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Westinghouse Hanford Company Special Nuclear Material Vault Storage Study

M. C. Higginson

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Westinghouse Hanford Company
P.O Box 1970
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C. Willingham

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WESTINGHOUSE HANFORD COMPANY
SPECIAL NUCLEAR MATERIAL VAULT STORAGE STUDY

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SPECIAL NUCLEAR MATERIAL VAULT STORAGE STUDY

1.0 INTRODUCTION/PURPOSE

Category I and II Special Nuclear Materials (SNM) require storage in vault or vault type rooms as specified in DOE orders 5633.3A and 6430.1A. All category I and II SNM in dry storage on the Hanford site that is managed by Westinghouse Hanford Co (WHC) is located in the 200 West Area at Plutonium Finishing Plant (PFP) facilities. This document provides current and projected SNM vault inventories in terms of storage space filled and forecasts available space for possible future storage needs.

2.0 DOE ORDERS/DEFINITIONS/DESCRIPTIONS

The primary DOE orders governing storage of Category I and II SNM are as follows:

- DOE Order 5632.1C, Protection and Control of Safeguards and Security Interests
- DOE Order 5633.3A, Control and Accountability of Nuclear Materials
- DOE Order 6430.IA, General Design Criteria

The following definitions and/or descriptions would apply to terms used within these documents:

- Vault Room - A penetration resistant, windowless enclosure that has (a) walls, floor, and ceiling substantially constructed of materials that afford penetration resistance at least equal to that of 8-inch thick reinforced concrete; (b) any openings greater than 96 square inches in area and over 6 inches in the smallest dimension protected by imbedded steel bars at least 5/8 inches in diameter on 6-inch centers both horizontally and vertically; (c) a built-in combination locked steel door that in existing structures is at least 1-inch thick exclusive of bolt Class 5 standards as set forth in FS AA-D-6008 of the Federal Specifications and Standards cited in 41 CFR 101.

- Vault-type Room - An enclosure having a combination locked door and protected by an intrusion alarm system activated by any penetration of walls, floors, ceilings or openings, or by motion within the room.

  Note: In this document the term "vault" will also refer to a vault-type room.

- Storage Can Configuration - Since 1979 all SNM has been packaged in a three can configuration for pedestal storage; the SNM is stored in a small slip lid can, bagged, and then stored in two mechanically sealed uncontaminated cans. Prior to 1979, SNM was packaged in a variety of can configurations involving double or single food pack cans. Larger "lard" cans

may contain from one to ten separate cans inside but are limited in the amount of total material contained. In all cases, the dimensions of the outer can plus the material per can limit determine storage space requirements. Currently a new container, the 3013 can, is being developed. All material in storage will eventually be repackaged into this new larger size can. In this document, all can references pertain to the outer can.

o Outer Can Sizes:

Can Types	Diameter (inches)	Height (inches)	Comment
Standard	4¼	7	(0.5 liter inner can)
PUREX	4¼	7	(0.8 liter inner can)
Oversize	4¾	6¾	(Diameter too large for pedestal storage)
Lard	12 top 11.5 bottom	15	
New 3013 Can being developed	4.9	10	Modification of pedestal storage required

o Pedestal Storage - Vertical storage locations attached to a center pole and designed to hold a standard round 4¼" diameter can; unauthorized removal sets off alarm monitor in 2736-Z, rooms 1,3,and 4 (see picture, page 12). Modification of pedestal storage will be required in order to accommodate the new 3013 can.

o Shelf Storage - Shelf storage for storage of oversize cans (see picture, page 15).

o Rack Storage - Metal racks for storage of "lard" cans (see picture, page 16).

o Model 60 Shipping container - Shipping storage container used to store and transport FFTF driver fuel pin bundles (see picture, page 18).

o Radial Reflector Shipping Container (RRSC) - Shipping/storage container designed to hold four FFTF Driver Fuel Assemblies (DFA's) (see picture, page 18).

o Bird Cages - Various types of containers that hold cans of SNM. The A type bird cage is a square aluminum container.

o Product Receiver Cans - A 10 liter stainless steel cylinder centered within a 55 gallon drum; in actual practice, used to

store ~8.5 liters of Pu nitrate or U nitrate (see picture, page 19).

- o FL-10's - A SNM shielded shipping container (two 55 gallon drums welded together) containing a steel containment vessel and a 10 liter polyethylene bottle for storing solutions or solids. The L-10 is a similar container used for storage but is not shielded.

3.0 PFP VAULT STORAGE STATUS

Storage vaults containing SNM at Hanford's PFP facility are currently divided into pedestal storage of cans, shelf storage of both oversize and standard diameter cans, rack storage of larger "lard cans", and a single vault room for storage of unirradiated fuel pins and assemblies. Short term vault storage for liquid nitrate in drums also exists within this facility. The following chart provides a listing of these types of storage, including current item inventories, and further clarifies vault storage availability on the Hanford site. In addition, pictures of each referenced storage type are included in pages 12 through 21 of this document.

