POSITIONING A MID-SIZED HAZARDOUS WASTE MANAGEMENT FIRM (SALES $30-50 MILLION) FOR THE NUCLEAR WASTE MARKET

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ABSTRACT

In the following paper an established mid-sized environmental consulting firm experienced in hazardous waste management with full AE/CM capabilities characterizes the nuclear waste management market for synergistic programs in the areas of professional services and environmental remediation. Current and future market demand for nuclear waste services or technologies is evaluated, the influence of federal and state legislation on market demand is considered; market potential is evaluated for selected niches; and barriers to market entry by a hazardous waste firm are assessed.

Selected near term/long term federal nuclear waste management programs are identified and major milestones evaluated and contrasted with those of nuclear utilities and the commercial nuclear waste industry. These comparisons are sorted by waste category and a time-phased market strategy is delineated. Requisite capabilities including hardware/services/individual qualifications necessary to penetrate selected market segments are defined.

COMMERCIAL NUCLEAR WASTE PROGRAMS

Today there are no new nuclear plant orders in the United States. This is due in part to the inability to close the nuclear waste management portion of the nuclear fuel cycle. The other major barrier is the uncertainty in the licensing process and the length of time from design and construction to licensing and the attendant impacts on return on investment (ROI). Today there is a finite commercial nuclear utility market of a total of 100 operating nuclear power plants in the United States.

Commercial utility nuclear waste markets are impacted by the lack of an away from reactor monitored retrievable storage (MRS), or a deep geologic repository. Utilities must look at constructing pool storage for discharged fuel aged less than five years or dry storage for greater than five year old fuel. High density storage racks and fuel consolidation are also additional service options that utilities are examining. Low level waste volumes from operating reactors are decreasing as reactor orders have ceased and the nation's first units reach the end of their useful life. The need for eight to ten regional low level waste disposal sites is being questioned as waste volumes decrease. The Nuclear Regulatory Commissions (NRC) requirements for decommissioning plans have generated a new service market. Reactor decommissioning experience to date has shown that waste disposal is the most costly part of any project. Low level waste "through the gate" is approximately $\$40/ft^3$. When surcharges are added, cost can average $\$60/ft^3$ at a commercial disposal site. Accordingly, volume reduction technologies and methodologies are in demand. The majority of commercial reactor decommissionings are still a decade away as schedules are slipped for monetary measures. As a result, federal waste management opportunities dominate the near term market.

FEDERAL NUCLEAR WASTE PROGRAMS

The Department of Energy (DOE) has announced its commitment to the 30 year goal to cleanup and restore the environment at its nuclear sites. DOE's priorities and five year spending projections include:

- Corrective Activities — $911 Million
- Environmental Restoration — $6.8 Billion
- Waste Management Operations — > $10 Billion
- Research & Development — ~ $1 Billion

Hazardous waste firms with RCRA/CERCLA experience will find abundant opportunities in this program. However, significant barriers to entry in this market currently exist.

The following sections characterize the market opportunities in the areas of low level waste, spent fuel, high level waste, transuranic waste, and reactor decommissioning.

LOW LEVEL WASTE DISPOSAL SITE MARKET

As shown in Fig. 1, defense low level waste volumes from DOE operations exceed those from commercial nuclear fuel cycle facilities by a margin of approximately 2:1, and commercial waste generation rates will decline with time under a no new nuclear plant orders scenario.1 Defense waste activities include operations, uranium enrichment, naval nuclear propulsion, and research and development activities. Fig. 2 depicts the locations and total volumes of low level waste disposal at both commercial and DOE/defense sites. As shown in Fig. 2, DOE defense programs account for more than 65% of the nation's low level radioactive waste. Typical LLW services which are contracted out include treatment, packaging, and transport for

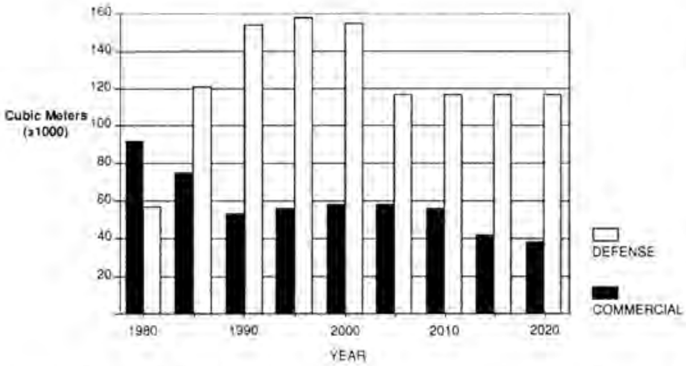

Fig. 1. Actual and Projected Volumes of Low Level Waste.

disposal, and burial site operation. Current treatment techniques include incineration or dewatering and solidification, followed by shallow land burial. Disposal (burial) costs for LLW have risen from \$10-12/ft^3 in 1980 to \$40/ft^3 in 1990 and could be as high as \$60/ft^3 with surcharges. At \$1412/m^3, the 1990 low level waste disposal market is projected at \$217 million (Defense) and \$74 million (commercial). The Low Level Radioactive Waste Policy Act Amendments of 1985 established rates and limits of acceptance at the currently operating LLW sites, including utility waste space allocations.

