ASSESSMENT OF THE ECONOMIC IMPLICATIONS OF 10CFR61 ON THE SOUTH TEXAS PROJECT

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ABSTRACT

The State of Texas, as an Agreement State, is developing Texas Part 45, "Licensing Requirements for Near-Surface Land Disposal of Radioactive Waste" to implement the intent of the Nuclear Regulatory Commission's (NRC) Title 10 to the Code of Federal Regulations, Part 61 (10CFR61) "Licensing Requirements for Land Disposal of Radioactive Waste." This paper addresses the potential economic impact of the proposed Texas Part 45 and 10CFR61 on the South Texas Project (STP). The Texas Department of Health is developing the proposed rulemaking Texas Part 45 pertaining to land disposal of radioactive waste, which together with proposed amendments to related portions of Texas Parts 11 and 21, provide the licensing procedures, performance objectives, and technical criteria for licensing disposal facilities. These regulations establish requirements concerning allowable waste forms, classification, packaging, and labeling of waste, as well as acceptable shipping records and manifests. Thus, the regulations' impact upon a nuclear power plant such as STP include not only shipping and disposal costs, but also the costs of proper preparation, classification, and labeling of waste, and the cost of associated recordkeeping and paperwork required for compliance with the regulations.

The State of Texas, as an Agreement State, is developing Texas Part 45, "Licensing Requirements for Near-Surface Land Disposal of Radioactive Waste" to implement the intent of the Nuclear Regulatory Commission's (NRC) Title 10 to the Code of Federal Regulations, Part 61 (10CFR61) "Licensing Requirements for Land Disposal of Radioactive Waste."

This paper addresses the cost impact of the proposed Texas Part 45 and 10CFR61 on the South Texas Project (STP). The paper is broken down into three main sections which provide technical and economic information required to determine Part 45's economic effects on STP.

Specifically addressed is Draft 5 of Texas Part 45, including proposed changes to Texas Parts 11 and 21 which provide the licensing procedures, performance objectives, and technical criteria for licensing low-level radioactive waste disposal facilities. These regulations establish requirements concerning allowable waste forms, classification, packaging, and labeling of waste as well as acceptable shipping records and manifests. Thus, the regulations' impact upon a nuclear power plant such as STP include not only shipping and disposal costs, but also the costs of proper preparation, classification, and labeling of waste, and the cost of associated recordkeeping and paperwork required for compliance with the regulations.

Waste Classification

In addition to the present classifications of radioactive waste specified in the U.S. Department of Transportation regulations (49CFR), Part 45 introduces three new categories of waste classification. These classifications, designated Classes A, B, C, and waste generally unacceptable for low-level burial are based on their long-term physical and chemical stability. Waste stability is intended to ensure that the waste does not structurally degrade and affect the overall stability of the site through slumping, collapse, or other failure leading to water infiltration and subsequent radionuclide migration.

The requirement to classify waste in accordance with Part 45 will impact a waste generator's operations, especially in the areas of waste sampling and counting programs by requesting generators to periodically verify the accuracy of radioactivity estimating techniques.

The problems of waste characterization include federally-defined hazardous waste characteristics which are generally less definitive than their radioactive counterparts. Uncertainties associated with hazardous waste analysis and characterization are much higher, and experience to date with hazardous components within radioactive waste is limited. Texas Part 45 radwaste analysis at a power plant requires an extensive laboratory and analytical capability coupled to a reliable physical sampling capability. Specialty sampling systems are available which are especially designed for sampling each individual waste stream, thus providing as representative a sample as possible for subsequent analysis. Once representative samples are taken, it is necessary to provide the required analytical capability to classify the resultant waste sample.

"Detailed sample analyses involving measurement of specific radionuclides for correlation with a gross activity method" or "direct measurement of radionuclide concentrations" are two of the methods listed as suitable for classification of reactor waste. Either method requires quantitative analyses of complex mixtures for specific x-ray, gamma, beta, and alpha emitters.

Specific radionuclide analyses are required for initially establishing and periodically checking either the gross or specific methods. Analyses are required which are equal to or better than the minimum sensitivity requirements of the NRC Branch Position on Waste Classification--minimum detection activity levels (MDAs) that are no more than 0.01 times the concentration of the radionuclides listed in Section 21.308, Table 1 and Table 2.

Isotopes requiring wet radiochemistry analysis, i.e., chemical separation, purification, and counting are C-14, Tc-99, I-129, alpha-emitting nuclides, and transuranics in Table 1, Section 21.308. Isotopes in Table 2 are some of the nuclides with less than five years half-life (such as Fe-55, Sr-89), tritium, Ni-63, and Sr-90.

It is highly likely that all nuclear plants will to some extent measure waste package dose rates and calculate curie content of the TRU, alpha, and beta emitting isotopes. This will be accomplished by ". . . indirect methods such as the use of scaling factors which relate the inferred concentrations of one radionuclide to another that is measured. . ." (21.308(g)). The NRC's activities involving scaling factor development are found in NUREG/ CR-1759 while a nuclear industry's program sponsored by AIF is nearing completion and undergoing NRC review. A three-year study of radionuclide correlation sponsored by EPRI was initiated in 1982.