TABLE #1

PFP Vault Storage Status: Limits, Can Inventory, and Availability
(as of 2/29/96)

Storage Type	SNM Container	Building	Vault Room #	Pu/can Limit[a]	Can Capacity	Can Inventory	Spaces Avail
Pedestal	Std-4 1/4" Dia can	2736-Z	Room #1	1.9 kg[b]	2970	2621	349
			Room #3	2.5 kg[b]	1904	1157	747
			Room #4		1904	1316	588
		234-5Z	#192-B Upper	0.4 kg[c]	768	0	768
			#192-C Floor		672	330	342
			Upper		576	157	419
Shelf	Standard & Oversize	234-5Z	Room #225	N/A (U only)	476	53	423
		2736-Z	Room #2 (A-G)	0.4 kg	252	239	13
			(H-U)	1.5 kg	448	430	18
Racks	Lard Cans	2736-Z	Room #2 (V-Z)	0.4 kg	296	276	20
		234-5Z	#192-B Floor		168	163	5
Floor	Model 60's & Radial Reflectors	234-5Z	#192-A	N/A	76	71	5
	Solution container	234-5Z	#236 Floor	4.5 kg	347	347	0
	Bird Cages		Mezzanine		~80	24	~56

a. Controlled by criticality specification.
b. 15 watts per can maximum heat load limit.
c. 25% Pu concentration limit.
Note: Does not include outside storage pad (2736-ZD) currently storing 3 casks.

4.0 BASE CASE ASSUMPTIONS

- All future receipts of SNM at WHC will have an H/Pu ratio of <2.
- WHC's management of special nuclear material (SNM) inventories, including the future receipts of SNM from off-site, assumes compliance with all federal and state government regulations and/or agreements and assumes safe, secure, and efficient management and storage practices.
- Vault room storage of SNM projected in the base case include the Feb 29, 1996 canister inventory (shown in table 1, above) plus the following assumed additions and removals shown below. Table #2 (paragraph 7.0) summarizes and projects the effects of these receipts and removals on the PFP SNM inventory.
- A new Pu Stabilization and Packaging System (PUSAP) is in the process of being procured from British Nuclear Fuels Limited (BNFL). Eventually, all Pu bearing material that will require interim storage at PFP will be processed through this system for additional stabilization and/or packaging into the new larger "3013" containers or cans. Material not processed through this system for storage in these larger cans will either be cemented and disposed of as TRU waste through WIP or shipped to an offsite location for stabilization and storage.
- Since projected use of the PUSAP system (FY 1999 through FY 2002) is not near term, the additions to and removals from inventory are still projected in current storage canister configuration. Storage requirements for the larger can size configuration and resulting space available at PFP are projected in table 3.

5.0 ADDITIONS TO INVENTORY

5.1 Stabilization Receipts

Planned stabilization of existing inventories of nitrate solutions will generate additional oxide for storage at the PFP facility. The oxide produced will contain approximately 335 kg Pu and will require approximately 240 "PUREX" cans (0.8 liter capacity) for packaging and storage (1.4 kg Pu in PuO_2 per can).

5.2 Material Receipts from FFTF

After removing residual sodium, 51 FFTF fueled components (46 DFA's and 5 Ident-69's) will be packaged into eight FFTF Interim Storage Casks (ISCs) and shipped to the PFP for outdoor interim storage. There are no plans to download any of these DFA's.

6.0 REMOVALS FROM INVENTORY

6.1 Consolidation Reductions

Planned stabilization and consolidation of Pu contained in polycubes will result in a net reduction in canister requirements; approximately 225 additional canister spaces will result.

6.2 Shipments to LANL

Twenty five cans of High Pu240 material are projected to ship to LANL in FY 1997. In addition, approximately 100 cans of SS&C at PFP are projected to ship to LANL (also in FY 1997) as part of 94-1 activities.

7.0 PROJECTED STORAGE SPACE AVAILABILITY (Current Can Configuration)

Based on the 2/30/96 PFP Vault inventory (table #1) and the additions and removals described in paragraphs 5.0 through 6.2 above, the following table (in terms of vault storage space locations) projects future storage availability within PFP vaults.