Table I depicts the status of state siting plans. Only

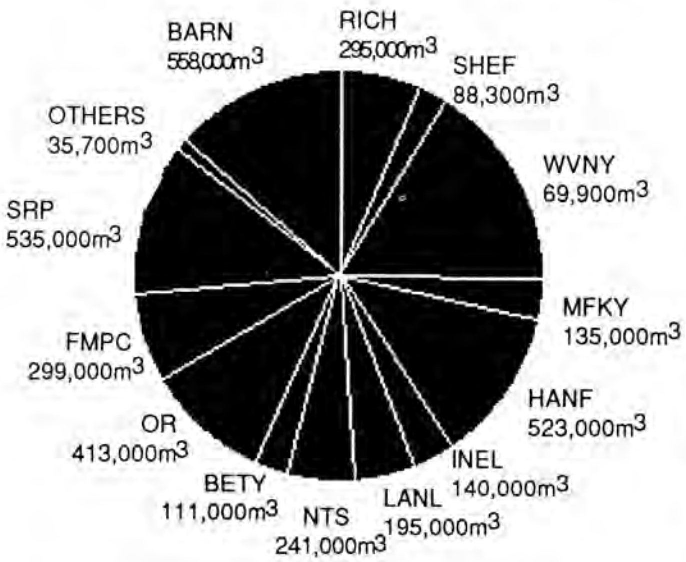

Fig. 2. Total Volume and Locations of Buried and Disposed Low Level Waste through 1987.

three states (California, Illinois, and Texas) are expected to submit disposal site license applications in January 1990.(3)

In summary, Tetra Tech views the commercial LLW market as one of declining waste volumes and intense competition. Our firm will limit its involvement in this market to remedial actions at closed sites and support services to waste management firms designated as developers to site, design, construct, and operate LLW sites for state compacts. Opportunities to provide support services include environmental impact report preparation, permitting, hydrogeological characterizations, and engineered disposal facility design, including automated leachate collection and sampling and operation and maintenance services. Tetra Tech's main market emphasis is in support of DOE operations including site characterizations, and LLW related remedial actions. Our market research indicates that firms having hydrogeological capabilities and experience in hazardous waste site characterization and remediation can provide experience directly applicable to the environmental challenges at DOE and commercial sites containing LLW radioactive waste.

SPENT FUEL

Spent fuel consists of irradiated fuel discharged from a nuclear reactor. Specific spent fuel markets are fuel type dependent. Spent fuel types can be categorized as follows:

- Fuel from light water reactors (LWR)
  - PWR - Pressurized Water Reactor
  - BWR - Boiling Water Reactor
- One of a kind, e.g., HTGR - High Temperature Gas Cooled Reactor Fuel
  - Special Fuels
  - Government sponsored R&D
  - Universities
  - Private Industry

PRODUCTS & SERVICE MARKETS

Commercial LWR at reactor pool storage provides a market for High Density fuel storage racks, fuel consolidation technologies, casks for transshipment, new water pools or dry storage casks. The market for one-of-a-kind fuel includes identification of practical and cost effective methodologies for recovery of unburned fuel, e.g., remote graphite crushing and extraction technology for HTGR or special fuel. Discharged fuel with less than five years of aging is generally stored in water pools at the reactor site. Fuel that has been aged greater than five years can be stored in a dry storage configuration either at reactor (AR) or away from reactor (AFR) in a monitored retrievable storage facility (MRS). Repository design and construction are additional longer term markets. Table II provides historical and projected spent fuel discharge data from the Ft. St. Vrain

TABLE I
Host State Siting Schedules (December 31, 1988)

Host State	Site Selection	License Application	Facility Operational
California (Southwestern) a/	March 1988	Mid 1989	2nd half 1991
Illinois (Central Midwest)	Sept. 1989	Dec. 1989	Jan. 1992
Nebraska (Central)	July 1990	July 1990	Jan. 1993
New York	June 1990	Sept. 1991	Jan. 1993
North Carolina (Southeast)b/	Dec. 1990	Dec. 1990	Jan. 1993
Texas	Aug. 1989	Jan. 1990	Dec. 1992

a/ California indicates the facility will be operational by the second half of 1991.

TABLE II
Historical and Projected Spent Fuel Discharged from the Fort St. Vrain HTGR

End of Calendar Year	Number of Fuel Assemblies Discharged		Mass of fuel discharged (MTIHM)	
	Annual	Cumulative	Annual	Cumulative
1979	245	246	2.80	2.80
1989	240	966	2.56	10.98
1991	282	1,248	3.06	14.04
1993	240	1,488	2.55	16.59
1995	240	1,728	2.46	19.05
1997	240	1,968	2.47	21.52
1999	240	2,208	2.48	24.00
2001	240	2,448	2.49	26.49

HTGR and is useful for quantifying the market size from one-of-a-kind fuel handling and recovery technology applications.(4) Table III provides cumulative data regarding the mass of commercial spent fuel discharges; Table IV provides projections for the number of permanently discharged LWR spent fuel (PWR/BWR) assemblies on an annual and cumulative basis.(5,6) NUREG 0383 (Directory of Certification of Compliance for Radioactive Material Packages) addresses the quantities of spent fuel casks currently available and identifies license expiration dates. The market for new casks is directly dependent upon the probability of license renewal for existing casks. Currently, low specific activity (LSA) packages are experiencing the most significant relicensing problems as NRC expresses concern for a stronger waste package.

