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SHALLOW LAND BURIAL HANDBOOK

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INTRODUCTION

Additional disposal facilities are needed to accommodate the low-level radioactive wastes being produced by both commercial and defense activities. DOE's Low-Level Waste Management Program is to "Develop the technology and documentation required to open a shallow land burial site." The Snallow Land Burial Handbook supports this goal by transmitting state-of-the-art information about shallow land burial technology to the user community. The handbook is structured to provide an overview and initial guidance to developers and state/local planners concerning development phases and activities required for establishing new facilities for near-surface disposal of low-level radioactive waste. Activities include defining and scoping the problem, establishing objectives, compiling information, considering alternatives, and establishing and implementing plans. These activities are implemented during the preliminary analysis, site selection, facility design and construction, facility operation, and facility closure/post-closure development phases.

PRELIMINARY ANALYSIS

The preliminary analysis phase of developing a new disposal site provides the data and assurance needed to proceed. Preliminary analyses define and scope the problem, evaluate regulatory and licensing requirements, establish basic objectives and goals required for facility development, and include preliminary design and economic studies. The objectives and goals addressed in the Shallow Land Burial Handbook are derived from basic scientific principles and engineering practices, DOE guidelines, NRC regulations and position papers, and regulatory requirements imposed by other federal and state agencies. The developer may choose to add other constraints such as waste acceptance criteria or desired facility capacity.

The compilation of information provides a basis for preliminary marketing, feasibility, and economic studies as well as for understanding site development strategies, alternatives, and interfaces. Sufficient information is required to prepare a logic diagram highlighting major requirements and decision points. All phases of development are interdependent.

SITE SELECTION

Successful site selection can simplify licensing, reduce site development costs, and simplify post-closure surveillance and maintenance. Site characteristics important to shallow land burial include predictability, stability, hydrogeology favorable for avoiding water, no exploitable resources, and public acceptance. The primary goal of site selection is to identify a site that can be suitably characterized, modelled, analyzed and monitored to show compliance with performance objectives. Site selection is completed in two stages - site screening and site characterization. Site screening analyses utilize reconnaissance level data and start with a region of interest to which area screening criteria are applied to identify a few candidate areas. Site screening criteria are then applied to the candidate areas to identify a slate of candidate sites. After data collection and evaluation, a preferred site can be identified from the slate of candidate sites. The logic is outlined in Figure 1.

Site characterization follows site screening and concentrates on evaluating the preferred site to confirm that the selected site meets performance objectives and collecting baseline site data. Detailed field studies and laboratory analyses are initiated and a preliminary pathways analysis is completed. If the preliminary pathways analysis complies with performance requirements a more detailed analysis is completed and site development proceeds. Site flaws identified in the preliminary pathways analysis will be addressed by adding design features, operating constraints, or waste form constraints to be considered in conjunction with site characteristics. The detailed pathways analysis will then be completed to either demonstrate compliance and proceed with site development or indicate that a new site must be considered. The site characterization logic is summarized in Figure 2. Input from parallel engineering studies is required during site characterization.

The handbook identifies the type of information required, sources of information, and limitations on its availability and use. Parameters important to both site screening and characterization are organized in the handbook according to the disciplines of geology, hydrology, meteorology, ecology, and socioeconomics.

FACILITY DESIGN AND CONSTRUCTION

Design requirements and preliminary design studies are important inputs to the previously described steps of preliminary analysis and site selection. Similarly, development of design strategies and alternatives are dependent on site operations and site closure/post-closure requirements.

The disposal unit is the portion of the facility where waste is placed for disposal. The important design objectives for disposal units are minimizing water contact with the waste, avoiding subsidence and

