THE ECONOMIC IMPACT OF 10CFR61

COMMONWEALTH EDISON OPERATIONAL PERSPECTIVE

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ABSTRACT

The economic impact of implementing 10 CFR Part 20.311 and the applicable sections of 10 CFR Part 61 has been analyzed. Two major influencing factors have been considered -- the interpretation applied to certain information provided by the operators of shallow-land disposal sites and the attitude with which the utility company approaches implementation of the rules. The analysis considers the following five general areas of power plant operations: (1) radiochemical analysis, (2) health physics, (3) radioactive waste processing, (4) packaged radioactive waste transportation, and (5) packaged radioactive waste disposal. The economic impact is provided for two different points of view -- depending on the results one wants to produce. A comment is also provided concerning the economic impact associated with the continuing implementation of the rules in future years.

INTRODUCTION

Over a period of time the term "10CFR61" has fallen into the realm of jargon. Within the nuclear power industry, references to this term are generally understood to include not only the appropriate sections of 10 CFR Part 61 itself but also 10 CFR Part 20.311. Such understanding is used throughout this work.

Other papers in this session will address the economic impact of 10CFR61 from the perspective of various enterprises and agencies. In this paper, I will present one view of the economic impact of 10CFR61 from the perspective of nuclear power plant operations.

Specifically, the perspective is one from within Commonwealth Edison Company (CECO). It is hoped that such a view will be of use to other utilities, enterprises, and agencies associated with the nuclear power industry as we all continue in our efforts of ongoing implementation of 10CFR61.

BACKGROUND

Commonwealth Edison Company has six nuclear power plants in various stages of operation and construction as indicated in Table I. All are located in northern

TABLE I.

CECO Nuclear Power Plants

Site	Symbol	In-service date
Dresden (GE BWR)	DNPS	1970/1971
Quad-Cities (GE BWR)	QUAD	1972/1972
Zion (WEST. PWR)	ZION	1973/1974
La Salle County (GE BWR)	LSCS	1982/1984
Byron (WEST. PWR)	BYRON	1985/1986
Braidwood (WEST. PWR)	BRAID	1986/1987

Illinois. Three plants are twin-unit General Electric boiling water reactor (BWR) sites; the others are twin-unit Westinghouse pressurized water reactor (PWR) sites. Thus, the perspective presented is one from within a large organization.

We have categorized our sources of low-level radioactive wastes as indicated in Table II. Not all sources exist at every site. The specific sites associated with each primary source of low-level radioactive waste are also indicated in Table II.

TABLE II.

Sources of Low-Level Radioactive Wastes at CECO Sites

Principal sources	Associated sites
DAW (dry radioactive wastes)	All
Spent resins	All
Filter sludges	DNPS, QUAD, LSCS
PWR filter cartridges	ZION, BYRON, BRAID
Concentrated liquids	DNPS, LSCS, BYRON, BRAID
Volume reduction system	BYRON, BRAID

Our plants which are equipped with functional solidification systems utilize either cement or vinyl ester/styrene as the stabilization medium. These systems use either metal drums or metal shipping cask liners as the container for mixing, transportation, and disposal of the stabilized wastes.

For a variety of reasons, we also utilize on-site solidification services provided by various vendors. We use mobile solidification services which utilize either cement or vinyl ester/styrene as the stabilization medium.

A summary of our currently-used low-level radioactive waste stabilization methods is provided in Table III.

TABLE III.

CECO Radwaste Stabilization Methods

Site	Plant equipment	Vendor service
DNPS	STOCK cement system	CHEM-NUCLEAR cement
QUAD	GE cement system DOW vinyl ester/styrene	None
ZION	None	HITTMAN cement
LSCS	STOCK cement system	None

IMPLEMENTATION OF 10CFR61

Within Commonwealth Edison Company we have developed and documented both broad corporate guidelines and specific implementation methodologies for each of five nuclear power plants. (Because the Braidwood facility is not scheduled for fuel load until 1985, we have not yet documented a specific implementing program for that site.)

For two separate reasons, we have developed and documented individualized implementation programs at the five affected nuclear plants in the Commonwealth Edison system. The first reason is the fact that the five plants are at different stages of operation and construction (see Table I). The second reason is the deliberate decision to encourage implementation by more than one of a number of acceptable approaches.

The economic impacts resulting from both corporate guidelines and site-specific implementation steps are described in this work.