Scaling is accomplished using data from waste samples which are analyzed for both the radionuclide to be scaled and the appropriate basic (readily measurable) isotope. The ratio of the concentration of the radionuclide to be scaled to that of the basic isotope is calculated for each data pair. A "scaling factor" for each of the radionuclides is then calculated. This is based upon the premise that an actual physical/chemical relationship exists between isotopes of interest.

Such an effort, for example, would require quarterly composite samples of possibly 4 to 6 waste streams and the reactor coolant. Unusual plant operational occurrences might justify additional grab samples. It would be expected that at least one and possibly three refueling cycles might be required for definitive and reasonable results. It might be expected that after appropriate scaling correlations are established, only limited semi-annua or annual confirmatory sampling will be required.

Since most waste generators lack extensive counting and analytical equipment on-site to identify concentrations of isotopes such as I-129, Sr-90 and various TRU isotopes in their waste streams, they must periodically contract with an independent radiological laboratory to perform analyses. There are several laboratories in the U.S. with the capability to conduct such analyses.

In addition to the radiological concerns, Part 45 has also formalized the necessity for chemical and physical assessment of radioactive waste. Wastes which are chemically reactive or explosive under ambient conditions, produce toxic gases, vapors, or fumes, or are pyrophoric, are prohibited. Wastes containing hazardous, biological, pathogenic, or infectious material must be treated prior to shallow land disposal. Other Federal and State regulations detail the monitoring and testing to be performed at land burial sites. The magnitude of these requirements is presently unknown but it is clear that the addition of radiological concerns to hazardous waste laboratory programs will further complicate a complex situation.

STP's radioactive waste processing systems generate various solid waste streams which are identified in Table I. These estimates reveal that a range of solidified waste generation between 25,100 ft^3/yr and 31,800 ft^3/yr is expected. This range is typical of operating PWRs. Actual waste generation could vary substantially from this range if certain operating conditions such as excessive or reduced steam generator maintenance are in effect.

To comply with the waste classification requirements of Texas Part 45, STP must have the following capabilities:

- Representative sampling of all major waste streams (e.g., those identified in Table I)
- Analysis of waste samples for:
  - Radionuclide identification and concentration determination
  - Hazardous and chemical analyses
- Waste processing and treatment, including:
  - Waste pretreatment.
  - Waste solidification and/or packaging in high integrity containers (HIC)

TABLE I

Solid Waste Expected from STP Operations Per Unit (Estimates)

	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

- Waste package monitoring and storage:
  - Waste classification
  - Waste monitoring
  - Waste characterization

- Waste recordkeeping:
  - Data collection, handling, and interpretation
  - Records and data recovery

Table II presents a compilation of individual costs. It should be noted that all capital equipment costs are included in Year 1 costs.

The estimates for HIC packages are based upon the use of HICs for disposal of dry active waste (trash). These costs assume that a HIC is provided at the burial site, i.e., concrete HIC for disposal, allowing the use of standard waste packaging, except for when box HICs are utilized. If other HICs were used, cost would be substantially higher. It should be noted that these costs apply only when a single trench is used to dispose of all Class A, B, and C wastes.

Personnel training is another area where Part 45 provisions will affect the waste generator's operations. Waste classification, segregation, packaging, labeling requirements, and quality assurance require a higher level of expertise in technicians, inspectors, supervisors, and managers. Formal training programs are essential to ensure waste classification is being performed in compliance with Part 45.

Waste Packaging and Shipping

Section 21.309 provides rules for packaging of radioactive waste in Classes A, B, and C. These requirements are based on handling the waste at the disposal site and on meeting the stability requirements discussed above. Additional packaging requirements are established for all classes of waste.

One requirement which may have some impact on waste generator operations is the new requirement that void spaces within the waste and between the waste and its package must be reduced as much as practicable. The purpose of this regulation is to maintain the physical dimensions of waste packages, thereby minimizing the possibility of trench cave-in or slumping. While 10CFR61 and Part 45 do not include specific criteria for meeting this requirement, the NRC suggests that filling voids with other wastes or inert material would be appropriate. Waste generators may have to initiate new procedures concerning the filling of waste packages for Classes B and C waste to eliminate void space. Such procedures will most likely result in increased waste handling and higher associated personnel radiation exposure.

