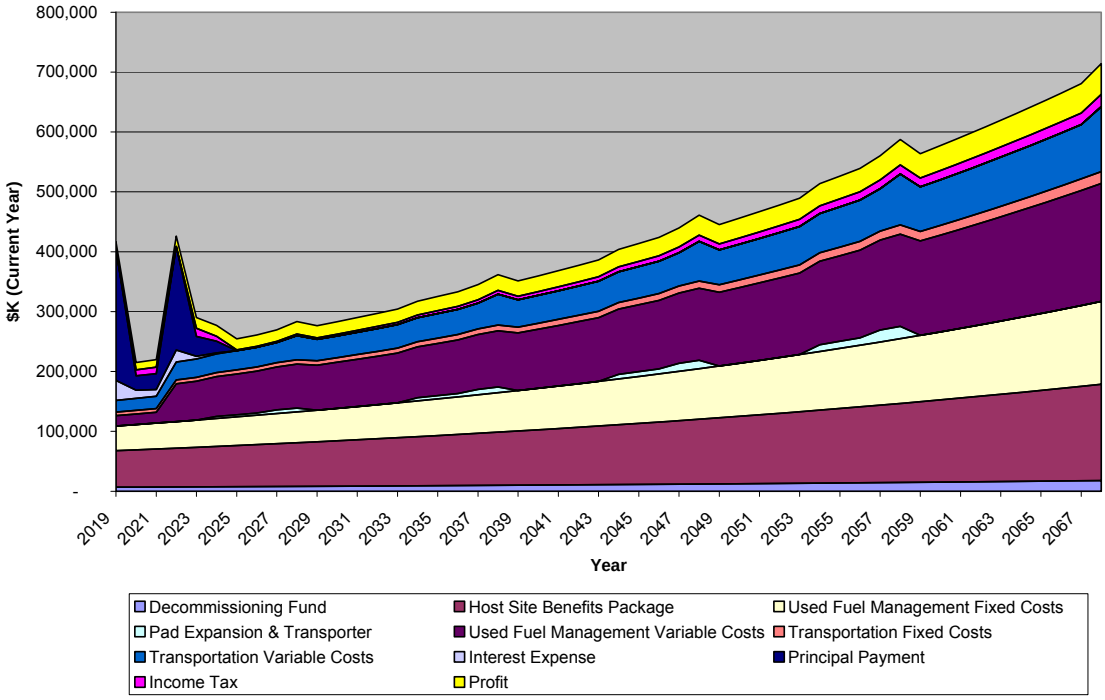

Figure 7-2 – UFMF Illustrative Business Case Annual Costs

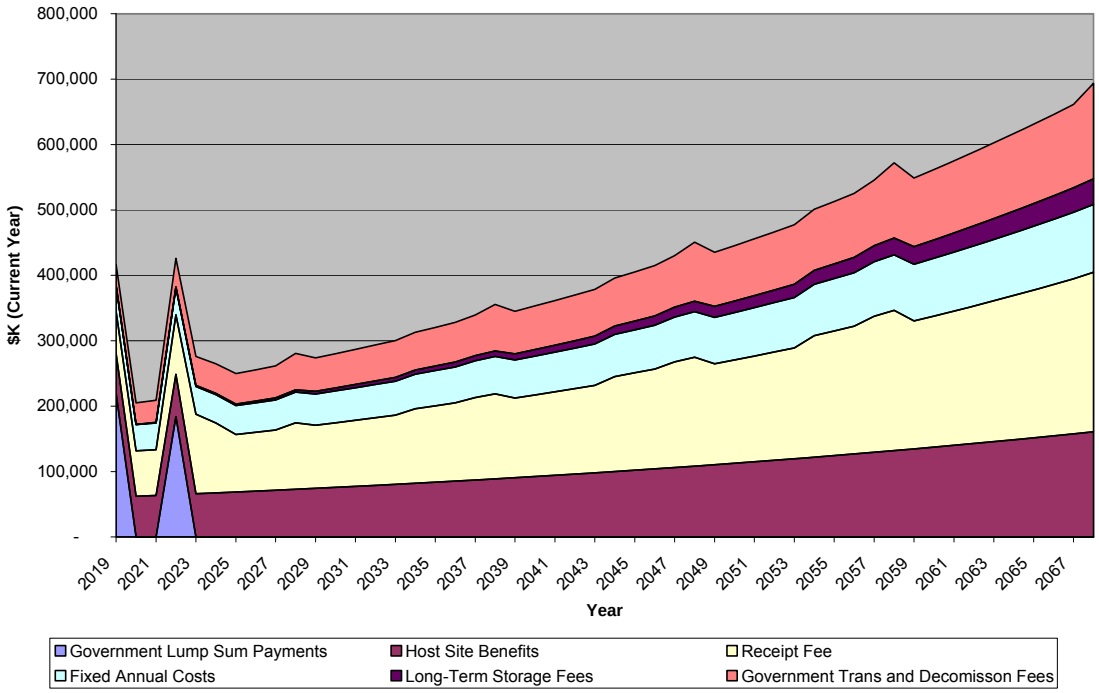

Figure 7-3 – UFMF Illustrative Business Case Annual Revenue

7.3.3 Business Case Life Cycle Cost Analysis

The results of the business case scenario cash-flow model are used to develop a total life-cycle-cost (LCC) for the construction, operation and decommissioning of a representative regional UFMF. The business case scenario analysis is performed using a nominal discount rate. The discount rate is the rate at which an investor would be indifferent as to whether they received a payment now or a larger payment in the future. For this business case scenario analysis, a discount rate of 8% is used. An 8% discount rate is used since this is typical value of money for a public utility and is equivalent to the yield on bonds issued to raise capital. The LCC for the regional UFMF is calculated over three time periods: 20 years; 35 years; and 50 years. Twenty years is chosen for the business case scenario analysis since this is the time period specified in the current 10 CFR Part 72 regulations for a license for an independent fuel storage facility without a license renewal. Fifty years is the assumed operating life of the UFMF and 35 years is midway between the two. The three LCC values are compared in Table 7-7 against the LCC for a dry storage facility operating on a reactor site the same number of years. The LCC values for the business case scenario UFMF all include the assumed annual host benefits program funding amount of $50 million per year. The LCC is based on a NPV at the first year of operation. For the business case scenario UFMF this is 2019.