MARKET SIZE

The spent fuel market is dependent upon the nuclear power growth scenario. The base nuclear power electrical growth scenario (Fig. 3) and attendant discharged spent fuel schedule (Table III) assumes "no new orders." An upper bound or "Upper Reference Case" for commercial nuclear power growth is added for planning purposes to bound projections (Fig. 4 & 5).(7) Both the base and upper reference cases are based on assumptions involving 1) fuel burn up levels, 2) reactor construction schedules; and expected design life of operating reactors. It is also assumed that commercial spent fuel is not reprocessed.

In summary, the spent fuel storage market (defense and commercial) holds promise of both limited temporary storage and permanent repository facility design and construction management opportunities. However, there are many uncertainties in the market timing. Limited markets exist for spent fuel hardware and services, and this market is small in contrast to low level, mixed, decontamination and decommissioning (D&D) and the hazardous waste market. Tetra Tech has elected to pursue very limited and focused spent fuel market niches. They include special studies for DOE HTGR and other special fuel handling, i.e., monitored retrievable storage (MRS) siting and design programs, and D&D of aging spent fuel storage demonstration sites (e.g., E-MAD, NTS).

HIGH LEVEL WASTE (HLW)

HLW is generated by the reprocessing of spent fuel and irradiated targets. It generally contains 99% of the non-volatile fission products produced in the fuel. The HLW radioactivity concentrations are generally measured in hundreds to thousands of curies per gallon or foot.(ft^3)

The present U.S. inventory is generated by DOE defense activities and is stored at the Savannah River Plant, Idaho National Engineering Lab, and Hanford. West Valley has a small amount of commercial HLW.

MARKET NICHES

Treatment, packaging, transport, and disposal steps offer market niches for firms possessing unique engineering capabilities including chemical processing and material handling and personnel with Q-clearances since this market is DOE defense waste dominated. Table V provides pro-

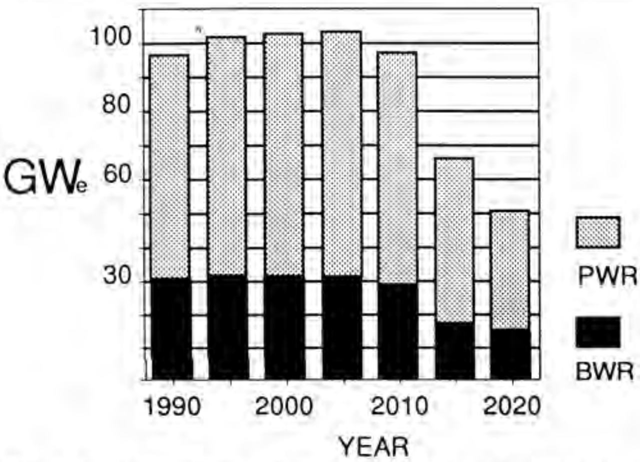

Fig. 3. Nuclear Power Growth Scenario: Installed LWR Electrical Capacity (Base Case "No New Orders").

TABLE III
Cumulative Mass of Commercial Spent Fuel Discharges, 10^3 MTIHM

End of CY Year	No New Orders	Upper Reference
1990	21.4	21.4
1995	30.9	31.1
2010	60.1	62.7
2015	71.0	79.0
2020	77.4	97.0

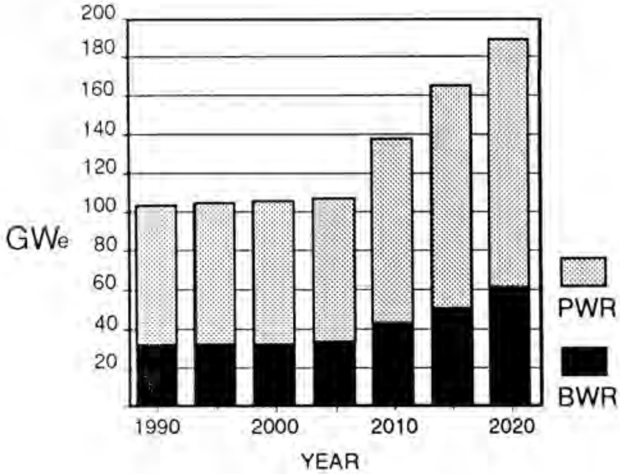

Fig. 4. Nuclear Power Growth Scenario: Installed LWR Electrical Capacity (Upper Reference Case).

jected volumes of HLW in storage by site through 2020.(8) Table VI estimates the potential number of HLW canisters by source.(9) The engineering opportunities would be in support of DOE site operating contractors or subcontracts to the A/E's affiliated with the vitrification process design, construction, and operation plans for Hanford, Savannah River, West Valley, or Idaho-ICPP. The near term HLW opportunities include Hanford's B Plant Waste Pretreatment process and facility upgrading and modification projects. The HLW from tanks will be pretreated. The LLW fraction will go to the grout treatment facility and near surface vaults while the TRU/HLW fractions will serve as feed for the Hanford Waste Vitrification Plant.

