SACRAMENTO MUNICIPAL UTILITY DISTRICT'S INTERIM ONSITE STORAGE BUILDING FOR LOW LEVEL RADIOACTIVE WASTE

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ABSTRACT

In order to meet current and anticipated needs for the low level radwaste management program at the Rancho Seco Nuclear Generating Station, the Sacramento Municipal Utility District has a design and construction program underway which will provide an onsite interim storage facility that can be expanded in two and one-half year increments. The design approach utilized allows capital investment to be minimized and still provides radwaste management flexibility in anticipation of delays in resolution of the nationwide long term radwaste disposal situation.

The facility provides storage and material accountability for all low level radwastes generated by the plant. Wastes are segregated by radioactivity level and are stored in two separate storage areas located within one facility. Lower activity wastes are stored in a lightly shielded structure and handled by lift trucks, while the higher activity wastes are stored in a highly shielded structure and handled remotely by manual bridge crane. The layout of the structure provides for economy of operation and minimizes personnel radiation exposure. Design philosophy and criteria, building layout and systems, estimated costs and construction schedule are discussed.

THE NEED

Even prior to the passage of PL 96-573, the Congressional Low-Level Waste Policy Act of 1980, it was evident that utilities could benefit from increased onsite storage capacity. The closures since 1970 of three of the six available burial grounds and the continually changing regulations of the remaining three sites emphasizes the need for flexibility. Burial grounds are restricting allocations, requiring costly inspections, increasing fees, and changing packaging guidelines. Waste generators are having difficulty dealing with the changing regulations. Increased storage capacity allows the waste generator to optimize shipments, take advantage of some decay, provide surge capacity, and allow flexibility to efficiently deal with the ever changing waste situation.

The Low-Level Waste Policy Act shifted the responsibility for waste disposal from the federal to the state level. In response, the states are grouping together to form regional compacts. At present only those states whose compact includes an existing burial ground are certain to have a place to ship after 1986. It is estimated that a minimum of 4 years is required to license and construct a disposal site (5 years in California).

The Sacramento Municipal Utility District (SMUD) of California resides in a state without a burial ground. As California does not seem likely to license a burial ground in the near future, and as a generator of a significant amount of low level radioactive waste, none of the states in the area actively sought California's participation. Neither a compact nor a California burial ground seemed likely to solve the utility's pending disposal difficulties.

Presently, Rancho Seco stores its waste in an open barrel farm for interim storage before shipment. High radiation dose levels have occurred at the protected area boundary caused by a buildup of wastes following major plant outages. The District's Operating Technical Specifications limit the security fence line dose rate to 10 mrem/quarter above background. This is not to be confused with the Federally mandated public site boundary dose limit of 25 millirem per year. The high fence line dose rates generated Licensee Event Reports and focused attention on the need for better onsite storage.

Because of uncertainty of shipment and inadequate method of storage presently used, in January 1981 SMUD's Management Safety Review Committee directed the staff to design a building for interim storage of low level radioactive waste.

The situation since 1981 has not greatly improved. The possibility of a state sponsored interim facility has not materialized. A new permanent burial site in California seems unlikely. A compact with Arizona has become a political pawn. And despite much activity on the national level concerning the existing burial grounds, their future availability is questionable.

CONCEPTUAL DESIGN

Location

The Sacramento Municipal Utility District hired the TERA Corporation to assist the District's engineers in the conceptual design. The first design parameter developed was location. The following options existed:

a. Within the Auxiliary Building

b. Adjacent to the Auxiliary Building

c. Onsite in an uncongested/out of the way site

d. Offsite but within utility's property boundary

e. Remote location

Rancho Seco's Auxiliary Building offered no space for the interim storage of low level radwaste. Additionally, due to previous space commitments, the area surrounding the Auxiliary Building did not allow for the construction of an addition, or a separate adjacent building, for storage purposes.

Currently Rancho Seco transports waste by flatbed or forklift to an open air barrel farm within its security boundary (see Fig. 1). The District considered locating its new storage building where the present barrel farm sits. Instead an area directly north of the existing barrel farm was chosen. This allows the barrel farm to remain operational during construction of the new building and maintain an existing traffic flow pattern for the transfer of radwaste.

An unattended building, offsite but within the utility's property boundary, is unattractive for security reasons. Sabotage and public safety were of concern. Constructing and operating a storage facility in a location remote from Rancho Seco did not seem to provide any benefits; only liabilities. A low level radioactive storage facility was certain to create a negative public reaction.