The Commonwealth Edison Company program for implementing applicable requirements of the subject rules is summarized in the following paragraphs.

10 CFR Part 61.55 --- Waste Classification

Existing plant practices call for the sampling and analysis of primary coolant and wastes. Using the results of such analyses, we classify our wastes as either Class A, Class B, or Class C. In certain cases we augment our on-site analyses with results from commercial laboratories. In certain other cases we augment analytical results by using the methodologies described in the AIF/NESP report entitled "Methodologies for Classification of Low-Level Wastes form Nuclear Power Plants."

10 CFR Part 61.56 --- Waste Characteristics

Existing practices at our stations utilize either installed or vendor-supplied solidification systems (as indicated in Table III). Administrative controls exist at each station which ensure the production of satisfactory waste forms (i.e., fully solidified product with not greater than 0.5% liquid). In certain cases we might utilize high integrity containers (HIC) which have been approved by the state in which the disposal site is located. Administrative controls are used to ensure that such containers do not contain more than 1% liquid at the time of shipment.

10 CFR Part 61.57 --- Labeling

Personnel at each station ensure that each package of waste is labeled to identify whether it is Class A, Class B, or Class C.

10 CFR Part 20.311 --- Manifests

The disposal site operators have each developed a new Radioactive Shipment Record (RSR) which provides for the manifest tracking requirements. Personnel at each station ensure the proper use of the new RSR forms.

ECONOMIC IMPACT OF IMPLEMENTATION

One major factor which influences the results of an evaluation of the economic impact of implementing 10CFR61 is the interpretation applied to certain information provided by disposal site operators. Once made, such interpretation provides for a direct evaluation of the economic impact on the transportation and disposal of packaged radioactive wastes.

Although a seemingly straightforward evaluation, this portion of the economic impact is made uncertain by the reluctance of disposal site operators to provide specific information concerning fee escalations directly related to implementation of 10CFR61 at their facilities.

We have been told that specific fee escalation information is proprietary. Therefore, in this evaluation, I have made certain assumptions based on the original information provided to us by the burial site operators.

The second major factor which influences the economic impact of implementing 10CFR61 is the attitude with which the utility company approaches implementation.

If a particular utility were to conclude that their existing practices and equipment were not adequate to ensure implementation of 10CFR61, then that utility would be committed to the expenditures necessary for enhancement of their capabilities. Such expenditures could have a direct impact in the analytical, health physics, and processing areas.

If the particular utility were to conclude that their existing practices and equipment were adequate to ensure implementation of 10CFR61, the associated economic impact would be considerably less.

In our judgement, the practices and facilities of Commonwealth Edison Company are such that no new equipment is required to ensure complete implementation of 10CFR61. Our confidence is reflected in the implementation program summarized earlier.

We do, however, see a benefit in the acquisition of software to assist with the increased calculational burden imposed by implementation of 10CFR61. To utilize such software, we must install additional video and printing terminals. Such equipment will impose a cost burden. However, the productivity improvement will offset the cost in a period of months. More importantly, the resultant elimination of transcription errors is invaluable.

ANALYSIS OF ECONOMIC IMPACT

Implementation of 10CFR61 can have an economic affect upon each of five general areas of power plant operations: (1) radiochemical analysis, (2) health physics, (3) radioactive waste processing, (4) packaged radioactive waste transportation, and (5) packaged radioactive waste disposal. For some of these areas the effects are rather direct results of implementation and are therefore relatively easy to evaluate. For other areas the economic impact is indirect and difficult to evaluate precisely.

Radiochemical Analysis

The results of any analysis are dependent upon the adequacy of the sample which is analyzed. The improvement of sampling locations and techniques for radioactive waste streams in nuclear power plants has been the topic of discussions at other radioactive waste conferences. Other papers in this conference also address the sampling concern.

Within our company, we consider improvements to our sampling locations and methods on an ongoing basis. Nevertheless, our existing equipment and procedures provide for obtaining appropriate samples from our radioactive waste streams. Implementation of 10CFR61 has not imposed increased costs related to sampling.

We have been a voluntary participant in past studies concerning the measurement of trace radionuclides in low-level radioactive wastes from U.S. nuclear power reactors. The results of such studies have been published by the Electric Power Research Institute (EPRI).[1] A sufficient number of such samples has been analyzed to allow certain conclusions to be drawn. We have invoked one such conclusion in our generic guidelines related to waste classification.

