ORNL/TM-9715

ornl

OAK RIDGE NATIONAL LABORATORY

MARTIN MARIETTA

Licensing Procedures for Low-Level Waste Disposal Facilities

R. D. Roop
J. W. Van Dyke

OPERATED BY
MARTIN MARIETTA ENERGY SYSTEMS, INC.
FOR THE UNITED STATES
DEPARTMENT OF ENERGY

Printed in the United States of America. Available from
National Technical Information Service
U.S. Department of Commerce
5285 Port Royal Road, Springfield, Virginia 22161
NTIS price codes—Printed Copy: A11; Microfiche: A01

ORNL/TM-9715

Energy Division

LICENSING PROCEDURES FOR LOW-LEVEL WASTE DISPOSAL FACILITIES

R. D. Roop
J. W. Van Dyke

Date Published - September 1985

Prepared for
DOE Low-Level Waste Management Program
Idaho Falls, Idaho

Prepared by the
OAK RIDGE NATIONAL LABORATORY
Oak Ridge, Tennessee 37831
operated by
MARTIN MARIETTA ENERGY SYSTEMS, INC.
for the
U.S. DEPARTMENT OF ENERGY
under Contract No. DE-AC05-840R21400

CONTENTS

LIST OF FIGURES AND PLATES

ABSTRACT

This report describes the procedures applicable to siting and licensing of disposal facilities for low-level radioactive wastes. Primary emphasis is placed on those procedures which are required by regulations, but to the extent possible, non-mandatory activities which will facilitate siting and licensing are also considered. The report provides an overview of how the procedural and technical requirements for a low-level waste (LLW) disposal facility (as defined by the Nuclear Regulatory Commission's Rules 10 CFR Parts 2, 51, and 61) may be integrated with activities to reduce and resolve conflict generated by the proposed siting of a facility. General procedures are described for site screening and selection, site characterization, site evaluation, and preparation of the license application; specific procedures for several individual states are discussed. The report also examines the steps involved in the formal licensing process, including docketing and initial processing, preparation of an environmental impact statement, technical review, hearings, and decisions. It is concluded that development of effective communication between parties in conflict and the utilization of techniques to manage and resolve conflicts represent prehaps the most significant challenge for the people involved in LLW disposal in the next decade.

1. INTRODUCTION

1.1 Purpose and Scope

The 1980 passage of the Low-Level Radioactive Waste Policy Act (Public Law 96-573) placed the responsibility for management and disposal of low-level waste (LLW) on the states (DOE 1983a). The law encourages the states to coordinate the development of disposal facilities by forming regional compacts, and Congress set January 1, 1986 as the target date after which states that have joined compacts can refuse to accept waste from outside the compact region. The U.S. Department of Energy (DOE) is the lead agency for national planning and coordination regarding LLW management (DOE 1982). One role of DOE's Low-Level Waste Management Program therefore is to assist the states in fulfilling their responsibilities for LLW management. Toward this end, the purpose of this report is to provide a description of siting and licensing procedures for a Mock Licensing Demonstration, a simulation of licensing for a hypothetical site and facility. It is hoped that the description of licensing contained in this report will help states, private enterprise, and the affected publics better understand the siting and licensing process for LLW disposal facilities.

This report places primary emphasis on those siting and licensing procedures which are required by regulations. However, LLW disposal facilities are likely to be controversial, and attempts to develop and license such facilities may not succeed if a developer puts forth only the minimum legally required effort. Thus, to the extent possible, we also describe supplemental, non-regulatory activities which may be desirable for successful licensing. While the legally required steps for siting and licensing can be identified by reading the appropriate regulations, the additional desirable steps are not as easily specified. One goal of the Mock Licensing Demonstration Project is to identify desirable patterns of interaction between disposal facility developers, regulators, and the publics. The Project's final report will provide a

more complete description of the supplemental activities appropriate for facilitating the siting and licensing of LLW disposal facilities.

1.2 Regulatory Background

Licensing of LLW disposal facilities can be divided into requirements which stem from federal regulations and other non-federal regulations. Non-federal regulations include state and local control of zoning, water quality, and similar aspects. This document focuses primarily on licensing activity stemming from federal regulations. As discussed below, federal licensing requirements may be adopted by states, thus allowing state regulation of LLW disposal facilities.

In the federal government the responsibility for regulating land disposal of low-level wastes rests with the Nuclear Regulatory Commission (NRC). In addition to radioactive waste disposal, the NRC regulates nuclear activities such as reactors, uranium mines and mills, and possession of nuclear material. The NRC has codified most procedures, performance objectives, and technical criteria into rules published in the Federal Register and incorporated into the Code of Federal Regulations (CFR) Title 10, Parts 0 to 199.

In December of 1982, specific licensing requirements for land disposal of low-level wastes were codified as 10 CFR Part 61. These regulations set out the procedures and criteria that must be met to license a facility for land disposal of radioactive waste. The impetus for developing these specific licensing requirements was "the needs and requests of the public, Congress, industry, the States, the Commission and other federal agencies for codified regulations to govern the disposal of low-level radioactive waste." Several sites had been licensed prior to issuance of 10 CFR Part 61, but there were no comprehensive national criteria to guide licensing. The NRC's 10 CFR Part 61 sets forth the required content of the license application, performance objectives and technical requirements for a disposal facility, and mechanisms through which state, local, and tribal

governments can participate in the review of a license application. Aspects of these license requiremets are discussed later in this document.

General procedures for licensing actions have also been established by NRC. Part 2 of 10 CFR contains rules of practice for domestic licensing proceedings. These rules establish the formal procedures that are followed in licensing actions for all nuclear-related facilities. They describe in detail the conduct of license proceedings including issuance/revision of a license, hearings, appeals, interrogatories, discovery, and evidence.

Within NRC's licensing authority is the option to relinquish to states the responsibility for regulating the use of reactor-produced isotopes, the source materials uranium and thorium, and small quantities of special nuclear materials (NRC 1982). The conditions under which a state may enter into an agreement with NRC and thus become an "Agreement State" are that 1) the government must certify that the state has a program that is adequate to protect the public health and safety, and 2) the NRC must find that the state's program is adequate from a health and safety standpoint and compatible with the Commission's program.

The Agreement State provision has important implications for states that may host a low-level waste disposal facility. An Agreement State adopts federal requirements for licensing, thus allowing the state to develop an integrated regulatory program. This arrangement potentially gives a state additional control over its responsibility to provide for waste disposal.

For an Agreement State to license and regulate LLW disposal, that state must have a regulatory program compatible with the NRC's. Thus, Agreement States are expected to adopt regulations equivalent to key provisions of 10 CFR Part 61 (Nussbaumer 1983).

1.3 Overview of Licensing

The development and licensing of a LLW disposal facility involves three major groups: the applicant, the affected publics, and the

regulatory agency. The applicant may be a state agency or a private or commercial entity that proposes to develop a facility. The affected publics includes private individuals and interest groups. The NRC constitutes the regulatory agency for Non-agreement States, while in Agreement States, the agreement between the state and the NRC indicates the state agency which performs the regulatory function under the agreement.

The overall process of securing a license for a LLW disposal facility (Fig. 1) can be divided into the prelicensing stage and the licensing stage. An applicant will perform many tasks before submitting a license application for review and action by a regulatory agency. Some of these prelicensing activites are required for licensing, such as site screening, site selection, site characterization and evaluation, facility design, and preparation of the license application. In addition, an applicant is likely to undertake a variety of non-mandatory activities to enhance public acceptance of the proposed facility; these may include public information programs, soliciting public input on the site and design, and conflict management activities. The activities which precede licensing are critical to its success or failure, and Section 2 of this report considers these steps in detail.

Once a license application has been prepared, the formal licensing process is guided by regulations issued by the NRC and Agreement States as described in Sect. 1.2. Section 3 of this report describes licensing procedures in detail.

1.4 How to Use this Report

Some of the procedures described in this report are well defined, while in other cases, there is considerable flexibility in the process. For instance, prelicensing procedures (e.g., site selection and characterization) are less rigidly defined than the formal licensing procedures. The reader should keep in mind that, because prelicensing activities are somewhat flexible, this report presents only one