Also, the Hanford Waste Vitrification Plant (A/E-Fluor-Daniel; General Contractor UE&C-Catalytic) offer material, equipment, and service contracts related to major facility construction for this high level waste treatment plant. Other high level waste service markets include environmental engineering, safety analysis, waste minimization, and laboratory analysis.

TRANSURANIC WASTE

Transuranic Waste (TRU) is that waste consisting of radionuclides with atomic numbers greater than 92, half

TABLE IV

Projected Number of Permanently Discharged LWR Spent Fuel Assemblies for the DOE/EIA No New Orders Case[a] and Upper Reference Case[d]

End of Calendar Year	BWR[b] Annual	BWR[b] Cumulative	PWR[c] Annual	PWR[c] Cumulative	Total Annual	Total Cumulative	Cumulative
1990	4,500	44,700	2,900	31,100	7,400	75,900	75,900
1996	3,200	65,300	3,200	49,300	6,400	114,600	115,400
2002	3,400	86,200	3,200	66,900	6,600	153,100	154,900
2008	4,400	108,000	2,600	84,800	7,000	192,800	196,900
2014	6,100	135,800	3,300	105,000	9,400	240,800	262,500
2020	1,100	148,300	2,200	118,900	3,300	267,200	333,300

[a]Based on 103 GW(e) installed in the year 2000 and 51 (GW(e) installed in the year 2020.
[b]Number of BWR assemblies estimated, based on 0.1818 MTIHM/assembly (historical average).
[c]Number of PWR assemblies estimated, based on 0.4246 MTIHM/assembly (historical average).
[d]Based on 107 GW(e) installed in the year 2000 and 189 GW(e) installed in year 2020.

TABLE V

Projected Total Accumulative Volume of HIW in Storage by Site Through 2020[a]

End of calendar year	Liquid	Sludge	Salt cake	Slurry	Calcine	Precipitate	Capsules[b]	Glass[c]	Total
				Volume, 10^3 m^3					
				Savannah River Plant					
1990	51.7	13.5	46.4	-	-	2.7	-	0.1	114
1995	37.3	8.9	36.7	-	-	3.3	-	1.4	88
2000	34.1	6.4	28.3	-	-	0.9	-	2.2	72
2005	34.1	3.7	22.1	-	-	0.4	-	2.8	63
2010	36.8	1.6	23.0	-	-	0.4	-	3.3	65
2015	36.8	1.5	23.0	-	-	0.4	-	3.5	65
2020	36.8	1.5	23.0	-	-	0.4	-	3.5	65
				Idaho Chemical Processing Plant					
1990	7.2	-	-	-	3.8	-	-	-	11
1995	6.0	-	-	-	5.1	-	-	-	11
2000	8.5	-	-	-	6.3	-	-	-	15
2005	8.1	-	-	-	8.9	-	-	-	17
2010	5.2	-	-	-	10.5	-	-	-	16
2015	3.3	-	-	-	14.2	-	-	-	18
2020	2.2	-	-	-	17.2	-	-	-	19
				Hanford Reservation					
1990	25.3	46.0	93.0	68.8	-	-	0.004	-	233
1995	8.6	46.0	93.0	92.0	-	-	0.004	-	240
2000	6.3	46.0	93.0	98.6	-	-	0.004	-	244
2005	6.3	46.0	93.0	104.7	-	-	0.004	-	250
2010	6.3	46.0	93.0	106.8	-	-	0.004	-	252
2015	6.3	46.0	93.0	108.5	-	-	0.004	-	254
2020	6.3	46.0	93.0	108.5	-	-	0.004	-	254
				West Valley Demonstration Project					
1990	2.150	0.17	-	-	-	-	-	-	2.320
1995	-	-	-	-	-	-	-	0.210	0.210
2000	-	-	-	-	-	-	-	0.210	0.210
2005	-	-	-	-	-	-	-	0.210	0.210
2010	-	-	-	-	-	-	-	0.210	0.210
2015	-	-	-	-	-	-	-	0.210	0.210
2020	-	-	-	-	-	-	-	0.210	0.210

[a]Historical inventories for HLW are taken from the previous edition of this report (i.e., DOE/FW-0006, Rev. 3 (September 1987)]. The inventories for 1987 and the projections through 2020 are taken from refs. 1 and 2.
[b]Capsules contain either strontium (^{90}Sr-^{90}Y) fluoride or cesium (^{137}Cs-^{137m}Ba) chloride.
[c]Glass may be in storage at the site, in transit to a repository, or in a repository.

