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BY THE COMPTROLLER GENERAL
**Report To The Subcommittee
On Energy And Power, House Committee
On Interstate And Foreign Commerce
OF THE UNITED STATES**

**Existing Nuclear Sites Can Be Used
For New Powerplants And
Nuclear Waste Storage**

Locating future nuclear powerplants at existing sites offers important advantages which warrant consideration by the Nuclear Regulatory Commission.

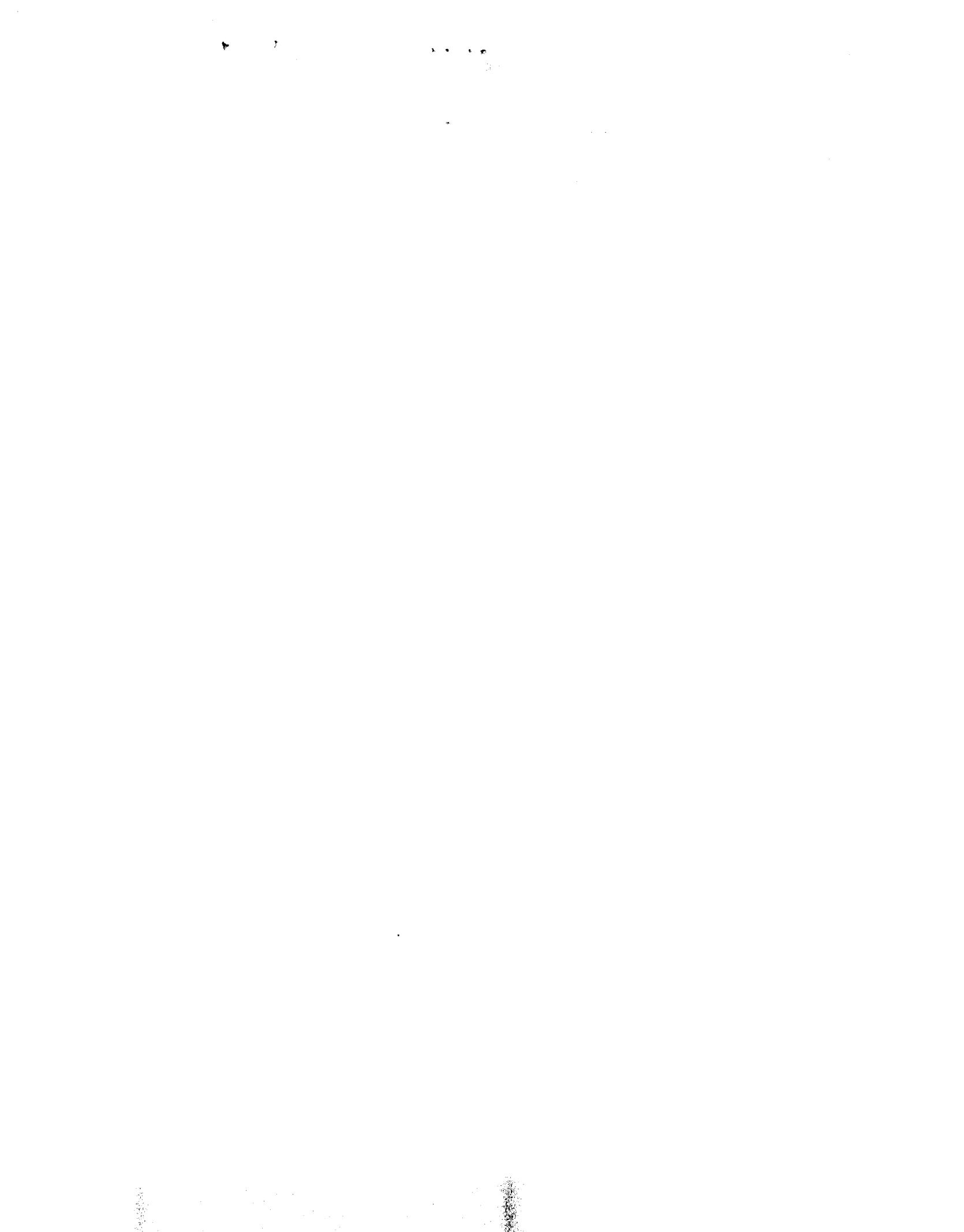
- The number of locations committed to long-term restricted use and periodic surveillance and maintenance could be limited.
- The burden of long-term care and final disposition of retired nuclear powerplants could be eased.
- Overall environmental impacts from the construction and operation of the powerplants could be reduced.
- Time and money in completing licensing proceedings could be saved.

GAO also found that low-level wastes can be stored at nuclear powerplant sites, but such storage only postpones the inevitable need for disposal. Finally, permanent waste disposal at powerplant sites should only be permitted when sites conform to the national low-level waste disposal plan being prepared by the Department of Energy.

GAO makes a number of recommendations to the Commission on these matters.



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COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON, D.C. 20548

B-198101

✓ The Honorable John D. Dingell
Chairman, Subcommittee on
Energy and Power
Committee on Interstate and
Foreign Commerce
House of Representatives

HISE 2303

Dear Mr. Chairman:

In response to your request of November 7, 1979, this report discusses whether existing nuclear powerplant sites can be used (1) as locations for new powerplants and (2) to dispose of wastes from nuclear powerplant operations.

In accordance with discussions with your office, we did not obtain written agency comments; however, we provided the Nuclear Regulatory Commission and the Department of Energy an opportunity to review a draft of this report. Commission and Department officials' comments are reflected in the report where appropriate. As arranged with your office, we will not release this report for 1 day unless you publicly announce its contents earlier.

Sincerely yours,

Comptroller General
of the United States

AGC 00067
AGC 00912

EPA



COMPTROLLER GENERAL'S REPORT TO
THE SUBCOMMITTEE ON ENERGY AND
POWER, COMMITTEE ON INTERSTATE
AND FOREIGN COMMERCE, HOUSE OF
REPRESENTATIVES

EXISTING NUCLEAR SITES
CAN BE USED FOR NEW
POWERPLANTS AND NUCLEAR
WASTE STORAGE

D I G E S T

Most of the Nation's 93 nuclear powerplant sites can support one or more additional powerplants. Locating future powerplants at these sites offers a number of advantages which include (1) limiting the number of locations committed to long-term restricted use and periodic surveillance and maintenance over what may be a 100-year or more period from construction through dismantlement and disposition; (2) easing the burden of long-term care and final disposition of retired nuclear powerplants; (3) reducing the overall environmental impacts from the construction and operation of nuclear powerplants; and (4) saving time and money in completing licensing proceedings. Concentrating more nuclear powerplants at fewer sites might also help to upgrade the quality of utilities' nuclear management and foster a higher level of operating competence at the nuclear powerplant sites. (See pages 4 to 12).