The available data indicate that low-level radioactive wastes from our plants will exceed the Class A criteria of 10 CFR 61.55 because of the amount of either Co-60 or Cs-137 (depending on the waste type) prior to exceeding the Class A criteria for any other radionuclide listed in 10 CFR Part 61.55. Based on this conclusion, we classify our wastes using the results of on-site gamma-ray spectrometric analyses.

We determine the concentrations of radionuclides not readily measurable by on-site gamma-ray spectrometry (for which quantification is required by 10 CFR Part 61.55) by using either calculational methods, available analytical results, or a combination of calculational methods and analytical results.

Although we believe it redundant, we are submitting to commercial laboratories more of our samples to be analyzed for all radionuclides specified in 10 CFR Part 61.55. Our present plans are to repeat such analyses on an annual basis or whenever we determine that a significant change in the radionuclide composition of a particular waste stream has taken place.

Therefore, one could say that the waste classification requirements of 10 CFR Part 61.55 have imposed a cost burden. The costs related to such analyses performed by commercial laboratories are presented in Table IV.

TABLE IV.

Costs for Radionuclide Analyses

Site	Service requested	Cost
DNPS (BWR)	10 samples and 2 correlations	\$23,000
QUAD (BWR)	7 samples and 2 correlations	\$17,300
ZION (PWR)	25 samples and 2 correlations	\$51,500
LSCS (BWR)	6 samples and 1 correlations	\$ 9,600
CECO		\$101,400

The site-to-site differences in analytical costs are the result of two main factors: (1) the differences between PWR and BWR plants, and (2) the differences in approach taken by site personnel.

It has long been the practice of Commonwealth Edison Company to periodically submit waste samples to commercial laboratories for complete analysis, including analyses for transuranic radionuclides. Thus, it might not be accurate to ascribe the cost of what we consider to be prudent practice to the implementation of 10CFR61.

Health Physics

All available analytical results are combined to establish the relative radionuclide concentrations (percent composition) for each principal waste stream. Such data are then turned over to the health physics personnel for conversion into quantitative values as described in the following paragraphs.

The (nuclear radiation) dose rate at a prescribed distance from each waste package is determined by plant personnel using either fixed or hand-held instrumentation. Such measurements are stipulated by prudent health physics practices as well as dictated by Department of Transportation (DOT) requirements.

The curie content of each package is calculated using established dose-rate-to-curie (commonly called dose-to-curie) conversion factors. The quantity of individual gamma-ray-emitting radionuclides is determined from the curie content and the percent composition.

Radionuclides which are not expected to contribute to the measured dose rate are quantified either by individual determinations or by using established ratios between the concentration of a measured radionuclide and the concentration of the radionuclide of interest.

If appropriate analytical results are not available for tritium (H-3), that radionuclide is quantified from an estimate of the absorbed water content of the waste package and the measured H-3 concentration in a primary coolant sample.

Information determined by the methods outlined in the previous paragraphs is used to complete certain of the manifest tracking requirements of 10 CFR Part 20.311. Such requirements impose an increased cost burden related to the time required for the recording of results for the radionuclides for which data were not previously required.

Additionally, the computations required to determine the 10 CFR Part 61.55 waste class do impose an increase in the time required to prepare the paperwork for transportation and disposal.

Our experience has indicated an increase by a factor of two to three in the time necessary for completion of the required paperwork.

Assignment of a dollar value to increases in time required to do any particular job is both imprecise and highly subjective. Rather, I have chosen to evaluate the costs associated with the hardware and software which we have chosen to acquire for dedicated processing of the paperwork required by 10CFR61.

At present, we plan to install two.or three additional terminals at each site. Assuming we can obtain software to run on one of our existing processors (as promised by the vendors involved), our costs will be limited to the cost of terminals and licensing of the software. The costs associated with this portion of our operations are estimated at \$150,000.00 for all sites.

(For convenience, I have included all paperwork requirements of 10CFR61 under health physics activities. In fact, at one or more of our sites, much of the paperwork is completed by radwaste operating personnel. Such a simplification of reality on my part has no effect on the overall economic impact for each site or our company as a whole.)

Whether or not one assigns the costs of productivity improvement tools to the implementation of 10CFR61 is a matter of point of view. Within Commonwealth Edison Company, we have the increased utilization of high technology for productivity improvement as a corporate goal. Therefore, I do not believe it would be accurate for us to include the costs of the hardware and software mentioned above in a figure for the economic impact associated specifically with the implementation of 10CFR61.