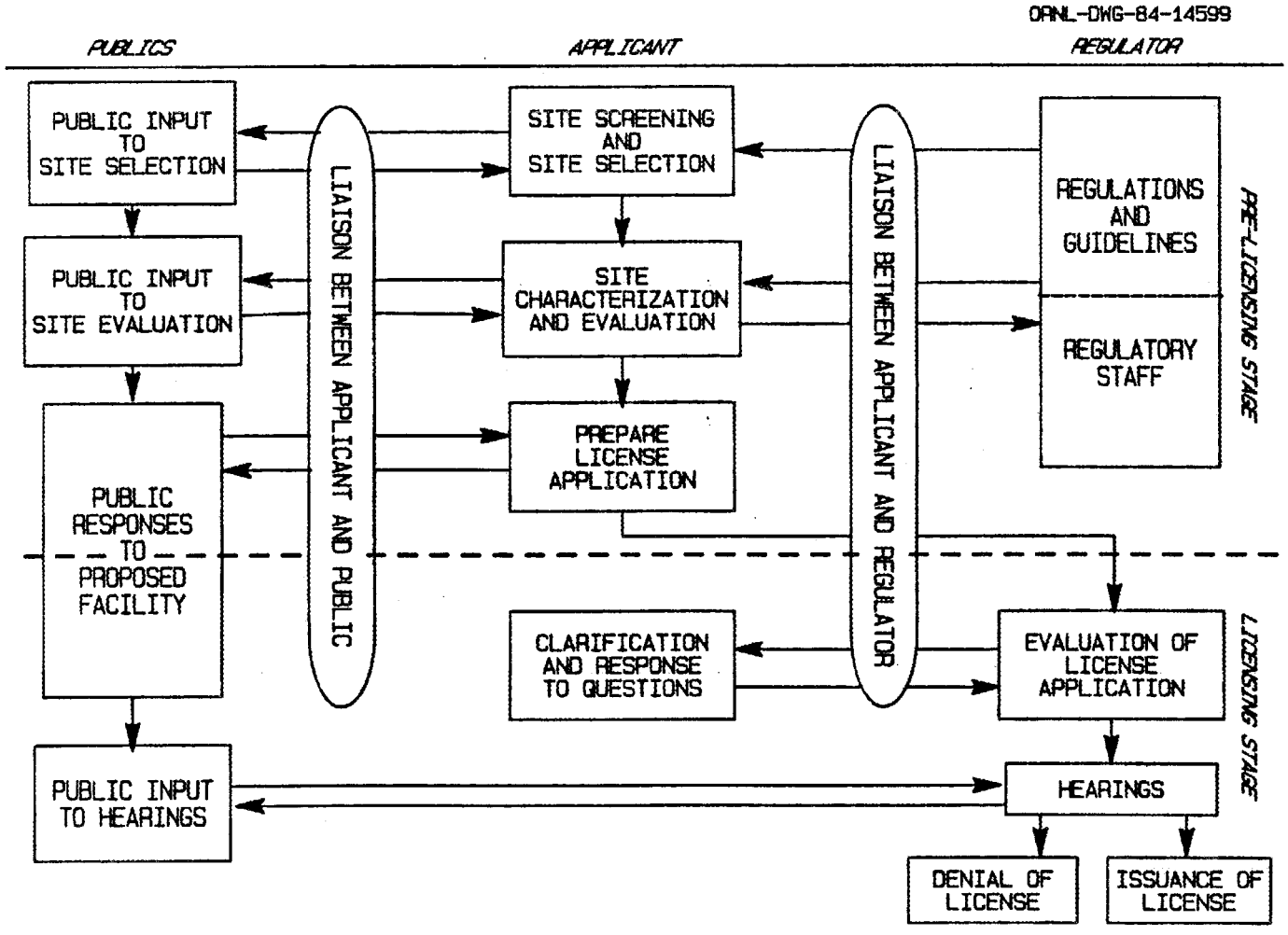


Fig. 1. Overview of licensing

representation of how these activities might be pursued. In addition, the descriptions of licensing found in this report are not official representations of procedures, but rather interpretations of federal and state processes based on a close reading of the regulations.

In order to provide a "roadmap" of licensing procedures, this document uses flow charts to summarize information. Oversize flow charts which describe the entire prelicensing stage and the formal licensing stage are attached to this document as Plates 1 and 2 respectively. Readers may refer to these Plates to "get their bearings". These flow charts, however, can provide only a skeletal description of the process, and readers who need more detailed discussions of various licensing steps should consult the regulations, statutes, and other sources cited.

2. PROCEDURES PRIOR TO LICENSING

2.1 Generic Description of Prelicensing Activity

Before a license application can be submitted for a LLW disposal facility, an applicant must undertake an extensive program of activities. This prelicensing stage (Fig. 2) can be divided into four stages: 1) site screening and site selection, 2) site characterization, 3) site evaluation, and 4) preparation of the licensing application and supporting documentation. This section discusses each of these stages in terms of both the technial requirements imposed by the regulatory framework and the non-regulatory considerations (i.e., appropriate liaison with publics and regulatory agencies).

Throughout the prelicensing period there are several general activities which occur in all or most of the stages above. One such activity is design work which produces the site utilization plan, specifications for the disposal facility, and other design elements. Also, throughout the prelicensing period the applicant must maintain liaison with the regulatory agency and the public (Fig. 1). Liaison with the regulators involves obtaining the appropriate, up-to-date regulations and guidance and, when appropriate, consulting with the regulatory agency to clarify uncertainties. Liaison with the public is an important function because frequently an applicant's inability to secure a license can be traced to poor communications and public opposition which develops in the prelicensing stage (O'Hare et al. 1983).

2.1.1 Site screening and site selection

The objective of site screening and site selection is to identify a preferred site for development. This process begins when a state, private developer, or other party recognizes the need to site a LLW facility, as for instance, when a state is designated a host state for a regional compact or when a state declines to participate in a compact and must develop its own facility.

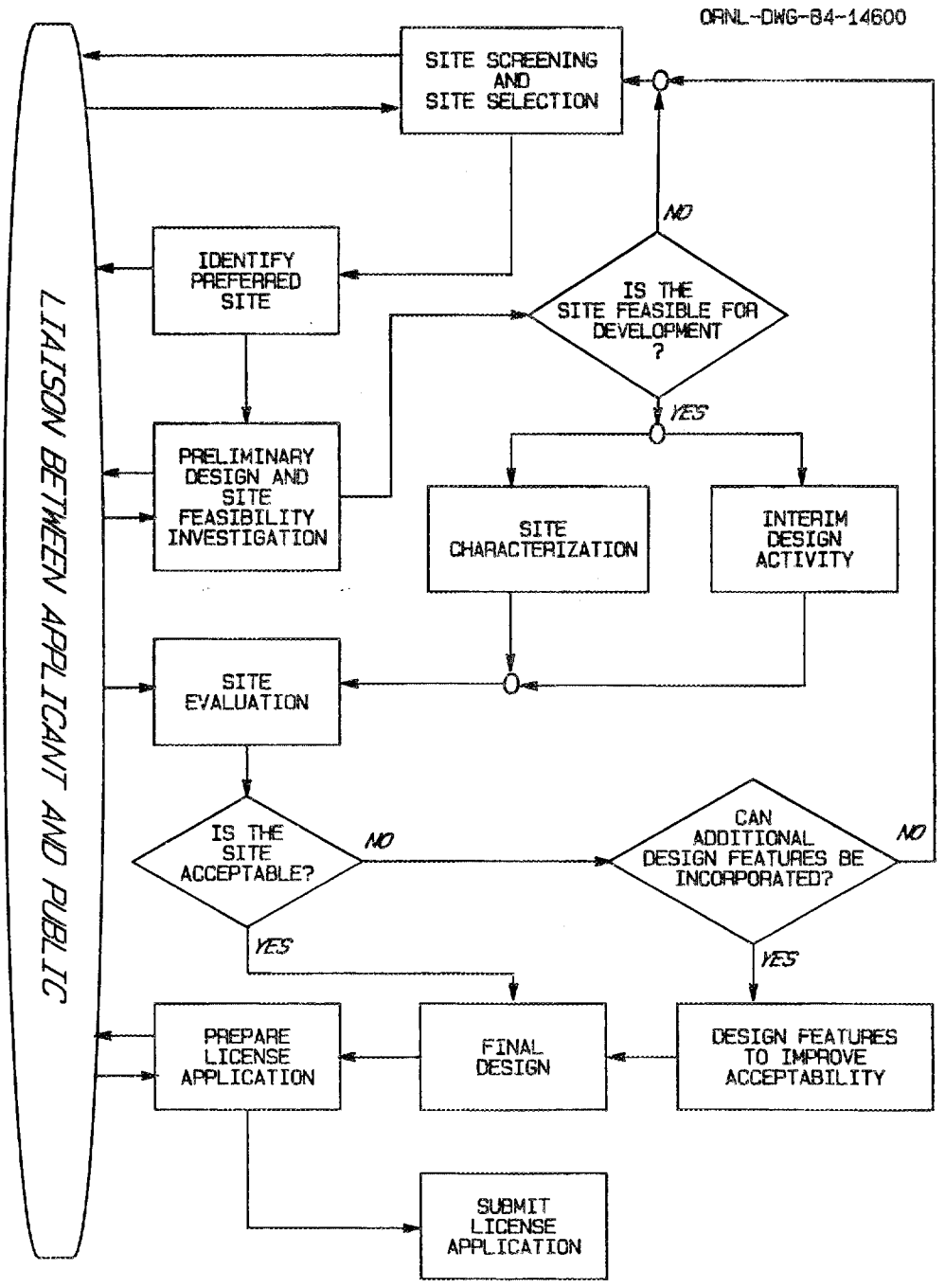


Fig. 2. Generic description of activities prior to licensing of a LLW facility

Regulatory requirements

The site screening and selection process must fulfill requirements set forth by the NRC in its rule 10 CFR Part 61 "Licensing Requirements for Land Disposal of Radioactive Waste." These regulations define "Performance Objectives" for LLW disposal facilities (Subpart C) and "Technical Requirements" (Subpart D). The Performance Objectives define the overall goals for a disposal facility in terms of 1) limits on radiation exposure to individuals, 2) releases to the environment during the facility's life and after its closure, and 3) stability of the site after closure. The Technical Requirements indicate the specific characteristics and features required for the site, facility design, operation, and site closure. Figure 3 provides these Performance Objectives and the site suitability requirements (those Technical Requirements that relate to site selection). In addition to the requirements specified in 10 CFR Part 61, the NRC has provided additional guidance regarding site selection and site characterization in a "Branch Technical Position" (Siefken et al. 1982).

A few of the site suitability requirements set forth in 10 CFR Part 61 identify characteristics which must exist at the site. For instance, a disposal site must be capable of being characterized, modeled, analyzed, and monitored; this implies that a site should be geologically and hydrologically simple. Another such requirement is good drainage at the site. Many of the site suitability requirements, however, indicate characteristics which must not be present at a proposed site. For example, suitable sites should be distant from areas where population growth or resource development is likely. Facilities should also be sited away from seismically active and geologically unstable areas, so that the adverse effects of earthquakes, volcanoes, landslides, and similar activity can be avoided.

The process of site screening and site selection is generally thought to include the following steps (see Plate 1): 1) defining the region of interest, 2) identifying potential sites; 3) screening these potential sites against the site suitability requirements and other

ORNL DWG 84-14601

Subpart C—Performance Objectives

§ 61.40 General requirement.

Land disposal facilities must be sited, designed, operated, closed, and controlled after closure so that reasonable assurance exists that exposures to humans are within the limits established in the performance objectives in §§ 61.41 through 61.44.

§ 61.41 Protection of the general population from releases of radioactivity.