TABLE #2

PFP Vault
Projected Short Term Storage Availability
Current Can Configuration

	Pedestal	Shelves		Floor		Outside Pads
	41/4" Dia. Std. Cans	Std + Oversize	Lard Cans	FFTF Pins & Assemblies	Nitrate Drums & Bird Cages	Storage Casks
Inventoryy 3/31/93	5581	722	439	71	371	3
Additions:						
Nitrate Stabilization	240					
FFTF Material						8
Removals:						
Nitrate Stabilization					(347)	
Polycube Consolidation	(225)					
To LANL	(125)					
Projected Inventory	5471	722	439	71	24	11
Capacity	8794	1176	464	76	427	12
Space Available[a]	3323[b]	454	25	5	56[c] 347[d]	1

a. Does not include storage requirements for contemplated stabilization of metals and oxides.

b. Full cans of PuO_2 and mixed oxides hold less than the Pu/can criticality spec. listed in table.

c. Bird Cage space

d. Drums

8.0 PROJECTED STORAGE SPACE AVAILABILITY (3013 Can Reconfiguration)

The DNFSB Recommendation 94-1 Hanford Site Integrated Stabilization Management Plan (SISMP), WHC-EP-0853, outlines stabilization and repackaging activities for the PFP inventory. Accordingly, and as stated in the assumptions (4.0), all Pu bearing material requiring interim storage at PFP will be removed for stabilization and/or repackaging into the new "3013" larger storage containers; these containers will comply with the DOE long term storage standard for Pu metals and Oxides (DOE-STD-3013-94). As part of the 94-1 implementation, modifications are planned to the existing vaults in 2736-Z to install new pedestals to accept the new larger storage containers. Initial estimates require approximately 2205 of the new canisters and pedestal spaces to hold the current PFP Pu inventory after consolidation and disposal of low assay material as waste (see SISMP). Retention of the low assay material would require an additional 1,000 of the large "3013" can pedestal storage spaces.

It is assumed that all four vaults in 2736-Z will be converted to 4 by 5 arrays with a capacity of 1360 storage spaces each. It is also assumed that the office area in 2736-ZB building will be converted to floor area vault storage and that the material currently stored in 192-A (fuel pin bundles contained in model 60 shipping containers and DFA's contained in RRSC's) be moved to this proposed new floor area. Eventually the DFA's will be repackaged into storage casks for storage on an outside storage pad.

TABLE 3

Projected PFP Vault Storage Availability
3013 Can Configuration in 4 Vaults

Building	2736-Z Bldg				234-5Z					2736-ZB	Outside Pad
Room	#1	#2	#3	#4	192A	192B	192C	236	225	Converted Office Areas	
	New 3013 Can Configuration										
Capacity	1360	1360	1360	1360	76	936	1248	427	476	Undetermined	12
Projected Inventory	650	650	265	640	0	0	0	0	0	71 M,R	11
Space Available	710 P	710 P	1095 P	720 P	Building to be deactivated after 94-1 stabilization					Significant but undetermined	1 SC but expandable

Note: P=Pedestal Storage R=RRSC Shipping Container
SC=Storage Cask M=Model 60 Shipping Containe

9.0 SNM NOT INCLUDED IN THE BASE CASE VAULT STORAGE PROJECTION

9.1 Other FFTF Material

In addition to vault storage of the SNM contained in the 51 FFTF fueled components (contained in 8 ISCs) referenced above, there are 9 additional fueled components (8 test assemblies and one

ident-69) that are being considered for transfer to either Idaho or to the PFP. The PFP has not agreed to take this material and no plans currently exist that would project receipt at PFP.

9.2 SNM from other offsite locations

No SNM receipts from any off-site locations are considered in this document. Recently however, discussions with Rocky Flats concerning transfer of approximately 2000 items (including 1000 pits) to Hanford have begun. In addition, Hanford origin material (yet undetermined) stored at the Savannah River Site (SRS) may be considered at some point in the future for transfer to Hanford, but at this time no plans exist to move this material.

9.3 Hanford irradiated material

This study does not consider vault type storage for SNM resulting from any potential processing or stabilization of the following irradiated material inventories stored on the Hanford Site: N Reactor fuel, Shippingport Reactor (Core II) fuel, FFTF fuel, and remaining single-pass reactor fuel pieces and experimental fuel assemblies. Disposition of these materials will be addressed in either of two documents: the K Basins Special Nuclear Fuel (SNF) Environmental Impact Statement (EIS) Record of Decision (ROD) or the SNF & Idaho National Engineering Laboratory (INEL) EIS ROD.

10.0 POTENTIAL PFP STORAGE AVAILABILITY INCREASES

10.1 PFP Facility Modifications and Room Reassignments

As stated earlier (paragraph 8.0), the base case plan for interim storage of Pu bearing material at the PFP requires pedestal modifications to accept the larger "3013" canisters in all 4 vault rooms in 2736-Z building. Certain modifications to other PFP vault type rooms in 234-5Z (not included in the base case) could increase SNM storage capacity in that facility and are listed below. It should be noted, however, that these modifications are not considered cost effective and that the base case plan stipulates deactivation of this facility after the 94-1 stabilization program is completed. These modifications are only listed as alternate possibilities for increasing storage capacity.

