Siting Study for a Consolidated Waste Capability at Los Alamos National Laboratory - 11087

Steven R. Booth
Los Alamos National Laboratory
P.O. Box 1663, Los Alamos, NM 87545

ABSTRACT

Decision analysis was used to rank alternative sites for a potential Consolidated Waste Capability (CWC) to replace current hazardous solid waste operations (hazardous/chemical, mixed low-level, transuranic, and low-level waste) at Los Alamos National Laboratory's Technical Area (TA)-54. An original list of 21 site alternatives was pre-screened to seven sites that were assessed using the analytical hierarchy process with five top-level criteria and fifteen sub-criteria. The top site choice is TA-63/52/46; the second choice is TA-18/36.

The seven sites are as follows. TA-18/36 (62 acres) is located on Potrillo Drive that intersects Pajarito Road at the bottom of a steep grade. It has some blast zone issues on its southwest side and some important archeological sites on the southeast section. TA-60 (50 acres) is located at the end of Eniwetok Road off Diamond Drive, east of TA-3. Most of the site is within a fifty foot-deep ravine (that may have contamination in the drainage), with a small section on the mesa above. TA-63/52/46 (110 acres) lies to the north of Pajarito Road along Puye Road. It is centrally located in a brown field industrial area, with good access to generators on a controlled road. TA-46 (22 acres) is a narrow site on the south side of Pajarito Road across from TA-46 office buildings. TA-48 (14 acres) is also narrow, and is located on the north side of Pajarito Road near the west vehicle access portal (VAP). TA-51 (19 acres) is located on the south side of Pajarito Road at the top of the hill above TA-18 near the current entrance to the TA-54. TA-54 West (16 acres) is just north of the entrance to TA-54 at Pajarito Road and is close to Zone 4. Although it is near the San Ildefonso Pueblo property line, there may be adequate set-back for sight screening.

INTRODUCTION

This siting study evaluates possible locations for a potential Los Alamos National Laboratory (LANL) consolidated waste capability (CWC). This capability will support on-going solid waste management operations for four waste streams: low-level waste (LLW), hazardous/chemical (haz/chem), mixed low-level waste (MLLW), and transuranic (TRU) waste. Capabilities provided by the CWC include "on-site transportation receiving, staging/storage, processing for disposition, and loading for offsite shipment."[1] The expected life time for the new capability is 30 years subsequent to the closure of the current waste disposal site at Los Alamos, material disposal area G (MDA G) at TA-54.

[1] Consolidated Waste Capability Pre-Conceptual Proposal," LA-CP-09-001148, Revision 0, September 2009, p. vii.

The preliminary concept of the CWC is that solid waste capabilities would be located at consolidated/coordinated site(s) to allow efficiencies of scale, development of and standardization of basic building designs, and a shared office space and operations center. A new TRU waste facility is the first planned construction project; additional separate projects are envisioned to handle the other types of solid waste. This siting study provides a basis for selecting a site for all these future facilities. The possible re-use of existing buildings is not part of the explicit scope of this study.

The concept includes multiple buildings for storage and operations, an office building, open pads for outside storage/staging, shipping, and onsite disposal. The concept depicts an eventual end point that may be achieved through multiple independent projects. The Radioassay and Nondestructive Testing (RANT) facility with life extension upgrades is assumed to continue as LANL's transuranic package transporter (TRUPACT) loading location.

This siting study applies multi-attribute decision analysis by a small team (eleven persons) of experts in site-wide planning, geology, ecology-cultural issues, environmental management and regulation, and economics to assess the site alternatives. The analytical hierarchy process is used in a software package called Criterium Decision Plus™ to build the model and calculate the results. A key aspect of the work is the careful documenting of the analysis through the steps of brainstorming the alternatives and evaluation criteria, building the hierarchy, rating the hierarchy, and reviewing and analyzing the results. The output of the siting analysis provides necessary data to the Los Alamos siting approval process by the Site Planning and Project Initiation (SPPI) group.