Radioactive Waste Processing

Normal prudent plant practices call for the use of strong, tight containers for all of our packaged low-level radioactive wastes. Therefore, implementation of the minimum waste form requirements of 10 CFR Part 61.56 imposes no additional costs on our company

We do not expect to produce any DAW package which exceeds the Class A criteria of 10 CFR Part 61.55. We also do not intend to stablize DAW packages. If, for operational convenience, we process a particular DAW package using one of the solidification methods of Table III, we will characterize that package as unstable for the purposes of 10 CFR Part 61.56. Thus we do not expect to incur any increased costs related to the implementation of 10 CFR Part 61.56 waste form requirements for our processing of DAW.

It has been our long-standing practice to stabilize low-level wastes from all principal sources other than DAW. We accomplish stabilization using the methods of Table III.

For vendor-provided mobile solidification services, it is our intention to require (as a condition of our purchase order) the vendor to certify that the waste form fully implements the stability requirements of 10 CFR Part 61.56(b). We further intend to withhold payment until the stabilized product is accepted by the disposal-site operator.

One could argue that we will incur a cost penalty for such a position. However, I do not believe that our expectations are beyond what is implied as normal service by vendors when they bid for such work. Thus, we do not expect to incur increased costs for such services as a consequence of our 10CFR61 implementation program.

In our judgement, all of our presently installed solidification systems (when operated according to our existing site-specific procedures which ensure the consistent production of a fully solidified product with not more than 0.5% liquid) produce waste forms which fully implement the stability requirements of 10 CFR Part 61.56(b).

We have evaluated the need for providing data to support our position. As described in the following paragraphs, our approach is different for the two media which we employ in our installed solidification systems.

We presently have in service at one of our plants (see Table III) a solidification system which uses vinyl ester/styrene as the stabilizing medium. (We will use the same medium at our Byron and Braidwood sites in the future.) At our request, we obtained from the vendor, DOW CHEMICAL U.S.A., the following statement: "...the Dow system will meet all requirements of 10CFR61 for all your recipes."[2]

DOW CHEMICAL has also informed us that they have a waste form stability testing program in progress. They have committed to provide us with a copy of the testing results as soon as all the data are collated and printed. It is our understanding that the Nuclear Regulatory Commission has reviewed their testing program with respect to 10CFR61.

We utilize cement media at a number of our plants. Such media are used in conjunction with a variety of permanently installed cement solidification systems. The solidification systems vary with respect to both equipment supplier (see Table III) and overall system design.

Because cements are such widely used and well tested media, we believe that adequate information concerning the stability of various cements already exists in published literature. In the following paragraphs, I will itemize some of the sources of such information. (My intention is not to present a complete literature review, rather, to provide a sampling of the wealth of existing data.)

Lime mortars have been used for centuries; modern hydraulic cements date back to about 1825. Portland cements of widely varying composition are known to be stable products in all but certain extreme chemical environments.

Published literature contains results of studies for the following parameters: chemical effects, chelates, freeze-thaw cycles, impurities, moisture, oils leaching, permeability, organic materials, additives, bacteria, and microorganisms.[3] Such information is available from professional organizations, such as the Portland Cement Association and the American Concrete Institute.

Within the nuclear power industry, studies have also been conducted related to the stability of power reactor wastes stabilized in cement.[4] These studies have included the following parameters: crushing strengths, immersion in water for five years, thermal cycling between -20°C, and +25°C, and leach-rates.

We have obtained, and retained in our files, a reference list of hundreds of published works related to the subject. In our judgement, the funding of tests to determine the stability of a Portland cement would be an imprudent use of rate payers funds. As long as our administrative controls assure that our systems produce a fully solidified product with not greater than 0.5% liquid, we are confident that the existing data base applies.

To augment the bulk of existing data, Commonwealth Edison Company has voluntarily participated in a joint program between Brookhaven National Laboratory (BNL) and Savannah River Laboratory (SRL). For this program, we provided typical full-scale (55-gallon) drum size) waste forms. Both liquid concentrates and (bead) ion-exchange resins stabilized in both cement and vinyl ester/styrene media were provided.

Preliminary results of this U.S. Department of Energy contracted program have been published.[5] The report contains results of leach-rate measurements. Since publication of the preliminary report, we have provided additional full-scale samples for further testing.