- Remodeling to secure the pedestals in room 192B vault upper level (currently containing no inventory) would allow an increased Pu per can limit and thus increase storage capacity.
- Remodeling room #236 mezzanine (currently containing some bird cages) to include racks or cubicals for pedestal storage is possible, however, the benefits have not been determined. This is not a probable option.
- Office space in the 2736-ZB facility is now being considered for modification and conversion to additional SNM storage space should additional requirements to store material from offsite

develop in the future. Storage locations of the converted office areas could accommodate pits as well as other types of SNM storage. Three other vault type rooms (#638,#641 and #642) located in this facility would not be used for SNM storage: #638 would continue to be used for shipping and receiving; #641 and #642 (previously designated as possible SNM Storage areas) are now designated as housing the future PUSAP line.

- Room 172, with the addition of motion detectors and structural upgrades, could qualify as a vault type room. Currently this room stores category III nitrate in ~40 Product Receiver (PR) cans and ~80 FL-10's and is considered full (no remaining storage space). With the conversion of most of this nitrate to oxide during the planned stabilization run, room #172 could be reassigned for vault type storage of Category I and II SNM, however, this option is not considered cost effective.

The costs and increased storage capacities of these modifications and room reassignments is beyond the scope of this study and are not included in any projections contained in this document.

11.0 OTHER POTENTIAL VAULT STORAGE AT HANFORD

11.1 Fuels and Materials Examination Facility (FMEF)

Completed in 1984, the FMEF is located in Hanford's 400 Area adjacent to the FFTF reactor and is a modern multipurpose and unused nuclear material processing facility with no fully committed mission. This facility meets all natural phenomena (design basis accident) earthquake and tornado criteria including safeguards and security requirements of a Class A facility for processing and storing Category 1 quantities of nuclear material (reference DOE Order 6430.1A). Its external security systems are in place and ready for activation. It is a reinforced concrete building that meets vault specifications and contains over 200,000 square feet of floor space on six levels. The elevation extends from 98.9 ft. above to 35 ft. below ground level and provides over 3 million cubic ft. of internal usable space. Construction and equipment costs have totaled over 400 million dollars to date. Once mission decisions are made, an environmental assessment completed, and funding is authorized for modifications, capital equipment, internal security upgrades, and operations, FMEF will be brought on line. In comparison to constructing a new facility elsewhere, FMEF modification costs are minimal and start-up time 4 to 6 years earlier.

The FMEF is currently being evaluated for potential use to support long term storage and disposition of surplus plutonium in the DOE Complex. Potential plutonium activities suitable for FMEF which are being considered in the PEIS on Storage and Disposition of Weapons-Usable Fissile Materials include: (1) long term storage of SNM, including pits, (2) vitrification, (3) conversion of pits to oxide, (4) conversion of all plutonium materials to pure oxide for MOX fuel fabrication, and (5) fabrication of MOX fuel. Available space within FMEF is discussed below:

A fully completed and remotely operated SNM storage vault, room 429, has a storage capacity of 4,000 kg Pu in Plutonium oxide or 10,000 kg Pu in compressed pellets. This vault is ready for operation awaiting an FMEF mission and start-up (see picture, page 20).

A total of 301 stainless steel cylinders (16 ft. long by 7" diameter) located in the concrete floor of room 101 (in the Fuel Assembly area wing) were originally designed for storage of FFTF mixed oxide test and driver fuel assemblies; each cylinder was designed to sustain a heat load limit of more than 100 watts and could easily accommodate can stacking or other SNM configurations. Enough open pit area remains that would allow for easy expansion of this cylinder type storage by 150 additional cylinders (see picture, page 21).

Large process areas totaling over 120,000 square feet exist within FMEF. These process areas were designed as hot cells, fuel fabrication areas, and laboratory areas and could be modified and equipped to store significant quantities of weapon return materials or "pits". Over the past five to six years while the FMEF mission to support the Liquid Metal Fast Breeder Reactor Program was more certain, several SNM storage studies were completed but considered only small portions of this facility for pit storage. One engineering estimate projected a potential storage capacity of 1,000 pits in shipping containers in room #507, the Upper Process Cell and 6,000 pits in rooms 604, 605, 605B, and 607 on the sixth level. A storage container stacking method that would have increased the storage capacity in all of these areas does not appear to have been considered. In addition, these storage areas represent less than 20% of available storage space in FMEF. Since additional space is available throughout the facility that could possibly accommodate pit storage in significant quantities, an engineering study that specifically addresses this type of storage at FMEF is highly recommended. Facility modifications, costs, and schedules would be included.

Until a SNM storage mission for FMEF is declared, existing and potential FMEF vault storage capabilities will not be included in Hanford's base case vault storage projections.

