

CANDIDATE SITES SELECTION FOR THE CALIFORNIA LOW LEVEL RADIOACTIVE WASTE DISPOSAL FACILITY

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ABSTRACT

This report describes the methods used to select three candidate sites for California's low level radioactive waste (LLRW) disposal facility. The three candidate sites are: Silurian Valley (San Bernardino County, 15 miles north of Baker), Ward Valley (San Bernardino County, 25 miles west of Needles), and Panamint Valley (Inyo County, 29 miles north of Trona) (1). US Ecology, Inc., intends to apply to the California Department of Health Services (CDHS) for a license to construct and operate the disposal facility at one of these sites.

BACKGROUND TO CANDIDATE SITES SELECTION

California law requires that a LLRW disposal facility be established in California to meet the state's responsibilities under the federal Low Level Radioactive Waste Policy Act for safe disposal of LLRW generated in the state by non-federal activities. California produces approximately 200,000 cubic feet of such LLRW annually, currently disposed at the disposal facilities in Richland, Washington, and Beatty, Nevada. In response to the Act, the California Legislature passed AB 1513, Chapter 95 (1982) and SB 342, Chapter 1177 (1983). Consistent with the California Radiation Control Law, AB 1513 directed the CDHS to develop a plan for the management, treatment and land disposal of LLRW and to assume responsibility as the licensing authority for the facility. Among other mandates, AB 1513 required CDHS to develop siting criteria consistent with 10 CFR Part 61, which was incorporated into the California Administrative Code under Title 17, Section 30470. In response, CDHS recommended criteria which incorporated the federal regulatory requirements, and made additional recommendations reflecting California's specific conditions (2).

Among other provisions, SB 342 directed the Governor to perform a statewide screening study to identify suitable disposal areas, and to select a "license designee" to establish a site. In response, CDHS conducted a statewide screening study and summarized the results in its 1984 report (3).

Consistent with SB 342, DHS selected US Ecology, Inc., as the license designee to find suitable sites for the facility, characterize them, apply for a license, and upon licensing, construct and operate the facility. The Legislature directed that the license designee would carry out these activities under CDHS oversight.

US ECOLOGY'S CANDIDATE SITE SELECTION PROGRAM

US Ecology carried out systematic statewide, regional and local screening studies during 1986-1987. The program was directed by Ronald K. Gaynor, Vice-President, and Stephen A. Romano, Assistant Project Manager at US

Ecology in Newport Beach, CA. US Ecology was supported in site selection by a team of primary contractors including: Environmental Science Associates, Inc., (ESA), program planning, environmental integration, public involvement program, mapping, physical and socioeconomic environment; and Harding Lawson Associates, Inc., geotechnical and groundwater. Additional support was provided by Hill and Knowlton, press and media relations; Bechtel National, Inc., surface hydrology; Ecological Research Services, biology; and Cultural Systems Research, ethnography.

The investigation included five primary elements: 1) Identification of site selection criteria; 2) statewide screening; 3) regional screening for potentially technically suitable siting areas; 4) screening and comparison of candidate siting areas using discretionary criteria developed with input of the public; 5) detailed surveys of candidate siting areas and selection of specific candidate sites.

SITE SELECTION CRITERIA DEVELOPMENT

Site Selection Goals

US Ecology's site selection process was driven by the overriding requirement of finding a technically suitable site. These requirements, codified in California law and set forth in CDHS's guidelines were the framework for selecting candidate sites. US Ecology began its site selection process by identifying four siting goals including:

1. Protection of public health and safety;
2. protection of the environment;
3. public acceptability; and
4. reasonable cost, and site selection on a schedule that would minimize financial penalties resulting from California's continued reliance on out-of-state facilities and, ultimately, failure to meet legally required siting milestones.

Types of Site Selection Criteria

Given the above goals, US Ecology developed three types of screening criteria:

- technical suitability criteria
- exclusionary criteria beyond technical suitability requirements, and
- discretionary criteria.

Site selection reflected the systematic development of the above criteria and their universal application as well as the degree of public acceptance.

Technical Suitability Criteria

Criteria development began with identification of regulatory requirements for near surface disposal from which most of the technical suitability criteria were developed (2, 3, 4, 5). All other criteria were subordinate to them. CDHS cannot issue a license for the facility until it is conclusively demonstrated that all the criteria are met. These criteria are discriminatory in part (e.g., eliminate all areas within the 100-year flood plain) but also establish performance standards for natural conditions at the facility site. US Ecology defined ten technical suitability criteria based on the regulatory requirements and state's guidelines. These included hydrological, geotechnical, demographic and resource suitability criteria.