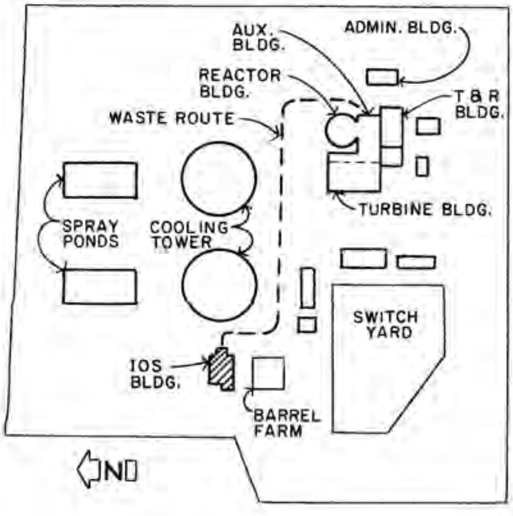

Fig. 1. Rancho Seco Site Plan.

Building Configuration

The next design parameter considered was building/storage configuration. The proper building construction is highly influenced by the location chosen. In essence these choices are interdependent.

Three basic types of building/storage configuration were considered:

(a) Metal Building

(b) Outdoor vaults (external material handling)

(c) Concrete shielded building (interior material handling)

The chosen location, just north of the existing outdoor storage area, essentially eliminated the first two configurations. High fenceline dose rates had already been the result of sky shine from the waste in the adjacent barrel farm. A standard metal building would not provide enough shielding for the anticipated larger accumulation of waste. Additionally, much of the waste in the barrel farm was already stored in shielded concrete lined drums. The utility wanted the ability to store wastes unshielded. The decision was made to store higher level waste in heavily shielded cells and lower level waste in lightly shielded warehouse area.

TERA Corporation did not recommend the outdoor vault concept either. Calculations showed that fence line dose rates would be exceeded due to dose accumulated during external material handling. Even if waste was shielded with overpacks while it was transported from the Auxiliary Building to the storage building, dose would be accumulated when waste was removed from overpacks and put into storage. It appears that the metal building and the outdoor vault concept should only be used in conjunction with a storage site far from a public area boundary.

Material Handling

The third major design option decision that needs to be made is the type of material handling equipment. Material handling is closely linked with the type and activity level of the container. Some of the options explored by the District included boom cranes, bridge cranes, gantry cranes, stacking cranes, elevators, monorails, conveyors, air cushion platforms, and shielded and unshielded forklifts. Ones choice is dependent upon the building type and waste characteristics. For example, it is doubtful that a 'cherry-picker' would be chosen for use inside a building but could be used for outdoor vault type storage. Overhead cranes are more appropriate than forklifts for 15 ton liners of solidified liquid. The level of activity of waste determines if remote handling or operator shielding is necessary.

In 1982 Gilbert/Commonwealth projected the 5 year waste accumulation to be as follows:

TABLE 1
Rancho Seco Five Year Waste Accumulation

Waste Types	Container	Volume ft3	Number Of Containers
Compacted Trash	drum	7.5	2866
Non-Compactible	box	128	61
Solidified Liquid	liner	200	384
Solidified Resins	liner	200	38
Spent Filters	drum	7.5	274
"Hot" Spent Filters	drum	7.5	42

The expected waste type covers the spectrum from low-level light weight drums, high level light weight drums, low level heavy 200 cu. ft. liners to higher level liners. The total building storage capacity is estimated at approximately 120,000 ft^3.

The District chose to use both an overhead crane and a forklift. The overhead crane will be used for heavier objects (solidified liners stacking platforms, and cell covers) and for waste requiring remote handling. The forklift will be used for lower level drummed waste. Plant personnel are familiar with these two material handling methods. Other material handling technologies were found to be either inappropriate for the building type or unfamiliar to plant personnel.

With this general concept, an onsite concrete shielded building utilizing a remotely operable bridge crane, the District prepared an RFP. This RFP requested that all firms "bid" (estimate their design time and cost) for a basebid (a sketch prepared by Tera Corporation). Firms were allowed to propose alternate designs in addition to their basebid. Gilbert/Commonwealth, Incorporated was selected on the basis of their alternative design proposal and their lump sum fee.

LAYOUT DESCRIPTION

Modular

Because of the uncertainties surrounding low level waste disposal and to minimize capital outlay, the building is modular in design. The current project contains storage areas for approximately 2 1/2 years of radwaste. Design of a second phase that would double capacity is essentially complete. All systems (structural, shielding, crane, sump and drain, fire protection, etc.) are designed to allow for easy expansion to a facility that can accommodate 4 times as much waste.