11.2 Long Term Storage

Potential long term storage options for surplus plutonium are being evaluated as part of the PEIS on Storage and Disposition of Weapons-Usable Fissile Materials. In support of this activity, several long term storage alternatives have been considered for Hanford. These include: (1) upgrades to existing storage facilities, (2) modifying FMEF, as mentioned above, and (3) constructing a new storage facility. Any of these options could involve storage of material received from offsite. This long term storage mission would last from 10 to 30 years in support of final plutonium disposition activities.

12.0 SUMMARY

As displayed in table #2, currently available SNM vault storage space at Hanford PFP facilities exceeds projected base case storage requirements. After considering forecasted additions and removals, it appears that remaining SNM storage space (in current storage configuration) could accommodate an additional 3,323 pedestal storage cans. However, in light of DNFSB recommendation 94-1 plans for inventory stabilization and repackaging and associated vault storage modifications, excess future capacity is less clear. Rough estimates indicate two of the four vault rooms in 2736-Z are required to hold the current inventory after repackaging into approximately 2,205 of the larger DOE-STD-3013-94 containers. Retention of the low assay material would require an additional 1,000 pedestal storage spaces for the "3013" can. It is assumed that three vault rooms will be converted to accommodate the new larger can; one vault room would remain available in the current can configuration to store future additions to the PFP inventory if required.

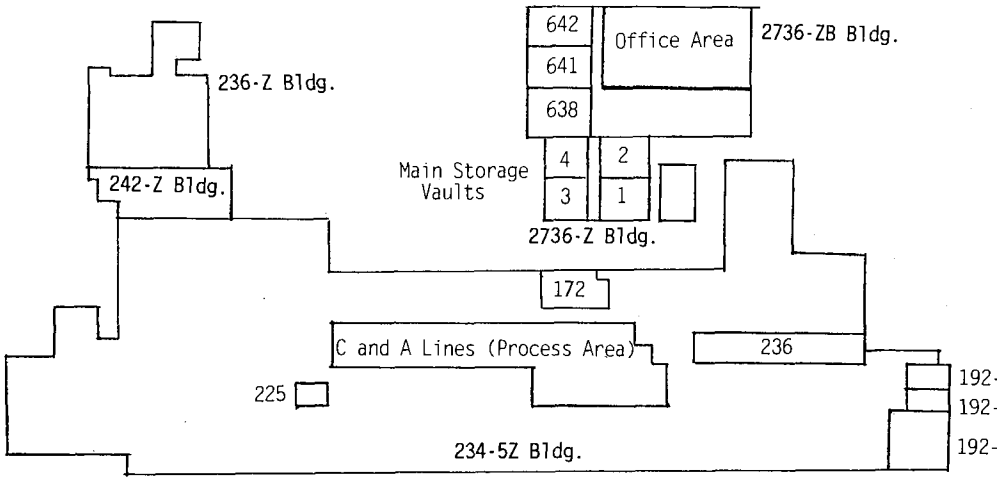
Increased vault storage availability is possible at PFP as outlined in section 10.0 of this study through facility modifications, and vault room reorganizations and reassignments. Engineering studies are required to determine the costs and practicality of these potential increases.

Another very attractive option for acquiring additional SNM storage capacity at Hanford utilizes the modern, multipurpose, and unused FMEF vault like facility described in section 11.1 of this document. This facility contains a fully completed and remotely operated SNM storage vault with a storage capacity of 4,500 to 10,000 kg Pu depending on the form and purity of the material. In addition, other SNM canister storage is available in the form of 301 stainless steel cylinders (16 feet long) that could accommodate can stacking or other storage configurations.