The hydrological suitability criteria included exclusion of areas 1) not in a topographically closed basin, 2) receiving more than ten inches mean annual precipitation, 3) water bodies, wetlands, and potential flooding areas and 4) areas with less than 100-foot depth to groundwater. Topographically closed basins provide hydrologic and geologic conditions that are likely to be less complex than those in large regionally extensive, or open integrated drainage systems. In a closed basin, surface and subsurface pathways (e.g., surface runoff or groundwater flow) for potential transport of contaminants from a site are more readily identified and modeled. This criterion is consistent with the requirement of 10CFR61 for characterization and modeling of the site.

The elimination of humid climatic regions is consistent with recommendations in the State's statewide screening study. In the warm mid-latitude arid zones, potential evapotranspiration greatly exceeds available moisture, thereby minimizing infiltration into the soil and greatly reducing the potential for contamination of groundwater by the wastes. The potential for groundwater recharge is small and localized to areas where surface water can concentrate, such as in drainage channels and areas of ponding.

The geotechnical criteria included exclusion of areas having: 1) Indurated geologic materials (bedrock) with difficult to characterize secondary (fracture or solution opening) porosity; 2) possible earthquake fault rupture hazard; 3) potential volcanic activity; and 4) unstable sand dunes, active dune sands, subsidence and landslide hazards.

The demographic suitability criterion included avoidance of existing and project areas of concentrated population. A resource suitability criterion excluded areas of existing or potentially economic mineral or energy resource development including mining, oil and gas and geothermal resource areas.

Concept of a Technically Suitable Site for California

The above technical suitability criteria, applied in combination, define US Ecology's conceptual technically suitable site. US Ecology sought an optimum site located on a large, stable alluvial area in a topographically closed basin in a portion of the desert that is remote from areas of concentrated or significantly growing population. The site would be situated well above the flood hazard zone of the dry lake and away from large washes. The site would not be situated where bedrock would be too close to the surface. The site would have a minimum depth of 100 feet to groundwater. The site would be free of hazards from fault rupture, landslide, sand dunes, subsidence and volcanism. The site would have no known economic mineral or energy resource potential and no nearby activities that could severely impair facility performance.

Exclusionary Criteria

Following development of the technical suitability criteria, the next criteria identified were exclusionary from an institutional or environmental perspective, but pose practical institutional and environmental prohibitions and severe restrictions to development. The exclusionary criteria included elimination of the following areas: National Parks and Monuments, National Forests and Recreation Areas, National Wildlife Refuges, State Parks and Recreation Areas, military reservations, U.S. Bureau of Land Management (BLM) Class C lands (recommended wilderness areas), BLM Areas of Critical Environmental Concern, the East Mojave National Scenic Area, University of California Natural Reserves, Nature Conservancy lands, closed basins extending across the state's borders (Oregon, Nevada and Mexico), designated historic landmarks in the National Register of Historic Places, and formally designated "critical habitats" of federally listed endangered plant and animal species.

Many exclusionary criteria were specifically identified in the State's suitability study (3); some were added upon recommendation by US Ecology's Citizens Advisory Committee. The early identification and application of the exclusionary criteria eliminated large areas of the state and helped to focus the more detailed studies on acceptable siting areas.

Identification and application of the technical suitability criteria and exclusionary criteria were straightforward processes involving interpretation of established regulations and guidance provided by the state and

NRC. The interpretation of requirements, specific criteria not only meet but also go beyond the established requirements. In addition, the suitability criteria address the existing site conditions, which, of themselves, must be able to safely contain the waste. No facility design was developed at the outset, however, it was assumed that near-surface disposal would be employed.

Discretionary Criteria

Discretionary criteria were developed after the technical suitability and exclusionary criteria were identified and applied in broad statewide and regional screenings. As that application left remaining areas totalling approximately 8,000 square miles in southeastern California which potentially met technical suitability requirements, further screening proceeded using discretionary criteria. Development of discretionary criteria was a more complex process than that for the other criteria because they could be formulated only through synthesis and interpretation of extensive information gathered from the citizens of the southeastern California desert region and from public agencies.