With respect to disposal of nuclear wastes at existing nuclear powerplant sites, GAO found that:

- While storage of spent fuel on-site for 3 to 10 years allows much of the radioactivity to decay, eventually the spent fuel must be transferred off-site to either a long-term storage or disposal facility or a reprocessing plant. (See pages 19 to 20).
- The potential does exist for storage of low-level wastes at all nuclear powerplant sites. Recent events severely limiting the availability of low-level waste burial grounds have heightened nuclear industry interest in both on-site storage and the use of low-level

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waste volume reduction technology. On-site storage, however, only postpones the inevitable task of disposing of these wastes. (See pages 20 to 22).

--Many existing nuclear powerplant sites may not be suitable for permanent low-level waste disposal by means of shallow or deeper burial in trenches. Moreover, permanent disposal at nuclear powerplant sites should only be permitted if the sites are capable of meeting regional needs as established in the national low-level waste disposal plan now being prepared by the Department of Energy. (See page 22.)

GAO believes that a properly formulated and implemented policy of locating new powerplants at existing sites need not constrain or stifle expansion of the Nation's nuclear power program, even if current safety and financial issues are resolved and a higher demand for new electrical power generating plants develops. New sites can be acquired as the need for new nuclear powerplants materializes. If relatively few new plants are proposed in the next two decades, either because the demand does not materialize or the Nation de-emphasizes nuclear power as a matter of policy, it seems wise to begin to limit the number of locations committed to the long-term presence of operating, mothballed, and/or entombed nuclear powerplants. Implementation of a policy favoring expansion of existing sites over the next two decades would permit a short-term period of physical entrenchment during a time when nuclear's long-term future may be decided, or at least be more clearly perceived.

On the other hand, the impacts of factors such as State and local government powerplant regulation on the practicability of a policy favoring use of existing sites for new nuclear powerplants have not been evaluated, nor have the possible effects of the Commission's ongoing efforts to develop new nuclear powerplant decommissioning and siting regulations.

RECOMMENDATIONS TO THE CHAIRMAN,
NUCLEAR REGULATORY COMMISSION

Based on GAO's evaluation of the potential for using existing nuclear powerplant sites as locations for new powerplants and for nuclear powerplant waste storage and/or disposal, GAO recommends that the Chairman, Nuclear Regulatory Commission:

- specify in the Commission's alternative site evaluation regulation that utilities must include available existing sites among their alternative sites for new nuclear powerplants;
- determine (1) if there are inherent advantages to limiting the number of nuclear powerplant sites by locating new powerplants at existing sites, and (2) the weight any such advantages should receive in environmental cost-benefit balancing;
- develop a policy on the use of existing sites for new nuclear powerplants which recognizes the environmental advantages and the potential constraints on practical implementation; and
- require utilities proposing to store low-level nuclear wastes at nuclear powerplant sites to provide specific plans for eventually disposing of these wastes, including assurances that funds will be available for disposal costs.

AGENCY COMMENTS

GAO obtained verbal comments from Commission and Department of Energy officials. Officials of both agencies agreed that the concept of locating new nuclear powerplants at existing sites is worthy of additional study. Commission officials, however, said it is not at all clear that the advantages warrant the Commission's adopting a policy favoring the use of existing sites. Additional Commission and Department officials' comments on using existing sites for new nuclear powerplants and nuclear waste storage and/or disposal appear beginning on pages 17 and 23, respectively.



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ABBREVIATIONS

DOE	Department of Energy
GAO	General Accounting Office
NRC	Nuclear Regulatory Commission



CHAPTER 1

INTRODUCTION

The first half of the 1970s saw a rapid increase in the number of nuclear powerplants planned, under construction, and operating. From January 1970 to December 1974, 41 nuclear powerplants were licensed to operate, construction permits were granted for 60 more powerplants, and by the end of 1974 a total of 233 powerplants were planned, under construction or operating. In 1974 the Atomic Energy Commission estimated that the number of nuclear powerplants would grow to between 800 and 1000 by the year 2000.

The year 1974, however, marked the beginning of a major decline in expectations for nuclear power. First, estimates of future electricity demand growth began to decrease, reducing both the need for new electrical generating capacity and the expected revenues needed to pay for new capacity. The financial aspects were further exacerbated by rising nuclear powerplant capital costs, and lengthening licensing and construction schedules. Finally, public concern grew over the safety of the nuclear option. This concern and the ensuing national debate over nuclear power have been intensified by the March 28, 1979, accident at the Three Mile Island nuclear powerplant.

As a result, utilities have cancelled large numbers of nuclear powerplants. Presently there are 67 powerplants licensed to operate by the Nuclear Regulatory Commission (NRC), 1/ 90 more with NRC construction permits, and 12 more under NRC construction permit review. This total of 169 nuclear powerplants is 64 less than the 233 powerplants operating, under construction, and planned just 6 years ago.

Despite the large number of cancellations, utilities and others continue to believe nuclear power is an essential source of electrical energy for the foreseeable future. Still others argue that the Nation can forego further expansion of nuclear power through conservation, development and use of renewable energy technologies, and additional use of coal. The present administration takes a position in between, believing the Nation must continue to rely on nuclear power to meet a portion of our energy needs, but viewing the nuclear option as a "last resort" to fill whatever energy gap remains

1/This number does not include the Three Mile Island plant, nor does it include two other plants with operating licenses that are indefinitely shut down.

above our ability to conserve energy, increase our use of coal, and use renewable energy technologies.

Thus, the range of expectations on the future of nuclear power is as broad as the public debate over the nuclear option is intense. Major nuclear issues include the safety of nuclear powerplant operations, the disposal of nuclear wastes, and the potential proliferation of nuclear weapons materials.

It was within this context that we undertook, at the November 7, 1979, request of the Chairman, Subcommittee on Energy and Power, House Committee on Interstate and Foreign Commerce, an evaluation of two nuclear powerplant siting-related issues: first, can existing nuclear powerplant sites be used as sites for future powerplants? And second, can nuclear powerplant wastes be disposed of at these sites?

SCOPE AND METHODOLOGY OF REVIEW

We conducted our evaluation at NRC offices in Bethesda, Maryland; at Department of Energy (DOE) offices in Washington, D.C., and Germantown, Maryland; at Environmental Protection Agency offices in Alexandria, Virginia; and at the Institute for Energy Analysis, Oak Ridge, Tennessee. We also talked with officials of the Tennessee Valley Authority and the Commonwealth Edison Company.

In performing our review we analyzed earlier Government and industry studies reporting on the technical feasibility and practicality of colocating multiple nuclear powerplants and related fuel cycle facilities. These studies, including one by NRC, provided the technical information base needed for evaluation purposes. As a test, we applied their findings to technical aspects associated with the concept of expanding existing nuclear powerplant sites.