Table 7-7 – On-site Storage vs. Regional UFMF Unit Life Cycle Cost Comparison

Period (yrs.)	At-Reactor On-site Storage			Regional UFMF		
	LCC ($M)	MTU	LCC/MTU	LCC ($M)	MTU	LCC/MTU ($)
20	$61	350	175	3,457	12,765	271
35	$63	350	180	4,181	22,440	186
50	$63	350	181	4,506	32,115	140

7.4 Business Case Risk Analysis

The top-level postulated risks associated a regional UFMF are analyzed by comparing the discounted life cycle cost of various future risk scenarios against the base business case scenario. Five future risk scenarios are postulated and investigated for the purpose of developing a contingency to mitigate the associated risks. These include:

- A two year delay in obtaining a license and start of construction;
- A 20% increase in the capital cost;
- A 5% increase in the operating and maintenance costs;
- A 2% increase in the commercial loan rate; and
- A 5% increase in the amount of private equity invested.

A delay in obtaining a license to construct and operate the facility could result from several situations, including delays in the Federal government process required to move the regional UFMF initiative forward. This scenario would also address the situation where start-up of the facility could be delayed for non-governmental reasons, such as delays in construction or inability to secure financing in a timely manner.

The capital cost estimates used in the business case scenario analysis do not include any contingencies for cost creep or other reasons. Costs would be expected to increase for several reasons, including commodity or labor escalation greater than the 2% assumed in the model and significant changes in the design due to site conditions, changes in regulatory requirements or major changes in the design basis. Similarly, the operating costs are only a best estimate of the expected expenses based on current industry practices. These are highly susceptible to regulatory changes and fluctuations in the commodity escalations.

The business case scenario cash-flow model assumes that commercial loans could be obtained at an interest rate of 9.00%. If commercial lenders question the likely success of a UFMF venture and assign a higher risk profile, then this rate could easily rise. The perceived risks could increase if the amount of support and funding provided by the Federal government through the RSPC is less than anticipated or stretched out over time. The backing of the Federal government and especially the two initial lump-sum payments under the RSPC at the receipt of DPC's and bare fuel are critical factors in reducing the perceived programmatic risks.

The commercial loan rate could also increase if the federal discount rate or London Interbank Offered Rate (LIBOR) increases over the coming years. At present this rate is low, but if current government stimulus expenditures drive up inflation in the U.S. or internationally, then there is a reasonable likelihood that these rates could also increase.

The final risk scenario investigated assumes that the commercial firms building and operating the UFMF will have to invest more private capital into the venture to mitigate unplanned events. This could result from federal requirements for more private investment, or aggressive competition with other firms interested in securing a RSPC contract. In total, the business case scenario assumes that approximately 95% of the costs to construct the base facility will be covered by Federal government contributions under the development contract and RSPCs. This contribution is unlikely to rise, particularly if the benefits of using a UFMF are not sufficiency attractive to some utilities based on the availability of on-site dry storage capability. In this case, there is a possibility that there would be reluctance on the part of utilities to 'subscribe' to this endeavor which would likely require more private equity investment.

Table 7-8 summarizes the results of the illustrative business case LCC analysis comparison. As shown in the table, the largest impact on the LCC is the delay in the facility start-up. A 2-year delay in accepting the first DPC could increase the LCC by 6%. At most, any of the other identified risk scenarios would only add 4% to the total LCC. If all of the anticipated risk scenarios were to impact the project, the net effect would be a maximum increase of 15% in the LCC over the assumed 50-year operating life of the facility, which is a reasonable contingency to cover risks for such a venture. A more detailed risk analysis is warranted, but is beyond the scope of the current effort.

Table 7-8 – UFMF Illustrative Business Case Risk Analysis Results Summary

Risk Scenario	LCC (2019$M)	% Increase in LCC
Life Cycle Cost	4,506	0
Delay in Start-up (2 Years)	4,781	6
Capital Cost Increase (20%)	4,687	4
O&M Cost Increase (5%)	4,629	3
Loan Rate Increase (2%)	4,568	1
Private Equity Increase (5%)	4,471	-1

7.5 Business Case Results Comparisons

The business case LCC is based on the total cost of the regional commercial UFMF initiative, including Federal government contributions for Phases 1 though 7, as defined in Section 1.2 and described throughout Section 6, excluding final fuel disposition. As the description of the business case scenario in this section indicates, the economic analysis of the representative regional UFMF is relatively complex, involving a number of assumptions and inputs derived and based on experience and best judgment. At this early phase of the initiative, there remains uncertainty in the analysis input data, as one would expect. A contingency to reflect this uncertainty and to account for mitigation of the risks identified and other unknowns of 10% on both capital and operating costs has been included in the business case scenario analysis results presented. Although the rigor of the analysis and the results presented are sufficient to provide a clear indication of the regional commercial UFMF concept viability, further underpinning of the assumptions and inputs used for this business case scenario is recommended going forward, as described in Section 8.