As part of normal maintenance, we are planning to change the mixing blades in our cement solidifiation system at Quad-Cities station. This will provide the rare opportunity to collect core samples from simulated waste forms in a relatively low-dose-rate environment. Our present plans are to collect a number of core samples to verify the mixing capability of the new blades. We are also considering the need for submitting the samples for waste form stability testing.

The activities described in the three prior paragraphs are among those efforts which we consider to be prudent operational steps. Although we incur a cost burden for such activities, I do not believe it would be accurate to consider the related costs as being a consequence of our program for implementation of 10CFR61.

Various vendors have proposed waste form stability testing programs. The cost estimates for their programs are in excess of $200,000.00 for each solidification system. Because we employ three different solidification systems, we estimated a cost burden to our rate payers of approximately three quarters of one million dollars for such testing.

We are confident that our approach (utilization of existing data, participation in federally-funded research, and capitalizing on operational opportunities) constitutes a fully adequate and much more cost-effective program. Therefore, we have not incurred expenditures related to waste form testing.

One could argue that the costs of waste form testing programs will be passed on to the customers by solidification system vendors. Such increases in system costs, however, can be kept under control by using a competitive bidding process when purchasing such equipment.

Packaged Radioactive Waste Transportation

Implementation of 10CFR61 has in no way changed our methods of packaging low-level radioactive wastes. We therefore have not incurred any cost increases related to the transportation of such wastes.

Packaged Radioactive Waste Disposal

As mentioned earlier, this portion of the economic analysis has been made difficult by the reluctance of disposal site operators to provide accurate information concerning the cost increases directly related to the implementation of 10CFR61. To provide a value for the economic impact directly related to disposal, I have used the information originally provided to us by the disposal site operators.

In 1982, Commonwealth Edison Company paid disposal site operators over two million dollars in fees and taxes. For that year, our transportation charges were approximately the same as our disposal charges. In 1983, although not finalized as of this writing, we will pay disposal site operators approximately four million dollars. We estimate that the ratio of disposal costs to transportation costs for 1983 will be approximately 1.3.

Based upon information provided to us by the disposal site operators, we have calculated that 1.2 million dollars of our 1983 cost increases have been attributed to implementation of 10CFR61 at the disposal sites. For our 10CFR61 implementation program, such increases overwhelm any other economic impact.

SUMMARY OF ECONOMIC IMPACT

The overall economic impact resulting from our implementation program for 10CFR61 is presented for two different points of view in the following tables. In Table V, I have presented the economic impact if one chooses to assign the maximum costs to implementation of 10CFR61. (Because the option for waste form testing is still available to us, I have included in Table V the estimated costs associated with such programs.)

If, on the other hand, one desires to maximize costs related to prudent operational practices (which would have been conducted even without 10CFR61 then the results are as presented in Table VI. (Because we would not have analyzed for C-14, Tc-99, or I-129, I have included the costs of such analyses in Table IV.)

TABLE V.

Economic Impact of 10CFR61 Implementation
(Biased Towards Maximizing the Effects of 10CFR61)

Operational Area	Costs
Radiochemical analysis	$ 101,400
Health physics	$ 150,000
Radioactive waste processing	$ 750,000
Packaged radioactive waste transportation	$ 0
Packaged ratioactive waste disposal	$1,200,000
Total	$2,201,400

TABLE VI.

Economic Impact of 10CFR61 Implementation
(Biased Towards Maximizing the Effects of Prudent Operational Practices Independent of 10CFR61)

Operational Area	Costs
Radiochemical analysis	$ 6,000
Health physics	$ 0
Radioactive waste processing	$ 0
Packaged radioactive waste transportation	$ 0
Packaged radioactive waste disposal	$1,200 000
Total	$1,206.000

By providing the results for two points of view, I have provided an example of a well known fact -- one can manipulate data related to such impact studies to favor the desired result. Nevertheless, the strong influence of the attitude with which the utility has approached 10CFR61 implementation is apparent.

FUTURE ECONOMIC IMPACT

We anticipate considerable increases in disposal costs between now and 01JAN86. How much of the anticipated increases are attributable to ongoing implementation of 10CFR61 at the disposal sites is not clear.

A reasonable approach towards our 10CFR61 implementation program by the NRC will result in no major economic impact between now and 01JAN86. Projection beyond that time is rather meaningless because of the uncertainty in the availability of shallow-land disposal after that date. We are presently planning for on-site storage facilities for our low-level radioactive wastes. Such facilities are being designed for availability as of 01JAN86.

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