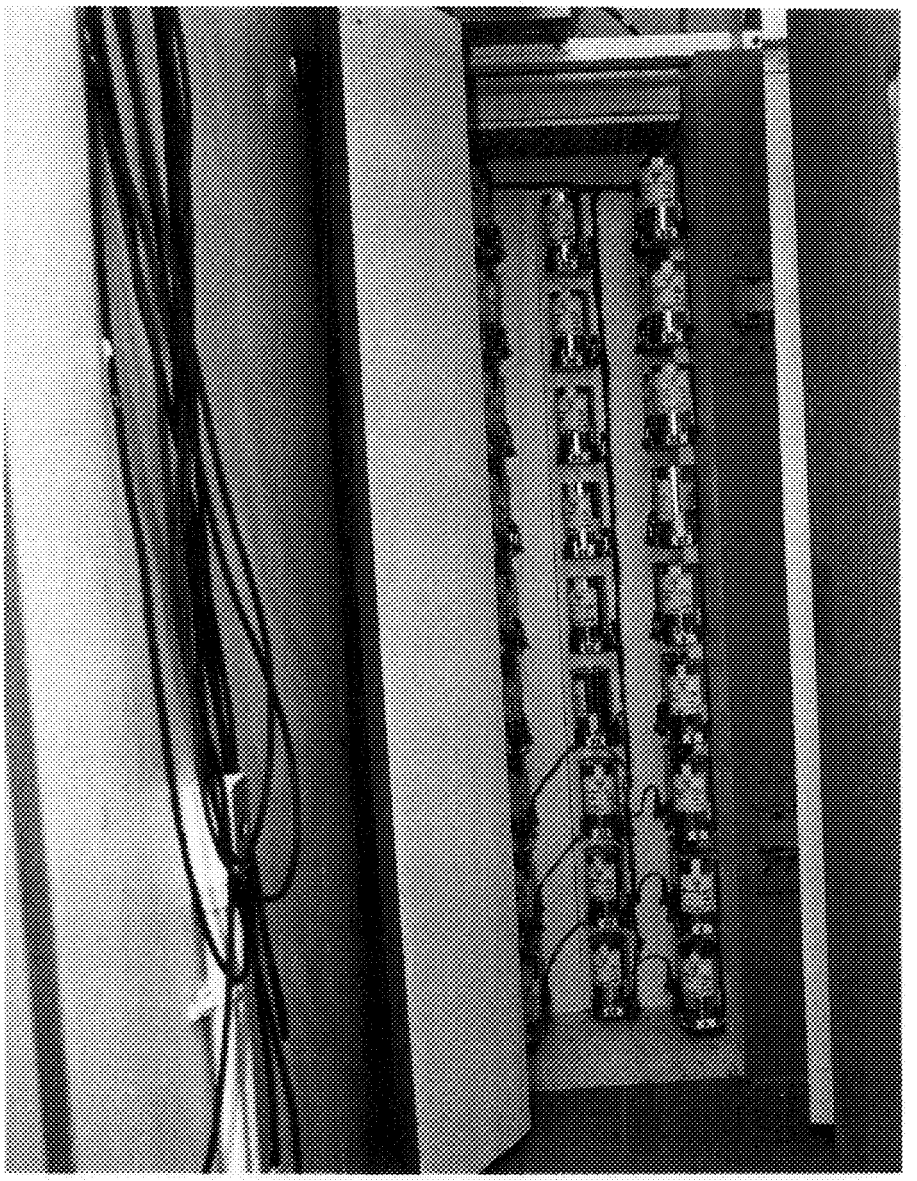
With significant usable floor space (over 200,000 square feet) originally designed for hot cell, fuel fabrication, and laboratory uses, FMEF could support multiple surplus plutonium disposition missions. Enough space exists to store all of the DOE surplus plutonium. Further investigation is required, and an engineering study that specifically addresses plutonium storage capabilities at FMEF, including costs, is highly recommended.

