

Appendix A

Site Evaluation Process

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Appendix A

Site Evaluation Process

A.1 Introduction

The U.S. Department of Energy (DOE) is preparing the Idaho High-Level Waste and Facilities Disposition Environmental Impact Statement (Idaho HLW & FD EIS), in accordance with the National Environmental Policy Act (NEPA), to evaluate alternatives for managing the high-level waste (HLW), *mixed transuranic waste/sodium bearing waste (SBW)*, and associated radioactive wastes at the Idaho National Engineering and Environmental Laboratory (INEEL). *Appendix B* describes the process DOE used to identify potential alternatives to be analyzed in the EIS. Each of the alternatives and options *other than No Action* would involve constructing *some* new facilities.

Because HLW *and mixed transuranic waste/SBW* treatment and interim storage facilities and low-activity waste disposal facilities are options being evaluated in the Idaho HLW & FD EIS, DOE performed a preliminary site evaluation to assess the feasibility of locating such facilities on INEEL. This appendix describes the selection process that DOE used to identify locations for the potential siting of waste processing facilities (Section A.3) and disposal sites (Section A.4) in support of HLW operations. DOE has not made the final site selection decision. The preliminary site evaluation described in this appendix was used to identify potential sites to allow for impact analysis within the EIS. A complete description of the process used and the factors considered in identifying off-INEEL locations and sites for HLW treatment operations are included in DOE (1999).

A.2 Methodology

DOE used a qualitative approach based on existing data for the preliminary site evaluations. Only those criteria specific to the preliminary evaluation of locations were considered. Other concerns such as radiological consequences, risk assessment, site-specific seismic studies, site characterization, consequences to air quality, proximity to known Resource Conservation and Recovery Act (RCRA) or Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites, safety analysis, and other requirements for final site selection were deferred pending the analysis in the Idaho HLW & FD EIS. If it is determined through this EIS process that new facilities will be located on INEEL, the preliminary site evaluations can be used to define additional data needed to support final site selections.

The scope for the preliminary site evaluation included:

- Identify critical ("must") and desirable ("want") site criteria.
- Identify candidate locations on INEEL for both HLW treatment and interim storage facilities and the Low-Activity Waste Disposal Facility.
- Limit candidate sites for the HLW treatment and interim storage facilities to existing operational facilities or areas not located over the Snake River Plain Aquifer.
- Consider any location, including an area not over the Snake River Plain Aquifer, for the Low-Activity Waste Disposal Facility.
- Screen candidate sites against the critical and desirable criteria using existing information.
- Rank the candidate sites based on their relative suitability.

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General assumptions applied to the preliminary site evaluations included:

- The new facilities will be dedicated primarily to the Idaho Nuclear Technology and Engineering Center (INTEC) wastes.
- Only sites on INEEL will be considered.
- If new facilities are constructed, appropriate site surveys, characterization, and risk assessment will be conducted before final site selection.
- DOE land-use plans will be observed.
- The draft U.S. Geological Survey approximate boundaries for the 100-year floodplain of the Big Lost River (Berenbrock and Kjelstrom 1998) are conservative and appropriate for preliminary site evaluation.

The first step in the evaluation process was to identify pertinent regulations for siting waste treatment, storage, and disposal facilities. Appendix A of Holdren et al. (1997) presents the results of this review of regulations. This information was used to develop two categories of site evaluation criteria: regulations with specific siting requirements designated as "must" criteria and regulations with recommendations for locating facilities designated as "want" criteria. In addition to the criteria that address regulatory requirements and recommendations, other "want" criteria were identified based on professional judgement. These other criteria address risk assessment, logistics, and other characteristics not clearly defined in regulations.

Once the criteria were determined, DOE identified candidate sites and performed initial screening against the criteria in preparation for decision analysis sessions. Candidate sites were identified based on professional judgement with the screening criteria in mind. *Therefore*, many areas of INEEL were not considered because of their inability to satisfy the screening criteria.