Storage Configuration

The structure allows for storage of waste in two basic configurations dependent on activity level. (Figure 2) The higher activity waste (greater than 100 mR/hr contact dose) is stored in a shielded, covered cell arrangement designed to accommodate a range of waste containers from 200 cubic foot disposable liners to drums. The cells have two individual shield covers. Cell cover and waste container handling is accomplished by an overhead remotely operated bridge crane system.

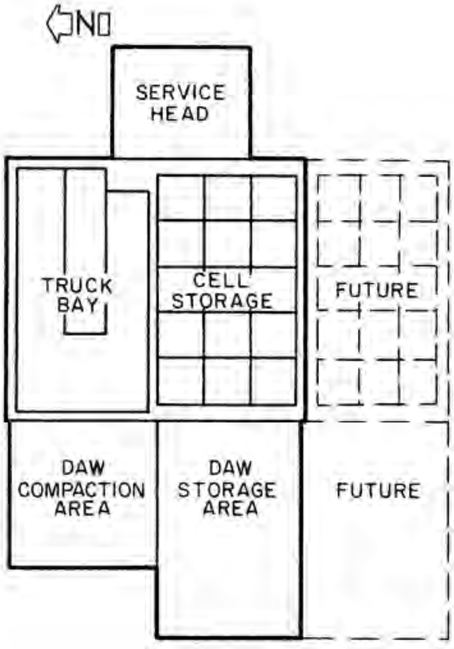

Fig. 2. IOS Building Layout.

Lower activity waste is stored in an open warehouse and handled by a forklift. Typically this waste is Dry Active Waste (DAW) such as contaminated coveralls, gloves, shoe covers, etc. The storage facility cell area and open floor warehouse storage area are covered by a 2 inch and 4 inch, respectively, concrete roof system to protect the radwaste from the environment and to provide additional shielding.

Cell Area

The cell area contains 15 cells approximately 16'x16'x36' deep. Structural steel stacking platforms allow vertical storage of waste. Four platforms can be stacked in a cell. The platforms are sized to hold four 200 cubic foot liners, or they can store boxes and drums in a less efficient arrangement. Direct stacking of liners is not allowed.

Dry Active Waste Storage Area

The low activity waste is administratively segregated by contact dose into two categories and will be stored in a shielded open floor warehouse. Waste containers from 55 gallon drums to 120 cubic foot metal bins can be accomodated. The first waste category (0-10 mR/hr contact dose) represents approximately 75 percent of the total quantity of low activity waste and will be stored on the outside face of the stacking volume.

The second category (10-100 mR/hr contact dose) is stacked in the center of the stacking volume and will be partially shielded by the first category. Stacking height for 55 gallon drums and for other containers is not to exceed 18 feet.

Dry Active Waste Handling Area

The handling area is next to the warehouse storage area. It is provided to allow for miscellaneous operations and possible future incorporation of a DAW compactor/baler unit. This area is designed so that it can be isolated from the remaining building by incorporation of shield walls and a separate heating and ventilation system.

Service Head

The service head provides a control room, a records center, a personnel access area, a fire service room, miscellaneous storage, and a mechanical/electrical equipment room. All areas are sized for a 10-year facility. The control room will accommodate two persons, a crane control panel (for remote operation), radiation monitoring, sump, HVAC, fire protection and balance of facility control panels. The personnel access area will serve to control access into the main facility, allow frisking and changing.

Truck Bay

The truck bay contains space for a 60 foot tractor-trailer combination, a wet decontamination area, a lay down area for grapples, a dock leveler area, and a holding vault for temporary storage.

BUILDING SYSTEMS

All building systems are designed to be expandable to accommodate facility sizing for up to four times as much waste.

Fire Protection

Many approaches to fire protection of the storage building were discussed. Could a large portion of a fire detection/suppression system be avoided due to the lack of combustibles (solidified liquid, drummed trash) in an essentially unmanned facility? Could manual techniques be used exclusively? In the end a very conservative approach was used: fire detection throughout the building, local and remote alarms, nitrogen supervised preaction sprinkler system, local hose stations and local extinguishers.

The automatic preaction dry pipe sprinkler is provided for the protection of areas where combustibles will be stored or may accumulate, including the Service Head, the Truck Bay, the DAW Handling Area, and the DAW Storage Area.

