ECONOMIC IMPACT OF 10CFR61
A UTILITY POINT OF VIEW

E. C. Tarnuzzer
Yankee Atomic Electric Company
1671 Worcester Road
Framingham, MA 01701

ABSTRACT

No one who is generating radioactive waste needs to be told what has happened to disposal costs over the past five years. The implementation of 10CFR61 has given disposal site operators another reason to increase site-related disposal costs. This, however, is only a part of our increased cost and not the part for discussion now.

The real impact to utilities of Part 61 comes in the reporting and documentation requirements of waste classification and waste form. Part 61 requires the reporting of the concentrations of certain isotopes. Some industries that utilize only a known number of isotopes can state with certainty those isotopes not present and usually know, within a reasonable range, the concentrations of others to be expected in their waste streams. Reactor operations, on the other hand, produces a broad spectrum of fission and activation products whose distribution and concentration may vary with time within a reactor system. The fact that nearly all of the isotopes listed in Part 61 might (or could) be present in reactor wastes means that measurements must be made for them down to the physical lower limits of detection. The problem is compounded when one must measure low concentrations of low energy beta and alpha emitters in the presence of higher concentrations of gamma emitters.

Part 61 mandates a waste classification system based upon isotopic concentrations. Wastes exceeding the limits for Class A have additional requirements on waste form that must be documented.

The paper will discuss actual cost associated with implementation of a Part 61 program, as well as annual costs for program maintenance. In addition, a range of costs will be discussed that should define the limits of an acceptable program.

No one who is generating and shipping low level radioactive waste needs to be told what has happened to the disposal costs for these wastes over the past five years. In addition to these increased costs associated with inflation, the political realities of the burial site states, and a lack of competition for the waste generators' dollar, can now be added the cost of implementing new NRC regulations regarding waste form and waste classification--popularly known as 10CFR61.

The total economic impact can be subdivided into two major components; one being the economics of classifying the wastes in accordance with 61.55, and the second, the economics of assuring that the waste meets the form requirements of 61.56, or other more severe requirements. These are really the only two sections of Part 61 that are directly applicable to waste generators. The specific reference for these requirements actually appears in 10CFR20.311 in the reporting requirements for waste manifests for disposal. In addition to generator and carrier identification information and certification statements, the manifest must include the following information:

- Physical description of waste
- Volume of waste
- Principal chemical form
- Solidification agent identity
- Weight % of chelating agent, if > 0.1%
- Total radioactivity
- Radionuclide identity and quantity
- The total quantity of four nuclides, three of which are difficult to measure and, in most cases are below the levels of detection by an analytical lab
- Waste classified A, B, or C in accordance with 61.55 and meets the waste characteristics of 61.56

It is the last three of the above requirements that cost all of the money.

Our old practice of analyzing a sample of a waste batch or representative waste stream for major gamma emitters with a GeLi detector and gamma spectrometer is simply no longer good enough. The fact that reactors might (or could) produce all of the isotopes of concern to disposal means that we must determine their concentrations and total quantities down to the lower limits of detection. The problem is compounded when one must measure alpha emitters and low energy betas in emitters. This requirement goes beyond the counting capability available at a power plant laboratory.

Wastes must also be placed into one of three classes, depending on the concentration or quantity of specified radionuclides, in order to be acceptable for disposal. Two of these classes, B & C, have additional waste form requirements that must be met in a documented manner in order that the wastes be acceptable for disposal.

Yankee was fortunate in that it has been involved in a cooperative effort with the NRC to determine the feasibility and costs associated with the implementation of the requirements of 10CFR61. Two of the Yankee plants, Maine Yankee, a PWR and Vermont Yankee, a BWR, were asked to participate in the program, leaving our third plant, at Rowe, alone to develop its own program. I would like to detail for you today what we have done at these three plants, what the approximate costs have been, what we have not yet done and what we expect these costs to be.

Reactor wastes consist of a broad spectrum of radioisotopes. Waste classification must be accomplished based upon those isotopes listed in both Table 1 and Table 2 of 61.55. Inferential techniques may be employed in classifying and quantifying wastes, provided a suitable, documented data base is constructed. The first step is identifying the streams and sources for the components that will eventually end up as waste. The reactor coolant system is the source that will eventually produce all the wastes. The waste streams will vary depending upon plant type--PWR or BWR, but should not exceed about three or four in number.

As mentioned earlier, we worked with the NRC and its contracted analytical laboratory in a program to catagorize and define the waste streams and determine the feasibility of compliance with 10CFR61. The sampling program was reduced to the following:

For A Pressurized Water Reactor

Primary coolant liquid and filtrate
Primary system clean-up resin
Waste disposal system evaporator bottoms
Cartridge filter sample
Smear samples to represent trash

For a Boiling Water Reactor

Reactor water liquid and filtrate
Reactor Cleanup resin
Condensate Demineralizer resins
Smear Samples to Represent Trash

These five or six samples represent "a set". It is recommended that an early data base be established. This should consist of at least two "sets" of samples followed by at least an annual set of samples. The price quotes we have received from analytical laboratories for complete analysis for Part 61 radionuclides are in the range of $2000 to $2500 per analysis, or $10,000 to $15,000 per "set". Each analysis provides the concentration of some 30 specific radionuclides. Typically, greater than 98% of the total sample activity is distributed among 4 or 5 radionuclides. We are committing substantial resources to further define a few percent of the total activity of the waste.