Utilities with operating nuclear power plants have the option to store their fuel in their on-site dry storage facility. Delays by the Federal government in meeting its obligations will result in most currently operating plants having constructed on-site dry storage facilities by the time a regional UFMF would be ready to accept bare fuel shipments. So the answer to value proposition test #4 at the beginning of this section lies in the ability of the commercial UFMFs to deliver storage services within an equitable cost range of (at the low end) the incremental cost/MTU for plants that already have an operating dry storage facility, to (at the high end) plants that need to construct and operate a new dry storage facility. McFarlane[124] compared such facility costs to centralized facility storage using 1998 Yucca Mountain data, and determined that centralized storage to have a life-cycle-cost advantage, excluding transportation costs and host

[124] A. Macfarlane, "The problem of used nuclear fuel: lessons for interim solutions from a comparative cost analysis," *Energy Policy* 29 (2001): 1379-1389.

benefits costs. As an additional analysis of the total LCC comparison between an on-site dry storage facility and UFMF, the LCC calculated for a UFMF is compared against a estimated LCC for such an on-site facility using published data. Since an independent fuel storage facility currently can only be licensed for 20 years, the LCC is compared over three time periods: 20 years, 35 years and 50 years. As a comparison, the unit cost to transport and manage the fuel is compared against the unit cost of dry storing fuel on-site. The UFMF benefits from the increasing amount of fuel it manages, whereas the on-site dry storage facility costs are reduced since its costs are not burdened with transportation or host benefits costs.

In a 2008 Plant Uprate Certificate of Need Application[125], the Minnesota Department of Commerce claimed storage hardware and canister loading campaigns costs of $33.5M for 30 canisters, or approximately $100,000/MT (not counting upfront capital costs or storage O&M costs). The same Minnesota data [125] provided the upfront capital costs for on-site dry storage facility design, licensing, and construction as $21.5M, or $62,000/MT. Bunn, et.al. reports the average on-site dry storage facility operating costs at $750,000/yr for facility O&M costs during the storage period for an on-site dry storage facility with 50MT of stored fuel.

Table 7-7 summarizes the LCC analysis for an on-site dry storage facility with a total capacity of 350 MTU and a UFMF which adds 645 MTU per year and a maximum capacity of 32,000 MTU. The LCC for the on-site dry storage facility is calculated using a real discount rate of 6%, comparable to the nominal 8% discount rate used for the LCC of a UFMF. As expected, the unit cost per MTU based on the LCC of a UFMF over the first 20 years of operation is greater than that based on the on-site dry storage facility LCC for the same period, since the UFMF costs include transportation and host benefits. After 35 years, the unit costs to dry store fuel on-site are essentially equal to the costs to manage fuel at a UFMF. Based on these results, it appears that the UFMF has distinct cost benefits over that of the on-site dry storage facility over the long-term.

It is expected that nuclear utilities that contract with the LLCs to accept, transport, and store their fuel will do so to: 1) avoid the need to build a new, or expand an existing dry storage facility on site, 2) accelerate the federal acceptance priority ranking, or 3) address plant-specific constraints related to on-site storage. As the recent announcement by the NRC to begin the process of accepting applications for independent fuel storage facility licenses to 40 years indicates, the trend in the utility industry is to dry store fuel on site for longer periods. If any of these scenarios apply to a utility site, then the long-term cost savings associated with using a UFMF

[125] Minnesota Department of Commerce, "Final Environmental Impact Statement to Establish an Independent Spent Fuel Storage Installation at the Monticello Generating Plant" in *Monticello Nuclear Generating Plant Uprate Certificate of Need Application* (St. Paul, MN: February 14, 2008), Appendix F - Attachment 1.

rather than dry storing fuel on site would make the UFMF option more attractive, even with a premium attached to at least partially offset transportation and host benefits costs.

8 Validation and Recommended Path Forward for Regional UFMF Initiative

Report Usage. It is emphasized that the illustrative business case presented in this report is based on a set of inputs and assumptions developed solely for the purpose of conveying a strategy concept, recognizing that there are many other assumptions and approaches that could be taken and that should be evaluated going forward. They are presented in this report with enough specificity to provide useful input to DOE for evaluation of the strategy concept and for developing next steps.

The envisioned business plan elements presented in this report are intended to represent indicative concepts and economics to support early consideration of a regional UFMF initiative as an initiating step in implementing an evolving national IUFM strategy. The report results indicate that workable business frameworks, implementation sequences and positive economic benefits are likely outcomes of this strategy. The concepts discussed in this report represent considerable experience and insights from similar initiatives and projects, including the PFS initiative, at-reactor dry cask storage projects and currently ongoing new nuclear power plant projects. The dollar amounts presented are considered representative based on limited analysis and applying such experience and inputs. A more detailed analysis of projected commercial frameworks and strategy economics is needed to address specific project requirements as the strategy continues to evolve. Initial steps taken toward site development will provide a much better understanding of specific constraints, requirements and opportunities which could significantly modify these concepts. Changes in law, policy and regulation will continue to inform the best path forward and will need to be re-evaluated as they occur. Therefore the details presented in this report, which provide important insights, should be considered indicative rather than prescriptive.

A private industry led regional UFMF initiative, including project development and implementation and subsequent facility operation requires further development of commercial structures that balance a number of challenges including risk management, public outreach, commercial viability, stakeholder requirements, and a host of legal and policy interpretations. The identification of potential volunteer sites with associated stakeholder requirements, evolution of relevant energy policy, and a more detailed accounting of the strategy economics will require continued re-assessment of these concepts to forge an effective commercial framework that can succeed in moving forward with a regional UFMF initiative as part of an evolving national IUFM strategy is a viable commercial venture. It is with this awareness that the conclusions of this report are presented.

8.1 Validation of Regional UFMF Initiative

Section 1.1 puts forth a value proposition for the national IUFM strategy and regional UFMF initiative and identifies four pertinent business model constructs to substantiate and validate the value proposition. Section 7 presents a financial analysis of an illustrative business case for one

representative regional, commercial UFMF to test the economic viability of the regional UFMF initiative as a commercial enterprise.

The results of the illustrative business case financial analyses indicate that the regional commercial UFMF initiative, based on a volunteer siting approach, can be a viable commercial enterprise, and as a result, the regional UFMF initiative can be an integral component of a national IUFM strategy. The regional commercial UFMF initiative is the first step in the Federal government's NWPA waste acceptance and disposal disposition pathway for commercial UNF and GTCC wastes, irrespective of whether the nation decides to continue to pursue direct disposal (the once-through fuel cycle approach) or to adopt a re-use approach (the close fuel cycle approach).