PFP Building Vault Layout

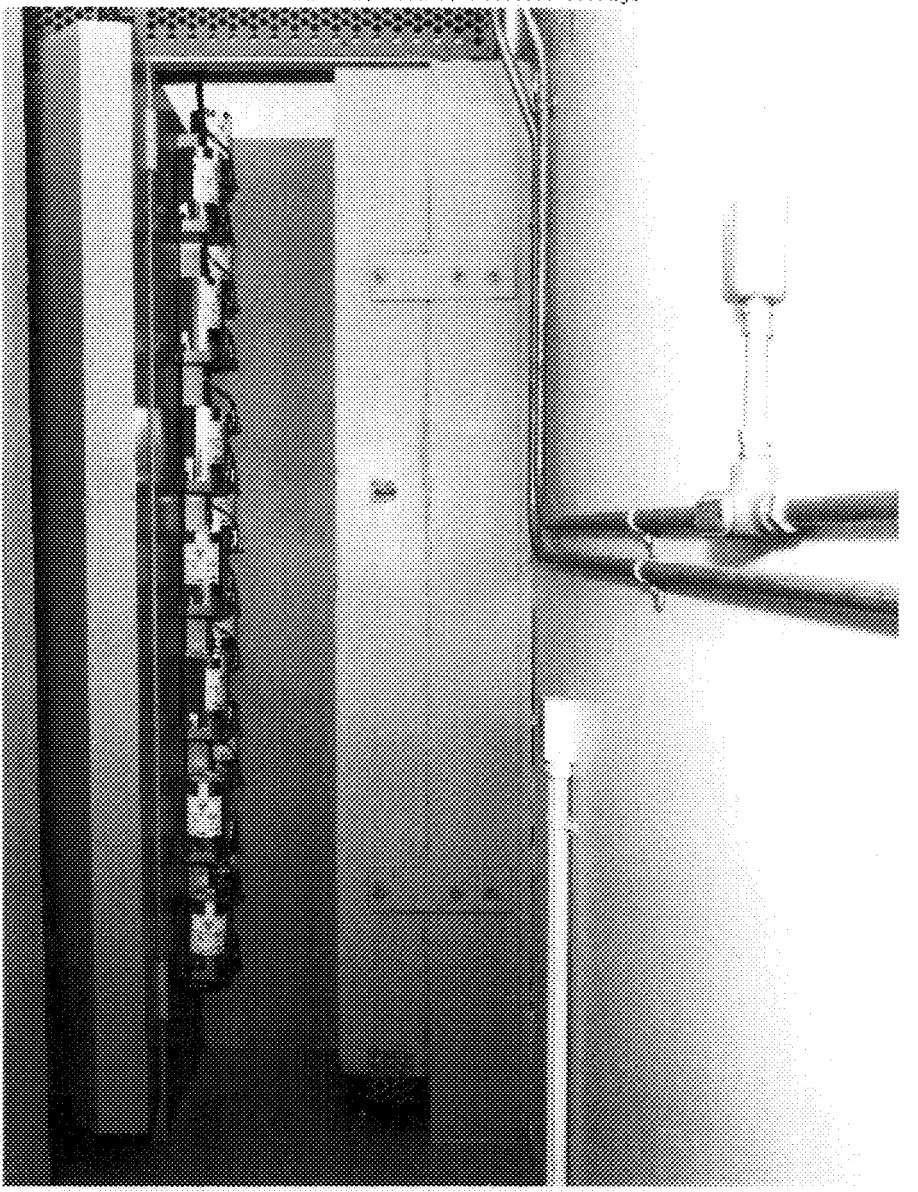
Figure 1



PFP/2736-Z, Room 1, Pedestal Storage



PFP/2736-Z, Room 3, Pedestal Storage



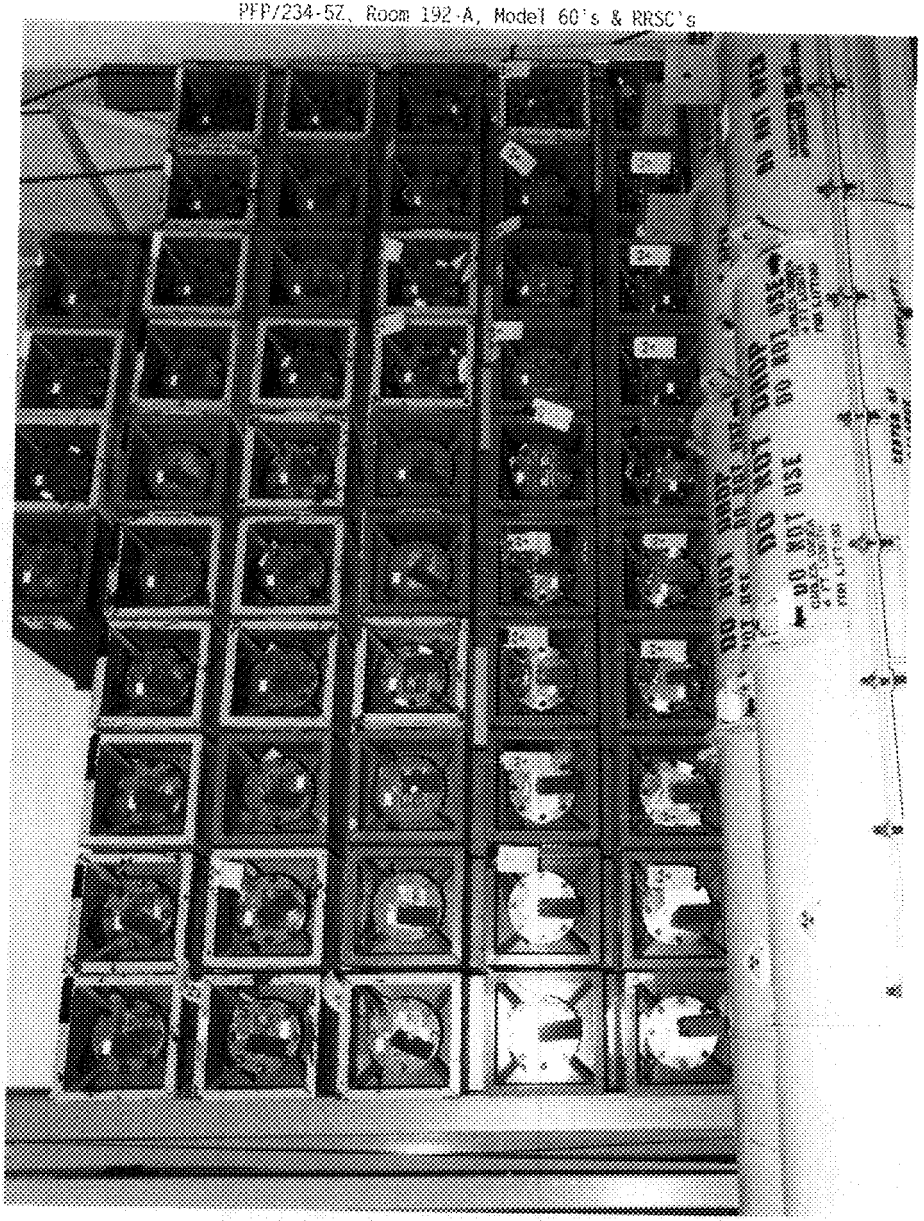
PFP/234-5Z, Room 192-B or C, Pedestal Storage