Using this approach we examined recent Institute for Energy Analysis studies which advocate a nuclear powerplant siting policy based on the expansion of existing nuclear sites. In analyzing the Institute's work we relied on its report data as being adequate for policy evaluation purposes. Our reliance was predicated, in part, on utility/industry comments that the report's technical data supported the hypothesis that nuclear expansion can be accommodated at existing sites. In this sense our review methodology was somewhat limited. Accordingly, we acknowledge that a more detailed, site specific study may find a number of additional existing

sites which are not suitable for expansion. We believe, however, that our review included such tests as were necessary under the circumstances to support the conclusions and recommendations presented in this report.

CHAPTER 2

CAN EXISTING SITES BE USED AS LOCATIONS

FOR NEW NUCLEAR POWERPLANTS?

From a technical viewpoint, most of the 93 existing nuclear powerplant sites are capable of supporting one or more additional units. Furthermore, there are advantages to locating new powerplants at existing sites. But at the same time, utilities, NRC, and DOE do not appear highly interested in pursuing a policy of preferring expansion of existing sites over locating new plants at new sites. They clearly prefer to let expansion take its own course over a longer period of time. In part, this is because social and political constraints at the State and local levels can be as important to site selection as technical factors. It also stems from concern that a Federal policy favoring expansion of existing sites over developing new ones will make it more difficult for utilities to obtain licenses for new plants.

We nevertheless believe such a Federal policy is in the national interest, but we hasten to add that the many variables in site selection call for a flexible approach which permits weighing a full range of site alternatives in each nuclear powerplant licensing proceeding. Therefore, NRC should require utilities to include available existing sites among alternative sites evaluated for new nuclear powerplants. Furthermore, NRC should develop a policy which both recognizes the environmental advantages of locating new powerplants at existing sites and considers the impacts of non-technical factors on utilities' site selections.

MOST EXISTING NUCLEAR POWERPLANT SITES CAN BE EXPANDED

Clearly, most existing nuclear powerplant sites can support additional units. In fact, utilities often select sites with the potential for future expansion in mind, and in some cases, utilities have already built new nuclear powerplants adjacent to existing ones.

For the last 3 years, the Institute for Energy Analysis, under a DOE contract, has been examining the technical feasibility of this siting practice. In its report, 1/

1/A.M. Weinberg, et al., Institute for Energy Analysis, "Feasibility of a Nuclear Siting Policy Based on the Expansion of Existing Sites," Oak Ridge Associated Universities, Nov. 1978.

issued in November 1978, the Institute concluded that about 75 percent of the existing sites selected for the 180 nuclear powerplants then planned could support from one to six, and in many cases even more, additional powerplants. Recently, however, the Institute has reduced its list of expandable sites by eight, primarily due to population density concerns in the aftermath of the Three Mile Island accident.

The Institute's approach to studying the capability of expanding existing sites was threefold: (1) determine electricity demand growth rate estimates, as compiled by each of the Nation's nine regional electric reliability councils, (2) estimate the nuclear-related share of growth in electrical generation capacity necessary to meet this demand, and (3) perform a technical evaluation of each nuclear site to determine if there is sufficient expansion potential at existing sites within each reliability region to accommodate the estimated number of new nuclear plants.

The Institute used site specific documents such as NRC environmental impact statements to evaluate each existing nuclear powerplant site for its expansion potential. The study addressed these technical factors: water availability; land requirements; power transmission; and radiological impacts of normal operations, and accidents, on surrounding populations. The Institute concluded:

- Closed-cycle (evaporative) cooling systems, which are planned for the majority of the nuclear powerplants to be in operation by 1988, largely eliminate water availability as a technical constraint on expansion capability at existing sites.
- Additional land is either not needed or is available at almost all existing sites.
- There is no appreciable difficulty in providing adequate power transmission for increased generating capacity, and right-of-way and transmission line requirements for expanded existing sites would be substantially less than that which would be required if new sites are developed.
- Expansion of existing sites would not be limited by current regulations governing radiological releases from operation or accident conditions.

The Institute received a wide range of both favorable and unfavorable comments from utilities on a draft of its report. Some utilities agreed with a policy favoring

expansion of existing sites, but others did not. The following capsulizes many of the comments:

- Further consideration of a policy favoring expansion of existing sites should focus on environmental, social, and political concerns. These will be more dominant than technical factors.
- Future nuclear policy should encourage expansion of existing sites, but should not confine new plants to them.
- Future powerplants should be located at sites selected on the basis of overall costs and environmental trade-offs.
- The technical data in the report support the thesis that existing sites are adequate for siting new plants in the coming decade.
- Adoption of a policy favoring existing sites for new powerplants is premature. There is no need to legislate changes which will come naturally.

An earlier study by DOE's Oak Ridge National Laboratory also concluded that the majority of existing or planned sites --67 out of 110 sites considered--could support at least one nuclear powerplant in addition to the number of plants planned for the sites at that time. Sites were evaluated on the basis of water availability, waste heat dissipation systems, population densities, land area requirements, seismic and geological considerations, meteorology, and environmental factors.

ARE THERE ADVANTAGES TO USING
EXISTING SITES AS LOCATIONS FOR
NEW NUCLEAR POWERPLANTS?

A decision to build and operate a nuclear powerplant is a commitment of the selected site, or a portion of it, to restricted use for over 100 years. Thus, building new nuclear powerplants at existing nuclear sites would help limit the number of locations that would have to be committed to long-term restricted use. In addition, using existing sites could ease the burden of caring for and finally disposing of retired nuclear powerplants, and could reduce the overall environmental impacts from the construction and operation of nuclear powerplants. Using existing sites for new powerplants could also make it easier to license the new plants.

Still another perceived advantage of using existing sites is that nuclear power operations would be confined to fewer utilities with higher levels of operating expertise.

Confining the locations committed to nuclear powerplants

A nuclear powerplant has a useful life of about 40 years. Unlike many other kinds of industrial facilities, however, it may not simply be dismantled following its removal from service because remaining radioactivity would be a hazard to personnel doing the dismantling. A 1976 Atomic Industrial Forum study concluded that because such hazards would be serious, nuclear powerplants should not be completely dismantled for 65 to 110 years after the end of their useful lives.^{1/} A decision to build a nuclear powerplant, therefore, may represent a commitment of a portion of the selected site to restricted nuclear use for 65 to 110 years beyond the plant's 40-year productive life.

If new nuclear powerplants could be built at existing sites, however, the number of locations committed to a century or more of restricted use would be kept to a minimum. This in turn would limit the number of locations where radiological safety-related events could occur during the operation, decommissioning, retirement, and dismantlement of a plant. It would also limit the number of places to and from which fresh and spent nuclear fuel, radioactive wastes, and dismantled radioactive powerplant materials must be transported.