Concentrations of radioactive material which may be released to the general environment in ground water, surface water, air, soil, plants, or animals must not result in an annual dose exceeding an equivalent of 25 millirems to the whole body, 75 millirems to the thyroid, and 25 millirems to any other organ of any member of the public. Reasonable effort should be made to maintain releases of radioactivity in effluents to the general environment as low as is reasonably achievable.

§ 61.42 Protection of individuals from inadvertent intrusion.

Design, operation, and closure of the land disposal facility must ensure protection of any individual inadvertently intruding into the disposal site and occupying the site or contacting the waste at any time after active institutional controls over the disposal site are removed.

§ 61.43 Protection of individuals during operations.

Operations at the land disposal facility must be conducted in compliance with the standards for radiation protection set out in Part 20 of this chapter, except for releases of radioactivity in effluents from the land disposal facility, which shall be governed by § 61.41 of this part. Every reasonable effort shall be made to maintain radiation exposures as low as is reasonably achievable.

§ 61.44 Stability of the disposal site after closure.

The disposal facility must be sited, designed, used, operated, and closed to achieve long-term stability of the disposal site and to eliminate to the extent practicable the need for ongoing active maintenance of the disposal site following closure so that only surveillance, monitoring, or minor custodial care are required.

Subpart D—Technical Requirements for Land Disposal Facilities

§ 61.50 Disposal site suitability requirements for land disposal.

(a) Disposal site suitability for near-surface disposal.

(1) The purpose of this section is to specify the minimum characteristics a disposal site must have to be acceptable for use as a near-surface disposal facility. The primary emphasis in disposal site suitability is given to isolation of wastes, a matter having long-term impacts, and to disposal site features that ensure that the long-term performance objectives of Subpart C of this part are met, as opposed to short-term convenience or benefits.

(2) The disposal site shall be capable of being characterized, modeled, analyzed and monitored.

(3) Within the region or state where the facility is to be located, a disposal site should be selected so that projected population growth and future developments are not likely to affect the ability of the disposal facility to meet the performance objectives of Subpart C of this part.

(4) Areas must be avoided having known natural resources which, if exploited, would result in failure to meet the performance objectives of Subpart C of this part.

(5) The disposal site must be generally well drained and free of areas of flooding or frequent ponding. Waste disposal shall not take place in a 100-year flood plain, coastal high-hazard area or wetland, as defined in Executive Order 11988, "Floodplain Management Guidelines."

(6) Upstream drainage areas must be minimized to decrease the amount of runoff which could erode or inundate waste disposal units.

(7) The disposal site must provide sufficient depth to the water table that ground water intrusion, perennial or otherwise, into the waste will not occur. The Commission will consider an exception to this requirement to allow disposal below the water table if it can be conclusively shown that disposal site characteristics will result in molecular diffusion being the predominant means of radionuclide movement and the rate of movement will result in the performance objectives of Subpart C of this part being met. In no case will waste disposal be permitted in the zone of fluctuation of the water table.

(8) The hydrogeologic unit used for disposal shall not discharge ground water to the surface within the disposal site.

(9) Areas must be avoided where tectonic processes such as faulting, folding, seismic activity, or vulcanism may occur with such frequency and extent to significantly affect the ability of the disposal site to meet the performance objectives of Subpart C of this part, or may preclude defensible modeling and prediction of long-term impacts.

(10) Areas must be avoided where surface geologic processes such as mass wasting, erosion, slumping, landsliding, or weathering occur with such frequency and extent to significantly affect the ability of the disposal site to meet the performance objectives of Subpart C of this part, or may preclude defensible modeling and prediction of long-term impacts.

(11) The disposal site must not be located where nearby facilities or activities could adversely impact the ability of the site to meet the performance objectives of Subpart C of this part or significantly mask the environmental monitoring program.

(b) Disposal site suitability requirements for land disposal other than near-surface (reserved).

Fig. 3. NRC's performance objectives and site suitability requirements

siting criteria; 4) identifying candidate sites; 5) collecting preliminary data for evaluation of candidate sites; and 6) identifying a preferred site. Generally, the personnel performing these site selection steps should rely on reconnaissance information, i.e., data which are available from existing sources or brief field surveys. However, NRC envisions that the data collection stage (Step 5 above) may require generation of conceptual designs, preliminary cost estimates, release scenarios, and pathway studies (Siefken et al. 1982).

The National Environmental Policy Act (NEPA) and its environmental impact statement process also impose requirements on site selection. When a developer submits a licence application, he must attach an environmental report (ER) providing information and documentation for use in preparation of the environmental impact statement (EIS). Both the ER and the EIS must document the site selection process in the discussion of alternatives to the proposed action. There are regulations which specify the required contents for ERs both in general (40 CFR 1500-1508) and specifically for LLW disposal facilities (NRC 1983). Thus site selection must be performed and documented so as to meet these requirements. The applicant must demonstrate that the candidate sites can potentially meet the minimum technical requirements and promote the goals of NEPA. Site selection must make a comparison between the preferred site and two or three viable alternative candidate sites, and it should be demonstrated that no alternative site is obviously superior to the preferred site (Siefken et al. 1982, NRC 1983).

Non-regulatory activity

The site selection process discussed in the previous section can be done without the involvement or even knowledge relevant of local governments or those who would be most affected by the siting decision. Land may be optioned, geotechnical analysis of alternative sites completed, and the preliminary design for the facility completed by the time that the preferred site is first announced publicly. The logic of

this "Decide-Announce-Defend" (D-A-D) pattern may be a developer's lack of eminent domain power (O'Hare et al. 1983). The developer may option property and perform preliminary analyses to avoid paying premium rates which a land owner might demand once he learned that his property was the "preferred site" for a facility. Another explanation of the "Decide-Announce-Defend" pattern may be the perception by the developer that any potential opposition is relatively weak and that a technically sound proposal and licensing effort should easily prevail against any potential opposition. On the other hand a developer may anticipate substantial opposition and try to put it off as long as possible.

Once the preferred site is announced, major decisions have been made. In the D-A-D pattern, communities, groups, and individuals perceiving negative impacts from the proposal tend to feel victimized by the developer who has used a process in which they have had no chance to participate. The developer's position often appears inflexbile. Alternative sites appear to be strawmen. Informed late in the game of a proposal about which they know little but which they perceive could have a major impact on their futures, a natural tendancy toward conflict develops. Individuals and groups with strong concerns see delaying or stopping the project as their only alternative to its total acceptance.

The consequences of strong public opposition should be a serious concern because of their potential effects in delaying projects, increasing costs, and in many cases effectively blocking projects altogether. Because any LLW disposal facility will probably face stiff oppostion, license applicants must consider every reasonable opportunity to minimize opposition and if possible find public support.

One of the most important factors in being able to cope with public opposition is credibility. Without credibility almost any effort to provide reassurance, to counter misinformation, or to deal with legitimate objections may be met with skepticism. It is especially crucial that the first impression of the applicant's approach to the public not be negative. This first impression sets the tone. Later disclosures to "set the record straight" may be of little help if the public perceives that the applicant has withheld information from the start.

Thus, the applicant's liaison with the public during the site screening and site selection phase is critically important. Since uncertainty is one of the primary sources of negative reactions to proposed waste disposal facilities, public information programs can be desirable. Developers can make positive efforts to disseminate information regarding the disposal technology, how the facility would operate, the siting process, and other prelicensing and licensing procedures which would follow. Early disclosure of possible plans and public information programs can enhance the credibility of an applicant.

However, mere public dissemination of information probably will not give individuals or community groups a feeling that they are involved or can influence events. Some states have legislation on facility siting which requires that hearings be held during the site selection phase (Sect. 2.2). An applicant also can sponsor or participate in community meetings to establish dialogue and demonstrate its responsiveness to the issues and concerns raised.

2.1.2 Site characterization

The site characterization phase begins when an applicant has identified a preferred site. From the regulatory perspective, the objective of site characterization is to investigate the characteristics of the preferred site to the extent necessary to support a license application and to support assessment activities required under NEPA. Site characterization is important to an applicant because it requires a substantial expenditure of time and money. To the affected publics this phase is important because of the applicant's escalating commitment to the site; liaison between the public and the applicant at this stage is crucial to insure that the applicant is aware of and responsive to the publics' concerns and information needs.

Regulatory requirements

The required site characterization activities are the investigations and tests undertaken to define the site characteristics

affecting the 1) isolation of the LLW, 2) the long-term stability of the disposal site, and 3) the interactions between the disposal site and its surroundings. The technical information developed during site characterization should be adequate to support the following tasks (Siefken et al. 1982):

1. demonstrate that performance objectives and minimum technical requirements on site suitability will be met;
2. evaluate the ability of the site characteristics to contribute to isolation of the low-level radioactive wastes;
3. design the disposal facility;
4. identify interactions between the site characteristics and the low-level radioactive waste and waste containers;
5. establish data collection points and a baseline of data for some portions of the site monitoring program; and
6. identify potential environmental impacts resulting from construction, operation, and closure of the near-surface disposal facility.

The NRC recommends that applicants consult with its staff regarding the technical site characterization program prior to the start of the program and frequently during its implementation. Investigations are recommended for meteorology, surface water, ground water, geology, geomechanics, air quality, ecology, land use and cultural resources, and socioeconomic resources. The procedures for site characterization (Plate 1) involve comprehensive field and laboratory studies and establishment of a monitoring program. Site characterization requires the utilization of technical specialists and specialized equipment for geological, hydrological, and other investigations. Because the monitoring program initiated as part of the field investigation must provide data for both immediate site characterization and long-term site monitoring, the program should be carefully planned prior to implementation to minimize costs. Greater detail regarding technical site characterization is available from Siefken et al. (1983) and DOE (1984).