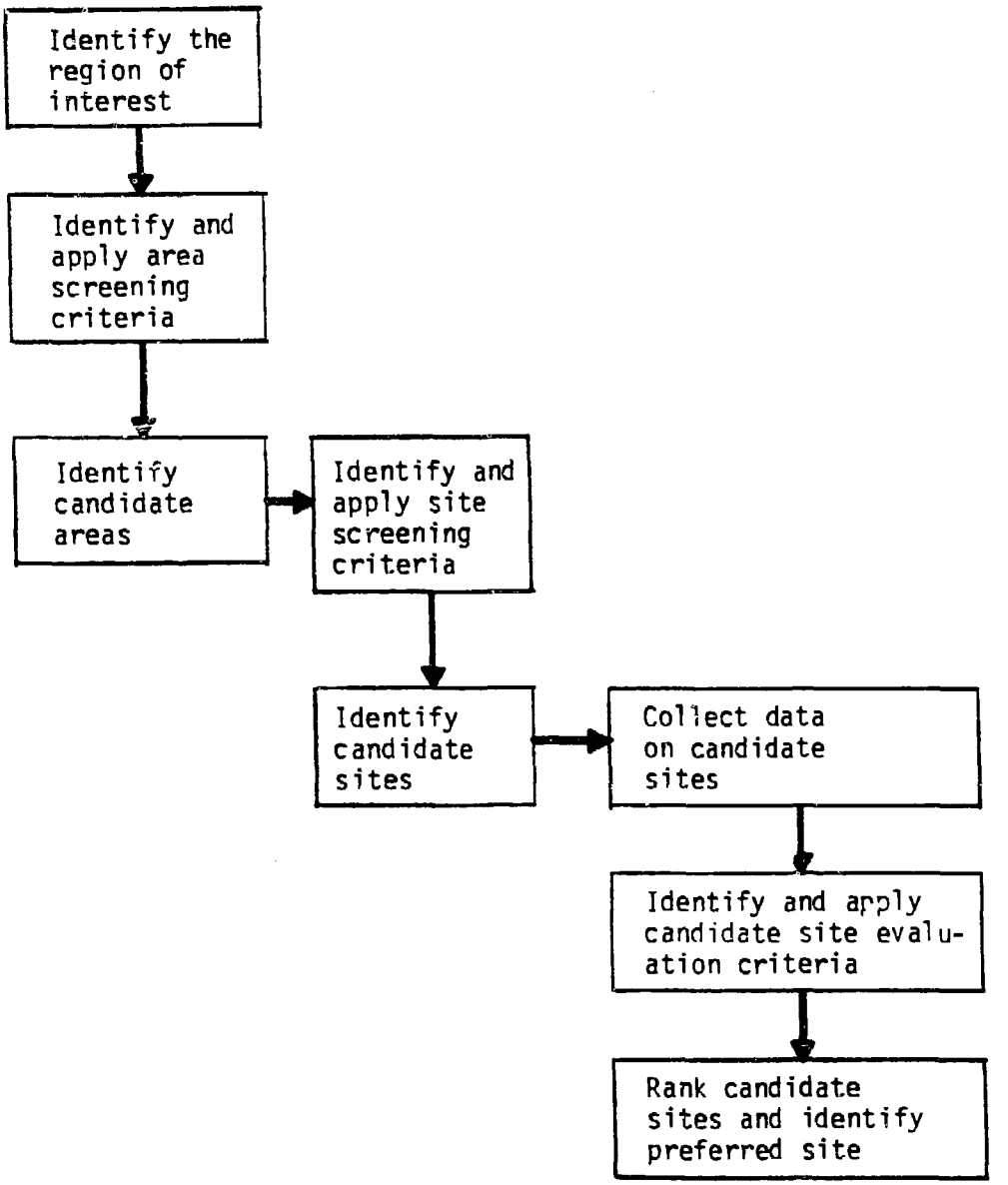

Figure 1. Site screening logic

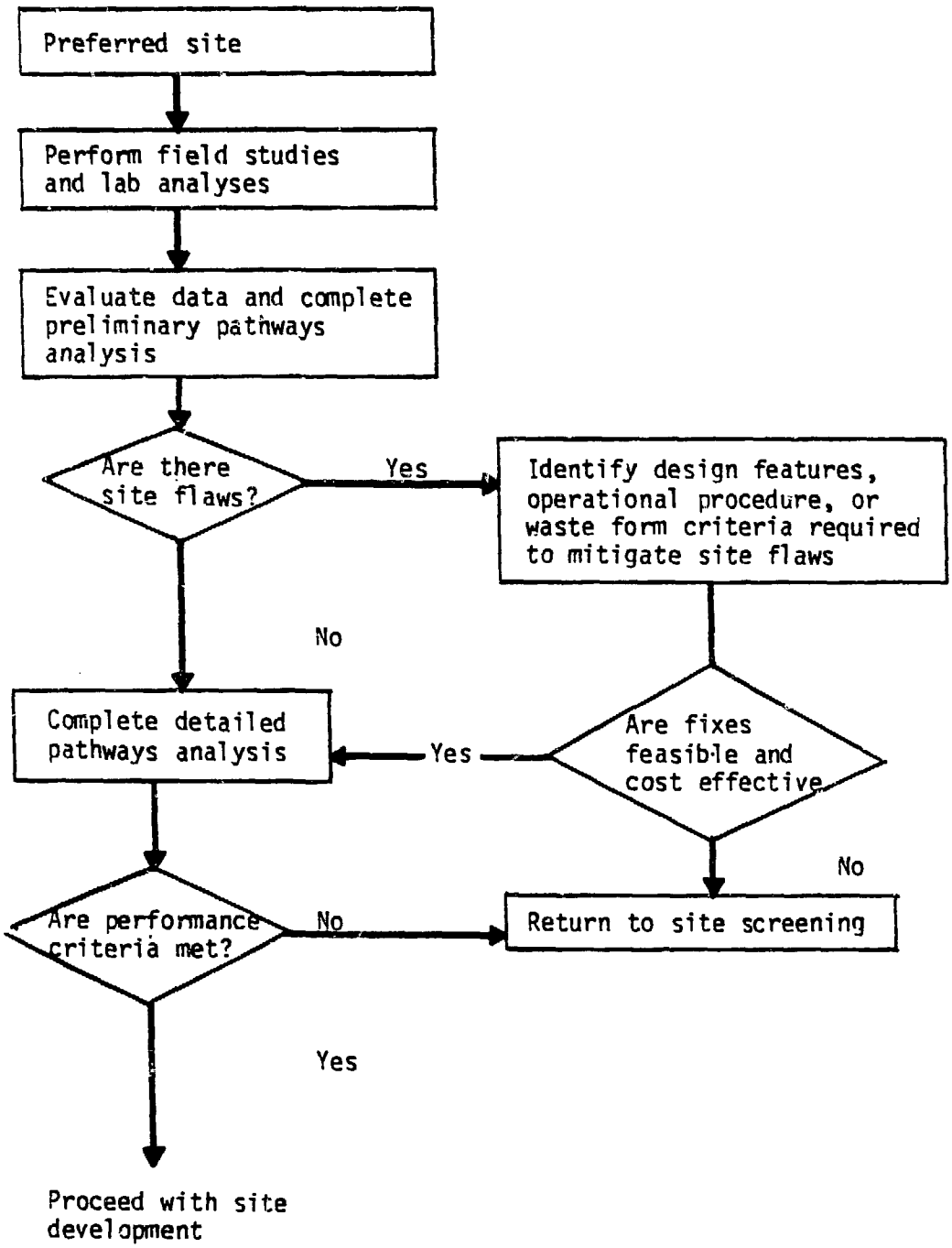

Figure 2. Site characterization logic

optimizing land use. Site and operations considerations influence these objectives. Typically, a variation of the trench concept is used in near-surface disposal. Options include vertical walled trenches, sloped trenches, broad trenches, or slit trenches. The site may use a combination of trenches depending on waste characteristics, soil stability, depth to groundwater, and available disposal area. Applications, advantages, and disadvantages are summarized in the handbook. A number of design features are considered for minimizing water contact, reducing subsidence, or optimizing land utilization; including sizing, drainage, liners, installing leachate detection systems, and interim closing with impermeable caps. Site development, assessments and permits (i.e., environmental, safety and quality assurance), and actual construction are also addressed.

FACILITY OPERATIONS

The primary objective of site operations is to avoid water contact with the waste and minimize subsidence. Facility operations and procedures applicable to low level waste disposal include waste handling, waste placement in trenches, interim closure and stabilization, personnel monitoring, and recordkeeping. These procedures must consider the nature of the waste handled and the regulatory requirements. Waste handling encompasses transport, receiving and storage. Waste placement techniques considered in the handbook are the ones currently used: remote mechanical placement using cranes at the trench edge, forklift placement from the edge of the trench or from the bottom of the trench, direct dumping into the trench. Reducing active areas and stabilizing by backfill and compaction are considered to be important actions in interim closure and stabilization. Personnel monitoring and recordkeeping requirements are addressed.

Other operational considerations such as environmental monitoring, operating equipment, security, staffing, contingency planning, and required assessment and audits are addressed in the handbook.

FACILITY CLOSURE/POST-CLOSURE

Strategies for site closure and post-closure affect site selection, design, and operation. Protecton of the public, protection of the individual and site stability are major goals. A final site closure plan which must be prepared prior to the end of facility operations, includes decontamination, dismantling, removing, and disposing of all facilities not necessary for post-closure or institutional controls and may require recontouring or revegetation of the entire site. Post-closure monitoring and maintenance and corrective actions are addressed. The institutional control period follows post-closure, with active control measures as necessary.

An important element in developing a commercial low-level waste disposal site is the requirement by NRC for financial assurance arrangements that finance final site closure, post-closure, and institutional care. Financial assurance must be fully funded prior to startup of site operations.

CONCLUSIONS

The facility development phases (preliminary analysis, site selection, facility design and construction, facility operation, and facility closure/post-closure) are systematically integrated into a logical plan for developing near surface disposal plans. The Shallow Land Burial Handbook provides initial guidance and concepts for understanding the magnitude and the complexity of developing new low-level radioactive waste disposal facilities.