Easing the burden of decommissioning nuclear powerplants

Cleaning up and disposing of a retired nuclear powerplant --a process called decommissioning--presents special challenges because the reactor portion of the plant is enormous in size and contains large inventories of induced radioactivity.^{2/} The major source of this radioactivity--cobalt-60--decays in approximately 100 years. Other sources of induced radioactivity

^{1/}The Forum is an international association of utilities, manufacturers, labor unions, and other organizations involved in the peaceful uses of nuclear energy.

^{2/}Induced radioactivity results from the nuclear fission process. Radiation is imbedded in equipment and materials in contact with the fission process, and therefore must be left to decay naturally.

present much lower safety hazards, but nevertheless require thousands of years to decay and are hazardous enough to require isolation from the public. This means that at some time after the end of its useful life, a nuclear powerplant's contaminated portions should be dismantled and removed to a nuclear waste disposal site if the powerplant site is to be returned to unrestricted use.

How best to decommission and eventually dispose of retired nuclear powerplants is one of the unresolved issues in the nuclear fuel cycle. In June 1977, we reported that NRC had done relatively little to provide regulatory guidance for decommissioning commercial nuclear facilities.^{1/} In March 1978, NRC began developing more explicit policies, regulations, and guidance for decommissioning nuclear powerplants and other nuclear fuel cycle facilities; but it does not expect to complete this effort for a few more years.

NRC presently permits utilities to mothball,^{2/} entomb,^{3/} or dismantle retired nuclear powerplants. However, it does not require them to develop plans or make financial provisions for decommissioning and eventual dismantlement until they are ready to retire their powerplants.

To date, only one licensed nuclear powerplant in the Nation has been dismantled. This powerplant, however, was a small Atomic Energy Commission demonstration-type reactor which operated for only about 4-1/2 years. Seven other licensed nuclear powerplants--all small compared to today's plants--have been permanently shut down, but none of these has been dismantled. Four have been mothballed and the other three have been entombed. For a mothballed facility, NRC requires a security system, annual radiological surveys, and periodic maintenance. NRC does not require a security system for an entombed facility, but does require annual surveillance for radioactive leaks and periodic maintenance to ensure the integrity of the entombed structure.

^{1/}"Cleaning Up The Remains Of Nuclear Facilities--A Multi-million Dollar Problem," EMD-77-46, June 16, 1977.

^{2/}Mothballing means removing the nuclear fuel and radioactive wastes and then placing the facility in protective storage.

^{3/}Entombment means sealing the reactor with concrete or steel after all liquid waste, fuel, and surface contamination has been removed and sent to fuel storage facilities and burial grounds.

In view of the need to mothball or entomb a retired nuclear powerplant for 100 years or more, and the present regulatory uncertainty in the area of decommissioning and final powerplant disposition, placing future powerplants at existing nuclear sites would help the utilities to safely perform the necessary surveillance of retired facilities. The cobalt-60 induced radioactivity would have time to decay, allowing utilities to reduce the occupational hazards associated with dismantlement. The contaminated retired facilities would be located within the perimeter of the controlled nuclear sites, and the site operating staffs could routinely perform the necessary maintenance, radioactive monitoring, environmental monitoring, and inspections during the long protective storage periods. Also, continued use of sites for nuclear operations could reduce or eliminate public and political pressures on utilities to dismantle retired nuclear powerplants at a time when the levels of induced radioactivity in the plants are still high.

Reducing nuclear powerplant environmental impacts

Locating new nuclear powerplants at existing sites could reduce the overall environmental impacts from nuclear powerplant construction and operation, even though the impact on the existing sites would be incrementally higher. In general, the major environmental impacts from the construction and routine operation of a nuclear powerplant are:

- The influx of construction personnel, and their families, to predominantly rural areas for the 6-or-more-year construction period.
- Removal of land within the powerplant exclusion zone from availability for other uses for the plant's operating lifetime.
- Construction of transmission corridors and lines connecting the powerplant to the electrical power grid.
- The dissipation of the plant's waste heat into the atmosphere or the source of cooling water, such as a river or lake.
- The visual impact of the powerplant and related structures, such as large cooling towers.
- Discharge of small quantities of radioactive materials into the air and water during routine plant operations.

For most of the above types of impacts, locating a new powerplant at an existing site rather than a new site would result in fewer or essentially the same environmental impacts. For example, locating an additional nuclear powerplant at an existing site might necessitate enlarging the site boundaries, but the additional land required would be much less than the land required at a new site. The same logic would apply to comparing the overall visual impact of two nuclear powerplants at separate sites or at a single site.

The Institute for Energy Analysis found that by widening existing transmission line corridors, increasing transmission line voltages, and/or running additional lines on existing corridors, the additional land required for transmission corridors for new powerplants at existing sites would be only 20 percent of that needed if only new sites are selected. While this estimate is not based on detailed transmission studies, and has been disputed by some utilities for their service areas, it nevertheless is an indication that transmission corridor land requirements--one of the major environmental impacts from large electrical generating plants--can be mitigated by locating new plants at existing sites.

Using existing sites for new nuclear powerplants could benefit utilities in the licensing process

Use of their existing nuclear powerplant sites as locations for new nuclear powerplants could result in time and cost savings to utilities in completing NRC and State licensing and certification proceedings. Some of these savings may be small because many important licensing matters require detailed review. For example, changes in NRC regulations and/or site-related factors such as surrounding populations would have to be taken into account. On the other hand, many technical factors considered in detail in earlier licensing proceedings would not have to be reviewed again. These include safety-related factors such as the site geology, seismology, and meteorology, and environment-related factors such as impacts on the local economy and terrestrial and aquatic ecology.

In some cases, public acceptance could also be easier to obtain at an existing site with a satisfactory record of safe operations. This is by no means certain, however, as some utilities have experienced stronger public resistance to adding another powerplant at an existing site than they experienced in licensing the initial powerplant.

Confining nuclear power to fewer
utilities with higher quality
operations

The Institute for Energy Analysis was motivated to do its research by the longstanding opinion of its Director, Dr. Alvin Weinberg, 1/ that nuclear powerplants and other major nuclear fuel cycle facilities can be operated most safely if they are concentrated in a limited number of locations with a long-term commitment to nuclear operations. This would both limit the number of organizations operating nuclear powerplants and other nuclear facilities and, in Dr. Weinberg's opinion, result in safer site operations because larger sites could support larger and more capable staffs which could profit more from first-hand operating experiences. Safer operations, in fact, was the major reason why Dr. Weinberg conceived and advocated, about 10 years ago, the development of nuclear energy centers as the best way to accommodate what was then expected to be a much larger nuclear power system. Section 207 of the Energy Reorganization Act of 1974 (42 U.S.C. 5847) required NRC to evaluate the concept of nuclear energy centers. In NRC's January 1976 report, 2/ it concluded that in the event of an accident, a nuclear center would have three advantages over an equivalent number of powerplants located at dispersed sites: (1) more trained emergency team members, (2) additional health physics personnel, and (3) potential for a stronger management team and for a more comprehensive and effective emergency plan. NRC's overall conclusion on the feasibility and practicality of nuclear energy centers, however, was that while the concept is feasible, there is no great advantage or compelling need for such centers.