TABLE VI
Estimated Potential Number of HLW Canisters by Source

	Number of canisters[b]							
	SRP[c]		ICPP[d]		HANF[e]		WVDP[f]	
Year	Annual	Accumulation	Annual	Accumulation	Annual	Accumulation	Annual	Accumulation
1990	102	102	-	-	-	-	-	-
1991	410	512	-	-	-	-	-	-
1992	410	922	-	-	-	-	50	50
1993	410	1,332	-	-	-	-	200	250
1994	410	1,742	-	-	-	-	50	300
1995	410	2,152	-	-	-	-	-	300
1996	410	2,562	-	-	-	-	-	300
1997	376	2,938	-	-	-	-	-	300
1998	205	3,143	-	-	-	-	-	300
1999	205	3,348	-	-	145	145	-	300
2000	205	3,553	-	-	145	290	-	300
2001	205	3,758	-	-	145	435	-	300
2002	205	3,963	-	-	73	508	-	300
2003	205	4,168	-	-	145	653	-	300
2004	205	4,373	-	-	145	798	-	300
2005	205	4,578	-	-	145	943	-	300
2006	205	4,783	-	-	-	943	-	300
2007	205	4,988	-	-	-	943	-	300
2008	205	5,193	-	-	-	943	-	300
2009	161	5,354	-	-	-	943	-	300
2010	30	5,384	-	-	-	943	-	300
2011	31	5,415	500	500	-	943	-	300
2012	30	5,445	600	1,100	-	943	-	300
2013	31	5,476	700	1,800	-	943	-	300
2014	30	5,506	1,000	2,800	-	943	-	300
2015	31	5,537	1,000	3,800	-	943	-	300
2016	30	5,567	1,000	4,800	-	943	-	300
2017	31	5,598	1,000	5,800	-	943	-	300
2018	30	5,628	1,000	6,800	-	943	-	300
2019	31	5,659	1,000	7,800	-	943	-	300
2020	30	5,689	1,000	8,800	-	943	-	300

[b]Canisters are 2-ft diam x 10 ft long.
[c]Each canister is assumed to contain 0.637 m^3 of glass made with HLW from the reprocessing of spent fuel at SRP. The glass incorporates 36 wt % oxides from waste (28 wt % from spent fuel and 8 wt % from processing chemicals) and 64 wt % oxides from nonradioactive glass frit. The total includes 534 canisters containing HLW from new production reactor (RPR) operations after 2000.
[d]Each canister is assumed to contain 0.57 m^3 of a ceramic waste form incorporating 70 wt % solids from waste.
[e]Each canister is assumed to contain 0.62 m^3 of a borosilicate glass incorporating waste oxides. The waste in these canisters includes neutralized current acid waste (NCAW) and complexant concentrate (CC) through 1987 (average value taken from Table 2.4). In addition to the canisters of glass, 320 canisters (overpacks) containing strontium capsules and cesium capsules are projected to be produced between 1995 and 2020.
[f]Each canister is assumed to contain 0.7 m^3 of a borosilicate glass incorporating waste solids.

lives greater than 20 years, in concentrations greater than 100nCi/gm. Transuranic Waste (TRU) results from the reprocessing of plutonium bearing reactor fuel and the fabrication of plutonium bearing weapons. There is no commercial reprocessing of spent fuel in the United States and the primary source of TRU waste is from defense applications. The major TRU contaminated waste market results from remedial actions and fuel cycle facility decontamination and decommissioning.

DISPOSAL PRACTICES

In 1970 DOE discontinued the practice of TRU waste disposal along with low level waste in pits and trenches in favor of a "greater confinement" strategy. TRU waste is currently treated, packaged, and stored separately from low level waste so that it can be retrieved. Transuranic waste was buried at six DOE sites until 1970 (Fig. 5).(10) About 2% of all currently stored TRU waste requires remote handling because of Beta-Gamma activity from fission products. TRU waste was reclassified in 1983 from <10 nCi/g to greater than 100 nCi/g. This has reduced the volume of TRU waste in storage.

MARKET NICHES

The Waste Isolation Pilot Plant (WIPP) located in Carlsbad, New Mexico was designed to receive retrievable stored TRU waste from the originating DOE sites, first on a demonstration basis, and if successful, on a permanent basis until 2013. Current delays in the opening of the WIPP have necessitated on-site storage at specific DOE sites. This presents a requirement for health, safety, and environmental impact assessments; as well as limited siting, design, and construction opportunities for treatment, packaging, and storage facilities. There are also engineering support contract opportunities at the WIPP site as the facility addresses the operational readiness milestones. It is intended that the first waste shipments to WIPP will consist of contact handled TRU from the Rocky Flats Plant (newly generated and stored). Shipments of certified contact handled TRU from Argonne East, Hanford, Los Alamos National Laboratory, Lawrence Livermore National Laboratory, Mound, Nevada Test Site, Oak Ridge National Laboratory, and the Savannah River Plant will follow. The certification status of retrievable TRU Waste suggests markets in technology development for waste certification and hardware and services related to TRU transportation to another site for processing. However, the most significant market appears to be associated with the decontamination and decommissioning of DOE fuel cycle facilities. Tetra Tech is positioning its personnel and resources to provide remedial action support services through contracts directly with DOE or its prime contractors. Recent additions to our staff include Q cleared special nuclear material process engineers with facility and glovebox design capability (for both installation or removal). Concurrently, our firm has proposed its support services to Idaho National Engineering Laboratory, and Los Alamos National Laboratory.