From the outset, it was recognized that development of discretionary criteria would be based on direct input of the public. Ms. Jane Doyle of the CDHS was instrumental in establishing public involvement goals for the project at its outset. The public involvement program designed primarily by ESA and US Ecology was unique on two counts. First, the publics were brought into the site selection process at its inception and their input had direct bearing on US Ecology's candidate sites selection. Second, through public involvement, environmental and ethnographic considerations were incorporated into screening studies before sites were selected. The input was obtained from the local communities within the region, public agencies, the Citizens Advisory Committee and desert researchers.

The discretionary criteria were defined by issues and concerns generally related to LLRW management (e.g., transport hazards) as well as topics specific to the desert region. The criteria were developed through a systematic process of 1) determination of issues and public concerns, 2) translation of issues and concerns to specific siting objectives and criteria, 3) criteria refinement, and 4) weighting of criteria importance for their application. Each step involved public input. Public involvement was a structured program of public information about LLRW management and the site selection process and, more importantly, a vehicle for obtaining information and input from the publics.

Public input to discretionary development and application involved four primary elements. The first element was direct input from the public obtained in three rounds of public meetings. The first round entailed a fairly formal presentation of technical information and the site selection

process (supported by informational handouts, a tabloid, maps and posters) followed by a question and answer period during which issues and concerns were recorded on a large tablet visible to the attendees. The publics completed a questionnaire designed to identify the issues and concerns of each community about the facility. That information was summarized and translated into specific objectives and discretionary criteria for site selection. Extensive consultations were also held with Native Americans.

At the second round of public meetings, the objectives and criteria were presented to the public for comment, and an exercise was devised in which the public rated the importance of criteria. This was a crucial step because it was the key vehicle by which the public influenced site selection. The format of the meetings was similar to that of the first round; additional information was developed in response to concerns identified in the first round. Organized opposition (as well as organized support) to the project had emerged in some communities by the second round of meetings; many questions were asked at the meetings, but no new major issues were raised. The criteria weighting information were summarized and applied in an opportunities and constraints overlay mapping exercise.

The third round of public meetings had an informal open-house format with no formal presentations. At this round, comparative information was presented about sixteen siting areas. The publics provided direct input on site selection choices, however the real value of the rating exercise lay in the publics' stated reasons for their siting choices.

At the outset of the program, the public were informed how and when their input would be put to use, and follow-up was provided. Limits to public involvement were also clearly identified: For example, a clear statement was made that the public had no role in development or application of technical suitability criteria. Additionally, it was publically reiterated that public input was of high value as a guide to site selection but the actual sites would not be chosen on the basis of a popular vote. It is important to note that the public in the California desert embraced the NIMBY syndrome as much as anywhere else in the nation. They have the universal fear of radioactivity, distrust of government and its inability to protect their health and safety, and dislike of the stigma of hosting a disposal site near their communities. Public involvement did serve as an important means to define and apply discretionary criteria as well as to determine community acceptance; as a result, the publics' input had significant influence in site selection. Additionally, the public involvement program helped to direct attention to technical, environmental and socioeconomic considerations rather than allowing a more politically based selection process to emerge.

The second crucial element of the public involvement program was the activities of the Citizens Advisory Committee (CAC). The CAC was comprised of twelve independently appointed citizens from the region representing different locales and interests and a non-voting convenor. The CAC provided a means to view and direct the process of siting from regional perspective. The California League of Women Voters, under a grant from US Ecology, took a leading role in organizing the CAC (including direct appointment of three of its members) and in providing administrative support.

The CAC met six times between June 1986 and February 1987. The meetings were designed to provide information about the desert and desert communities, and to obtain guidance on the conduct of and results from the public meetings. At the meetings, ESA and US Ecology led the CAC through a series of structured exercises that resulted in translation of local issues and concerns into specific site selection objectives and criteria and weighting of their importance. The CAC's recommendations carried substantial weight with regard to conduct of the public meetings, to discretionary criteria development and application, and ultimately to US Ecology's selection of the candidate sites. The CAC also served as a sounding board of public attitudes as they developed during the siting process.

The third element of the public involvement program entailed input from public agencies. Input from three rounds of interagency meetings provided parallel information to that obtained from the public. The meetings focused attention on regulatory concerns and issues of federal and state responsible and trustee agencies. The BLM, which manages most of the California desert, provided substantial valuable input in the form of guidance as well as background data on the region.