The ability of utilities to safely construct and operate nuclear powerplants has become an issue following the Three Mile Island accident. Both the President's Commission on the Accident at Three Mile Island and the NRC Commissioners' Special Inquiry Group concluded that the

1/Dr. Weinberg was associated with the Oak Ridge National Laboratory from 1945 through 1973, serving as its Director from 1955 to 1973. He holds or shares patents for the original Hanford plutonium-producing reactor, the original homogenous reactor, the first light-water reactor, the first heavy-water reactor, and the original liquid cooled, graphite moderated reactor.

2/U.S. Nuclear Regulatory Commission, "Nuclear Energy Center Site Survey-1975," NUREG-0001, January 1976.

nuclear industry as a whole must make a stronger commitment to effective management and safe nuclear powerplant operations, and that improvements in utility management are needed at all levels from plant operators to the highest officials.

Institutional aspects of limiting
entry to the nuclear power business

The 169 nuclear powerplants operating, under construction, or firmly planned are or will be operated by 64 utilities at 93 sites. These powerplants are owned, however, by a much larger number of utilities. Sixty-five of the plants are jointly owned, each typically by from four to six utilities. Seventeen plants are each owned by three or more utilities located in two or more States.

These statistics suggest that even a rigid policy of restricting nuclear power operations to those utilities now operating, constructing, or seeking NRC construction permits need not deny the benefits of nuclear power to other utilities. What would be required are even more cooperative ventures among utilities to finance new powerplants jointly and share in the electricity they would generate.

ARE THERE DISADVANTAGES TO
LOCATING NEW NUCLEAR POWERPLANTS
AT EXISTING SITES?

During the course of our evaluation, we were told of several major disadvantages to and constraints on locating new nuclear powerplants at existing sites. The perceived disadvantages were: social inequity in requiring populations around existing sites to bear all of the risks associated with nuclear powerplant operations, national security risks from concentrating electrical generating capacity, and potential conflict with more remote siting for nuclear powerplants. The perceived constraints on expanding existing sites included State and local government regulation, Federal anti-trust laws, and electrical power system reliability and stability.

NRC officials pointed out that using existing sites for new nuclear powerplants would make the people living around these sites bear an inequitable share of the risks of nuclear power. To these people, this may in fact be a major disadvantage. On the other hand, in licensing nuclear powerplants NRC has consistently decided that the risks of constructing and operating from one to four plants at one site is acceptably small. Furthermore, distribution of risk among the population in a utility's service area is not an NRC licensing criterion.

NRC concluded from its evaluation of the nuclear energy center concept that (1) the probability of successful sabotage is very low; (2) in a limited nuclear attack more damage could be inflicted on energy centers than at a larger number of dispersed sites, but loss in electrical power production could be accommodated without long-term disruption; and (3) in the event of full-scale nuclear war, it would make little difference whether nuclear powerplants were located in energy centers or at a larger number of dispersed sites.

Before the Three Mile Island accident occurred, NRC had been trying to develop new nuclear powerplant siting criteria; and since the accident, there has been much talk of requiring new sites to be more remote from populations. Thus, new siting regulations with restrictive population density criteria could foreclose expansion of some existing sites. In fact, of the 25 sites the Institute found unsuitable for further expansion, 12 were so listed at least in part because of excessively high population densities. On the other hand, the Director of an NRC task force on siting policy told us that he would not expect a new NRC siting regulation to rule our further expansion of most existing nuclear powerplant sites.

State and local governments can and often do regulate electrical power generating facilities in the areas of the sale and transmission of electricity, environmental protection, siting, and zoning. Any and all of these areas of regulation can affect a utility's ability to build and operate a nuclear powerplant at either an existing nuclear site or a new site. These potential constraints on expansion of existing sites can only be addressed on a case-by-case basis.

Before NRC can permit a utility to construct a nuclear powerplant, NRC must find that construction and operation of the plant will not result in violation of Federal antitrust laws. Thus, to the extent that the location of a nuclear powerplant may affect the sale and transmission of electricity from the plant, NRC siting policies must not inhibit utilities' compliance with antitrust laws.

Electrical power system stability and reliability are major factors influencing utilities' selection of sites for nuclear powerplants, and would therefore be an important case-by-case consideration in a comparative evaluation of an existing site and one or more proposed new sites for a new nuclear powerplant. In this regard, NRC, in its nuclear energy center study, concluded that there need be no significant difference in plant or transmission reliability between large or small energy centers and dispersed nuclear powerplant sites. At reasonable cost, NRC concluded,

transmission systems and regional interties could accommodate outages at a nuclear energy center. Finally, NRC found that the likelihood of a complete energy center outage should be less than the one day in 10 years criterion commonly used by utilities.

WHAT IS THE BEST WAY TO ENCOURAGE
EXPANSION OF EXISTING SITES?

Locating new nuclear powerplants at existing sites has advantages throughout the nuclear powerplant life-cycle --construction and operation, decommissioning, and dismantlement and final disposition. But the only real constituency for this policy is the general public. While some utilities recognize the advantages to them, and acknowledge that their long-range plans call for site expansion in any event, they do not want to be constrained in siting new generating plants by a Federal policy arbitrarily requiring the use of expandable existing sites for new powerplants. They argue that for any given powerplant project there are already a myriad of technical, environmental, social, and political issues which they must address and resolve along a tortuous path toward gaining public and legal acceptance of a new powerplant and its site--regardless of whether a new or existing site is selected. Some utilities believe a policy strongly favoring use of existing sites for new plants will stifle the industry's ability to license new plants. In part, they fear that by being arbitrarily required to use an existing site, they will then encounter heavy antinuclear intervention in licensing proceedings against the additional use of existing sites.

NRC officials we spoke to were indifferent to the idea of favoring expansion of existing sites as a matter of Government policy, primarily because they share the utilities' long range view that many sites will eventually be expanded anyway.

Although the DOE Office of Nuclear Energy Analysis, under the Assistant Secretary for Policy and Evaluation, has been funding the Institute for Energy Analysis' existing site studies, the Office has not taken a position on whether or not a Federal policy favoring expansion at existing sites is desirable. The DOE Office of Plans and Evaluation, under the Assistant Secretary for Nuclear Energy, favors the concept of expanding existing sites. This Office said it believes the concept makes sense from both an economic and safety point of view. The Office, however, deferred taking a position on an NRC policy favoring expansion of existing sites until such time as NRC could develop the specific details of such a policy.