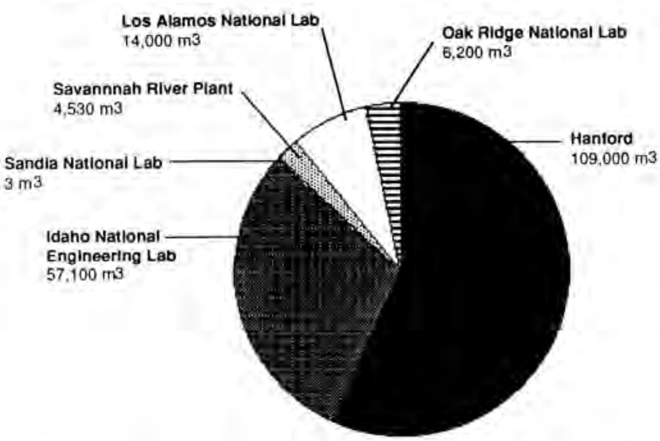

Fig. 5. Total Projected Volume of Buried DOE/Defense TRU Waste Through 2020 is $191000m^3$

Table VII projects the volume, mass, and radioactivity of TRU wastes currently buried at DOE sites, and estimates the volume of contaminated soil that is anticipated to exist as a result of breach of disposal containers.(11) Further characterization of these sites may be necessary, and several sites may require soil remediation. Currently, each site generating large quantities of TRU has nondestructive assay/nondestructive examination (NDA/NDE) equipment and is screening the currently stored TRU waste against the 100 nCi/g TRU standard. Some of this waste will be disposed of as low level radioactive waste (<100 nCi/g TRU) following screening. DOE estimates that 38% of currently stored TRU will be disposed of as low level waste (~35,800 m^3).

TRU WASTE INITIATIVES

The DOE RDDT&E Plan includes funds to support the development of technology to characterize RCRA regulated materials in TRU waste to meet transportation requirements, certify the waste for WIPP disposal and meet RCRA regulations.

Another goal is to support the development of technologies that can be available within the next five years to treat TRU waste that is currently unacceptable for disposal, to yield a waste form that meets acceptance criteria.

DOE REMEDIAL ACTION PROJECTS

DOE conducts its remedial action activities through five programs:

UMTRAP - 11 states have inactive mill tailings sites.

Projected total volumes of remaining mill tailings are shown in Fig. 6.(12)

FUSRAP - formerly utilized sites remedial action program has sites in 12 states.

SFMP - 100 DOE owned radioactively contaminated facilities that have been declared surplus. Facility types include power and research reactors, fuel reprocessing plants, laboratories, storage tanks, pipelines, waste treatment systems, ponds, cribs, trenches. Projected volumes remaining and schedules for remedial action are shown in Fig. 7, below.(13)

GJRAP - Grand Junction Remedial Action Project involves the cleanup of Uranium mill tailings that were removed from the Climax Uranium Company's mill tailings pile in Grand Junction, Colorado and used in construction projects. Tailings have been removed from 593 properties in order to meet criteria for gamma radiation/radon (10 CFR 1020). The market is small as remediation of most properties has been completed.

Environmental Restoration (ER)

The ER Program has two areas of responsibility:

1. Remedial Action of inactive defense waste sites - this includes plants and offices in twelve states assigned to DOE/DP Field offices. Estimated funding requirements by DOE for Fiscal Year 1991 through 1995 total $6.8 billion.
2. Defense D&D Programs Cover Seven States - As shown in Fig. 8, one of the largest D&D programs is the K-25 Oak Ridge Gaseous Diffusion Plant - cleanup costs estimated to be $1.8 billion.(14)

COMMERCIAL URANIUM MILL TAILINGS

Uranium mill tailings are classified as "commercial" if at licensed sites. Existing tailings at sites no longer licensed are classified as "inactive" mill tailings and are part of the DOE remedial action program.

