FINANCING A NEW LOW-LEVEL RADIOACTIVE WASTE DISPOSAL SITE

A. L. Dressen, P. J. Serie, R. S. McGarvey, and R. A. Lemmon
Chem-Nuclear Systems, Inc.

No new commercial low-level radioactive waste disposal site has been licensed in the past decade. During that time, inflation has wreaked havoc on the costs for the labor, equipment, and buildings that will be necessary to develop and operate new sites. The regulatory environment has become much more complex with enactment of the National Environmental Policy Act (NEPA) and the recent issuance by the Nuclear Regulatory Commission (NRC) of a draft set of comprehensive regulations for land disposal of low-level waste (10 CFR Part 61). Finally, the licensing process itself has become much lengthier as both the site developers and regulators respond to the public's desire to be more involved in decisions that may affect their lives.

All these factors point to a generally recognized conclusion: a new disposal facility will cost more to develop and operate than was the case at existing sites. In the past year or two, attempts have been made by several organizations to estimate those costs so that State and regional policy makers, disposal site developers, and waste generators can better evaluate the potential impacts of various size regions. The most recent of these was issued by the NRC as Appendix Q to the EIS for 10 CFR Part 61. Today, I will offer a presentation of the basic financial considerations faced by a private firm that seeks to develop and operate a new disposal site.

Timing

The technical and legal requirements for licensing a new site necessitate a lengthy and costly start-up procedure. The timeframes to develop a site are outlined in Fig. 1. To meet the spirit of NEPA, it will be necessary to conduct a site selection process that gradually narrows down from a region of interest to a specific site in three major steps:

1. Area screening to eliminate from consideration areas with characteristics that have a high potential of leading to long-term problems for site stability, predictability of performance, and radionuclide retention.
2. Evaluation of candidate areas for combinations of natural conditions that will enhance long-term site stability and radionuclide retention.

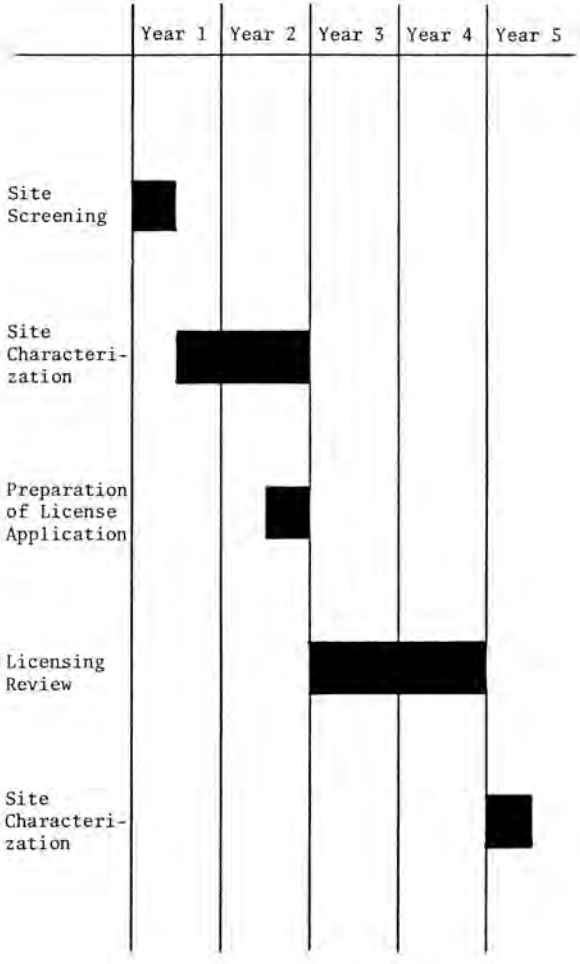

Fig. 1. NEW SITE DEVELOPMENT SCHEDULE

3. Selection of a specific site for in-depth characterization to evaluate its long-term capabilities.

After allowing time for informal review by the appropriate regulatory agency at each step, the time to complete site screening is estimated to be six months.