The best way to encourage utilities to locate future powerplants at existing sites is for NRC to recognize explicitly the advantages of expanding existing sites in the environmental reviews it is required to make under the National Environmental Policy Act of 1969 (42 U.S.C. 4321). A more difficult issue is determining how the policy should be written, and how vigorously pursued by NRC. The nuclear industry is concerned that such a policy will mean arbitrary and unreasonable restrictions which in turn will stifle necessary nuclear power expansion. This is a reasonable concern, and any such policy must therefore be sufficiently flexible to mitigate it. On the other hand, a policy favoring expansion of existing sites must be sufficiently rigid to have practical results.

The logical vehicle for balancing the competing needs for rigidity and flexibility is the alternative site comparisons included in NRC's environmental reviews. In reviewing the environmental impacts of proposed nuclear powerplants, NRC evaluates alternatives to applicants' proposed powerplant sites to determine if there are "obviously superior" sites available. In this regard, NRC intends to publish in the Federal Register in April 1980, a proposed regulation setting out procedures utilities, NRC, and the interested public must use to identify and evaluate alternative nuclear powerplant sites. The proposed regulation is intended to permit the early resolution of the alternative site portion of NRC's environmental review. It does not, however, require utilities to include existing nuclear powerplant sites available to them in their alternative site analyses.

CONCLUSIONS

From a technical point of view, most existing nuclear powerplant sites are capable of accommodating one or more nuclear powerplants. Furthermore, there are advantages in using these sites for future plants in lieu of using new sites. The major advantage in the long term is in limiting the number of locations committed to 100 years or more of restricted use and periodic surveillance and maintenance. How important this advantage and the related advantage of easing the decommissioning burden really are depends to a large extent on what NRC requires in the new decommissioning regulations it is preparing, and the specific decommissioning strategies utilities eventually choose. In the short term, locating new nuclear powerplants at existing sites could also generally minimize the environmental impacts from construction and operation of new plants, and could offer licensing cost and schedule savings.

Concentrating more nuclear powerplants at fewer sites might help to upgrade the quality of utilities' nuclear management and foster a higher level of operating competence at the nuclear powerplant sites. Utility management and operating group competency, however, is an important subject which should be dealt with on its own instead of indirectly as a part of a review of siting policy.

Any discussion of a major change in nuclear powerplant siting policy may seem irrelevant, or at best academic, given the number of nuclear and national energy-related issues which have a bearing on the use of nuclear power. Many argue that the Nation need not increase its use of nuclear power, while others foresee that a substantial number of new plants will be needed in the coming decades to ensure the economic prosperity to which the Nation is accustomed.

In our judgment, the uncertainties over the future of nuclear power--safety, waste disposal, costs and financing, use of alternative energy sources--are great enough, and the advantages of using existing sites for nuclear construction in the next two decades important enough, that such a policy should be pursued. A properly formulated and implemented policy need not constrain or stifle expansion of the Nation's nuclear power program, even if current safety and financial issues are resolved and a higher demand for new electrical power generating plants develops. New sites can be acquired as the need for new nuclear powerplants materializes. Conversely, if relatively few new plants are proposed in the next two decades because the demand does not materialize or the Nation de-emphasizes nuclear power as a matter of policy, it seems wise to begin to limit the number of locations committed to the long-term presence of operating, mothballed, and/or entombed nuclear powerplants. Implementation of a policy favoring expansion of existing sites over the next two decades would permit a short-term period of physical entrenchment while nuclear power's long-term future is being decided, or at least being more clearly perceived.

On the other hand, there are many factors which affect nuclear powerplant siting--for example, State and local government regulation--which have not been evaluated in relation to their potential impacts on the practicability of a policy favoring use of existing sites for new nuclear powerplants.

Considering the advantages and disadvantages, the potential constraints, and the uncertainties surrounding the practicability of requiring utilities to use available

existing sites for new nuclear powerplants, NRC should in the short term specify in its final alternative site evaluation regulation that utilities must include available existing sites among their alternative sites for new nuclear powerplants. In conjunction with completing its new decommissioning regulations, NRC should also determine (1) if there are inherent advantages to limiting the number of nuclear powerplant sites and, if so, (2) the weight these advantages should be given in balancing the costs and benefits of locating new nuclear powerplants at existing versus new sites. In conjunction with this determination, NRC should develop a policy on the expansion of existing sites which appropriately recognizes environmental advantages and considers other factors such as State and local government regulation.

RECOMMENDATIONS TO THE CHAIRMAN,
NUCLEAR REGULATORY COMMISSION

The Chairman, Nuclear Regulatory Commission should specify in NRC's alternative site evaluation regulation that utilities must include available existing sites among their alternative sites for new nuclear powerplants.

The Chairman, Nuclear Regulatory Commission should also:

- determine if there are inherent advantages to limiting the number of nuclear powerplant sites by locating new powerplants at existing sites,
- determine the weight any such advantages should receive in environmental cost/benefit balancing, and in conjunction,
- develop a policy on the use of existing sites for new nuclear powerplants which recognizes environmental advantages and potential constraints on practical implementation.

AGENCY COMMENTS

We obtained verbal comments on a draft of this report from NRC and DOE officials. NRC officials had three major comments. First, they said it is not at all clear that there are sufficient advantages to locating new nuclear powerplants at existing sites to warrant NRC adopting a policy favoring the use of existing sites. Second, they said our report did not adequately address the potential disadvantages of locating new nuclear powerplants at existing sites. Third, these officials agreed that the concept is worthy of further exploration.

We disagree with the NRC officials' first comment. In our opinion, the advantages discussed in our report are important, and should be recognized in nuclear regulation. We did, however, modify our suggestion to indicate specifically how this could be accomplished. In response to their second comment, we have provided more discussion and emphasis on the potential disadvantages and constraints on the further use of existing sites. With respect to all of these comments, we modified our draft report to recognize (1) the uncertainties of NRC's eventual decommissioning and revised siting regulations; (2) the many factors beyond utilities' and NRC's control which can affect nuclear powerplant site selections; and (3) the need for NRC to further explore this concept.

Officials from the Offices of the DOE Assistant Secretaries for Nuclear Energy and for Policy and Evaluation said the concept of multiple-plant sites makes sense from the standpoint of economics, operational safety control, and opening up the possibility that other elements of the nuclear fuel cycle could be considered at these sites. They expressed reservations, however, about the lack of criteria by which NRC will determine if a new site should be used in lieu of adding plants to an existing site. Perhaps a better approach, in their view, would be to find and offer some type of incentive for the utilities to consider the use of multiple-plant sites. This approach stems from their position that the obstacles to the continued use of nuclear power are mainly institutional and not technical in nature. They support attempts by Congress to address these institutional problems and believe there is a need for the responsibility for the resolution of these problems to be focused in a single organization. They also said that specifying that new sites must be able to support a minimum number of powerplants, as we had suggested, could be unduly restrictive. We agreed and have deleted the suggestion.