After the preliminary identification of criteria and screening of candidate sites was completed, decision analysis sessions were conducted to validate the results. Two decision analysis sessions were conducted, one for the HLW treatment and interim storage facilities and one for

the Low-Activity Waste Disposal Facility. Participants from various areas of expertise (i.e., facility planning, transportation, safety, engineering, waste management, environmental affairs, risk assessment, hydrology, archeology, ecology, and seismology) formed an interdisciplinary team to ensure that all relevant screening criteria and viable candidate sites were identified and to evaluate the candidate sites against the screening criteria.

The decision analysis sessions began with refinement of the screening criteria. Through a consensus process, the team developed lists of criteria. The "want" criteria were assigned a weight, based on relative importance, on a scale of 1 to 10. A "want" criterion considered extremely important was assigned a weight of 10 with smaller weights assigned to criteria judged to be less critical. Criteria of equally perceived importance could be assigned equal weights.

The preliminary list of candidate sites was reviewed. With one exception, candidate locations for the HLW treatment and interim storage facilities were limited to current operational areas with at least some level of infrastructure. The preliminary list of candidate sites for the HLW treatment and interim storage facilities was accepted without change. Although the preliminary list contained candidate low-activity waste disposal sites representative of the most desirable physical characteristics of INEEL, three additional sites were added based on the potential to reuse previously disturbed areas.

The team then evaluated the candidate sites against the screening criteria. Sites were first evaluated against the "must" criteria. Any site failing to satisfy all of "must" criteria was eliminated from further consideration. If all of the "must" criteria were satisfied, the site was evaluated against the "want" criteria. For each "want" criterion, the candidate sites were assigned a value from 1 to 10 to describe how well, in the judgement of the team, the site satisfied the criterion. The site or sites that best satisfied the criterion were rated a 10, with lesser values assigned to the remaining sites.

The final component of the decision analysis was to compile overall rankings for the candidate sites based on the "want" criteria. The overall ranking was determined by calculating the

product of the weight assigned to each criterion and the relative site ranking, and then summing the results.

DOE applied input from the decision analysis sessions during a secondary data gathering and screening phase to produce the final results. Data were gathered to support additional requirements defined during the decision analysis sessions. The relative comparisons of the candidate sites were then completed. A draft report was prepared and submitted to a peer-review committee comprised of members representing the areas of expertise pertinent to the preliminary site evaluation. In general, the comments generated by the peer review resulted in refinement or clarification of the information. No additional candidate locations or screening criteria were identified during the peer review.

A.3 High-Level Waste Treatment and Interim Storage Site Selection

The Idaho HLW & FD EIS analyzes facilities for treatment and interim storage of HLW and mixed transuranic waste/SBW that lie within the current INTEC boundaries. The INTEC candidate site for the proposed HLW processing facilities had the least impact to human health and the environment and the most advantageous logistical characteristics. DOE selected the site using a formal evaluation process that considered various INEEL locations and evaluated each against a set of evaluation criteria (Holdren et al. 1997). This section summarizes the HLW treatment and interim storage facilities site evaluation process.

A.3.1 IDENTIFICATION OF "MUST" CRITERIA

The first step in the evaluation process was to identify pertinent regulations for siting HLW treatment and interim storage facilities. For this evaluation, DOE assumed the HLW treatment and interim storage facilities would be subject to RCRA siting requirements and U.S. Nuclear Regulatory Commission (NRC) regulations. This step resulted in the development of a set of

three specific siting requirements designated as "must" criteria:

1. Avoid the 100-year floodplain unless mitigations acceptable under RCRA are demonstrated
2. Avoid wetlands
3. Avoid critical habitats of endangered species

A.3.2 IDENTIFICATION OF "WANT" CRITERIA

In addition to those criteria formulated to address regulatory requirements and recommendations, DOE identified other "want" criteria based on professional judgment. These criteria address risk assessment, logistics, and other characteristics not clearly defined in regulations. Table A-1 provides the 17 "want" criteria and their relative weights.

A.3.3 IDENTIFICATION OF CANDIDATE SITES

With one exception, candidate sites were limited to existing operational areas because of the prohibitive costs that would be associated with establishing the new infrastructure (i.e., roads, utilities, emergency services, and technical and administrative support). For programmatic reasons, the analysis included one site *that may* not be over the Snake River Plain Aquifer and remote from existing facilities. There were twelve candidate sites evaluated for the HLW treatment and interim storage facilities:

1. INTEC
2. Central Facilities Area
3. Test Reactor Area
4. Power Burst Facility
5. Auxiliary Reactor Area
6. Argonne National Laboratory-West
7. Naval Reactors Facility

Table A-1. “Want” criteria and relative weights for the HLW treatment and interim storage facility candidate sites.

