LONG- AND SHORT-TERM RADWASTE SYSTEM CHANGES

AT THE SOUTH TEXAS PROJECT

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ABSTRACT

The South Texas Project (STP) consists of two Westinghouse 1250 MWe PWRs located on a manmade cooling reservoir near Bay City, Texas. For the past two years, Houston Lighting & Power Company (HL&P) has been evaluating, redesigning, and otherwise modifying the STP radioactive waste management systems.

The review was initiated with the following goals:

- To identify any changes which are <u>required</u> to assure reliable radwaste operation on a short term, three (3) year basis and to provide the following information on each change:
  - -- Reasons or problems requiring this change
  - -- Potential problems caused by the change
  - -- Plants successfully using the hardware, etc., required for the application
- Identify the changes which are <u>recommended</u> for long term STP radwaste operations. Provide the information requested above.
- For each of the changes recommended, identify which will require implementation prior to operation and which could be made after plant startup.

The results of this effort were:

- Extensive addition of temporary connections
- Enhancement of DAW processing and handling
- Changes required to comply with 10CFR61
- Some 50 short- and long-term modifications

In addition, plans for an interim on-site storage facility, upgraded secondary system water treatment, and new stringent RCS water chemistry are also briefly addressed. Each of these areas are discussed and tables presented identifying proposed changes, purpose of change, and schedule.

<u>Introduction</u>

The radioactive waste handling systems at STP provide controlled handling, processing, and disposal of gaseous, liquid, and solid wastes. The systems are designed to ensure that plant personnel and the general public are protected against excessive exposure to radiation from wastes in accordance with limits defined in 10CFR20, 10CFR50 Appendix I Guidelines, and the plant's technical specifications.

The area of radioactive waste treatment has undergone an evolutionary process which reflects a maturing of the LWR technology. With this maturing of LWR technology and definitive evolution of regulatory positions and criteria, the importance of a support technology such as radwaste treatment is emphasized. One of the more important areas of concern is the ability to adequately handle the waste generated during various plant operational modes. This is emphasized when plant availability, increased releases to the environment, and increased operating costs due to waste disposal are considered.

The primary premise for a radwaste design is that the process perform satisfactorily during all expected operating events, including abnormal occurrences experienced at operating facilities. The radwaste system should not be responsible for plant shutdowns, deratings, or abnormal occurrences which would result in Technical Specification or Environmental Technical Specifications violations. Secondly, the most cost-effective (in terms of both monetary and man-Rem expenditures) and proven technology capable of ensuring the first premise is desirable.

To meet these requirements and the intent of the ALARA philosophy, the gaseous, liquid, and solid waste sources of the plant must be identified, characterized, and quantified for both normal and abnormal occurrences.

To meet the regulators', health physicists', and operators' concern that releases are ALARA and to minimize the potential dose to plant personnel and off-site people, it is necessary to design a series of systems which can handle a wide range of source terms--both quantity and quality. Therefore, it is necessary to provide the capability to collect, monitor, and treat wastes over a wide range of operating conditions. Source terms may be developed from many sources--nuclear steam supplier, equipment vendor, personnel operating experiences, regulatory agencies, and appropriate design standards. Major emphasis should be given to appropriate operating experience. This compilation should include such things as pump leakage, catastrophic valve failure, tank overflow, major decontamination operations, and certain operator errors, as well as the "normal" operating source terms usually considered.

The choice of system design must also reflect the limits anticipated due to the plant's operating and environmental technical specifications concerning operations during normal and abnormal conditions. Special emphasis should be given to the time allowed to recover from an abnormal condition if the time could result in limitations on plant availability or operations.

Liquid radwaste volumes produced during the plant startup phase (and usually through the first three or four refuelings) have been substantially larger than initially contemplated. The reasons for this vary from plant to plant. Most often, the larger waste volumes are the result of system flushing, frequent tripouts, continued construction activity without proper waste and water management, leaking pump and valve seals, and system misoperation.

The combination of regulatory changes and increased waste volumes has made it evident that many nuclear plants will have to redesign their waste processing system to meet the more stringent regulations. Nearly every plant that has been in operation for at least a year has modified its liquid radwaste processing system. Most have backfitted to incorporate additional processing and solidification equipment as well. This includes both installed and mobile services. For a plant such as STP, where various aspects of a radwaste design have been completed, certain commitments in design and procurement made, and numerous components been installed, it is more difficult to ensure the flexibility desired by HL&P is available or obtainable.

A design review of the STP liquid radwaste system was undertaken to provide HL&P with an evaluation of the existing design and to identify areas of possible improvement and methods to accomplish these improvements. The emphasis of this review was upon the operational capability of the current STP radwaste system and the means to improve its flexibility of operation.