MARKET CHARACTERISTICS

U.S. uranium production has declined due to nuclear power plant cancellations/deferments and consequently, mill tailing production is declining. Lower cost imported uranium has also impacted uranium production. In situ leaching technology and recovery from wet process acid effluents, copper byproduct operations has also reduced tailings. There are six licensed conventional uranium mills in the U.S. with the capacity of processing 12,020 T of ore per day. Tailings production for 1990 is projected at $400{,}000 m^3$ with an accumulation to date of 116 million m^3. By the year 2000 total accumulation is projected at 124 million m^3. The EPA rulemaking of August 1986 regarding ^{222}RN emissions from tailings piles has created two markets:

1. Mill owners have 6 years to phase out of use of large existing tailings piles.
2. New tailings piles must be contained in small (<40 acre) impoundments or disposed of by con-

TABLE VII
Inventories and Characteristics of DOE/Defense Buried TRU Waste and Contaminated Site through 1987

Burial site	Volume (m^3)	Contaminated Soil Volume (m^3)
HANF	109,000	31,960
INEL	57,100	56,000-156,000
LANL	14,000	1,140
ORNL	6,200	12,000-60,000
SNL	3	
SRP	4,534	
Total	190,837	139,100-287,100

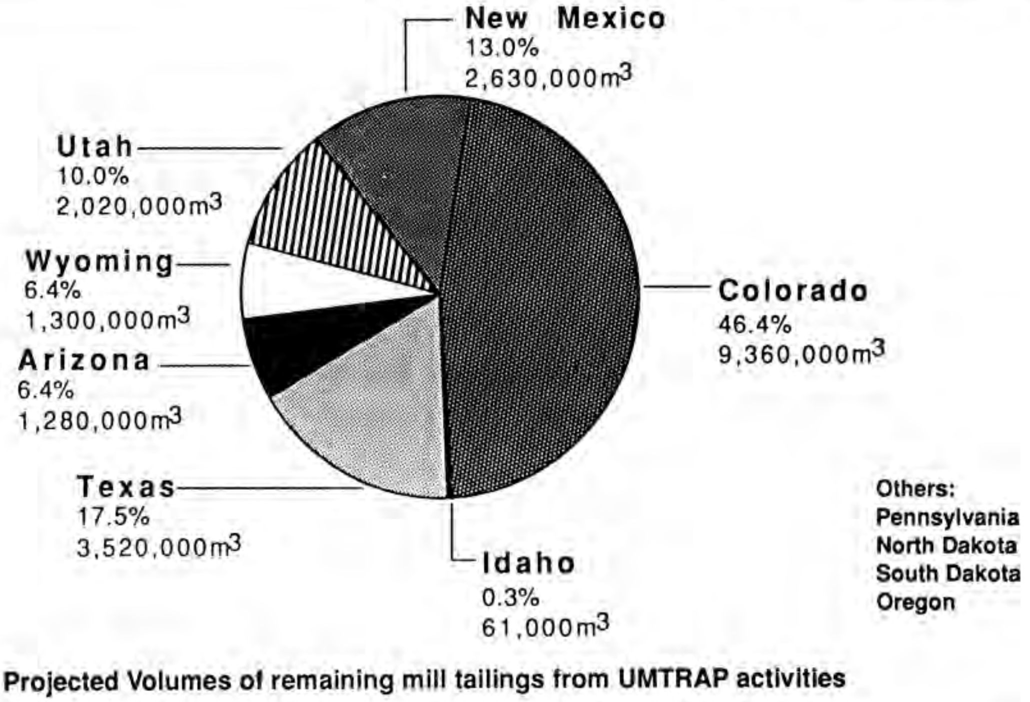

Fig. 6. Projected Total Volumes of Remaining Mill Tailings from UMTRAP Activities in Various States.