Non-regulatory activity

Once a preferred site has been selected, an applicant may wish to begin site characterization by performing a site feasibility investigation (Plate 1). Such a study allows an applicant to verify that a site is suitable for further consideration prior to the long, expensive process of full-scale site characterization. In performing a site feasibility investigation, the applicant would develop a preliminary facility design and plan for site utilization. Relying primarily on available, reconnaissance information, the applicant would make a preliminary analysis of the site performance. If the site is unsuitable, the applicant should return to the site screening phase; otherwise the results of the study can be used to define the scope of further design work and detailed site investigations which follow.

When a preferred site is announced, the focus of attention shifts from the general to the specific. Some of the affected publics want details (What? Where? When? Who? Why?), and the developer is only beginning the process of acquiring detailed information. However, to gain and maintain credibility at this point, a developer must meet the public's information needs to the extent possible. The results of preliminary feasibility investigations and preliminary design work can be useful for this purpose.

Public opposition frequently develops due to distrust of the developer and the lack of adequate information about the project during the crucial early period when opinions are being formed. Opposition may come from both inside and outside the host community. The development may provide some form of benefit such as jobs or tax revenues to the host community. However, benefits and costs may not be equitably distributed within the host community, and neighboring communities outside the taxing jurisdiction may perceive only the facility's negative impact on their communities. Alliances may form between local opposition groups and national organizations.

Formation of a community-based review committee is one vehicle which a project sponsor may use to help local interests get information

about the project and its likely impact. One model for the operation of a review committee (Keystone Center 1983) involves public meetings, briefings by the applicant, and preparation of a committee report. The Keystone Center model recommends that the committee be composed of twelve members, eight from the region representing various interests (environmental groups, industry, etc.), and four local officials. Using a review committee may 1) allow early citizen input; 2) address socioeconomic and other non-technical issues; 3) permit conflict identification and resolution; 4) provide reliable information to the community; and 5) provide an informal exchange of information.

The early functioning of a review committee may allow public input to the design of the applicant's site characterization program and eventually to the design of the facility. An applicant may wish to sponsor or provide financial assistance for independent studies performed by representatives of local communities. Alternatively, the applicant may seek a mechanism which gives the community or other interested parties some control over the scope or conduct of the site characterization effort.

The use of a review committee can provide important channels for communication between the applicant and the public. The fact that the process is less formal than hearings may be of great advantage, since the parties can avoid being "locked-in" to their positions. If the review committee identifies significant conflict, the process can provide an avenue toward conflict management activity if the parties involved wish to pursue it.

Although the review committee provides a structure in which many issues of conflict may be resolved, it may happen that the review committee and applicant are unable to successfully negotiate all the issues raised by a LLW disposal facility. A review committee's difficulties may stem from 1) the complexity of the issues, 2) inability to communicate clearly, 3) personality conflicts, 4) a large number of parties involved, and/or 5) lack of skill in negotiation and meeting facilitation (Keystone Center 1983). If the parties feel that these conditions exist, they may want to consider calling in a third party to assist in facilitating the conflict management process.

A third party mediator can assist in several ways: 1) identify all parties in a dispute and ensure that all are represented; 2) assist in clarifying factual details regarding the site, the proposed facility and other matters; 3) assist in improving communication between the parties; 4) identify common interests of the parties; 5) assist parties in prioritizing their concerns; 6) assist parties in presenting their interests and concerns in a constructive manner; 7) identify what is negotiable; and 8) serve an a catalyst for negotiations and maintain a smoothly functioning negotiation process.

Regardless of the outcome of the negotiations, a report should be made to document the areas of agreement and disagreement. Clearly there can be no guaranteee of success from conflict maangement activity. However, if the parties involved are patient and make good faith efforts, the result can be a better long-term relationship among the parties and a shorter and less acrimonious hearing process (Keystone Center 1983).

2.1.3 Site evaluation

At the completion of site characterization, an applicant must perform an evaluation of the proposed site, considering both the technical information which has been gathered and the social, institutional, and financial aspects of the project.

Regulatory requirements

At this stage, the applicant must have a reasonably complete understanding of how the disposal system and its components will work in order to make a performance assessment. This assessment is a systematic evaluation of the predicted performance of the facility relative to the performance objectives (Plate 1). The performance assessment should include analysis of the likelihood and consequences of human intrusion, evaluation of exposure to individuals during operations, prediction of the long-term stability of the site, and a prediction of radionuclide

migration via major pathways. These analyses allow an assessment of whether the characteristics of the site, together with the design features proposed for the facility, can meet the performance objectives defined by 10 CFR Part 61.

One part of the performance assessment is to analyze possible inadvertent intrusion to the site. Such an analysis seeks to identify what radiological exposures or other ill effects might result to persons occupying the site or contacting the waste after the removal of institutional controls over the site. The applicant must demonstrate that there is reasonable assurance that waste classification and segregation requirements will be met and that adequate barriers to inadvertent intrusion will be provided. An applicant must also perform analysis of occupational exposure during the facility's operation. These analyses must demonstrate that the site characteristics and design characteristics will keep exposures to acceptable levels.

The analysis of site stability must demonstrate that environmental processes, such as water and wind erosion, surface geologic processes, and seismic events will not cause unacceptable releases of radionuclides or allow unacceptable doses. Assessing site stability requires knowledge of the waste form and waste characteristics (especially knowledge of the content of long-lived radionuclides), as well as knowledge of the site characteristics and design features which contribute to stability.

Probably the most critical part of the performance assessment is the pathways analysis of radionuclide migration. This analysis predicts the degree of containment provided by the site to ensure that radionuclide movement will not lead to violation of performance objectives. The pathways analysis identifies potentially significant routes of migration, predicts the doses to humans, and identifies those locations that are most suitable for sampling and monitoring stations. All the major pathways for a given site should be considered, such a leaching of radionuclides from wastes to groundwater and uptake by vegetation. Secondary pathways and interconnections between pathways should also be considered, such as uptake of radionuclides by animals

from vegetation and surface water. All reasonable scenarios that may affect the pathways analysis should be evaluated. The range of scenarios should include all potentially significant situations and should realistically describe the range of conditions likely to be encountered.

If the site evaluation indicates any negative aspects of the site or facility, these problems may be mitigated by altering the facility design. This may involve changing the site utilization plan, the design of actual disposal units, or modification of the facility's waste acceptance criteria. As shown in Figure 2, the site evaluation activity can have three eventual outcomes: 1) determination that the site is acceptable, 2) identification of problems solvable through design changes, and 3) identification of irremediable problems which force selection of a new site.

Non-regulatory activity

Perhaps as important as evaluating whether the site and disposal facility can meet the regulatory performance requirements is to evaluate the public's acceptance of the proposed facility and site. The site evaluation phase provides an applicant with another opportunity to evaluate public opposition, pursue conflict management activity, and respond to concerns of the publics.

Input for the non-regulatory evaluation may come from a public review committee or from negotiation sessions with representatives of interest groups. Various interest groups are likely to bring forth a great variety of issues and objections, such as transportation of radioactive wastes, impacts to groundwater, and future performance of the facility in the far future. The applicant may be able to deal with such concerns by releasing for public review site characterization data and results of the performance evaluation. Additionally, an applicant may negotiate design modifications and/or appropriate compensation for the real and perceived negative impacts resulting from the facility.

The basis for negotiation is that each group has something the other wants. The applicant has control over the project and can provide

compensation for negative impacts. Members of the public who may be negatively affected have the option of opposing the project, making it more costly and perhaps impossible to ever operate the facility at a profit or at all. Both sides can escalate legal costs to the other side. Therefore, while a negotiated agreement that provides compensation to those who are negatively affected may be costly, following this strategy may avoid a protracted struggle that can be even more costly. It may be difficult to negotiate an arrangement which gives net benefits to all parties, but voluntary negotiation during the prelicensing stage may provide a better alternative for resolving conflicts than the protracted wrangling which may occur during licensing procedures and postlicensing litigation.

There are many forms that compensation might take. One obvious type of compensation is money. This has the advantage of providing the impacted individual or group with flexibiity to deal with the impact according to their own preferences. Tax rates may be lowered if local governments are compensated through tax agreements or direct compensation payments. Representative organizations could use compensation payments to pursue their objectives. However, the form of compensation is important because of non-economic considerations. This is especially true where officials or environmental organizations are concerned. An offer or acceptance of money compensation may be labeled a bribe; the equivalent value provided through some service or in-kind payment may be considered appropriate.

Another obvious type of compensation is impact mitigation. This is a type of compensation that typically is called for in the EIS process. Both direct mitigation (such as reducing pollution levels) or indirect mitigation (such as ameleorating pollution consequences) are options. An example of an indirect mitigation measure may be providing additional roads to relieve congestion. In-kind compensation may be appropriate in some cases where the negative impact reduces the supply of some amenity. Developing replacement recreation areas for areas lost through project development is an example of this form of compensation. Compensation could be made contingent on whether negative impacts actually occur.

2.1.4 Preparation of license application

When an applicant has completed its site evaluation and determined that the site is acceptable for development, it can begin the process of preparing the license application.

Regulatory requirements

The requirements for a license application are set forth in 10 CFR 61, Subpart B, Sections 61.11 through 61.16. The application must provide details regarding the site, the facility design, and the applicant's plans for operation and closure of the facility. An Environmental Report (ER) must also be prepared describing the environment and the facility's impacts on it. Information contained in the application and ER must demonstrate that the facility will meet the performance requirements.

To start the process, the applicant must finalize its design for the facility in order to have a fixed basis for the application. The license application must describe the anticipated design features such as the trenches, trench covers, drainage systems, how waste containers will be placed in disposal units, what material will be used for backfill, and how it will be stabilized. Design features and criteria must be related to the performance objectives.

In the license application, general information must be provided such as the applicant's identification and qualifications. Applicants must also describe the disposal site location, types and quantities of waste to be handled, land use plans, proposed facilities and equipment, and the proposed schedules for construction and operation. The license application must include technical analyses performed for site evaluation (Sect. 2.1.3), including the pathways analysis, inadvertent intruder analysis, stability analysis, and analysis of occupational exposures. The applicant must also provide a plan for closure of the facility and documentation that the site is owned (or will be owned) by the federal government or a state that will assume responsibility for

custodial care after closure. Also required are financial information and assurances regarding the applicant's ability to cover the costs of operation and closure. Financial arrangements during the post-closure and insitutional control periods must also be documented.