Once a preferred site is designated, a very detailed characterization of the site's geology, hydrology, topography, climate, ecology and socioeconomic conditions must be conducted. For those features that may have seasonal variations, NRC's 10 CFR Part 61 requires that data be collected for a full year. Preparation of an environmental report and review of the results will bring the total time for site characterization to about 1.5 years.

While the last stages of site characterization are being completed, work can begin to design the disposal area, an environmental monitoring system, site security, a laboratory, a decontamination facility, and support buildings. Operating procedures will be prepared and a plan for site stabilization and closure will be developed. These will be compiled with the environmental and safety analysis report into a license application and submitted to the NRC or an Agreement State licensing agency, as appropriate.

The NRC staff has estimated that a minimum of two years will be required to review the application, conduct public hearings, and issue a license. This step creates the major uncertainty in the schedule because the time needed for hearings and resolution of appeals is difficult to project.

Once a license has been issued, approximately six months will be needed to construct the facility, procure equipment, and train personnel. Thus, a firm that seeks to develop a new low-level waste site will face almost 5 years of effort and expenditures with no off-setting revenues.

Cost Elements

Site development is a complex process that demands close coordination with the regulators and that takes extensive financial resources. Many of the start-up costs summarized in Table I are relatively fixed (i.e., they vary little or not at all with the size of the market served by the site). The data in Table I are for a site that would receive about 1.2 million cubic feet of waste per year over a 30-year year lifetime and are escalated at 10% per year to 1985. The costs for site

Table I

Site Development Costs

Item	Estimated Cost
Site Screening & Characterization	$ 2,620,000
License Application & Fees	880,000
Legal Fees	1,000,000
Land	750,000
Buildings	2,400,000
Security	225,000
Equipment	4,100,000
Indirect/Admin.	550,000
	$12,525,000

selection, characterization and licensing can be expected to remain about the same for any size site. It may be noted that the estimate for site characterization is conservatively high. Chem-Nuclear operates under a philosophy that we will not take any short cuts in the site characterization that could delay or jeopardize our ability to successfully license the site and keep it open.

The amount of land required will vary with market size. The cost also varies dramatically from region to region and will rise further with each year that passes before the siting process is initiated. Any new site, regardless of size, will require buildings for administration, health physics and security, maintenance, and storage. A decontamination facility and an environmental laboratory are also needed for high-quality protection of public health and safety and the environment.

Equipment is the largest cost component and varies most with market size. The earth-moving activities at a disposal site require a number of pieces of expensive heavy equipment such as bulldozers, motor graders, pans, and backhoes. Based on our experience at Barnwell, Chem-Nuclear has found that it is less expensive to purchase this equipment than to lease it.

The costs incurred by a site operator for annual operations are a function of the amount of waste received at the site but include a fixed segment necessary to maintain a high standard of quality control. Table II lists typical operating costs for a site that receives 1.2 million cubic feet of waste per year; these are escalated at 10% per year to 1985. The estimate for labor is higher than that used in the EIS for 10 CFR Part 61

primarily because it includes a larger number of operating personnel in line with our corporate policy of keeping occupational exposures to a fraction of legal limits. An extensive environmental and personnel monitoring program will be necessary and will be expensive whether the analyses are performed at an onsite laboratory or are contracted out.

Table II also lists fees for site closure and long-term care that reflect the fact that today's charges at the existing sites are nearly $2 per cubic foot. Actual long-term care costs at new sites may well require a smaller fee but I question whether any host State will volunteer to accept the lower fees.