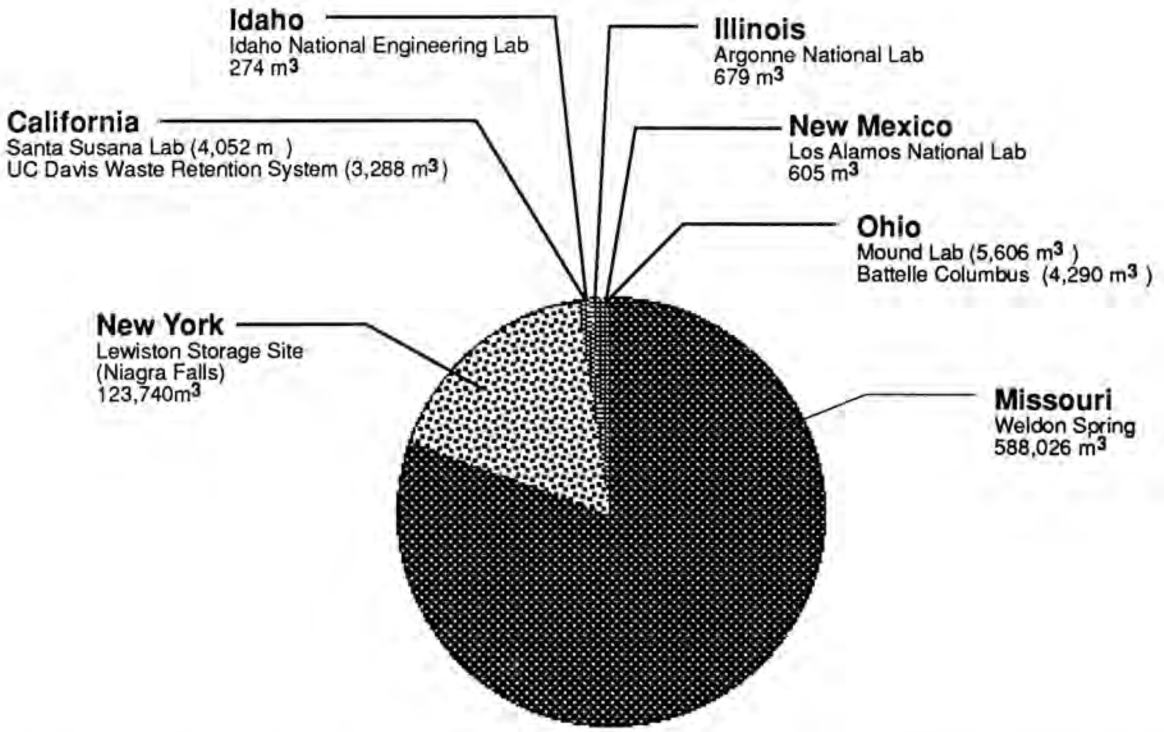

Fig. 7. Projected Volumes Remaining for Remedial Action from the Surplus Facilities Management Program.

tinuousdewatering and burial with no more than 10 acres uncovered at one time.

DECOMMISSIONING OF COMMERCIAL NUCLEAR POWER REACTORS

Commercial nuclear power reactors will be decommissioned at the end of their useful life. The projected schedule for commercial LWR shutdowns is shown below in Table VIII.

THE MARKET

In accordance with Table VIII, it is not anticipated that many commercial reactor decommissionings will occur in this decade.(15) A Decommissioning Plan is being completed for Rancho Seco (SMUD) and Ft. St. Vrain plans-some activities. Commonwealth Edison Plans to decommission Dresden Unit 1 beginning in 2017.(16)

SUMMARY

While the commercial nuclear waste market is generally soft, the Department of Energy has both near term and long term Environmental Restoration, Corrective Actions, Waste Management Operations, and Research and Development Milestones to complete at a cost of several billion dollars over the next five years. Requirements for D&D are similar to RCRA/CERCLA. Firms with RCRA and CERCLA hazardous waste remediation experience can transition to the Environmental Restoration/D&D programs of DOE. This effort will require augmentation of existing skills bases with selective recruiting of nuclear material handling specialists and health and safety personnel (e.g., health physicists), but the task of qualifying for DOE programs is attainable.

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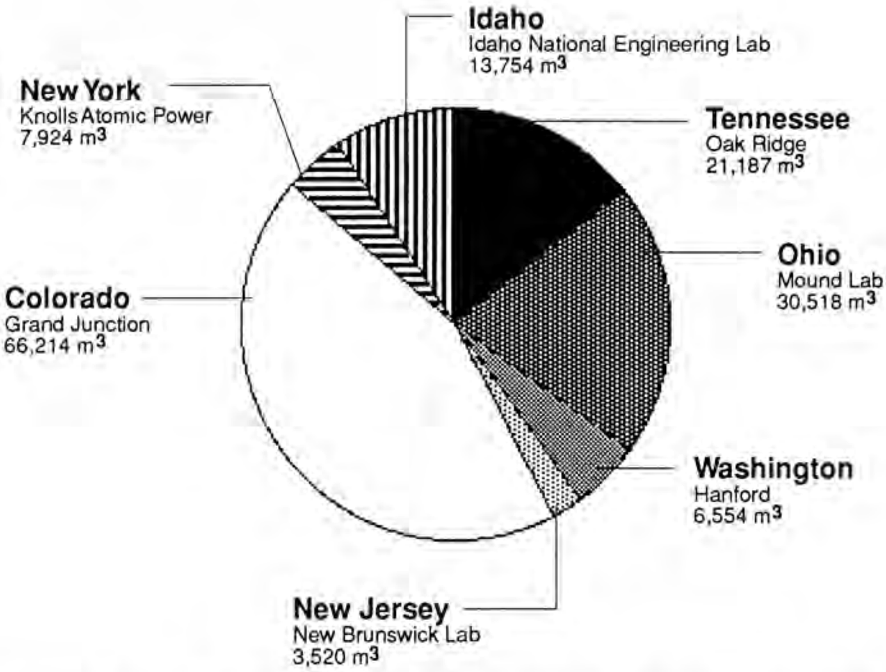

Fig. 8. Projected Remaining Volumes of Low Level and TRU Wastes Scheduled for Disposal from the Defense D&D Program.

TABLE VIII

Projected LWR Shutdown Schedule (Candidates for Decommissioning)[a]

End of Calendar Year	LWR No.	LWR MW(e)
1987	1	48
1999	3	436
2001	1	247
2002	1	50
2004	1	650
2005	1	620
2006	3	2,157
2007	8	5,288
2008	15	11,982
2009	3	2,907
2010	5	3,670
2011	2	1,935
2012	7	5,726
2013	4	3,642
2014	5	4,396
2015	3	2,656
2016	4	3,620
2017	2	1,971
2018	1	907
2020	2	2,022
Projected Total (1988-2020)	70	54,882

[a]Reactor shutdown date is based on utility estimate of reactor lifetime availability. Years in which no reactor shutdown is expected are eliminated.