A total of 30 discretionary criteria were developed and weighted. Discretionary criteria varied greatly in importance. Discretionary criteria rated as high avoidance included cultivated agricultural lands and BLM Wilderness Study Areas. High importance criteria involved such considerations as avoidance of individual residences and aqueducts. Other criteria (e.g., access, recreation, utility corridors, air quality, visual) were rated as moderate, low, or no-consensus.

A fourth, vital element of the public involvement program was focused on public information. US Ecology carried out an extensive program of getting information to and from the public. Besides the public meetings, staff made numerous presentations to local community service organizations, planning agencies, high schools and other interested groups. Numerous interviews were carried out on radio, many with a listener call-in format. The public information program (including the public meetings) was not

oriented toward "selling" the facility, which approach would only have produced mistrust of US Ecology's motives and information. Rather, the program was focused on getting the facts to the public; this was important because of misinformation being disseminated in some communities by opposition groups. A very successful element of the public information program was tours to the Beatty, Nevada, disposal facility, sponsored by the California Radioactive Materials Management Forum. Most citizens who visited the facility returned to the communities with a high level of confidence about radioactive materials management; they undoubtedly had a major influence in developing support for the facility in their communities.

In sum, criteria development occurred in three steps. Technical suitability criteria were developed first, followed by the exclusionary criteria. The discretionary criteria were developed last, over a six-month period as public input was obtained. Preliminary technical suitability and exclusionary criteria application proceeded as the discretionary criteria were developed.

CRITERIA APPLICATION

Criteria application was a tiered process. Technical suitability and exclusionary criteria were applied first; broad application occurred in statewide screening and then screening advanced at a more refined level as the siting areas were narrowed in number and size. Next, the discretionary criteria were applied to a limited number of areas. Finally, the technical suitability were applied at an area-specific level to narrow down to specific small sites. The criteria application methods are summarized below.

STATEWIDE AND REGIONAL SCREENING

Statewide and regional screening involved small-scale mapping of technical suitability and exclusionary criteria. Application was uniform and non-selective. Any area failing to meet any one of the criteria was eliminated. This was a three-step process. First, the CDHS siting guidelines regarding avoidance of populated areas, humid areas, and various publically owned lands were applied. This screening eliminated most of California and identified large areas located in southeastern California, the southern San Joaquin Valley and isolated basins in northeastern California.

The second step entailed small-scale mapping of the remaining areas to eliminate areas failing to meet technical suitability criteria related to topographic closure, unstable soils, depth to bedrock and volcanic hazards. This led to identification of 71 topographically closed basins mostly in southeastern California, the southern San Joaquin Valley, and the northeastern part of the state.

The third step was a more detailed mapping (ca. 1:250,000 scale) of the technical suitability and exclusionary criteria in the topographically closed basins. It included

criteria that could not be mapped in the previous screening levels at small scale, e.g., potentially shallow groundwater, earthquake fault rupture zones, sand dunes, and groundwater use areas. This screening identified 18 topographically closed basins that potentially contain technically suitable sites; all are located in southeastern California. The results of this screening were presented at the first round of public and interagency meetings in June 1986.

BASIN SCREENING

The fourth screening step was mapping of the technical suitability and exclusionary criteria within the 18 basins at a fairly detailed level. Mapping proceeded at a greater level of refinement that included data collection by field reconnaissance, aerial photo interpretation, and detailed archival map retrieval. Detailed maps (ca. 1:110,000 scale) were produced of potential 100-year flood plains, shallow groundwater and bedrock, fault rupture zones, unstable soils, concentrated population, mineral resources, historic landmarks and critical habitats of plants and animals. The screening eliminated two basins and narrowed the remaining area in 16 basins. At this stage, US Ecology had a high level of confidence that the remaining areas probably contained suitable sites that could be licensed. The remaining areas encompassed a combined area of about 8,000 square miles.

The fifth step marked a major shift in the type and method of criteria application. The first four screening levels eliminated areas on an either-or basis (i.e., all technical suitability, exclusionary and high avoidance discretionary criteria were met or the area was eliminated). In the fifth screening, since the remaining areas were considered technically suitable, only discretionary criteria were applied. A real elimination occurred only by the combined presence of highly constrained areas, i.e., the occurrence of weighted criteria (based on public input) that related to conditions making facility development difficult. The data were stored and manipulated in an automated mapping system; a Geographic Information System was used to overlay the mapped criteria (approximately 43 layers of information). This method was used to identify 16 candidate siting areas with a combined total area of about 2,000 square miles.