Ionization-type smoke detectors are provided throughout the facility to automatically detect fires in the incipient stage. Detectors are located in the Service Head, Truck Bay, Cell Storage Area, DAW Handling Area and DAW Storage Area. Smoke detectors are also located in the facility HVAC system. Activation of any smoke detector will shut off the HVAC supply and exhaust fans in the appropriate zone. This will effectively isolate the building.

Activation of the automatic fire detection system (smoke detectors) or activation of a manual fire alarm system pull box causes the deluge valves for the sprinkler system and the hose station systems to open in the appropriate area. After activation of the deluge valve, the preaction sprinkler piping fills with water and is discharged only by the melting of a fusible link on the sprinkler from the heat generated by a fire.

The facility hose stations are provided for manual control and extinguishing of fires by facility personnel in the Service Head, Truck Bay, Cell Storage Area, DAW Handling Area and DAW Storage Area. All areas of the facility are within reach of at least one interior hose line. Pressurized water, CO_2, and appropriately sized dry chemical fire extinguishers have been located throughout the facility as required by NFPA.

HVAC

Two separate air handling systems ventilate the IOS Building. The service head system is designed for personal comfort and provides heating, cooling and humidity control. The system for the storage areas is designed for minimal ventilation, sufficient to satisfy OSHA requirements. The cell storage area located above cell covers, truck bay and DAW storage and handling areas, is designed for a temperature range of 80 to 120 degrees F with no humidity control. Air particulate sampling of ventilation is available.

Radiation Monitoring

Area radiation monitors are located throughout the facility. Indication is provided locally, in the IOS Building Control Room, and in the plant Control Room.

The following zones comprise the expected radiation levels:

Zone I -	0.25 mRem/hr - Service Head
Zone II* -	2.5 mRem/hr - Truck Bay, Above Cell Covers
Zone III -	25 mRem/hr - DAW Handling Area
Zone IV -	100 mRem/hr - DAW Storage Area
Zone V -	100 mRem/hr - Beneath Cell Covers

* Zone II with all cell covers in place and all waste stored in cells.

A General Atomic supplied radmonitor system was selected for consistency with balance of plant.

Sump and Drain

The facility is design to contain all liquids generated within the storage facility. Curbs, trench drains, sumps, etc., are placed in the facility to preclude release of any liquids from the facility.

The cell storage area is provided with trench drains capable of pinpointing any leakage to an individual storage cell. Manual sampling through covered openings in the cells allows sampling without recurring cell cover removal. Cell area trenches drain to the facility sump.

The truck bay area is provided with a catch basin, including a gravel trap, to contain accumulated uncontaminated liquid. The catch basin drains to the facility sump through valved connections.

The DAW Storage Area is provided with a grating-covered trench drainage system having a low point collection area and gravity drains to the facility sump.

The facility sump is equipped with a motor driven pump that is manually valved for discharge into portable tanks.

Material Handling

The material handling system provided an opportunity for unique design. When designing and choosing the crane type and manufacturer, many options were explored including semi-automatic vs. manual crane control, absolute vs. relative position indexing, and AC vs. DC drive. The District selected a DC drive, manual, remotely operated bridge crane system manufactured by Ederer Incorporated of Seattle, Washington. The crane uses CCTV cameras for viewing, a position indication system, some unique grapple designs and liner modifications to allow remote handling. A multi-use grapple is used to handle cell covers, stacking platforms, and liners. Ederer also designed a drum grapple for both 30 and 55 gallon drums with positive engagement indication for both sizes.

CONCLUSIONS

The project schedule was as follows:

Conceptual design:	Jan 1981 - Nov 1981
Detailed design:	Dec 1981 - Sep 1983
Construction Building	Jan 1984 - Aug 1985
Utility tie in, Startup:	Sep 1985 - Mar 1986
Operational	Apr 1986

The project costs were as follows:

Design	$ 500,000.00
Crane	657,000.00
Construction Contract	3,800,000.00
Total Project (Includes all overhead, utility tie in work, in house support, etc.)	8,700,000.00

The safety analysis determined that the modification did not represent an unreviewed safety question. In fact, the modification "provides for safer handling of waste than now exists at Rancho Seco". Because of sensitivity to the subject of LLRW storage, an Environmental Impact Report was filed, even though a negative declaration would probably have satisfied the California Environmental Quality Act. The EIR was approved by the District's Board of Directors in April 1983 with little public reaction.

While it appears that SMUD will be able to ship its waste to Richland, Washington, for how long and at what cost is unknown. The District is comfortable with its decision to construct a storage building. The Interim Onsite Storage Building will allow prudent and efficient waste management.