The regional commercial UFMFs provide the capability for the Federal government, through performance-based contracts with the UFMF LLCs, to start accepting waste from the utility sites (starting with the orphaned shutdown reactor sites) and thereby begin to meet its obligations under the Act and the standard disposal contracts with the utilities. A commercial UFMF would not be limited by the restrictions of the Act that would prevent the creation of a federal UFMF due to statutory linkages with a repository. At the same time, the regional commercial UFMFs satisfy the interests of the nuclear utilities by removing and taking possession of their UNF (constrained by the federal acceptance priority ranking) and, thereby, providing the nuclear utilities the opportunity to satisfy plant-specific constraints, and to focus their resources on the generation and distribution of electrical energy rather than UNF management.

The four constructs and corresponding tests to validate the value proposition in Section 1.1 (as supported by the illustrative business case in Section 7) are:

Construct #1. To site, design, and license regional UFMFs (particularly the first one) will require a reasonable front-end investment and a binding contractual commitment by the Federal government to adequately motivate private industry and potential volunteer host State and local governments to build the necessary institutional infrastructure, attract private investment and capital, and to convince the respective hosts that a regional UFMF is in their best interest.[126]

Test #1. *How much front-end Federal government investment is required to site, design, and license a regional UFMF and over what timeframe?*

The Federal government, private industry, and host partnership, envisioned in the regional commercial UFMF initiative is illustrated in Figure 6-1, including the respective roles and responsibilities. The strategy envisioned for a regional volunteer process to site multiple commercial UFMFs is presented in Section 6.2. An implementation plan overview and the

[126] Deliberate and concurrent development of a final UNF disposition policy by the Federal government is also essential in this respect.

suggested funding mechanisms for the regional commercial UFMF initiative are provided in Figure 8-1 and described in Section 6.1.2, based on the illustrative business case analysis presented in Section 7.

Figure 8-1 divides the envisioned lifetime of the regional, commercial UFMF initiative into five overlapping phases – the Site Development Phase from 2010 through 2012, the Engineering and LLC Business Infrastructure Development Phase from 2011 through 2013, the Licensing and LLC Business Implementation Phase from 2012 through 2016, the Construction and Procurement Phase from 2016 through 2021, and the Commissioning and Operations Phase from 2018 through 2069 (based on the assumption that the UNF and GTCC wastes will be removed from the UFMF site 50 years after initial receipt). A sixth phase, Decommissioning is assumed to start in 2070.

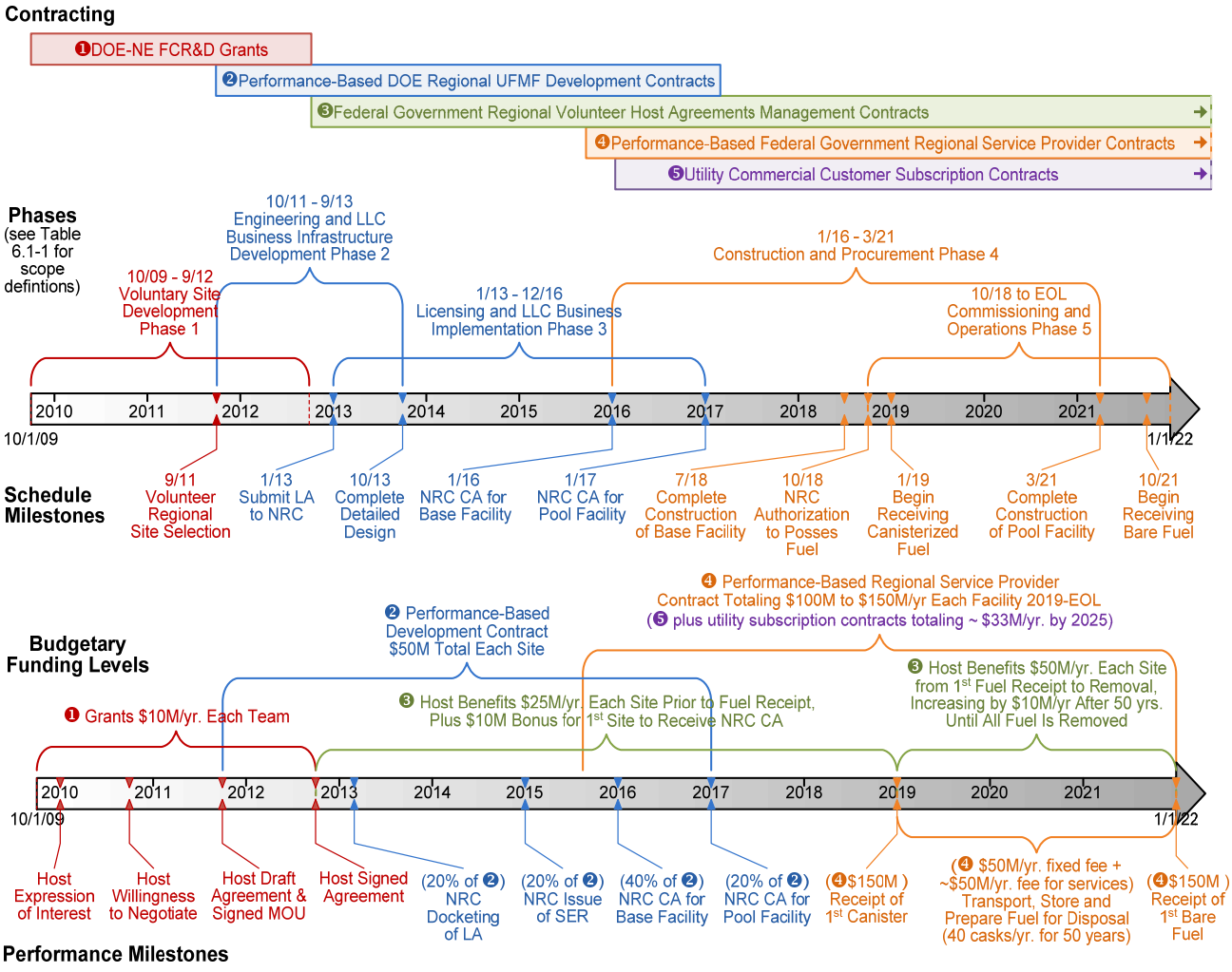

Figure 8-1 - 10-Year Regional UFMF Implementation Plan

The planned approach for the regional commercial UFMF initiative maximizes flexibility and provides a means to achieve incremental progress.