The ER which must accompany the license application is used by the regulatory agency to assess environmental impacts statement of the proposed facility. If the NRC has jurisdiction (Non-agreement States), an environmental impact statement (EIS) would be mandatory. When Agreement States have jurisdiction, the state would prepare an environmental assessment. Guidance regarding the preparation of an ER has been published by the NRC (1983).

Non-regulatory activity

As various parts of the license application package are completed, the applicant may wish to release them for public information purposes prior to the formal filing. Dissemination of design information, plans for operation and closure, and information on financial assurances may provide reassurance to the public, especially if the applicant can show that modifications have been made to respond to concerns previously expressed by the public. Review committee activity and mediation efforts may still be appropriate while the license application is being prepared.

2.2 Procedures of Individual States

The description of prelicensing activities provided in Sect. 2.1 gives only a generic picture of the process and does not describe how the laws and regulations of individual states overlay the basic federal requirements for site selection and site development. While states can impose regulatory requirements on the siting of LLW disposal facilities, the laws and rules must not conflict with the requirements of the NRC. This section describes the prelicensing procedures established by several states, discussing examples of Agreement States, Non-agreement

States, waste-intensive states, states with little waste, and states which have done little to prepare for siting a facility.

If a state is not a member of a regional compact, it has the primary responsibility to provide for disposal of the LLW it generates, and presumably must select a site and build a facility. Texas is an example of a state which has taken responsibility for siting a facility. It has enacted legislation which permits only a public entity to develop and operate a low-level waste disposal facility. The Texas Low-Level Waste Disposal Authority has been set up by statute to perform this task. In the Texas process for site selection (Fig. 4) a site is selected by the Authority's Board of Directors; the Authority must then apply for a license from the Texas Radiation Control Agency. The central elements of the Texas process are: 1) studies of potential sites from which a preferred site is selected and 2) a public hearing. The public hearing is informal and helps to generate information for final approval of the preferred site or rejection and consideration of other sites. The site selection process gives Texas maximum control over which site is actually selected. It also generates public input before a preferred site is selected.

The Illinois site selection process shown in Fig. 5 is somewhat different than for Texas. In Illinois, which is a Non-agreement State, the State Department of Nuclear Safety (lead agency) and the Illinois Geological and Water Surveys must complete studies of the technical considerations related to siting a regional low-level radioactive waste facility. If a decision is made to develop a site in Illinois, then proposals for contractors to design, develop, and operate a facility are solicited and a contractor(s) is selected. At the same time the Department of Nuclear Safety initiates any studies it deems necessary for the characterization of potential sites. The contractor then proposes at least three sites as alternative locations for the facility. Figure 5 shows the opportunity for public participation during the initial and final selection process.

Most states have not provided for a site selection process, and presumably states generating relatively small amounts of waste are

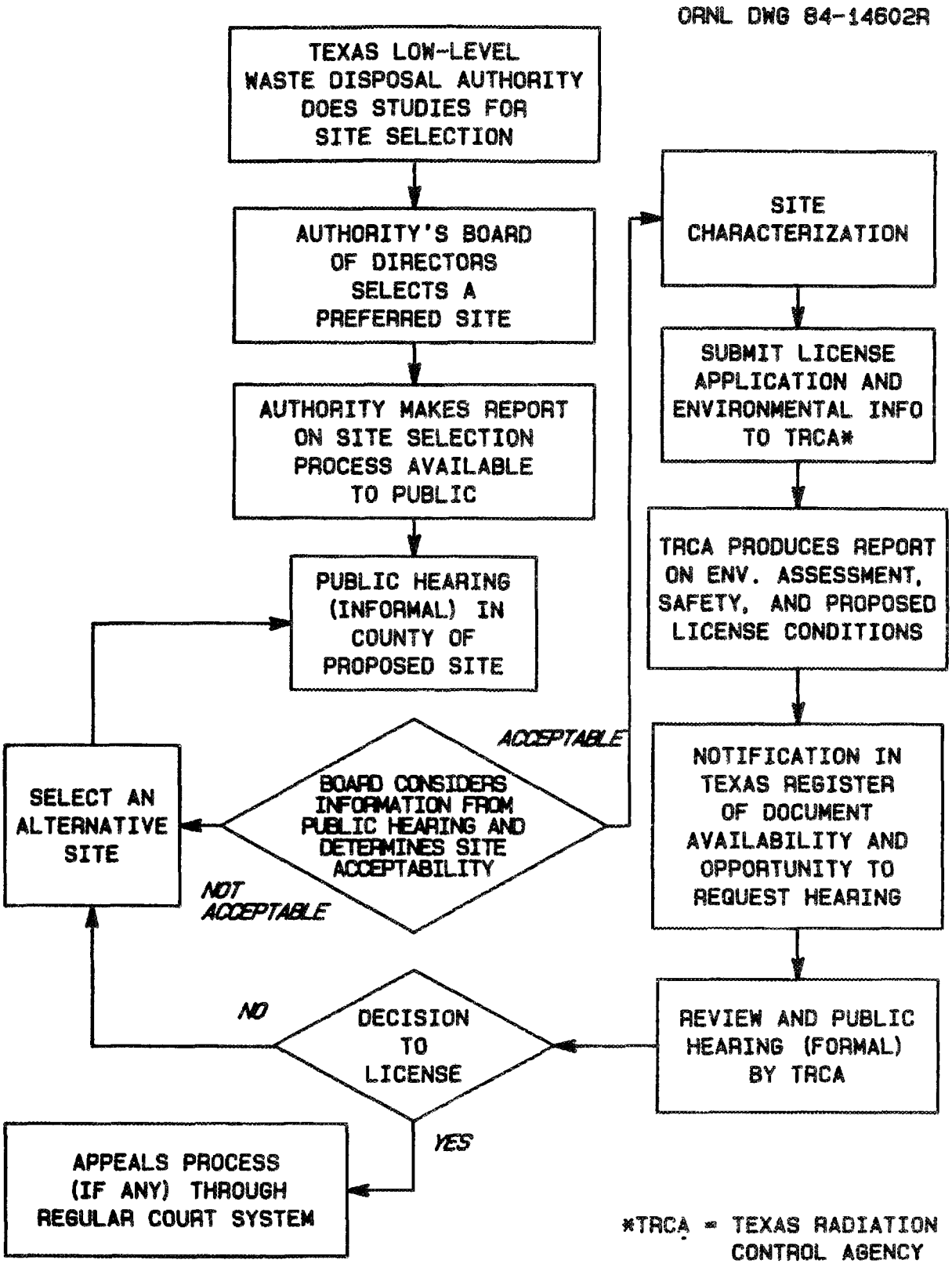


Fig. 4. Site selection process in Texas

ORNL DWG 84-14603R

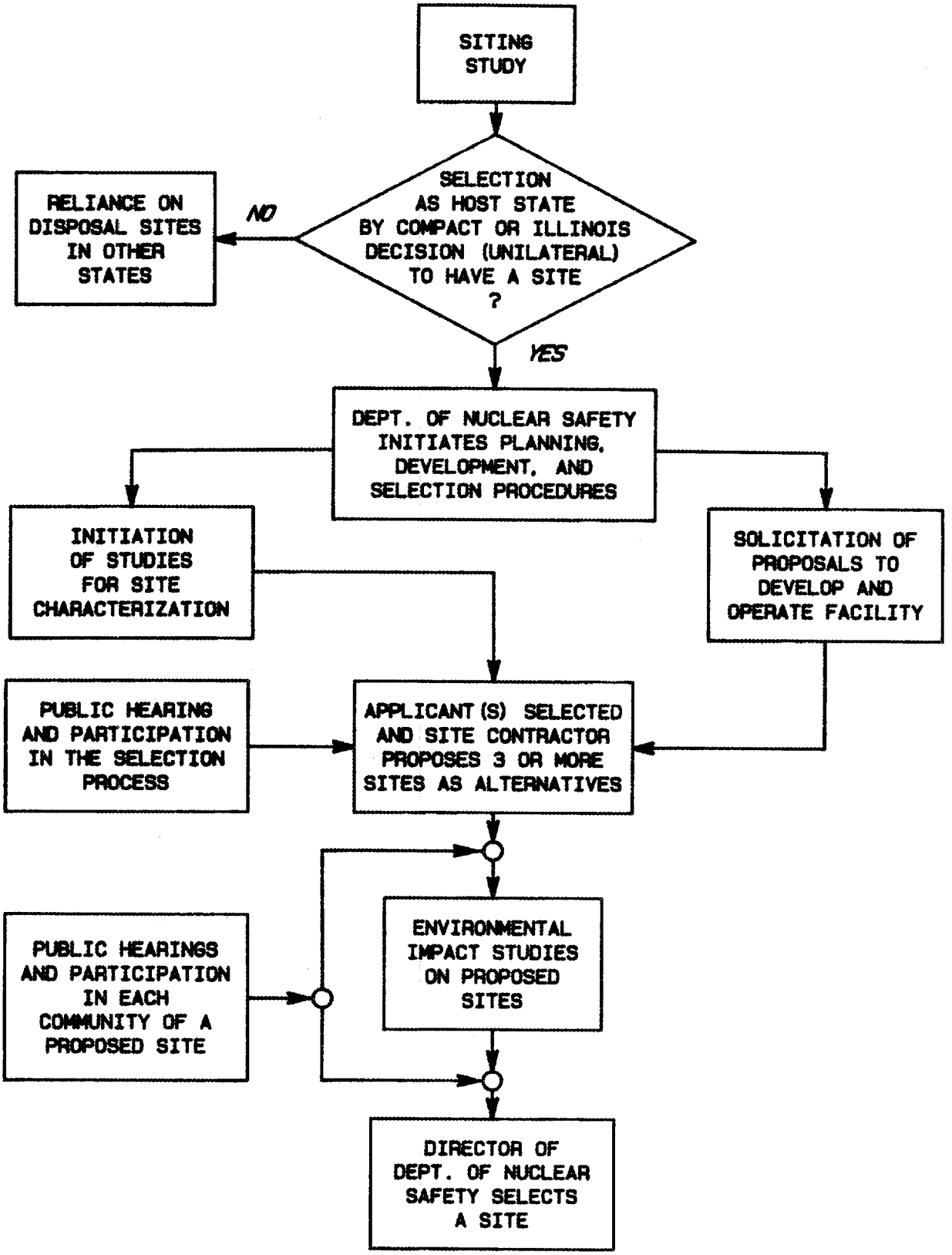


Fig. 5. Site selection process in Illinois

expecting to be non-host members of compacts. The State of New York is an example of a large generator of radioactive waste which has not formulated a site selection process. However, New York is aware of the likelihood that a site selection process will need to be implemented (NY State Energy Office 1984). Actions which are contemplated include: arranging options for interim disposal or storage; a study to identify environmentally sound sites for permanent sites within New York; and preparation to eventually host a LLW disposal site regardless of the near-term option chosen for compliance with its mandated responsibility (NY State Energy Office 1984).