Regulatory and Operational Factors

Numerous regulatory actions have been taken in the past decade which impact STP including 10CFR50 Appendix I, Environmental and Technical Specifications, ODCM, numerous Regulatory Guides, and most recently, 10CFR61 and implementing Branch Technical Positions, Texas LLW burial site rulemakings, and changes in the Department of Transportation regulations impacting low-level waste. Besides these factors, STP is also faced with numerous changes required to minimize future technical problems. These include such items as changes to the reactor coolant system chemistry specifications, boron recycle criteria, development of a formal water balance program, addition of liquid and solid waste processing system temporary connections, and site-specific changes such as the elimination of chromated water and requirements of additional refueling water. These changes are supplemented by numerous changes to plant systems and proposed operating procedures and programs to minimize waste generation. Included are changes in the waste segregation procedures, use of drycleaning in the laundry facility, and addition of waste management capabilities and increased recycling of the liquid effluents.

Finally, experience over the past decade has identified numerous areas where improved engineering practices are expected to result in improved operations. This includes improved technology for decontamination and desludging, collection and processing of oily wastes, improved waste sampling and solid waste processing, and justification of improved process controls and use of data logging computers.

Impact on the South Texas Project

The impact of the above-identified factors has been quite extensive on STP. Other work, "Assessment of the Economic Implications of 10CFR61 on the South Texas Project" addressed the impact of 10CFR61 and Texas Part 45. Major areas impacted includfe waste sampling, and increased data logging and handling coupled with substantially increased rad-chem analysis. Other changes involve waste segregation to allow economical compliance with 10CFR61 requirements. A major impact is the addition of a second spent resin tank to allow segregation of high and low level resins. Compliance with Texas Part 45 will have impacts on waste disposal procedures, practices, and cost, which can not presently be definitively identified.

Another development is the addition of an interim on-site low-level waste storage facility which is, of course, in response to both 10CFR61 and Texas Part 45. The STP facility, like others, is affected by the state compact process and must consider ways to meet the intent of Generic Letter 81-38 (Storage of Low-Level Radioactive Waste at Power Reactor Sites, November 10, 1981). Present on-site storage is limited to less than six (6) months of waste generation. Since the State of Texas Burial Site may not be available until 1988, STP is faced with the need to proceed with plans to construct an interim on-site storage facility. Initial waste generation sources and rate estimates are given in Table I.

Other impacts on STP will arise from changes in acceptable waste forms and classification as well as projected changes in transportation regulations. These will range from major changes to the existing cement solidification system to increased costs associated with program and procedural changes in presently proposed practices.

Much more definitive changes are associated with the increasingly stringent Westinghouse RCS chemistry criteria. These criteria impact water makeup systems as well as boron recycle and boric acid recovery systems. If boric acid cannot be recycled, then between 7,000 and 9,000 cubic feet of solidified boric acid concentrates will have to be disposed of, along with increased numbers of filters and a larger volume of ion exchange resin waste. If boric acid can be recycled, then this 7,000 to 9,000 cubic foot amount will be reduced. However, additional reverse osmosis and ion exchange equipment will be required. An alternative to either of the above processes is to boric acid saturate the demineralizer resins and discharge the purified and neutralized boric acid stream.

STP has added extensive temporary connections to allow mobile processing of the following, without use of the solid waste processing system:

- Liquid waste processing system liquids
- Spent resin
- Waste evaporator and boron recycle evaporator concentrates

In addition, connections for use of mobile filtration, ion exchange, and drycleaning are provided.

Consistent with these changes, HL&P has initiated a major water balancing program to review all radioactive and non-radioactive water sources during normal operation and refueling. This has resulted in some major changes in process rates, discharge rates, and increased collection and waste monitoring tankage. HL&P has also decided to eliminate the use of chromates from the STP closed loop cooling system, thus minimizing environmental impacts of inadvertent releases to the cooling lake.

The detailed operational design review of STP resulted in 50 major recommendations for short- and long-term changes which were broken down into 14 topic areas as shown in Table II.

Table III presents a brief description and status of the major recommendations. These recommendations were prepared by KLM Engineering. Bechtel and HL&P evaluated the practicality and feasibility of the recommendations from engineering and operational perspectives. Currently, several of the recommended items--those indicated as "included" in the Status column of the table--are being reviewed to ensure that they can be incorporated under the present startup schedule. Decisions whether to incorporate particular recommendations were based upon technical feasibility, practicality, cost, and scheduling considerations.

Summary

The South Texas Project, conceived in the early 1970s, has been extensively modified and upgraded to insure that it can operate safely and effectively in the 1980s and beyond. The changes to the radwaste system discussed above clearly point out the intensive effort to update technologies to handle the challenges of the future.