As illustrated in Figure 8-1, there are three distinct federal funding actions over the approximately 6-year time frame covering the period starting with seeking EOIs from potential interested volunteer hosts and ending with the receipt of a license from the NRC authorizing construction of the base facility for already-canistered UNF in 2016, and a license amendment from the NRC authorizing construction of the full capability facility for bare fuel assemblies in 2017.

For the first three years, it is envisioned that DOE-NE will provide FCR&D cooperative agreement grants to nuclear firms interested in forming a UFMF, LLC at the successful completion of the voluntary site development phase of the initiative. This initiative phase starts with the soliciting interested volunteer local communities and states who are interested in evaluating the opportunity by returning an EOI, proceeding through negotiations culminating in a signed MOU. It continues until the signing of binding court-enforceable negotiated host agreements between the UFMF, LLC and the local and State governments, with the DOE as a signatory.

Other activities during this initiative phase also include preparing a preliminary design of the UFMF and evaluating the candidate host sites to support site selection, and to begin gathering the necessary data for preparing the license application (LA) and environmental report. In this phase, each firm will receive three years of grants, at approximately $10 million each year.[127] The cooperative agreement grants will be issued in much the same manner as the previous DOE-NE FCR&D studies and will cover all activities, including sub-grants made by the firms to interested local communities in a region to participate in the voluntary siting process described in Section 6.2, which is planned to be completed in the nominal three year period.

After all three parties (the UFMF, LLC and the host local and State governments, with the DOE as a signatory) sign the binding host agreements, the LLC will enter into a separate Host Agreement Management Contract with the DOE, and the DOE will begin funding the associated host benefits program under the HAMC, as described in Section 6.1.2. For purposes of this report, a funding level of $25 million per year is assumed, starting in 2013 and continuing until the first shipment of already canistered fuel is received at the UFMF in 2019. The LLC will manage and implement the host benefits program in accordance with the agreements with the hosts, and provide payments to the State and local governments for this purpose.

In addition, it is envisioned that the hosts for the first volunteer regional UFMF site to receive NRC construction authorization will receive a one-time $10 million incentive bonus paid by DOE. As described in Section 6.1.2, the host agreements will also likely need to include penalty payment provisions and opt out off-ramp clauses tied to measurable progress being made by the Federal government in developing a definitive final UNF disposition policy prior to initiating facility construction in 2016, and beginning to implement such a policy prior to first receipt of fuel at the UFMF in 2019. These incentives and penalties are considered necessary to address permanence concerns by potential hosts, as described in Sections 2, 3.2.2 and 5.3. For purposes

[127] Grant recipients may also make discretionary contributions, depending on circumstances and conditions.

of this report, none of these incentive or penalty payments are included in the illustrative business case analysis.

Upon the selection of one or more regional volunteer sites for the first commercial UFMF, estimated to be at the end of the second year, the sponsoring firm will enter into a federal performance-based federal development contract with DOE. Major activities during this phase of the initiative include completing the site characterization, preparing the detailed design of the facility and systems, performing the safety analysis and environmental assessment, and preparing the LA, including the environmental report. Under this contract, DOE will make payments tied to key milestones for completion of NRC docketing of the LA, NRC issuance of the safety evaluation report, NRC granting a license authorizing construction of the base capability facility, followed separately by NRC granting a license amendment authorizing construction for the full capability facility.

Facility construction documents and equipment procurement specifications will also be prepared during this phase of the initiative, following LA submittal. Also during this phase of the initiative, the dedicated UFMF, LLC will be legally formed and the business infrastructure necessary to resource and provide the management, business operations and regulatory compliance systems will be put in place in place. The LLC business infrastructure will be sufficient for the LLC to obtain a line of credit for cash-flow purposes, sign major contracts and hold the NRC licenses for the regional UFMC.

It is assumed that the total amount of performance-based milestone payments under the federal development contract will be approximately $50 million in the 2013 to 2016 timeframe. Table 7-1 provides the corresponding estimated cash-flow and Figure 8-1 provides the planned timeline, schedule milestones and funding sources for these initiative phases.

The amount of front-end Federal government funding needed for these initiative phases, prior to receipt of the NRC license authorizing construction of the base capability facility for the first regional UFMF in 2016 is estimated to total approximately $180 million ($30 million from DOE-NE for grants, $100 million from DOE for the binding host agreements under the HMAC, $50 million from DOE for the performance-based development contract).

Construct #2. To construct, commission and operate regional UFMFs (particularly the first one), will require a reasonable front-end investment and a binding contractual commitment from the Federal government and mutually beneficial agreements with the respective volunteer host State and local governments, to secure the private investment and capital necessary to finance such a commercial venture. It is also desirable, but not essential to have subscription contracts with as many nuclear utility commercial customers committing to use the UFMF as possible.