We agree with the DOE officials' comments that additional work is necessary to develop regulatory criteria for a policy favoring expansion of existing sites, and are recommending that NRC pursue this matter.

CHAPTER 3

CAN EXISTING SITES BE USED TO DISPOSE OF WASTES FROM NUCLEAR POWERPLANT OPERATIONS?

Nuclear powerplants produce two basic types of radioactive wastes. Used (spent) fuel is extremely radioactive, must be stored in specially constructed facilities, and must eventually be either reprocessed or transferred to the Federal Government for long-term storage or permanent disposal. Low-level nuclear waste is generated in liquid, gaseous, and solid forms, and consists of a wide range of materials and levels of radioactivity. Traditionally, utilities have shipped low-level wastes to commercial nuclear waste burial grounds.

Spent fuel is so potentially hazardous for such a long time that it must eventually be removed from nuclear powerplant sites. Nevertheless the potential does exist for long-term storage of low-level wastes at all nuclear powerplant sites, and perhaps for permanent low-level waste disposal at some sites.

Recent events severely limiting the availability of low-level waste burial grounds have heightened nuclear industry interest in the use of volume reduction techniques, on-site storage, and permanent disposal of low-level wastes at nuclear powerplant sites. On-site low-level waste storage for a number of years could provide the time needed to develop adequate national burial ground capacity, but it only defers the inevitable need to dispose of the wastes. Any plans to use an existing nuclear powerplant site as a permanent site for low-level waste disposal, however, should be examined and authorized in the context of a national plan for low-level nuclear waste disposal.

SPENT-FUEL STORAGE

Until 1977 the nuclear industry anticipated retaining spent fuel on-site in spent fuel storage pools for 6 months or longer and then shipping it to a commercial spent-fuel reprocessing plant. At the reprocessing plant, the spent fuel would be dissolved in chemicals, the unused enriched uranium and the plutonium in the fuel extracted for reuse in fresh reactor fuel, and the radioactive reprocessing wastes eventually disposed of in a Federal high-level waste underground repository. In April 1977, however, the administration decided to defer indefinitely commercialization of technologies that reprocess or depend on recycling of plutonium which can be used to make nuclear weapons. As a result,

utilities are now faced with unexpectedly long possession and storage of their spent fuel. The problem has become so acute that some utilities are seeking NRC approval to transfer spent fuel among their nuclear powerplant sites.

It is the policy of DOE to provide necessary spent fuel storage capacity beyond that available at existing nuclear powerplants until the Federal Government can provide a long-term or permanent storage/disposal solution. In a June 1979 report, we concluded that instead of developing an interim spent-fuel storage program, DOE should commit itself to a timetable for having permanent spent-fuel storage available, and only if it cannot meet this timetable should it provide interim spent-fuel storage facilities. 1/

On-site spent-fuel storage for up to about 10 years does provide an opportunity for about 95 percent of the radioactivity in spent fuel to decay. In fact, about 80 percent of the radioactivity in spent fuel decays within 3 years. Most of the radioactivity remaining after 10 years of storage will take thousands of years to decay. Thus, from the standpoint of shipping and handling spent fuel, on-site storage for from 3 to 10 years does have advantages. After that time, the only advantage of continued on-site interim storage over interim storage at DOE facilities would be savings in the additional handling and transportation required to transport spent fuel first to the DOE storage facility and then to either a reprocessing plant or a DOE long-term storage/permanent storage facility.

LOW-LEVEL WASTE STORAGE

Low-level nuclear wastes are produced from many sources, including university and industrial research centers, medical diagnostic and treatment centers, nuclear powerplant operations, and other nuclear fuel cycle activities. Nuclear powerplant operations, however, generate the largest volume of these wastes. Low-level wastes produced at a nuclear powerplant include such things as waste treatment system sludges, resins, used filter cartridges, and evaporator bottoms, which contain about 15 to 20 percent of the plant's low-level waste radioactivity and about 40 percent of the volume; dry, slightly contaminated equipment and materials such as rags, plastic bags, gloves, coveralls, paper, and tools, which comprise over 50 percent of the volume; and reactor core structural components, such as control rods,

1/"Federal Facilities for Storing Spent Nuclear Fuel--Are They Needed," EMD-78-82, June 27, 1979.

which comprise less than 5 percent of the volume but about 80 percent of the radioactivity.

Traditionally, utilities have routinely packaged and shipped these wastes to commercial shallow-land nuclear waste burial sites. At one time, there were six commercial burial sites, but three of them are now closed. Furthermore, in the last year Governors in two of the States where the other three sites are located have temporarily closed the burial grounds and the volumes of low-level wastes to be accepted at the third site have been reduced. These actions have been taken to dramatize the need to develop more regional low-level waste disposal sites.

Concern over the availability of low-level waste disposal capacity has caused utilities to examine other alternatives, including on-site interim storage, on-site burial, and volume reduction techniques. At its three-unit Browns Ferry nuclear station, for example, the Tennessee Valley Authority has taken administrative steps to minimize the volume of waste it generates, and plans to install volume reduction and solidification equipment and construct low-level waste storage capacity adequate for the remaining operating lives of the three units.

Volume reduction and solidification systems for nuclear powerplants are a relatively new technology. The system the Authority plans to use is based on incineration of resins and combustible trash with recapture of the radioactivity by means of filters and absorbers before discharge of the gases from incineration. About 90 percent of the contaminated trash produced at the Browns Ferry nuclear station can be incinerated. Once it has completed construction of a volume reduction system, the Authority expects that the total volume of low-level waste produced and stored at the nuclear station will be only 10 percent of what the station now generates.

Storage of low-level wastes at nuclear powerplant sites through the operating lives of the plants, such as that planned by the Tennessee Valley Authority, has the advantage of insuring that nuclear powerplant operations would not be curtailed due to unavailability of low-level waste disposal capacity. It also allows for decay of some of the radioactivity in the wastes, and the longer the wastes are stored prior to permanent disposal, the less the radioactivity which must be shipped to a low-level waste disposal site. On the other hand, on-site storage only defers the inevitable need to dispose of the waste, and would add one more task to eventually decommissioning a nuclear powerplant site. In view of the relatively low risks associated with handling and shipping low-level nuclear wastes--as compared to spent fuel and other

hazardous materials such as chlorine gas--it may be prudent to get the permanent disposal job done sooner rather than postponing it until it becomes a part of the plant and/or site decommissioning process.