The State of Indiana (a Non-agreement State) is an example of a very small waste generator. Indiana has ratified the Midwest Interstate Low-Level Radioactive Waste Compact; however, it has no site selection procedure. As a Midwest Compact member, Indiana could be designated as a host state and consequently be obligated to provide a regional disposal facility under terms of the Compact. The State Legislature has been informed of this possibility and would be required to pass legislation to implement a site selection and development procedure if it is designated as a host state (Berger 1984). The situation in Indiana is not uncommon; several states do not have contingency plans for siting a disposal facility and will presumably make plans only if siting a facility becomes imminent (Funderberg 1983, Halverson 1984).

North Dakota (an Agreement State) has not joined a compact, although it is still eligible to do so. A legislative resolution has been passed which directs the North Dakota Legislative Council to study the options available and to report its findings to the 1985 legislative session (DOE 1983a).

New Jersey (a Non-agreement State) has ratified the Northeast Compact which has also been ratified by Connecticut, Delaware, and Maryland. As a member of the Compact, New Jersey recognizes its potential for hosting a facility but has not enacted specific siting legislation. This will probably be done after the deadline for ratifying the Northeast Compact. The Northeast states are negotiating

with other regions for interim disposal. This will be necessary since the earliest the Northeast Compact could have its own disposal facility is approximately 1990 (Gordon 1984).

3. LICENSING PROCEDURES

3.1 NRC Procedures

The NRC has established general procedures which govern licensing all types of nuclear facilities (10 CFR Part 2); additional procedures which apply specifically to LLW disposal facilities are provided in 10 CFR Part 61. The NRC's procedures apply to license applications for facilities in Non-agreement States. The core of the NRC licensing process is a technical review of the application. The process also involves public notification, an environmental review, and public hearings on the license application. Figure 6 provides a flow chart which outlines the NRC licensing process. The following sections describe the various stages in NRC's licensing process. A detailed flow chart of the process is provided in Plate 2.

3.1.1 Docketing and initial processing

The licensing process begins when NRC receives the license application and the accompanying Environmental Report (ER). The steps which follow include assignment of a tentative docket number, notification of appropriate officials and governing bodies, and an evaluation whether the application is complete. If the application is complete and acceptable, NRC assigns a docket number and distributes copies of the application and ER to the appropriate officials and public library reading rooms. At this point NRC begins the process of preparing an Environmental Impact Statement (Sect. 3.1.2), publishes a notice of docketing, and publishes a notice offering the opportunity to request a hearing.

3.1.2 Preparation of Environmental Impact Statement

NRC's issuance of a license to a LLW disposal facility is considered in most cases a "major federal action significantly affecting

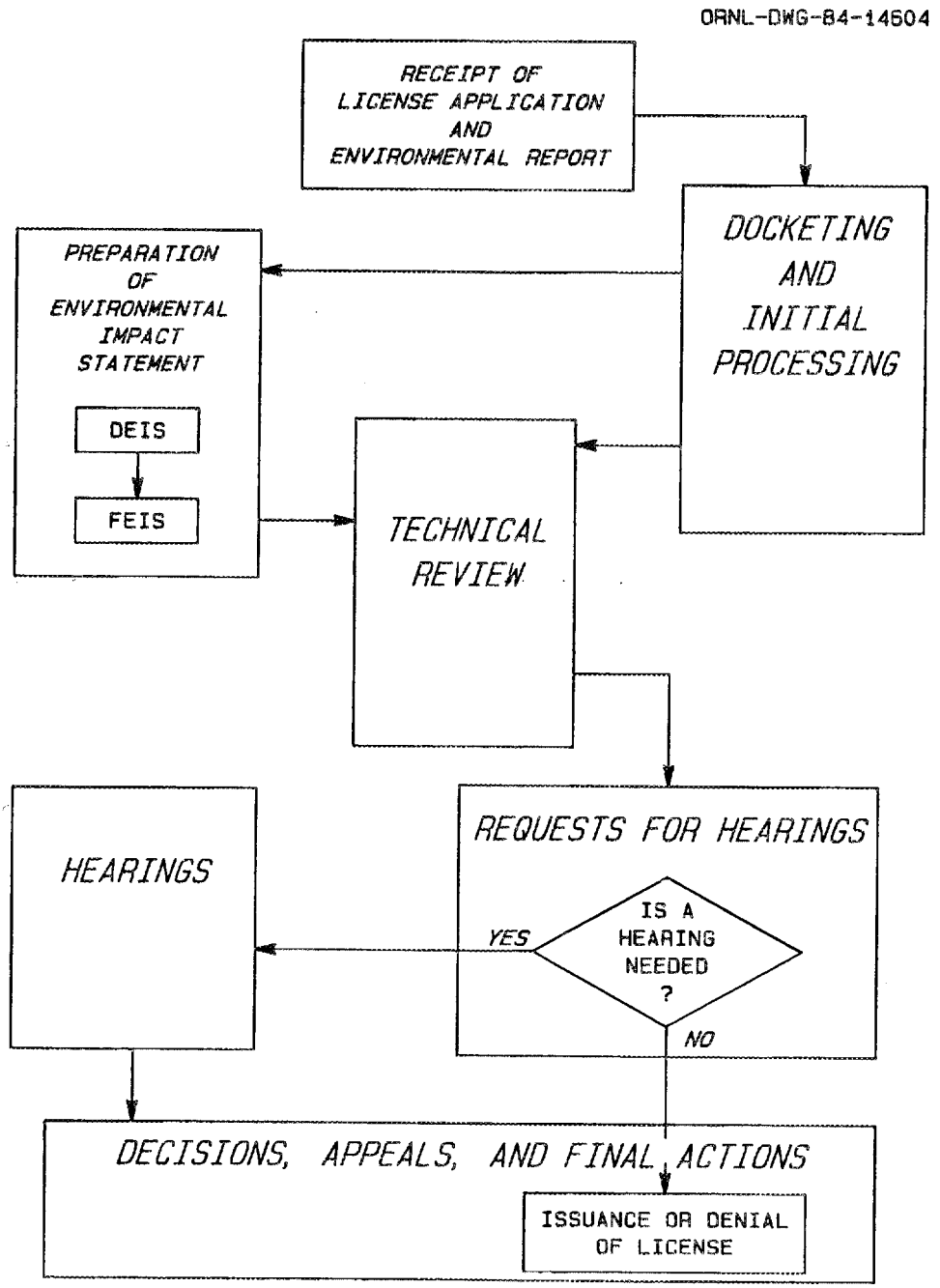


Fig. 6. NRC licensing procedures for low-level waste disposal facilities

the quality of the human environment". Thus, under the requirements of the National Environmental Policy Act (NEPA), NRC must prepare an Environmental Impact Statement (EIS) which analyzes the potential effects of the facility and examines alternative actions. The procedures for EIS preparation (see Plate 2) are specified by NRC's regulations on environmental protection (10 CFR 51) and the Council on Environmental Quality's guidelines (40 CFR 1500-1508).

The EIS process begins with a scoping activity to identify the issues that are important to the public and other agencies. NRC then prepares an analysis of the impacts of licensing the disposal facility and of alternative actions. This NRC analysis may make use of information and analyses available in the applicant's ER, but, since NRC must make an independent assessment, additional information and analyses also may be considered. NRC's assessment is prepared as a Draft Environmental Impact Statement (DEIS) which is issued for review by the public and other agencies, states, and groups. Based on the comments which are received on the DES, NRC then revises the document and issues a Final Environmental Impact Statement (FEIS), which contains NRC's conclusions and recommendations regarding the proposed action. The entire package of DEIS, comments, and FEIS is considered by the Commission in its technical review of the application and in the public hearing, if one is held.

3.1.3 Technical review

The NRC's technical review of a license application addresses the question of whether the facility can meet the performance objectives and technical requirements in 10 CFR Part 61. All aspects of the license application will therefore be closely scrutinized. The applicant's qualifications must be evaluated and all aspects of the proposed facility will be reviewed, including the site, the site utilization plan, design of disposal units, plan of operations, closure plan, institutional arrangements, and financial assurances. The NRC will

examine the assumptions which form the basis of the applicant's analyses; when appropriate, NRC will recheck calculations and attempt to verify the validity and accuracy of any models used by the applicant. Environmental impacts of the proposed facility will also be reviewed.

3.1.4 Requests for hearings

When NRC has completed its technical review of a license application, it must determine whether to hold a public hearing (see Plate 2). NRC will have published a notice of opportunity to request a hearing after the application is docketed. If no requests have been received, NRC can proceed directly to issue a license (assuming that the technical review was favorable). If a hearing has been requested, NRC may attempt to resolve the issues of concern through some mechanism other than a formal public hearing. The formal hearings process is typically lengthy, complex, and expensive (Sect. 3.1.5), and if issues can be resolved by less formal methods, all parties benefit (NRC 1981). Requests for a hearing will be reviewed by an NRC presiding officer, who can reject a request which is deemed to be without merit.