***Test #2**. What is the nature, scope, and approximate total value of the contracts and agreements required, and when are they needed to secure the necessary commercial financing to facilitate construction, commissioning, and operation of a regional UFMF?*

To provide funding for the regional, commercial UFMF initiative envisions near-term grants from DOE-NE, long-term contracts with both the Federal government and utilities as regional UFMC commercial customers, equity contributions from the commercial entity (the UFMF, LLC), for construction, procurement, commissioning, operation and decommissioning of the UFMF, including a contract to implement the binding host agreements; using commercial loans as the source of financing for facility construction. The performance-based Regional Service Provider Contract and the Host Agreement Management Contract are the two federal contracts for this purpose. The timeframe and suggested level of federal funding for these initiative phases is provided in Section 6.1.2, based on the illustrative business case analysis presented in Section 7. Table 7-1 provides the corresponding estimated cash-flow and Figure 8-1 provides the planned timeline, schedule milestones and funding sources for these initiative phases.

It is envisioned that the cost for facility construction and major capital equipment procurement will be financed by short-term loans from commercial lending institutions entered into by the UFMF, LLC with a payback schedule of five years. As described in Sections 6.1.2 and 7.1.3, a Federal government RSPC that includes 'take-or-pay' provisions that act as a guarantee, together with private equity and any utility subscription contracts, will be necessary to collateralize the loans and reduce the project risk profile to enable more favorable/less costly commercial loan terms.

The regional, commercial UFMF initiative envisions that the LLC will negotiate a performance-based RSPC with DOE in 2015, after the NRC has issued its SER. The federal RSPC will be signed in late 2015, before the expiration of the development contract, and several months ahead of mobilizing for facility construction in early 2016, to allow sufficient time to secure financing and award contracts to a general contractor and long-lead equipment suppliers. The estimated capital cost of these items and activities is summarized in Section 7.2.1. Two one-time performance-based lump-sum payments of approximately $150 million will be made under the RSPC; the first upon receipt of the first already-canistered UNF and GTCC waste in 2019, and the second upon receipt of the first bare UNF assemblies in 2022. These two lump-sum payments will offset the costs for procurement, construction and equipment installation for the base capability facility, the fuel pool facility, and major capital equipment, including the transportation equipment needed for the base and full capability facility. They are the primary means to pay-down the associated construction loans.

Thereafter, it is envisioned that payments under the federal RSPC (and the utility commercial customer subscription contracts) will proceed on the basis of a performance-based set fee structure, as described in Section 6.1.3. The total amount of the regional UFMF annual revenues and payments under the RSPC (that largely depend on the level of service provided by the UFMF, LLC in any given year) during the operations phase of the initiative is estimated to be in

the range of $100 to $150 million per year, including one-time fuel receipt fees and recurring annual fees. Approximately $50 million of this is the fixed operating cost annual fees and recurring storage fees. For purposes of this report, utility subscription contracts are also assumed to generate additional annual revenues estimated to be $33 million per year by 2025. The envisioned fee-structure for utilities as commercial customers is provided Table 6-3. In addition, it is assumed that annual host benefits payments of $50 million will commence beginning in 2019 under a separate federal HAMC.

It is assumed that revenues generated by the LLC during the operational phase of the initiative under the federal RSPC and utility subscription contracts will cover the O&M costs for the UFMF, beginning in 2019 and continuing through the end of the assumed 50-year operating life of the UFMF. The estimated O&M costs for facility operations covered by payments made under RSPC and subscription contracts are summarized in Section 7.2.2, including annual contributions to the regional UFMF decommissioning fund that is held in a dedicated trust fund for this purpose per the requirements of the NRC license. A plot of the estimated annual O&M costs is provided in Figure 7-3.

For the illustrative business case, it is assumed that all UNF transportation costs are assigned to the federal RSPC and will be reimbursed under that contract in accordance with the fee structure concept described in Table 6-2. For purposes of this report, Section 180c costs are not estimated or included, as discussed in Section 6.1.2. Annual payments under the federal HAMC for the binding court-enforceable host agreements to fund the associated host benefits program are assumed to be $50 million per year until the end of operating life in 2070. These payments are escalated by $10 million annually thereafter until all UNF and GTCC waste are removed from the UFMF site.

Construct #3. For a regional UFMF to be a viable on-going commercial enterprise, sufficient revenue must be generated through user fees and service contracts with the Federal government and utility commercial customers to fully offset the associated capital and operating costs (including costs associated with host benefits) and to generate a reasonable fee and rate of return on equity investment.

Test #3. *How much revenue is needed to make a regional UFMF commercially viable and what is the fee structure necessary to generate this revenue from the Federal government and utility commercial customers?*

The estimated revenues generated through user fees for operation of a representative regional, commercial UFMF are discussed above under Construct #2. As indicated there, the revenues generated by the UFMF LLC will be derived from several sources, as shown in Table 7-1.

These include:

- Cooperative agreement grants from DOE-NE,
- A performance-based development contract between DOE and the respective firm,

- A performance-based Regional Service Provider Contract between DOE and the dedicated UFMF LLC, and
- Subscription contracts between the UFMF LLC and individual utility commercial customers.

A plot of the estimated annual revenue derived from UFMF operations under the federal RSPC and the utility subscription contracts is provided in Figure 7-3. In addition, the funding needed to cover the costs for implementing the host benefits program under the federal HAMC as described under Constructs #1 and #2 above are also included in the plot.

The results of the regional, commercial UFMF illustrative business case economic analysis presented in Section 7.3 indicate that, consistent with the assumptions used in the cost estimates, project financing, revenue generation, cash-flow and other inputs, a regional UFMF can be commercially viable. As described in Section 7.3.3, the estimated total system life cycle cost for the commercial UFMF included in the illustrative business case economic analysis (from site selection through the assumed 50 years of facility operation, including the accrual of a decommissioning fund) is approximately $4.5 billion. A large fraction of this amount is allocated to funding the host benefits program which is considered necessary for the regional UFMF voluntary site development process envisioned in Section 6.2 to be successful.

Figure 8-1 identifies the principal methods of funding, other than equity contribution and commercial borrowing, needed to cover the total system life cycle costs for the UFMF. Illustrative business case analyses are performed using the model, inputs and assumptions described in Section 7. The results of this analysis indicate that a regional, commercial UFMF can generate sufficient revenues to cover costs during each regional UFMF initiative phase (including D&D), while providing a reasonable rate of return on equity and profit for the UFMF LLC, for the commercial business venture to be judged viable.