Once a few sets of samples have been analyzed, and the waste streams characterized, the development of correlation factors can commence. The traditional relationships looked at are: CO-58 & Co-60 for other activation products such as Ni-59, Ni-63 & Fe-55; Ce-144, if detectable, or Cs-137 for Pu & Cm radionuclides. The on time cost of developing and documenting a set of correlation factors has cost us about $5,000 per plant. An annual "update" or update when a new set of sample results become available, should not have a major cost impact.

To bring the entire program together, and to produce the required waste manifest form and DOT shipping papers, makes it almost a necessity that a computer program be available. As a minimum, this program should calculate the total waste container activity based upon the data available. Typically, one would be expected to have the results of a GeLi analysis of a waste batch, maybe a contact or 3 foot dose rate on a container, and container weight and volume. The computer stored correlation factors and constants are applied to the inputted data to calculate the necessary values for the container. The specific container information is then stored and is available to produce the necessary manifests and reports. Costs for these programs will range from tens of thousands of dollars to well over one hundred thousand dollars, depending upon the features requested and the hardware provided along with the software. We have chosen a program at the lower end of the price scale that will run on our existing shared VAX system and has a cost figure of approximately $15,000 per plant.

Changing burial site requirements as well as possible changes to DOT & NRC regulations may result in some changes being required to the software program. Our current estimate is that this cost should not exceed "a few thousand" dollars on an annual basis.

Waste stabilization criteria have a major economic impact on waste disposal costs. I cannot attribute the total cost of waste stabilization to the implementation of 10CFR61, but on the other hand, one cannot easily separate the part 61 requirements from specific burial site requirements. Part 61 has imposed certain stability requirements on waste in the Class B and C classifications. These requirements, as stated in 61.56(b)(1) are quite straight forward and simple:

> "Wastes must have structural stability. A structurally stable waste form will generally maintain its physical dimensions and its form, under the expected disposal conditions such as weight of overburden and compaction equipment, the presence of moisture and microbial activity and internal factors such as radiation effects and chemical changes. Structural stability can be provided by the waste form itself, processing the waste to a stable form, or placing the waste in a disposal container or structure that provides stability after disposal."

I strongly suspect, although I don't know for sure, that the Portland cement mixture of evaporator bottom, with a density of about 100 lbx/ft^3 that we have been producing for years, would meet these stability requirements. The whole purpose of which is to prevent trench "slumping collapse, or other failure...lead(ing) to water infiltration".

The NRC has provided us guidance as to what would be considered as acceptable in meeting the stability requirements in the Branch Technical Position Paper on Waste Form. This has been interpreted by some as law, and we are still attempting to obtain clarification on what is really required. This guidance goes far beyond the regulation and states:

> For solidified Class A wastes; a free standing monolith with no more than 0.5% free liquid
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> In addition, for Class B and C wastes, requirements include:
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> > Exposure to 10 8 rads gamma
> > Specific ASTM biodegradation test with no indication of cultural growth
> > Immersion in demineralized water with a minimum 90 day leak test
> > Cycle through 30 freeze thaw cycles from -40 C to 60 C
> > Compressive strength requirement of 50 psi

The acceptable alternative to meeting these requirements is a container that provides the stability--a high integrity container. Burial sites are allowed to be more restrictive than federal regulation, and in South Carolina and Washington, they have been. All liquids greater than 1 microcurie per ml must either be solidified to meet the stability requirements of the BTP, placed within an approved HIC, or some other approved process (either NRC or state).

At our Rowe plant, although the evaporator bottoms are currently below the 1 microcurie/ml concentration, we have estimated the cost of a test program to demonstrate compliance with the BTP requirements, not just the 10CFR61 regulation, to be in the range of $100,000. We are currently attempting to determine from the NRC exactly what are the requirements and the extent of an acceptable program. The costs of the ultimate program will be compared with the costs of a HIC option to determine feasibility.

Vermont Yankee has chosen the HIC route to meet the stability requirement for dewatered resins whose activity exceeds the 1 microcurie/ml limit. The program to design and gain state approval for the container with South Carolina has cost in the range of $240,000. In addition, each HIC has a cost differential of $2300 over a carbon steel cask liner.

Maine Yankee, using a mobile solidification system, is relying upon the system vendor to provide the necessary acceptable process control program to meet the stability requirements of the burial site and 10CFR61. The submittal has been made to the NRC, however, final acceptance has yet to be recieved. The ultimate cost of this submittal will be shared by those utilities using this system and is not determined at this time.

We are all paying much more money to dispose of our processed wastes in essentially the same manner as has been done for years because of 10CFR61 and increased requirements on the part of the states licensing the active burial sites. This total addition cost per plant will range from $150,000 to $200,000 per year, discounting any increases passed on by the burial site operators to implement and manage their part of the 10CFR61 implementation program. If these efforts will result in public acceptance of shallow land burial as a means of disposal and result in the licensing of regional facilities, it will all have been well worth the effort. I can only hope that this is the case, and that we have not been squandering the precious resources of our ratepayers.