Criterion number	Relative weight	Criterion
1	8	Minimize potential impacts from earthquakes
2	4	Minimize proximity to the 500-year floodplain
3	3	Reduce risk of a release to a stream
4	3	Minimize local flooding and ponding
5	2	Minimize impact to riparian areas
6	5	Minimize impact to ecologically sensitive areas
7	9	Locate in areas controlled by the DOE Idaho Operations Office
8	3	Minimize impacts to cultural resources
9	8	Locate in an area with optimal surficial sediment and topography for construction
10	2	Avoid areas over perched water
11	2	Locate in an area with characteristics that would impede downward migration of contaminants
12	9	Locate near existing infrastructure
13	9	Minimize transportation costs
14	5	Avoid vegetation transects
15	5	Locate in accordance with projected land-use plans
16	10	Minimize transportation safety issues
17	8	Minimize environmental impacts from transportation

8. Radioactive Waste Management Complex

9. Test Area North

10. Experimental Breeder Reactor-I

11. Security Training Facility

12. Area north of the Big Lost River Sinks

Candidate sites 1 through 11 are located near or within existing INEEL operational areas. Site 12 was included to meet the programmatic need to consider a location *that may* not *be* over the Snake River Plain Aquifer. The locations of the candidate sites evaluated for the HLW treatment and interim storage facilities are shown in Figure A-1.

A.3.4 EVALUATION PROCESS

Because detailed specifications for the HLW treatment and interim storage facilities were not available, several assumptions were made for

purposes of the preliminary site evaluation. These assumptions include:

- The facilities will include treatment, processing, and a co-located interim storage facility for HLW.
- Waste acceptance criteria for a federal repository will be finalized and the HLW from INTEC will eventually be transferred to a federal repository.
- The design description in Raytheon (1994) provides an adequate approximation of the required area for the HLW treatment and interim storage facilities (approximately 36,000 square meters), roughly equivalent to 9.2 acres.
- Up to five times the area of the facilities (180,000 square meters), equivalent to approximately 46 acres, may be required for construction, support facilities and future expansion.

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- The facilities will process primarily INTEC waste.
- NRC licensing may eventually be negotiated for the HLW treatment and interim storage facilities.
- High activity liquid waste will be transported by pipeline. Transport by truck, rail, or other means is not currently feasible.
- The facilities will be housed in new construction. Existing buildings may be used for support activities *and* existing facilities may be reused for HLW treatment or interim storage facilities. ***However, existing facilities are already sited, therefore, they were not included in the siting evaluation.***
- Construction on sediment is significantly less costly than construction on basalt for comparable seismic designs.
- The HLW treatment and interim storage facilities will be classified as moderate hazard for purposes of seismic evaluation.

A.3.5 RESULTS OF EVALUATION PROCESS

Each of the candidate HLW treatment and interim storage facility sites satisfied the "must" criterion, although engineering controls or local restrictions may be required. If a candidate site had failed, it would have been eliminated from further consideration.

Each candidate site was then evaluated against the "want" criteria. Failure to satisfy one or more of these criteria is not a basis for eliminating a site from consideration. Depending on the relative importance of the criterion, engineering controls or other mitigative measures may be used to address the concern reflected by the criterion. In such cases, an estimate of the resources that may be required to implement the necessary engineering controls or mitigative measures is reflected in the relative site rankings.

The relative ranking for the HLW treatment and interim storage facility candidate sites against the "want" criteria are provided in Table A-2.

For HLW treatment and interim storage facilities, the location at INTEC ranks far above the candidate sites in other operational areas on INEEL. The INTEC location meets the "want" criteria better than any other location because of the emphasis on transportation issues and infrastructure to support the new waste processing facilities. All other candidate sites require potentially hazardous and costly transportation of the waste from INTEC. With the exception of the area north of the Big Lost River Sinks (site 12), the range of scores for the remaining candidate sites is fairly small.