Table II

Annual Site Operating Costs

Item	Estimated Cost (1985 dollars)
Licensing & Fees	$ 85,000
Salaries/Benefits	3,300,000
Standard Operating Costs	1,600,000
Environmental and Personnel Monitoring	438,000
Contingencies	500,000
	$5,923,000
Closure/Long-Term Care Fees ($2.50/cubic foot)	$3,000,000

Financial Model

I have outlined the extensive costs faced by a firm that is considering development of a new site. Now, how does that firm decide whether to proceed with the investment? The one overriding question that any Board of Directors will ask is: What rate of return can be realized on the investment? The rate of return is the criterion of decision-making rather than profit margin because of the need to consider the time value of money. The time value of money means that a dollar now is worth more than the prospect of the same dollar at some future date. The use of the rate of return as a decision criterion recognizes the importance of the time value of money and the role of cash flows in capital decisions. Thus, the rate of return figure allows a firm to compare the proposed investment with other possible investments that may involve different risks.

The rate of return must reflect the risk of the investment. Five basic elements make up that risk:

1. The foregone opportunity for making other relatively risk-free forms of investment such as government securities. According to Appendix Q of the 10 CFR Part 61 EIS, the historical risk-free rate of return is 1-2%.
2. The general economic risk, which reflects perceptions of the health of the nation's economy such as inflation, recession and other pressures on interest rates. This would currently add another 11% or more.
3. The risks of the business itself, reflecting its specialty nature. For example, predictions of revenues for a low-level waste site depend on a healthy nuclear industry, a predictable regulatory environment, and stability in political and public acceptance of a site.
4. The financial risk involved in an investment which will require at least 5 years of expenditures before any revenues can be generated.
5. Investor/lendor perceptions of the likelihood of success. For example, does the company have a track record of successfully establishing a site and keeping it open? If not, site development will be reviewed as decidedly more risky and, thus, requiring a higher potential compensating return.

As the risk of an investment increases, the investor must be compensated by a higher rate of return. Once a rate of return or discount rate is determined, it is used in the textbook present value equation to perform a discounted cash flow analysis:

$$PV = \frac{FV}{(1+i)^n}$$

where PV = present value
FV = future value
i = rate of return or discount rate
n = number of time periods

The rate of return is the discount rate that sets the net present value equal to zero (i.e., the present values of cash outflows equal the present values of cash inflows). To determine the revenues that will set the net present value to zero, trial and error values for the key revenue variables, pricing and volumes, are used to generate a series of future cash flows. The cash flows are based on after-tax income adjusted for depreciation, capital expenditures, and contributions to working capital. Over the life of the site, cash flows will look similar to those shown in Fig. 2.

This approach recognizes the time value of money in contrast to the case where a flat "profit" value is added to the site

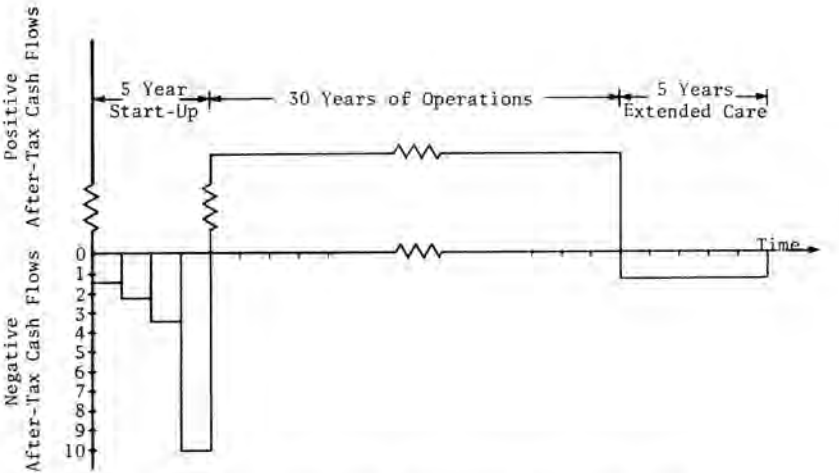

Fig. 2. NET CASH FLOWS FOR A LOW-LEVEL WASTE SITE

costs over the total site lifetime. For example, the EIS for 10 CFR Part 61 assumes a 20% profit margin. It is difficult to calculate the real rate of return for the NRC analysis because of the uncertainties over the detailed cost breakdowns and timing of cash flows. However, a rough calculation indicates the NRC approach may yield a real rate of return that is less than 10%.