Construct #4. For a regional UFMF to be a viable on-going commercial enterprise the evaluated benefits and cost to the Federal government and utility customers must be equitable and beneficial compared to other alternatives that the Federal government and utility customers may have.

Test #4. *Are the estimated costs and benefits to the Federal government and utility commercial customers for using a regional UFMF equitable and competitive with other available options?*

As indicated in Section 4, the Act provides the DOE with exercisable authority to accept UNF from nuclear utilities for interim storage at an MRS and for disposal in the geologic repository at Yucca Mountain that are not co-located. In addition, the Act firmly ties the acceptance of UNF at an MRS to progress in the development of the geologic repository at Yucca Mountain. Thus, the Act intentionally limits the means by which the DOE can discharge its responsibilities under the act to a narrow range of options. As a result, new federal legislation authorizing, funding, and defining a siting process for a federal interim storage facility (or federal UFMF) appears to be needed for development of such a federal facility. Also, any decision by the Federal

government to pursue long-term interim storage of UNF would likely constitute a major federal action that would require a new federal EIS, (rather than the more limited EIS required by a private industry entity under NRC regulations, as described in Section 4.1.

As a result, the Federal government is most likely decades away from beginning to accept UNF and beginning to meet its obligations under the Act and the utility standard disposal contracts. Due to extended delays in the Federal government's ability to begin waste acceptance in 1998, nuclear utilities have filed 71 lawsuits against the Federal government, and, the federal courts have held the Federal government in partial default of the disposal contracts. The current liability to the Federal government is estimated to be $1.3 billion, and, the liability is growing rapidly and is estimated to reach $12.3 billion in 2020 and continue accruing at approximately $500 million per year or more. Over the next 10 years, i.e., the time estimated to implement the regional commercial UFMF initiative, the liability of the Federal government will increase by approximately $10 billion. Assuming the Federal government begins to accept waste from the nuclear utilities in 2020, the future federal liability can begin to be mitigated and reduce the increasing cost to the taxpayer.[128]

As shown in Figure 8-1, the conceptual planning for the regional commercial UFMF initiative shows that receipt of already-canistered fuel from permanently shutdown nuclear reactors can reasonably be expected to start in early 2019 and receipt of bare fuel assemblies can reasonably be expected to start in late 2021. Therefore, the regional commercial UFMF initiative provides a viable option for the Federal government to begin to meet its obligations under Act and the utility standard disposal contracts with the nuclear utilities, but also, it provides a means to mitigate (but not eliminate) the future financial liability of the Federal government due to extended delays. The envisioned schedule for implementation of the regional, commercial UFMF initiative also allows the Federal government to begin waste acceptance starting in 2020, consistent with DOE's planned schedule[129].

During this same ten-year period, contributions to the NWF will continue at approximately $750 million per year and interest on the corpus of the NWF can be expected to continue at approximately $1 billion per year (based on Figure 5-10), the annual NWF receipts (contributions plus interest on the invested corpus of the fund) have averaged an annual increase of $1.75 billion for the past nine years. By comparison, the total life cycle cost over the 50 year operating life of a regional UFMF is estimated to be approximately $4.5 billion. Assuming that there are three regional UFMFs that have approximately equal cost structures, the total life cycle

[128] This liability is paid by the taxpayers through a DOJ judgment fund, not by the utility ratepayer contributions to the NWF established by the NWPA.

[129] U.S. Department of Energy, Office of Civilian Radioactive Waste Management (OCRWM), *Total System Life Cycle Cost Report*, DOE/RW-0591, Washington, DC, July 2008.

cost for regional UFMFs as part of a national IUFM system is estimated to be $13.5 billion, a small fraction of the NWFs estimated total value[130].

The availability of regional, commercial UFMFs provides the Federal government with the opportunity to start waste acceptance sooner than it is likely to be able to otherwise. Initially, it is envisioned that the Federal government will exercise its authority under the Act and the standard disposal contracts to prioritize waste acceptance from the permanently shutdown nuclear reactors (i.e., all of the UNF and GTCC wastes received at the UFMFs will be received under a performance-based RSPC). A few years later, it is envisioned that the Federal government will accept UNF (consistent with the federal acceptance priority ranking and the standard disposal contracts) from operating reactors, primarily from the plants' spent fuel pools. The annual costs during this initial period for a UFMF to receive containerized and bare fuel is estimated to be on the order of $250M in 2009 dollars. This includes the small amortization costs to retire accumulated interest on borrowed monies to facilitate facility construction. If three UFMFs are operating, this would be $750 million annually to provide UNF management services for all the UNF generated by the current commercial reactors, (which is on the order of the estimated DOJ judgment fund payments of $500 million per year).

The Federal government has the responsibility for disposition of the UNF and GTCC wastes, including both finding a acceptable host site(s) and transportation of the UNF and GTCC wastes from the nuclear utility sites to the point of final disposition. The costs for the negotiated host benefits program included in the host agreements and the transportation of the UNF and GTCC wastes, including equipment costs, are assumed to be assigned to the Federal government. The costs for Section 180c of the Act have not been estimated for the purposes of this report; however, those costs would be assignable to the Federal government. These allocations appear to be consistent with the costs that would be incurred by the Federal government to develop a Federal centralized interim storage facility (which would likely have more limited capabilities that the envisioned UFMF). These transportation costs are the same, whether the facility is owned and operated by private industry or the Federal government.

The nuclear utilities with operating nuclear power plants have the option of using an NRC-licensed on-site dry storage facility. It is expected that the nuclear utilities that contract with the UFMF LLCs to accept, transport, and store their UNF will do so to: 1) avoid the need to build a new, or expand an existing dry storage facility on site, 2) accelerate the federal acceptance priority ranking, or 3) address plant-specific constraints and/or local public policy issues related to on-site storage. Such utilities may be willing to pay some premium to utilize a UFMF.