DOE is integrating its NEPA evaluation with other planning documents early in the decision-making process. In accordance with 40 CFR 1501.2(b), DOE must "identify environmental effects and values in adequate detail so they can be compared to economic and technical analyses...." The site evaluation process used for the EIS provides comparative analysis and considers DOE needs (such as mission) beyond only environmental concerns. Environmental factors must be considered but do not necessarily require equal weighting with other factors.

A.4 Low-Activity Waste Disposal Site Selection

The processes being analyzed in the Idaho HLW & FD EIS alternatives produce a variety of waste types and forms. These include HLW, transuranic waste, low-level waste, mixed low-level waste, and industrial waste. Selection of the sites for disposal of these wastes is outside the scope of this EIS. These sites are or have been the subject of separate NEPA analyses. The Idaho HLW & FD EIS analyzes disposal of the low-activity waste fraction produced under *various* alternatives as either Class A or Class C-type grout. A preliminary site evaluation was performed to identify a low-activity waste disposal site at INEEL for purposes of analysis in the EIS.

Table A-2. Total scores and overall rankings for HLW treatment and interim storage facility candidate sites.^a

Number	Candidate site	Total weighted score	Percent of maximum score ^b	Overall rank
1	INTEC	872	92	1
2	Central Facilities Area	660	70	2
3	Test Reactor Area	634	67	3
4	Power Burst Facility	590	62	4
5	Auxiliary Reactor Area	524	55	7
6	Argonne National Laboratory-West	502	53	10
7	Naval Reactors Facility	503	53	9
8	Radioactive Waste Management Complex	529	56	6
9	Test Area North	506	53	8
10	Experimental Breeder Reactor I	471	50	11
11	Security Training Facility	557	59	5
12	Area north of Big Lost River Sinks	321	34	12

a. Details of the evaluation of candidate sites against each of the criteria can be found in Holdren et al. (1997).

b. The maximum possible score was 950.

The overall scores for the low-activity waste disposal candidate sites indicate that several locations on INEEL would be suitable for such a disposal facility. The two highest scoring locations were a site near INTEC and a location in the central part of INEEL (near U.S. Geological Survey Site 14) removed from current operational facilities. The advantages of the INTEC location include reuse of a previously disturbed area, reduced transportation hazards, and existing seismic hazard evaluation. The other location is in a pristine area far away from existing INEEL infrastructure, but has characteristics that offer better natural reduction of contaminant migration in the vadose zone.

In this EIS, DOE analyzed one onsite location. Although there are geohydrological differences across the INEEL, the single location analyzed would be representative of many potential locations that DOE could select within the INEEL boundaries. A site co-located with the INTEC was selected for analysis. The general location of this site identified by Holdren et al. (1997) was narrowed to a specific location for analysis in the EIS (Kiser et al. 1998).

A.4.1 IDENTIFICATION OF "MUST" CRITERIA

The first step in the evaluation process was to identify pertinent regulations for siting waste disposal facilities. For this preliminary evaluation, DOE assumed the Low-Activity Waste Disposal Facility would be subject to NRC regulations. RCRA regulations would not apply because DOE has assumed that the low-activity waste would be delisted prior to disposal (see Chapter 6). The result of this step was the development of a set of four specific siting requirements designated as "must" criteria:

1. Avoid the 100-year floodplain
2. Avoid wetlands
3. Avoid critical habitats of endangered species
4. Avoid areas in which tectonic processes such as faulting, folding, seismic activity, or vulcanism (1) may occur with such frequency and extent to significantly affect

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the ability of the disposal site to meet performance objectives or (2) may preclude defensible modeling and prediction of long-term impacts.

A.4.2 IDENTIFICATION OF "WANT" CRITERIA

In addition to those criteria formulated to address regulatory requirements, "want" criteria were developed based on regulatory recommendations and professional judgement. Table A-3 provides the 19 "want" criteria and their relative weights. Most of the "want" criteria for the Low-Activity Waste Disposal Facility are duplicates of those identified for the HLW treatment and interim storage facilities. However, the relative weights assigned to the Low-Activity Waste Disposal Facility emphasize environmental issues because this facility would be a disposal facility whereas the HLW treatment and interim storage facilities would have limited operational lifetimes.