PFP/2736-Z, Room 2, Shelf Cubical

PFP/2736-Z, Room 2, Lard Cans on Racks

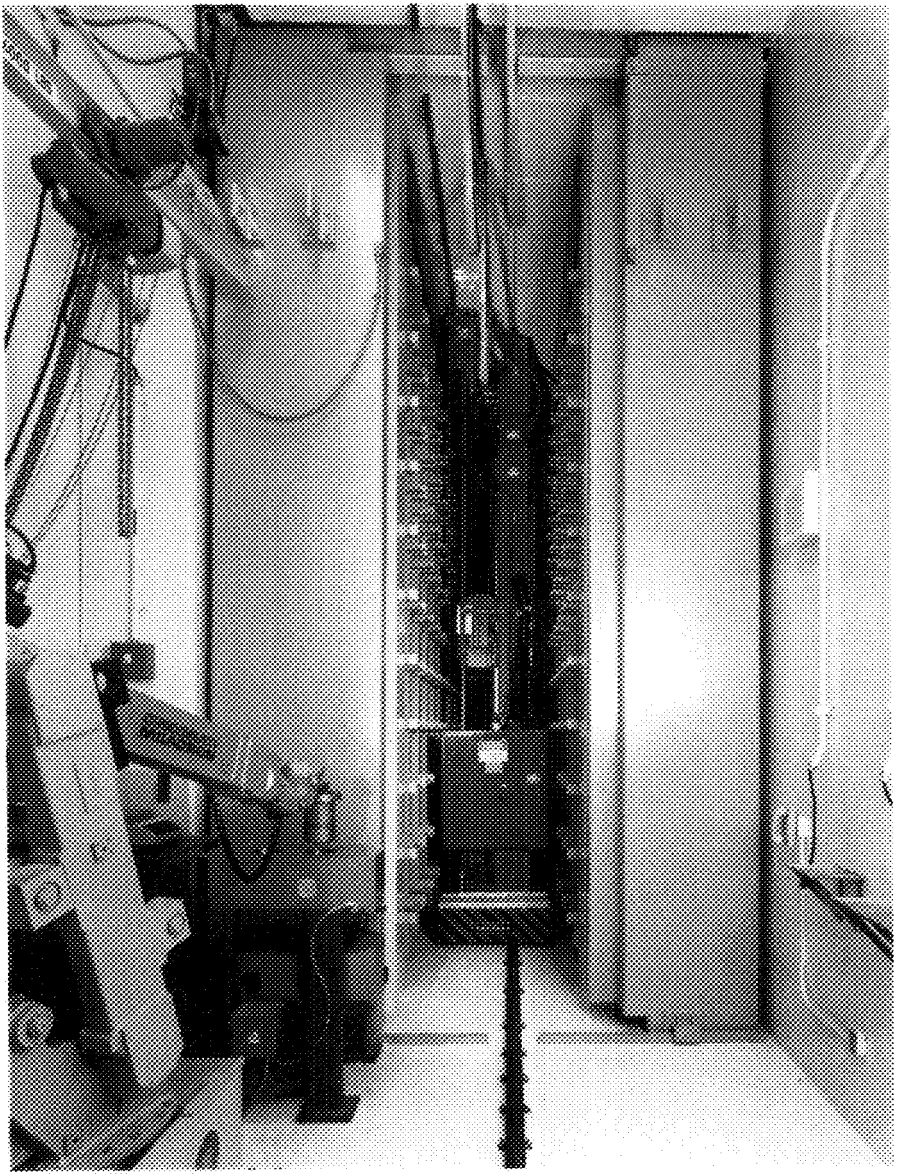
PFP/234-5Z, Room 192-B, Lard Cans on Racks

PFP/234-5Z, Room 192-A, Model 60's & RRSC's



PFP/234-5Z, Room 236, Nitrate Drums (PR Cans)

FMEF, Room 429, SNM Storage Vault



FMEF/Fuel Assembly Wing, Room 101, Cylinder Storage