As the illustrative business case results comparisons provided in Section 7.5 indicate, the cost to a utility to use a UFMF in the early years of operation exceeds that of on-site dry storage due to the larger initial capital investment required for a UFMF. However, over time, the cost to a

[130] U.S. Department of Energy, Office of Civilian Radioactive Waste Management, *Fee Adequacy Assessment Report*, DOE/RW-0593, Washington, DC, July 2008.

utility to use a UFMF (excluding transportation and host benefits costs), are comparable to that of on-site dry storage, as shown in Table 7-7, due to the relative economies of scale. Also, as described in Section 4.2, some nuclear utilities may opt to transfer both possession and ownership to the UFMF, LLCs (i.e., the UFMF, LLCs would take title to the UNF thereby removing the nuclear utilities from any future responsibilities for the UNF) and, therefore, those utilities seeking to also transfer the title to the UNF will be expected to pay an additional premium.

8.2 Recommended Path Forward for Regional UFMF Initiative

Building on the national IUFM strategy and regional UFMF initiative described in this report, and the work already accomplished by DOE with respect to the final UNF disposition polity, it is recommended that the DOE take the following next steps over the next three fiscal years beginning in October of 2009:

1. For FY 2010, it is highly recommended that DOE-NE continue their ongoing FCR&D work as it pertains to helping solve the nation's UNF disposition issues, of which this and similar programmatic efforts and their resulting outputs are but one important component.

This suggested action appears to be consistent with DOE-NE's authority for nuclear R&D under the Atomic Energy Act, current FY 2009 activities, and with the Administration's FY 2010 budget request (which states on pages 621 and 622 that the FY 2010 Fuel Cycle R&D program plans to implement various strategies, including private sector partnering). The budget request language states DOE-NE's mission is to "… develop nuclear fuel and waste management technologies for safe secure and economic …storage and disposal of nuclear waste."

2. It is asserted that the continuation of the FY 2009 effort documented in this report to further develop and expand upon the concept of a national IUFM strategy, starting with further development and initiation of the volunteer siting process for regional UFMFs and conceptual designs in FY 2010, would be very beneficial and helpful to the most challenging and schedule intensive aspect of UNF management, namely facility siting.

The further development of the volunteer siting process outlined in Section 6.2 beginning in early FY2010 by building on the previous efforts of DOE-NE in this regard, is considered to be essential. This would include the preparation of a detailed regional voluntary siting plan that complements the efforts of DOE-NE as a key participant in the Secretary's ongoing policy review. In addition, early engagement with potential volunteer UFMF host communities, including their State governments, to explore the components of a voluntary siting agreement would be mutually beneficial. History clearly indicates that the societal and political aspects of site selection are the most difficult issues to resolve. It is asserted that the fusion of new technologies and new approaches together with creative commercial business partnerships with potential volunteer host local, regional and State entities can break through past impasses leading to a vitally needed path forward for the nation.

In addition, further development of alternative commercial business models, cost analysis and of a range of business case scenarios would be beneficial in FY2010. These may include investigating a range of topics such as the feasibility of non-profit commercial business models, a range of host benefits program options and funding models informed by early discussions with potential hosts, and evaluating other inputs and feedback provided by DOE and policy makers based on their consideration of the concepts presented in this report.

3. In fiscal years 2011-12, (based on concurrent Congressional appropriations and guidance language), DOE should contract with multiple commercial entities to develop the best regional UFMF concepts for implementation. The detailed design and licensing of the best regional UFMF(s) concepts would follow, with the goal of having the first regional UFMF "shovel-ready" for construction by the end of CY2015.

Specifically, it is recommended that DOE-NE, under existing Atomic Energy Act (AEA) authority for a Fuel Cycle R&D program, further develop a national IUFM strategy consistent with past appropriations language and the Administration's FY 2010 budget request, including directions for DOE-NE to review the options for commercial UNF management. As described in this report, the concept of a national IUFM strategy will be closely coupled to on-going and future fuel cycle technology R&D activities and repository development in order to be able to adjust, adapt, and utilize new technologies for final UNF disposition as they may develop. This action is consistent with the Administration's goal of reviewing the policy options for the disposition of UNF.

Should the Congress determine in the future that this is an appropriate use of the Act's NWF, there is historical precedent for funding such activities from the NWF. In the 1980s, under the Congressional appropriations process, DOE expended over $100 million from the NWF under Section 303(d) for the Monitored Retrievable Storage (MRS) facility program. Since the functions of the regional UFMFs include much of what the MRS would have done, there is a good historical basis for using the NWF to perform the same functions today, should the Congress so stipulate. It is emphasized, however, that development and implementation of the regional, commercial UFMF intitiative described in this report does not depend on use of the NWF.

In essence, taking these steps now buys the Federal government the necessary time to develop a thoughtful robust policy for the final disposition of the nation's UNF and reactor-related GTCC waste, while concurrently beginning to meet its moral and legal obligations for waste acceptance and disposal as contemplated by the Act.

In summary, taking these next steps is considered to be independent and complementary of the Secretary's concurrent policy review and development of options for the final disposition of UNF, whether it result in the continued direct disposal in one or more geologic repositories, or reuse by advanced fuel-cycle technologies, or some combination of both, or some future 'break-through' technology. In fact, it is asserted that expanding upon the envisioned national IUFM strategy concept, starting with further development of the regional, commercial UFMF initiative now would be highly beneficial as informed input to the forthcoming Blue-Ribbon Panel. It would also support the ongoing efforts of DOE-NE to review and develop policy options for the

management of commercial UNF. In addition, doing so would allow the Federal government to begin making forward progress with respect to UNF management now in a manner that is consistent with that contemplated by the Act while advanced fuel cycle R&D continues and final disposition policy options are carefully considered and evaluated by the Secretary and the Congress.