A.4.3 IDENTIFICATION OF CANDIDATE SITES

The only limitation applied to selecting the candidate sites for the Low-Activity Waste Disposal Facility was that they be located within the boundaries of INEEL. The evaluation included a site *that may not be* over the Snake River Plain Aquifer. DOE based selection of candidate sites on professional judgment, as well as familiarity with the physical characteristics of INEEL and the potential influence of those characteristics on risk to human health and the environment. Many areas of INEEL were not considered because of their inability to satisfy screening criteria. The 16 candidate low-activity waste disposal sites evaluated were:

1. Area north of Big Lost River Sinks
2. Area south of INTEC
3. Near Auxiliary Reactor Area
4. Near Power Burst Facility
5. Near Test Reactor Area

6. Near Test Area North
7. Near the Radioactive Waste Management Complex
8. Near the New Production Reactor site
9. Near U.S. Geological Survey (USGS) Site 14
10. Near Corehole 2-2A and USGS-18
11. Playa area southeast of USGS Site 14
12. Crater in Section 23
13. Area near the Second Owsley Canal
14. Near Argonne National Laboratory - West
15. Within the Naval Ordnance Disposal Area
16. Near the Security Training Facility

The locations of the candidate sites evaluated for the Low-Activity Waste Disposal Facility are shown in Figure A-2.

A.4.4 EVALUATION PROCESS

The screening process used for the Low-Activity Waste Disposal Facility resembled the process described for the HLW treatment and interim storage facilities site. For the most part, the same methodology was used to evaluate Low-Activity Waste Disposal Facility candidate sites. The major difference was that the environmental criteria received more weight.

Because detailed specifications for the Low-Activity Waste Disposal Facility were not available, several assumptions were made for purposes of the preliminary site evaluation. These assumptions include:

- The waste will be grouted solid waste that will be delisted and meet the applicable RCRA Land Disposal Restrictions standards (i.e., the waste will not be regulated as hazardous waste under RCRA).

Table A-3. "Want" criteria and relative weights for the Low-Activity Waste Disposal Facility candidate sites.

Criterion number	Relative weight	Criterion
1	6	Minimize potential impacts from earthquakes
2	2	Minimize proximity to the 500-year floodplain
3	5	Reduce risk of release to a stream
4	8	Minimize local flooding and ponding
5	3	Minimize impact to riparian areas
6	7	Minimize impact to ecologically sensitive areas
7	9	Locate in areas controlled by the DOE Idaho Operations Office
8	7	Minimize impact to cultural resources
9	6	Locate in an area with thick surficial sediment
10	8	Avoid areas over perched water
11	10	Locate in an area with characteristics that impede the downward migration of contaminants
12	4	Locate in an area conducive to future expansion
13	2	Locate in accordance with projected land use plans
14	6	Locate near existing infrastructure
15	8	Minimize transportation issues
16	8	Locate in an area where discriminatory monitoring can be achieved
17	9	Avoid vegetation transects
18	8	Use previously disturbed areas
19	1	Avoid unexploded ordnance areas

- The waste will meet requirements for classification as low-level waste.
- The Low-Activity Waste Disposal Facility will be an engineered structure designed to achieve long-term stability (i.e., for at least 500 years) and potential release from the disposal facility after 500 years will be sufficiently slow to maintain risk below acceptable levels. Locations were evaluated on the basis of natural and logistical considerations such as stable terrain and proximity to existing roads. Long-term stability during operation and ultimate closure of the facility will be dependent on engineering controls.
- In the absence of U.S. Environmental Protection Agency (EPA) siting regulations relative to earthquake ground motion and unstable terrain, it was assumed that compliance with RCRA, DOE, and NRC regulations would suffice to address any EPA concerns.
- The waste volume to be disposed of will be no greater than 25,000 cubic meters based on approximations for either Class A or Class C grout developed by Lockheed Martin Idaho Technologies Company.
- A minimum depth of 3 meters of surficial sediment is mandated by landfill design criteria.

A.4.5 RESULTS OF EVALUATION PROCESS

The overall scores for the candidate sites indicate that there are several locations on INEEL suitable for a Low-Activity Waste Disposal Facility. The total scores and relative ranking for the candidate sites against the "want" criteria are provided in Table A-4.