Public hearings may also be necessary if the NRC's technical review of the license application is unfavorable. In this case, NRC would issue a notice of proposed denial of license, and the applicant has the right to demand a hearing.

3.1.5 Hearings

The process which occurs prior to holding a public hearing determines the scope of hearings and who may participate. Following notice of a public hearing in the Federal Register, any person whose interest is affected by the proceeding and has a desire to participate can file a written petition for leave to intervene. Parties admitted to the hearing have a right to generate evidence through various methods of discovery including depositions upon oral examination or written interrogatories, production of documents, permission to enter land for

inspection and other purposes, and requests for admission (10 CFR 2.740). In general, parties to the hearing may obtain discovery regarding any matter that is relevant to the subject matter of the proceeding.

Presiding at a public hearing may be one or more Commission members, an Atomic Safety and Licensing Board (ASLB), or a named officer who has been delegated final authority in the matter. An ASLB is comprised of three members, one of whom is qualified in the conduct of administrative proceedings and two of whom have qualifications appropriate to the issues to be decided.

3.1.6 Decisions, appeals, and final actions

At the conclusion of the hearing, the presiding officer will make an initial decision based on the hearing record. Appeals of the initial decision can be made within a specified period. They are considered by the Commission or an Atomic Safety and Licensing Appeal Board (ASLAB). Three members of NRC's Atomic Safety and Licensing Appeal Panel are assigned for each proceeding based on possession of qualifications deemed appropriate for each proceeding. Following the consideration of any appeals to the initial decision, NRC will issue its final decision and publish a notice of issuance or denial of the license.

3.2 Agreement States

Each Agreement State must have a regulatory program that is compatible with the NRC's, and thus, most Agreemnt States have adopted or will adopt specific regulations designed to insure compatibility with 10 CFR Part 61. NRC has designated the following sections and subparts of 10 CFR Part 61 as matters of compatibility for Agreement States: Sect. 61.2, Definitions (applicable technical definitions); Subpart C, Performance Objectives; Subpart D, Technical Requirements for Land Disposal Facilities; those parts of Subpart B that are necessary to implement the provision of Subparts C and D; and those portions of

Subpart E, Financial Assurance, which deal with ensuring adequate funds for decontamination, closure and stabilization of a LLW disposal site. Agreement States are also expected to adopt provisions equivalent to 10 CFR 20.311, which established a waste transfer and manifest system, and 10 CFR 61.55, 61.56, and 61.57, dealing with waste classification, waste characteristics, and labeling, respectively. Agreement States are expected to have their compatible regulatory programs in place as soon as practicable and before 1987 (Nussbaumer 1983).

California is an Agreement State which in March 1984 adopted licensing regulations for a low-level disposal facility. California is not an eligible state in any regional compact and is currently anticipating siting and licensing its own facility (Hickman 1983, DOE 1983b). California's Public Health Code was revised to include "Regulations for Land Disposal of Radioactive Waste," and Article 1 of these regulations adopts most of 10 CFR Part 61 by reference (State of California 1984). The state is currently in the process of selecting a private contractor which will select a site and develop a disposal facility (Hickman 1984).

Another Agreement State of interest is Colorado, which ratified the Rocky Mountain Compact in 1982. Presently, Colorado is the largest generator that has ratified the Rocky Mountain Compact and may be a possible candidate as a host for the Compact's regional disposal site. Colorado's Radiation Control Act (Part 1), Title 25 Part 11, enacted in 1965, gives the Colorado Department of Health the authority to license LLW disposal facilities.

Although Colorado has not yet developed the specific licensing regulations for LLW disposal Title 25 Part 11 requires that regulations be modeled after "Suggested State Regulations for Control of Radiation" which have been proposed by the Conference of Radiation Control Program Directors, Inc. Substantial deviation from these guidelines, according to Colorado's statute, must be based on detailed findings that show such deviation is warranted.

The Colorado regulations provide for an environmental report and public hearing for commercial disposal of low-level waste on state-owned

property. Requirements for a public hearing generally follow the NRC procedures outlined for Non-agreement States (Sect. 3.1) including hearing notice, intervenor status, discovery, presentation of evidence, cross examination of witnesses, and appeal of decision as provided by the Colorado Administrative Procedures Act. At present Colorado does not require a state EIS, although this could be changed as specific regulations for licensing LLW disposal facilities are adopted.

4. CONCLUSION

Future disposal of low-level radioactive wastes requires the selection, development, and licensing of new facilities. This process is guided by the Low-Level Waste Policy Act of 1980 and by the Nuclear Regulatory Commission's regulations 10 CFR Part 61. Although the NRC's rules establish a basic regulatory framework for siting and licensing new facilities, the process will be somewhat varied because it will involve many different compacts, states, private enterprises, and other interest groups. This report provides a general outline of the procedures for site selection, site evaluation, and licensing.

It is interesting to note that states may choose a greater or lesser extent of participation in site selection, site characterization, and facility design. For instance, Texas intends to exercise total control over the process through the Texas Low-Level Waste Disposal Authority. Illinois is active in the selection process but allows important input from the contractor selected to develop the site. California is tentatively depending on applications from potential contractors. Every state must eventually provide a mechanism that assures there is an option for disposal of their own wastes. However, trends are not yet established, and it is possible that only a few states will actually implement site selection procedures. The actions of states such as Texas, California, and Illinois which are "out front" in implementing site selection may set precedents which affect other states that eventually find it necessary to site a facility.

At present it is difficult to predict what patterns of licensing activity will evolve for LLW disposal facilities, since no new facilities have been licensed for over ten years. In the last decade the most visible example of licensing for nuclear-related facilities were the license proceedings for nuclear power reactors. These proceedings frequently involved concerted opposition from interest groups which raised a great many technical and other issues. Reactor licensing took place in the context of increasing polarization over the

technology; some opponents of reactor licensing depicted nuclear power as an insufficiently mature technology, while some proponents depicted opposition to reactors as irrational obstructionism. Licensing proceedings frequently involved significant delay, cost, and frustration.

In the forthcoming efforts to license LLW disposal facilities, new patterns may emerge. This may result from a different public perception of disposal facilities vs. power facilities, or through the need for states (either individually or through compacts) to take responsibility for their own wastes. However, a fundamental requirement for the successful siting and licensing of any controversial facility is development of effective communication between parties in conflict and the utilization of techniques to manage and resolve the conflicts. This represents perhaps the most significant challenge for the people involved in LLW disposal in the next decade.

5. REFERENCES

Berger, Pat, 1984. Indiana State Health Committee. Phone conversation with J. W. Van Dyke, ORNL, (March).

DOE (Department of Energy), 1983a. Managing Low-Level Radioactive Wastes: A Proposed Approach. DOE/LLW-9, National Low-Level Radioactive Waste Management Program, EG&G, Idaho Falls, Idaho.
DOE, 1983b. Radioactive Waste Management: A Summary of State Laws and Administration, DOE/LLW-18T Rev. 2, National Low-Level Radioactive Waste Management Program, EG&G, Idaho.

DOE, 1984. Procedures and Technology for Shallow Land Burial of Low-Level Radioactive Waste. Prepared by ORNL for DOE Low-Level Waste Management Program, Idaho Falls, Idaho, ORNL/NFW-84/10.

DOE, 1982. The Siting Process: Establishing a Low-Level Waste Disposal Facility, DOE/LLW-6Tc, National Low-Level Waste Disposal Management Program, EG&G, Idaho, (November).

Funderberg, Robert, 1983. Radiation Safety Officer for Idaho Department of Health and Welfare. Phone conversation with J. W. Van Dyke, ORNL, (December).

Halverson, Don, 1984. North Dakota State Geologist Director. Phone conversation with J. W. Van Dyke, ORNL, (March).

Hickman, John, 1983. California Radiological Health Branch, Department of Health Services. Phone conversation with J. W. Van Dyke, ORNL, (December).

Hickman, John, 1984. California Radiological Health Branch, Department of Health Services. Phone conversation with R. D. Roop, ORNL, (September).

Gordon, Cindy, 1984. New Jersey Bureau of Radiation Protection. Phone conversation with J. W. Van Dyke, ORNL, (March).

Keystone Center, 1983. The Keystone Center Siting Process Handbook. Prepared for the Texas Departments of Health and Water Resources and the Texas Air Control Board by the Keystone Center, Keystone, Colorado, 32 pp, (September).

NRC (Nuclear Regulatory Commission), 1981. Draft Environmental Impact Statement on 10 CFR Part 61, "Licensing Requirements for Land Disposal of Radioactive Waste," NUREG-0782, Vol. 2, Main Report, Office of Nuclear Material Safety and Safeguards, Washington, D.C., (September).

NRC, 1982. Policy, Procedures, and Information Manual, Enclosure to Attachment A-2, State Agreement Program, Office of State Programs, (June).

NRC, 1983. Standard Format and Content of Environmental Reports for Near-Surface Disposal of Radioactive Waste. Regulatory Guide 4.18, Office of Nuclear Regulation Research, 33 pp. (June).

Nussbaumer, D. A., 1983. Letter to Agreement States from Assistant Director for State Agreements Program, Office of State Programs, NRC, March 29.

New York State Energy Office, 1984. Low-Level Radioactive Waste Management Study, draft report, (January).

O'Hare, M., L. Bacow, and D. Sanderson. 1983. Facility Siting and Public Opposition, Van Nostrand Reinhold Company, New York, N.Y., 223 p.

Siefken, D., G. Pangburn, R. Pennifill, and R. J. Starmer, 1982. Site Suitability, Selection, and Characterization, NUREG-0902, NRC Office of Nuclear Material Safety and Safeguards, Washington, D.C., (April).

State of California, 1984. Title 17, Public Health Code, Part 1, State Department of Health Services, Chapter 5, Sanitation, Sub-Chapter 4.5, Group 7, Regulations for Land Disposal of Radioactive Waste, (March).