In the future, permanent disposal of low-level wastes may be an option at some existing nuclear powerplant sites. The acceptability of existing nuclear powerplant sites for low-level waste disposal, however, depends on detailed investigations necessary to determine if the sites meet NRC's waste disposal regulations. NRC is drafting new low-level waste disposal regulations which would permit traditional shallow-land burial of some types of low-level wastes at sites meeting NRC's technical criteria. The more hazardous low-level wastes, including the higher activity resins from nuclear powerplants, would have to be disposed of in deeper trenches, mines, or engineered structures. NRC expects to issue proposed regulations by early 1981.

Many, if not most, nuclear powerplant sites may not be technically acceptable for traditional shallow-land or deeper burial of low-level wastes because the geological and hydrological conditions desirable for powerplants differ substantially from conditions desired for low-level waste disposal. Because of cooling water requirements, for example, most nuclear powerplants are located beside or close to large rivers, natural or man-made lakes, or the oceans. Water, on the other hand, is undesirable at low-level waste disposal sites. Many of these sites may be acceptable sites for disposal of shorter-lived low-level wastes in engineered structures. Shorter-lived wastes are wastes which would completely decay within about 50 years.

Technical constraints aside, it may not be desirable from a policy perspective to encourage or permit low-level waste disposal at nuclear powerplant sites. It is important to first decide how many total low-level waste disposal sites are needed to balance the desirability of having regional disposal sites against the desirability of minimizing the number of places in the Nation containing sufficient radioactivity to require restricted access and long term surveillance. In this regard, DOE expects to complete a national low-level waste disposal plan by June 1981.

CONCLUSIONS

On-site storage of spent fuel for about 3 to 10 years permits the shorter-lived radioactivity in the fuel to decay, but eventually the fuel must be transferred to either a DOE long-term storage or permanent disposal facility, or a

spent-fuel reprocessing plant. The potential does exist, however, for storage of low-level wastes at nuclear power-plant sites for the operating lives of the plants, and perhaps for permanent disposal at some sites.

Recent events limiting the availability of low-level waste disposal capacity have caused utilities to seriously consider on-site storage and acquisition of volume reduction systems. Eventually, however, the low-level waste stored on-site will have to be shipped to a burial ground or buried on-site, and any plans for on-site storage should include consideration of how the wastes will ultimately be disposed of.

Permanent disposal on-site by burial in shallow or deeper trenches may be an option at some sites. Detailed studies would be necessary to determine each site's acceptability under regulations being developed by NRC. Moreover, policy considerations are important in deciding whether or not to permit permanent disposal of low-level waste at nuclear powerplant sites. DOE expects to complete a national plan for low-level waste disposal by June 1981. Permanent disposal of low-level wastes at any nuclear powerplant site should be examined and authorized in the context of a regional need for disposal capacity as eventually defined in DOE's National Plan. This plan and its relationship to the development of new low-level waste disposal capacity is discussed in a companion to this report, also requested by the Subcommittee on Energy and Power, House Interstate and Foreign Commerce Committee, entitled "The Problem Of Disposing Of Nuclear Low-Level Waste: Where Do We Go From Here," EMD-80-68.

RECOMMENDATION TO THE CHAIRMAN,
NUCLEAR REGULATORY COMMISSION

Before permitting utilities to store low-level waste at nuclear powerplant sites the Chairman, Nuclear Regulatory Commission should require the utilities to provide specific plans for eventually disposing of these wastes, including assurances that funds will be available for disposal costs.

AGENCY COMMENTS

NRC officials said we should include an analysis of the present political nature of the spent fuel storage and low-level waste disposal issues. This subject is discussed at some length in our companion report EMD-80-68. NRC officials also said that as a part of reviewing a utility's request for permission to store low-level wastes at powerplant sites, NRC intends to require the utility to state how it would ultimately dispose of the wastes. We agreed that this should be done and, therefore, added the above recommendation to our report. DOE officials had no comments on this chapter.

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CONGRESS OF THE UNITED STATES
 HOUSE OF REPRESENTATIVES
 SUBCOMMITTEE ON ENERGY AND POWER
 OF THE
 COMMITTEE ON INTERSTATE AND FOREIGN COMMERCE
 WASHINGTON, D.C. 20515

November 7, 1979

The Honorable Elmer B. Staats
 Comptroller General of the United States
 General Accounting Office
 441 G Street, N.W.
 Washington, D.C. 20548

Dear Mr. Staats:

Although the incident at Three Mile Island is presently attracting most of the attention regarding nuclear energy, there are a number of additional issues which are of great concern to this Subcommittee and which should be addressed.

Two years ago, a number of Congressional subcommittees held hearings on the closing of the Nuclear Fuel Services, Incorporated Reprocessing Plant at West Valley, New York. At those hearings, the General Accounting Office presented the results of its investigation of this facility which included a number of recommendations to the Nuclear Regulatory Commission relating to resolving a number of problems resulting from the closing of this plant. At the time the Nuclear Regulatory Commission stated that it was either taking or planning to take corrective action.

Several years have now elapsed since the closing of that facility, and the West Valley situation still remains a matter of great concern. This is so not only because of the unique decisions which must be made concerning technical alternatives and financial responsibilities but also because some of the issues, such as decommissioning, high level waste disposal, spent fuel storage, and low-level waste burial ground have national relevance.

The problems associated with the disposal of low-level wastes, however, are not confined to West Valley. The recent closing of low-level burial grounds in Nevada and Washington, together with the decision by the Governor of South Carolina to reduce the quantities of material which can be stored at the Barnwell site, have created a national problem of immediate concern. Already, difficulties are being encountered by medical schools and universities in disposing of their low-level wastes. The present problem stems from the lack of an effective program to reduce the volume of low-level wastes and the failure to develop a comprehensive policy on this issue which gives full consideration to regional interest. As a result, consideration is now being given to using federal facilities for the disposal of such wastes.

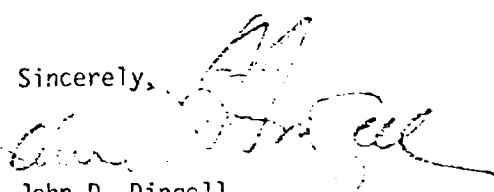
Alternatively, consideration is also being given to making additional use of existing reactor sites by making them into multi-purpose facilities which would not only produce energy but dispose of the waste generated by such facilities using a variety of technologies. Related to this proposal are discussions about the potential for using existing sites as locations for new power plants. The concept of a multi-purpose site is a matter which requires further study and consideration.

Although these are related issues, I request that the General Accounting Office conduct a separate investigation and review of each of the three issues discussed above. This effort should identify the relevant problems, determine who is responsible for resolving them, and evaluate the progress made by the relevant government agencies in addressing them. As I expect that many of these issues will arise in the course of this Subcommittee's considerations of next year's authorization bills, I would appreciate receiving your report on each of these issues by April 1, 1980.

I thank you for your cooperation.

With every good wish,

Sincerely,



John D. Dingell
Chairman

JDD/Jlc

(301547)



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