The scores for the top four candidate sites vary by less than 10 percent. Therefore, these sites could be worthy of further consideration in a final site selection study.

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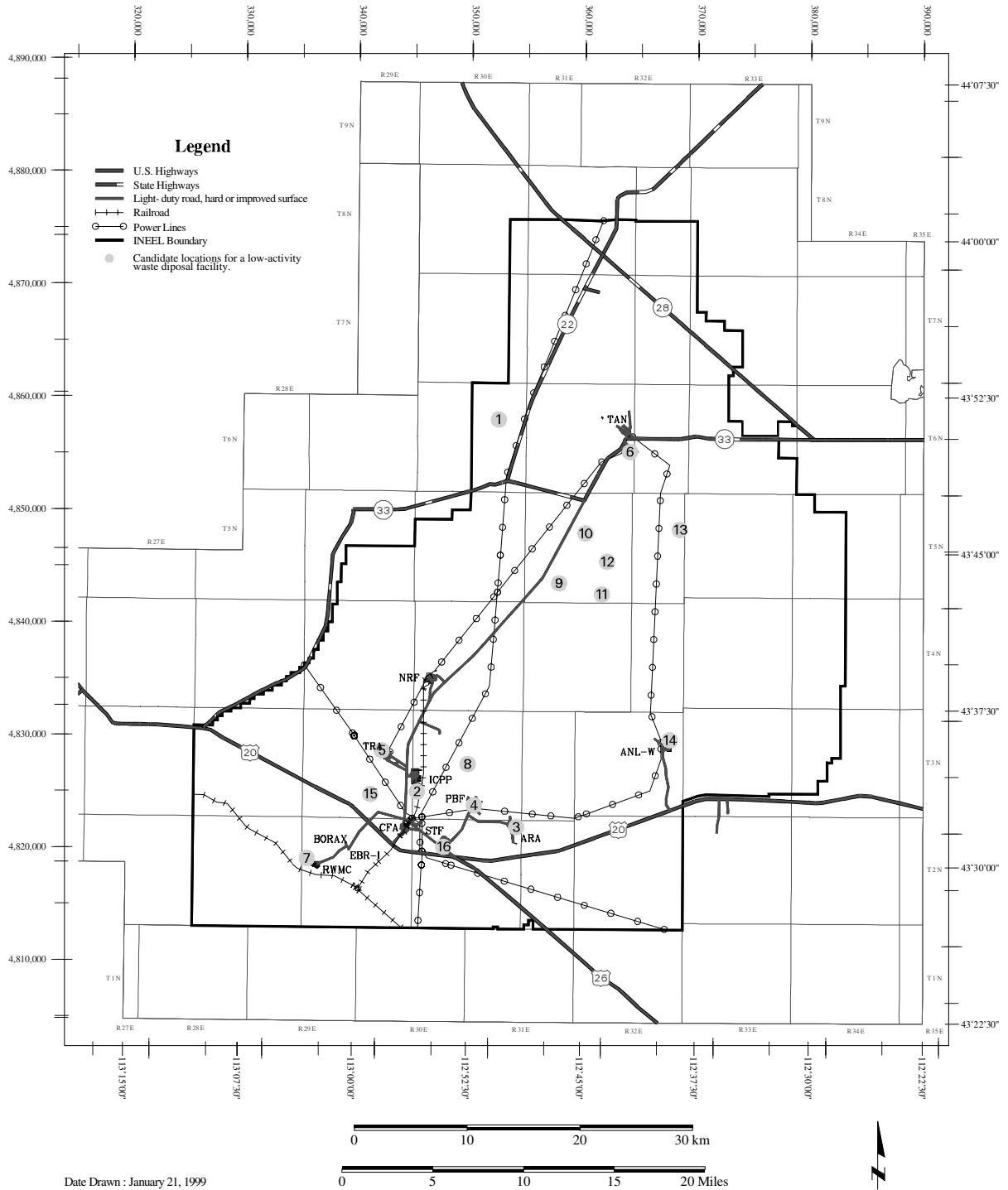


FIGURE A-2.
Candidate locations on the INEEL for a Low-Activity Waste Disposal Facility.