Part 21.309 provides requirements for packaging Classes A, B, and C wastes. For the most part, these requirements can be met at STP with minimal impact. Depending upon the interpretation of waste void minimization requirements, the establishment of an arbitrary in-container waste volume efficiency could result in large expenditures if existing solidification systems must be modified or re-

TABLE II

Cost Assessment of Texas Regulation Part 45 on STP Per Unit

Item	Annual Cost Estimates - $K*				
	1	2	3	4	5
Waste Sampling(1)	40/320	2/15	2/15	2/15	2/15
Waste Scaling Factor Program(2)	85/200	85/175	85/175	25/30	25/30
Radiological Analysis(3)	50/50	50/50	50/50	50/50	50/50
Trash Waste Frisking(4)	-/110	-/60	-/60	-/60	-/60
HIC Packaging(5)	-/300	-/300	-/300	-/300	-/300
Waste Classification(6)	75/130	15/40	15/40	15/40	15/40
Waste Monitoring(7)	-/120	-/20	-/20	-/20	-/20
Yearly Total Range	250/ 1230	152/ 660	152/ 660	152/ 660	152/ 660

* __/__ represents estimated minimum/maximum cost estimates for Part 45 implementation.

Notes:

(1) Minimum figure includes additional specialty sampling stations on the concentrates storage tank and spent resin storage tank. Maximum figure includes additional specialty sampling stations on these tanks as well as the condensate polishing regeneration waste collection tank and waste solidification system.

(2) Minimum figure represents fewer number of samples taken, lower analytical costs per sample, and more reliance on installed plant analysis equipment. Maximum figure represents larger number of samples taken, outside laboratory analysis, and consulting services:

(3) Represents one full-time chemical technician performing radiological analysis.

(4) Minimum figure indicates no waste segregation volume reduction program performed. Maximum figure represents equipment/personnel costs required to segregate dry active waste.

(5) Estimate range based on burial site-specific management practices as opposed to Part 45 specific requirements. HIC packaging only required if burial site elects not to include dedicated Class A waste trench.

(6) Maximum figure represents purchase of additional hardware/software to perform necessary administrative tracking. Minimum figure assumes existing hardware is adequate.

(7) Maximum figure represents procurement of package monitor as a volume reduction technique in the eventuality that regulations are developed which establish exempt concentrations of radionuclides in various waste media.

placed. Void minimization for Classes B and C trenches are expected to result in small cost increases unless unusual means are taken to comply with this requirement by the disposal site operator.

Package Labeling and Other Factors

Section 21.310 requires that waste packages be identified as Class A, B, or C waste. Generators can meet this requirement by color-coding packages, by utilizing special labels consistent with already established Department of Transportation (DOT) requirements, or by various other methods that can be postulated. Since the identification label is for the benefit of the disposal site operator, specific implementation requirements are up to the site operator. This is expected to result in minimal cost impact on the waste package--less than $10.00/package.

Each package of waste must be clearly labeled as to its identity and whether it is Class A, B, or C. Each waste shipment must be accompanied by a manifest containing the name, address, and telephone number of the waste generator and shipper. The manifest must also include as completely as practical, the type of waste, the waste volume and mass, the waste radionuclide identities and concentrations, the total radioactivity, and the chemical form. Any solidification agent must be specified. Wastes containing more than 0.1% chelating agent by weight must be identified and the weight percent chelate estimated. The total quantity of H-3, C-14, Tc-99, and I-129 must be specified. Each manifest must include a certification by the waste shipper that the materials are properly classified, described, packaged, marked, and labeled and are in proper condition for transportation.

Texas Part 21.311 requires a definitive waste transfer and manifest system. Compliance with these requirements necessitates a definitive set of procedures for all parties, an effective Quality Assurance program, and probably a computer-based system for waste classification and handling/shipping tracking of waste packages. This Quality Assurance Program must include management audits. If not reasonably implemented, establishment of quality assurance requirements could result in significant costs.

Section 21.312 requires that each waste shipment to the Texas disposal facility be inspected by the (Texas) Agency prior to shipment, thus adding an additional burden to the facility user. These include not only the cost of the inspection, but also the cost of delay on equipment and personnel, with cost increases of 50 percent or more expected. Thus, cost increases of $50,000 to $100,000 might be experienced, even though an extensive QA program existed and all aspects of waste transportation were carefully monitored.

It is obvious that Part 45 will have both operational and administrative impacts at reactor sites. It also appears that burial costs will increase significantly for Class C compared to Class B compared to Class A wastes. Thus, there is likely to be a severe economic penalty for overclassifying wastes. In addition, since there will be a maximum permissible disposal site inventory for certain nuclides, overstatement of the concentrations or total quantities of these nuclides could result in premature burial site closing. Finally, many of the listed nuclides currently cannot be readily analyzed at the power plants. Thus, there will be significant costs for outside analyses required to establish and maintain correlations with more readily measured nuclides.

The implementation of the current Part 45 will have a significant effect on STP's operations. The new waste classification requirements have already resulted in large disposal cost increases and in cost increases associated with isotope concentration determination. Improved radioactive waste packaging and shipping training programs must be implemented to verify that radwaste is managed in a proper, cost-effective manner. The overall impact of two unit operations at STP will be approximately double that discussed in the previous sections since very little of the equipment can service both units. Any commonality is well within the uncertainty of the estimates.