TABLE I

Solid Waste Expected from STP Operations Per Unit (Estimates Prior to Study)

	Unsolidified Waste ft^2/yr	Solidified Waste ft^2/yr	Drums/year
Spent Resin	2,415	5,888	890
Boric Acid Concentrate	3,900 - 4,875	7,315 - 9,141	1,105 - 1,382
Regeneration Waste	1,125	1,824	1,382
Cartridge Filters	488	488	74
Trash Compacted (1:3)	4,750 - 9,500	4,750 - 9,500	718 - 1,436
Non-Compactable Waste	4,875	4,875	54 $100ft^2$ boxes
	17,553 - 23,278	25,138 - 31,716	3,065 - 4,058
Waste Generated (Range per Unit)	17,500 - 23,300	25,100 - 31,800	3,060 - 4,060 drums + 54 $100ft^2$ boxes

TABLE II

Proposed Operational Changes at STP

Designation	Subject Category	No. of Recommendations
A	Decontamination and Desludging	3
B	Hot Machine Shop	2
C	Laundry Facility	2
D	Temporary Connections	3
E	Oily Waste	3
F	Boric Acid Reclamation	3
G	Solid Waste Processing System	5
H	Sampling System	3
I	Data Logging Computer	1
J	Water Management Program	8
K	Compliance with 10CFR61	2
L	Gas Waste System	2
M	Vents and Drains	2
N	Miscellaneous	11

TABLE III

Status of Recommended Changes at STP
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Recommendation Number	Subject Category Reference	Recommendation	Status
1	A	Add penetration to containment (decon)	Included
2	A	Add penetration to mechanical equipment auxiliary building and fuel handling building (decon)	Under evaluation
2	A	Add penetration to turbine building (decon)	Not included
3	D	Waste Processing temporary connection and bypasses	Included
4	D	Utilization of portable solidification capability	Included
5	C	Laundry, respirator processing (large permanent facility or smaller facility and mobile capability	Included
6	B	Miscellaneous services including electropolishing, small tool cleaning, and refueling canal decontamination	Not included
7	C	Laundry wastes - reverse osmosis, ultrafiltration, or combination system--to be chosen after laundry requirements decision	Not required with dry cleaning
8	E	Oily wastes - further evaluation of waste oil production needed. Prepare an analysis on permanent facility vs. temporary processing capability including use of reverse osmosis	Under evaluation
9	F	Boric acid reclamation - further evaluation is required on waste generation rates, esspecially floor drains; consider application of reverse osmosis	Not included
10	G	Replace existing compactor with improved compactor and/or box compactor	Included
11	K	Review liquid wastes, spent resins, evaporator concentrates, and solid waste characteristics to allow compliance with waste form and waste classification requirements.	Under evaluation
12	K	Evaluate radwaste operations for waste segregation, waste sampling, recordkeeping, and rad-chem lab adequacy	Not included
13	J	Develop water management program	Included
14	J	Review waste generation design base including waste characteristics, etc.	Included
15	J	Review process design operating modes	Included
16	J	Review miscellaneous water sources and inputs	Included
17	N	Butt welds for resin and slurry transfer	Included
18	A	Tank decontamination capability	Not included
19	N	Add chemical addition capability	Included
20	N	Sump design review including sump liners	Included
21	N	Radwaste equipment maintenance problems	Included
22	N	Review adequacy of active components - pumps	Included
23	H	Waste sampling system needs	Under evaluation

TABLE III

Status of Recommended Changes at STP
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Recommendation Number	Subject Category Reference	Recommendation	Status
24	N	Consider recirculating of tanks on miniflow through respective filters	Included
25	J	Changes to waste monitor tank operations to allow processing from one tank through a demineralizer to a second tank	Included
26	J	Review demineralized water use	Included
27	I	Data logging computer and surveillance instruments	Not included
28	J	Add radiation monitors to turbine building drains; consider additional discharge points	Included
29	E	Add waste oil separators, collection, and processing	Included
30	F	Ensure waste segregation and potential for boric acid reclamation	Not included
31	J	Review handling of all secondary system drains	Included
32	G	Add second spent resin tank	Included
33	H	Ensure EPA criteria re chemical constituents can be met with present waste monitor tank	Not included
34	G	Review representative sampling capability	Under evaluation
35	F	Review impact of stringent STP water chemistry on boron recycling	Included
36	N	Reassess impact of use of boron recycle system evaporator on liquid radwaste processing system	Included
37	L	Review GWPS process tanks to ensure presence of drains	Included
38	L	Review handling of charcoal	Included
39	M	Seal off all floor drains during construction	Not included
40	M	Reevaluate radioactive vent material selection	Included
41	E	Provide curbing of equipment containing oil	Included
42	D	Bypass solid waste processing system	Included
43	G	Upgrade drum capper	Under evaluation
44	G	Ensure filter handling capability	Included
45	G	Capability to chemically exhaust resin	Included
46	B	Reevaluate need for "hot" machine shop	Not included
47	N	Review access control	Not included
48	N	Consider use of double valves in radioactive pressure and/or high temperature drains and vents	Not included
49	N	Filter/strainer downstream of all demineralizers	Included
50	N	Recycle waste evaporator collector tank deareated water	Not included