Table A-4. Total scores and overall rankings for Low-Activity Waste Disposal Facility candidate sites.

Number	Candidate site	Total weighted score	Percent of maximum score ^a	Overall rank
1	Area north of Big Lost River Sinks	NA ^b	NA	NA
2	Area south of INTEC	976	83	1
3	Near Auxiliary Reactor Area	823	70	5
4	Near Power Burst Facility	821	70	6
5	Near Test Reactor Area	897	77	3
6	Near Test Area North	774	66	11
7	Near the Radioactive Waste Management Complex	690	59	15
8	Near the New Production Reactor site	778	67	10
9	Near USGS Site 14	924	79	2
10	Near Corehole 2-2A and USGS-18	806	69	7
11	Playa area southeast of USGS Site 14	749	64	13
12	Crater in Section 23	709	61	14
13	Area near the Second Owsley Canal	758	65	12
14	Near Argonne National Laboratory - West	793	68	8
15	Within the Naval Ordnance Disposal Area	867	74	4
16	Near the Security Training Facility	787	67	9

a. The maximum possible score was 1,170.
b. NA means not applicable. The area north of the Big Lost River Sinks (site 1) failed the screening against the “must” criteria and was not evaluated further against the “want” criteria.

The preliminary evaluation used existing data for the candidate sites. Total scores for some candidate sites (9, 10, 11, 12, and 13) could be higher because the average data for the cumulative sediment and surficial sediment thicknesses at these location may not be representative of the maximum possible score. Knowledge of these areas supports the conclusion that the sediment thicknesses are probably greater than indicated by the currently available data used in the preliminary site evaluation. These sites may be worthy of further consideration in a final site selection study.

A.4.6 FINAL SELECTION OF A LOW-ACTIVITY WASTE DISPOSAL FACILITY SITE FOR ANALYSIS

After further considering the preliminary evaluation, DOE selected a specific location adjacent to INTEC as the site to be analyzed in the EIS (Kiser et al. 1998). The final selection of the analysis site resulted from a determination that the site was the most cost-effective for inclusion in the feasibility design process. This site is generally located outside the southeast corner of and as near as possible to the INTEC security

perimeter fence. (Subsequently, DOE also selected the Envirocare facility 80 miles west of Salt Lake City to be analyzed to provide an off-INEEL evaluation for disposal of the Class A grout produced under the Full Separations and Planning Basis options *and the Chem - Nuclear Systems facility in Barnwell, South Carolina to be analyzed for disposal of Class C grout produced under the Transuranic Separations Option.*)

A.5 Conclusions and Summary

Evaluation of many site characteristics provides useful insight for decision-making and points out some of the tradeoffs that must be made. Each candidate location offers some advantages over the others for both waste processing and disposal. For example, if aquifer protection were the most important consideration for a Low-Activity Waste Disposal Facility, a site within the thick lake sediments in the central portion of INEEL would be desirable. This area is also conducive to construction. However, this generally low elevation and low-relief area is sometimes subject to local flooding events. If protection from flooding were a major criterion, the basalt highlands offer good choices but may

involve some sacrifice of aquifer protection or ease of construction. These highland areas are also far from existing infrastructure and would require waste transport over several miles.

Unlike the preliminary evaluation of candidate sites for HLW treatment and interim storage facilities that indicated clear advantages for siting the facilities at INTEC, the range of total weighted scores for the Low-Activity Waste Disposal Facility was very small. Emphasis on environmental issues (e.g., Criterion 11 - Locate in an area with characteristics that impede downward migration of contaminants) tended to balance against other highly weighted criteria. The overall scores for the Low-Activity Waste Disposal Facility candidate sites indicate that there are several suitable locations on INEEL. If it is determined that a Low-Activity Waste Disposal Facility will be constructed at INEEL, the final site decision analysis must determine whether locations, such as the INTEC site that reuse previously disturbed areas *and* reduce transportation hazards, have been favorably evaluated for seismic hazards and possess physical characteristics that impede contaminant migration are preferred over pristine locations such as U.S. Geological Survey Site 14 that offer better natural reduction of contaminant migration but are not in the preferred seismic zones and are far away from existing INEEL infrastructure.

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