ORNL-DWG-84-14916

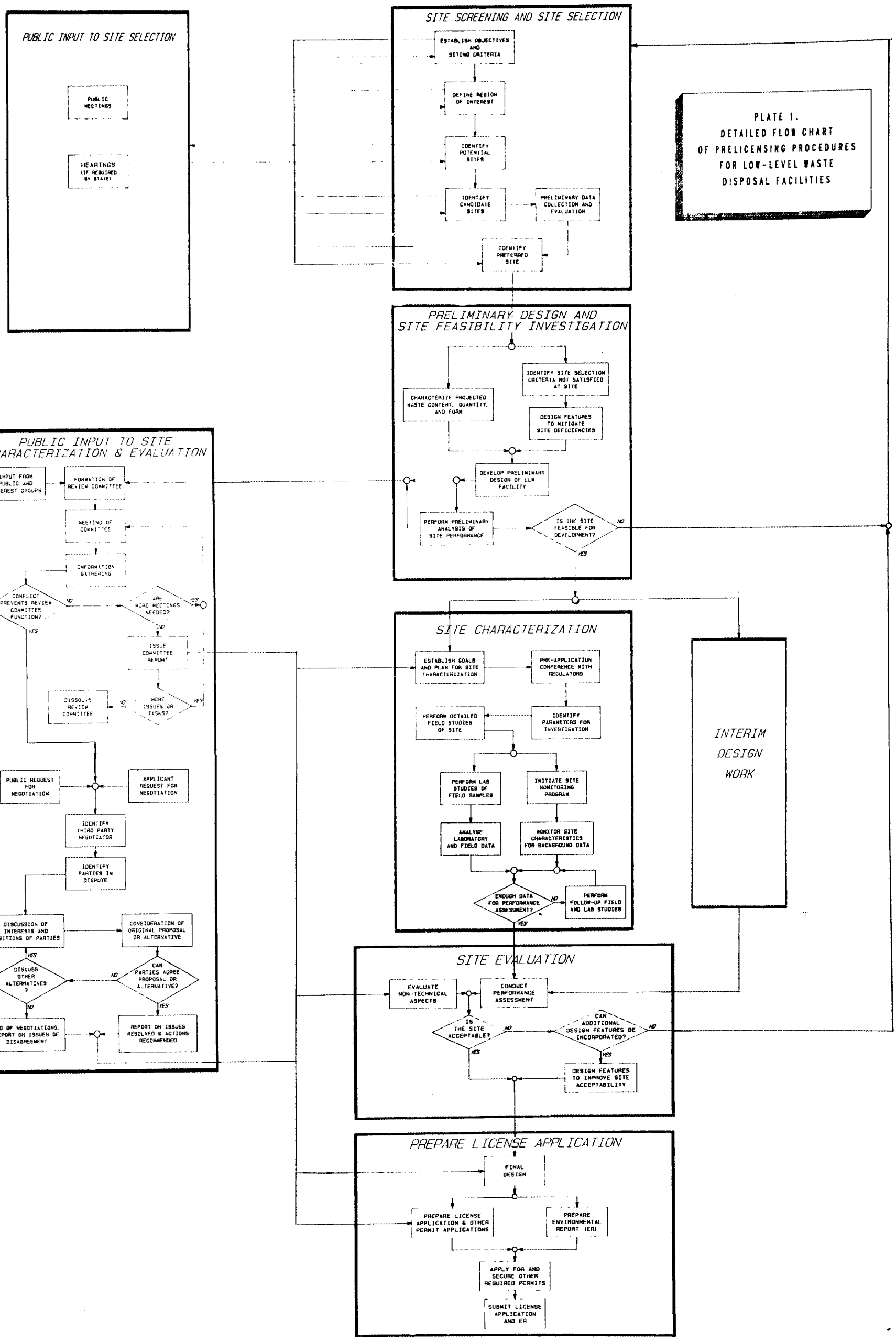
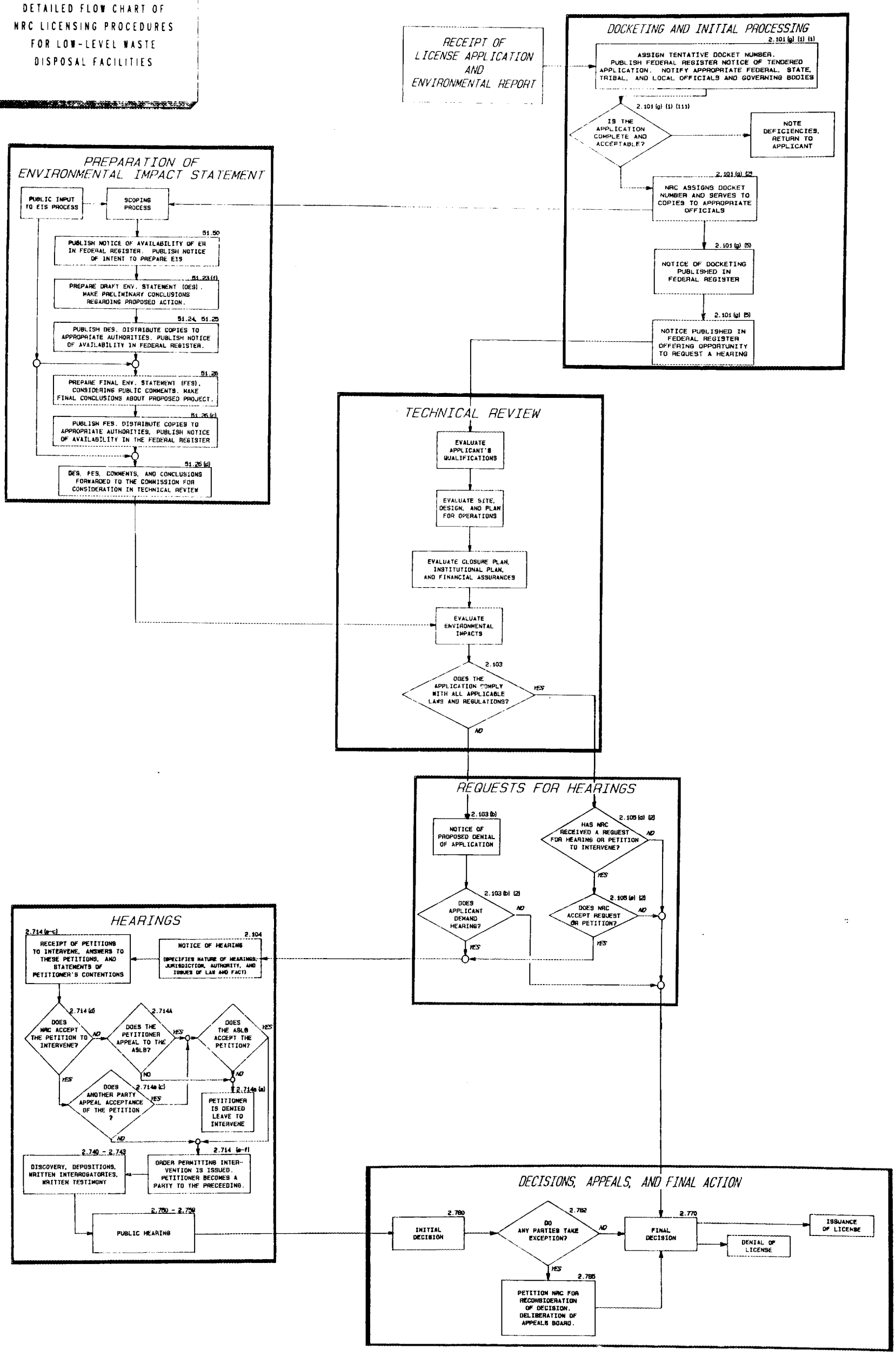


PLATE 2.
DETAILED FLOW CHART OF
NRC LICENSING PROCEDURES
FOR LOW-LEVEL WASTE
DISPOSAL FACILITIES



NUMBERS ABOVE RIGHT-HAND CORNES OF SYMBOLS REFER TO
SECTIONS OF NRC RULES 10 CRF PARTS 2 AND 51

ORNL/TM-9715

INTERNAL DISTRIBUTION

1. S. I. Auerbach
2. D. J. Bjornstad
3. C. R. Boston
4. J. B. Cannon
5. R. A. Cantor
6. S. A. Carnes
7. F. C. Chen
8. E. C. Davis
9. P. D. Fairchild
10. R. J. Friar
11. W. Fulkerson
12. E. L. Hillsman
13. N. E. Hinkle
14. D. W. Jones
15. D. W. Lee
16. F. C. Maienschein
17. L. N. McCold
18. R. B. McLean
19. E. Peelle
20. S. F. Rayner
21. L. W. Rickert
22. T. H. Row
23-27. R. D. Roop
28. R. E. Saylor
29. R. B. Shelton
30. J. H. Sorensen
31. B. P. Spalding
32. L. E. Stratton
33. R. E. Thoma
34-38. J. W. Van Dyke
39. A. J. Witten
40. H. E. Zittel
41. Central Research Library
42. Document Research Section
43. ESD Library
44. Lab Records
45. Lab Records - RC
46. ORNL Patent Section

EXTERNAL DISTRIBUTION

47. Office of Assistant Manager, Energy Research and Development, DOE-ORO, P. O. Box E, Oak Ridge, TN 37831.
48. Dr. S. M. Gillis, Professor, Public Policy and Economics, Duke University, 4875 Duke Station, Durham, NC 27706.
49. Dr. F. R. Kalhammer, Vice President, Electric Power Research Institute, P. O. Box 10412, Palo Alto, CA 94303.
50. Dr. R. E. Kasperson, Professor of Government and Geography, Graduate School of Geography, Clark University, Worcester, MA 01610.
51. Dr. Martin Lessen, Consulting Engineer, 12 Country Club Drive, Rochester, NY 14618.
52-78. Technical Information Center, Oak Ridge, TN 37831