COMPARISON OF THE CANDIDATE SITING AREAS

The sixth step entailed a selection among the 16 candidate siting areas, any of which probably is technically suitable. This was based on a rating exercise provided to the CAC and at the third round of public and interagency meetings. Detailed information about the discretionary criteria for the 16 areas (e.g., distance to nearest residence, type of recreational use) was summarized in handouts to the public and agencies. This was accompanied by a short exercise in rating the siting areas. The summarized rating information

from the public, as well as more detailed profiles of the areas and information on public acceptance was presented to the CAC. The CAC members, in turn, carried out a fairly lengthy and carefully considered rating exercise and presented summary recommendations on site selection to US Ecology. That input, as well as public acceptance considerations (some communities and governing bodies passed resolutions in support of the facility, others formally or informally rejected it), led US Ecology to identify three siting areas for further study in February 1987. These were located in Upper Ward Valley, Silurian Valley and Panamint Valley.

CANDIDATE SITES SELECTION

The three candidate siting areas were large parcels. The seventh screening level entailed field and air reconnaissance studies, and detailed information gathering about the areas to narrow them to a size that would allow efficient detailed field surveys. Large scale mapping (scale 1:62,500) of geotechnical suitability and surface hydrology was conducted. Land ownership and access were evaluated. Each of the selection areas is on BLM land. This screening led to identification of a four-square mile area at each of the three candidate siting areas.

The eighth and final screening was based on detailed site surveys of the four-square mile areas at each site in spring 1987. On-site surveys and mapping of biological resources and surface hydrology were conducted. Optimal locations were mapped (scale of 1:24,000), and a one-square mile area was selected at each of the three Candidate Siting Areas. US Ecology and its contractors then prepared Characterization Plans and Environmental Assessments for the three candidate sites. Following characterization, an application for license will be submitted for one of those sites.

CONCLUSION

California is the first of the non-sited states to select candidate sites for the LLRW disposal facility and initiate characterization studies. Characterization studies began in autumn of 1987 and it appears that California will be able to meet all milestones of the Low-Level Radioactive Waste Policy Amendments Act. The success which California has had to date in this effort can be attributed to a number of factors.

1. California early-on made the commitment to develop a facility irrespective of any compact agreements. The state mobilized the CDHS in 1982 and rapidly took steps to develop siting requirements and guidelines. The CDHS, under the direction of Don Womeldorf, R.P.E., has provided good support to the license designee, US Ecology, in carrying out its site selection responsibilities. CDHS'S role has been one of independent oversight

with commitment to ensuring progress in siting. Candidate site selection has been the responsibility of the license designee.

2. The US Ecology team developed a structured and systematic program of site selection that included development of siting criteria which respond to regulatory requirements for site suitability, state guidelines, environmental and socioeconomic constraints and opportunities, and concerns of the citizens living in and using the siting areas. Criteria development included identification of technical suitability criteria, exclusionary criteria and discretionary criteria. The application of these criteria to identify technically suitable, environmentally manageable and publically accepted sites helped to prevent site selection from becoming a political process.

3. The California desert has numerous potential sites that probably are technically suitable. While this offered the advantage of choice, the site selection decisions required careful evaluation of environmental, regulatory and socioeconomic constraints spread over an immense and diverse geographic area. Those constraints have resulted in a higher degree of regulation (especially in environmental issues) in California than in many states. Additionally, strong political and public resistance exists in desert communities to the widespread perception that the desert is ideal for the disposal of waste (of any type) from California or the nation. In short,

US Ecology's success in selecting sites in California should not be viewed as the result of an "easy" environment for LLRW facility development. Rather, the success of the program rests in the systematic manner in which selection criteria were developed and applied, and in the scope and method of public involvement.

4. A model program for public involvement was developed and employed. That program realized the

mutual goals for public information and public input into site selection. While that program required considerable effort and cost, it resulted in three candidate sites having a high degree of public acceptance. Acceptance was achieved without reliance on incentive packages or a public relations program oriented toward "selling" the facility to the local communities. The public involvement program provided a means for citizens to be heard and to become a part of siting decisions.

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