Implications for Site Timing and Size

This model has been applied to several scenarios of large and small sites. The sensitivity of pricing to changes in the time-table for licensing a site and the size of the annual waste receipts has been analyzed. The carrying costs associated with each year of delay in opening a new site will obviously increase the ultimate disposal charge although the amount will depend on the stage in the process where the delay occurs. The additional impact of inflation and financing costs suggests that it is imperative to begin new site development soon and complete it expeditiously if prices are to be minimized.

A more startling relationship exists between the size of the market served by the site and the necessary disposal charges. The fact that a large portion of site development and operating costs are fixed means that larger markets allow these costs to be spread over a larger base. To demonstrate this, Fig. 3 shows the relationship between annual waste receipts and pricing. This figure demonstrates that regional compacts that encompass large markets are desirable from the standpoint of the waste generators who will use the site and the State policy makers as well as the site developer. All three are concerned with minimizing the prices ultimately borne by their citizens for electricity, medical diagnosis and therapy, research and consumer goods without sacrificing high quality operations that will protect public health and safety.

Summary

Disposal prices at new low-level waste sites will be higher than those at the existing sites due to inflation, increased capital costs, increased regulatory requirements and a lengthier licensing process. Four ways to reduce those prices are:

1. The States move quickly to negotiate and ratify regional compacts.
2. The search for new sites begins as soon as possible.
3. The States include as large a market as possible under the umbrella of a regional compact.

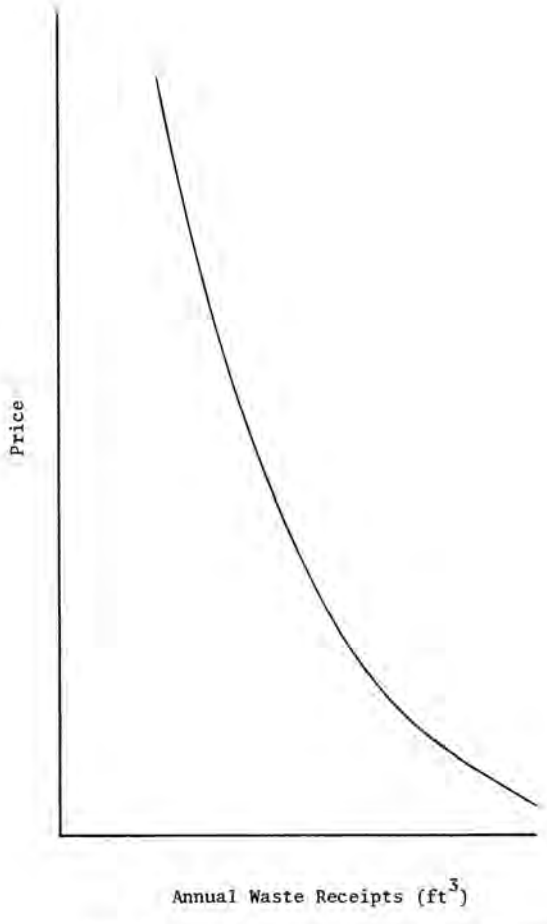

Fig. 3. PRICE EFFECTS AT DIFFERENT VOLUMES

4. The waste generators reduce the risks of site developers through public education on the need for a new site and safety precautions taken in low-level waste management.

While the costs for the disposal segment of low-level waste management can be expected to increase with the advent of new regional sites, total waste management costs should decrease. This is due to the substantial decrease in transportation distances and, thus, costs. For example, the Department of Energy reported in its response to the Low-Level Waste Policy Act[1] that the Northeast could realize a 76% decrease in waste transportation costs if a regional disposal site were available. This opportunity for savings is still another reason for beginning the search for new regional sites as soon as possible.

REFERENCES

1. "Low-Level Radioactive Waste Policy Act Report - Response to Public Law 96-573", U.S. Department of Energy National Low-Level Radioactive Waste Management Program, July 21, 1981.