For the purpose of evaluating appropriate sites for the CWC, the following assumptions as to functional requirements are made, taken from the pre-conceptual proposal.[2]

- Capabilities for storage and processing of environmental restoration (ER) and decontamination and decommissioning (D&D) wastes will not be within the scope of the CWC. These LLW, MLLW, or haz/chem wastes will be direct-shipped by ER and D&D subcontractors to approved disposal sites. Limited overflow storage will be included in space programmed for the CWC to address off-normal issues. Any TRU waste generated through ER and D&D activities will be managed and shipped to the Waste Isolation Pilot Plant (WIPP) via RANT.
- Remote-handled waste will not be within the scope of the CWC Program.
- Loading of TRU waste into TRUPACTs for shipment to final disposal at WIPP is assumed to continue to be performed within the existing RANT facility. Consequently, the CWC Program will not construct a new TRUPACT loading/shipping facility. Shipping and receiving functions for moving wastes from generators to CWC storage, and from storage to RANT, will be provided at the CWC.
- Packaging and characterization for final destination shipment is required for all waste types.

[2] Taken directly from ibid, p. 5, with small editorial modifications.

- On-site treatment functions will be required to prepare wastes for off-site shipment (absorption, repackaging, over packing, etc.).
- The CWC capabilities and capacities will be developed to address the enduring waste missions for newly generated wastes only.
- In addition to its enduring mission, the CWC (if capacity is available) may assume responsibility to accept select legacy and stored newly generated waste not dispositioned at TA-54 prior to MDA G closure. The legacy problematic waste transitioned out of TA-54 to facilitate the TA-54 integrated closure will likely require capabilities above those required for only enduring TRU waste.
- Green-Is-Clean (GIC) wastes segregated by the generator are verified by assay within the same spaces as the LLW prior to release and shipment to a public sanitary landfill.
- Management of sanitary (other than GIC) and high-explosive (HE) wastes is excluded from the CWC Program.
- Office space for about 100 employees will be included in the CWC for enduring waste management personnel displaced through consent order closures of existing waste management facilities.
- Development and management of a sanitary landfill is excluded from the CWC.

SITE DESCRIPTIONS

Minimum Site Size

The CWC essentially serves as a transfer station to prepare waste for offsite disposal. Consequently, the minimum acreage required for the conceptual CWC considers only waste transfer rather than onsite disposal requirements.

For the purposes of this siting study, solid waste operational activities excluding disposal are estimated to require a minimum of twelve acres of space (with fifteen acres preferable) for all aspects of the CWC (LLW, MLLW, haz/chem, and TRU) including facilities, parking and roads, storage/staging pads, surface water retention, security buffer, and utility corridors. Offices will be provided for 100 persons. The total facility space is assumed to be about 61,000 square feet (including RANT), based on the pre-conceptual report. (See Table 1.)

Siting Alternatives

For the pre-conceptual CWC proposal, a set of eight potential sites that satisfied the initial size goal of 85 to 100 acres was identified at a brainstorming meeting with SPPI in April 2009.

For this current study, thirteen additional sites were selected by the evaluation team to satisfy the new minimum acreage requirements described above. These 21 sites were pre-screened by the team using several criteria such as the presence of flood plains, blast zones, and TRU waste transportation. TRU waste transport on public roads requires rolling road closures, and is considered a No-Go issue for sites. This process down-selected the valid sites to the seven shown in Figure 1.

Table 1. Preliminary CWC Facility Estimated Space Requirements.

Facility Type	TRU (Sq-Ft)	LLW (Sq-Ft)	MLLW (Sq-Ft)	Haz/Chem (Sq-Ft)	Total (Sq-Ft)
Admin/Office	5,100	3,000	3,900	0	12,000
Nuclear HC 2 RCRA Facility	8,400	0	0	0	8,400
Nuclear HC 3	TBD	TBD	TBD	0	TBD
Radiological facility non-RCRA	TBD	4,800		0	4,800
Radiological facility RCRA	0	0	2,000	0	2,000
Non-Rad RCRA Enclosed Facility	0	0	0	6,500	6,500
Covered open space	1,200 (Shipping)	6,000 (Shipping and Storage)	2,400 (Shipping)	0	9,600
Open pad	1,500	2,500	2,400 +1,920	1,920	10,240
Existing RANT	7,576				
Total	**23,776**	**16,300**	**12,620**	**8,420**	**61,116**

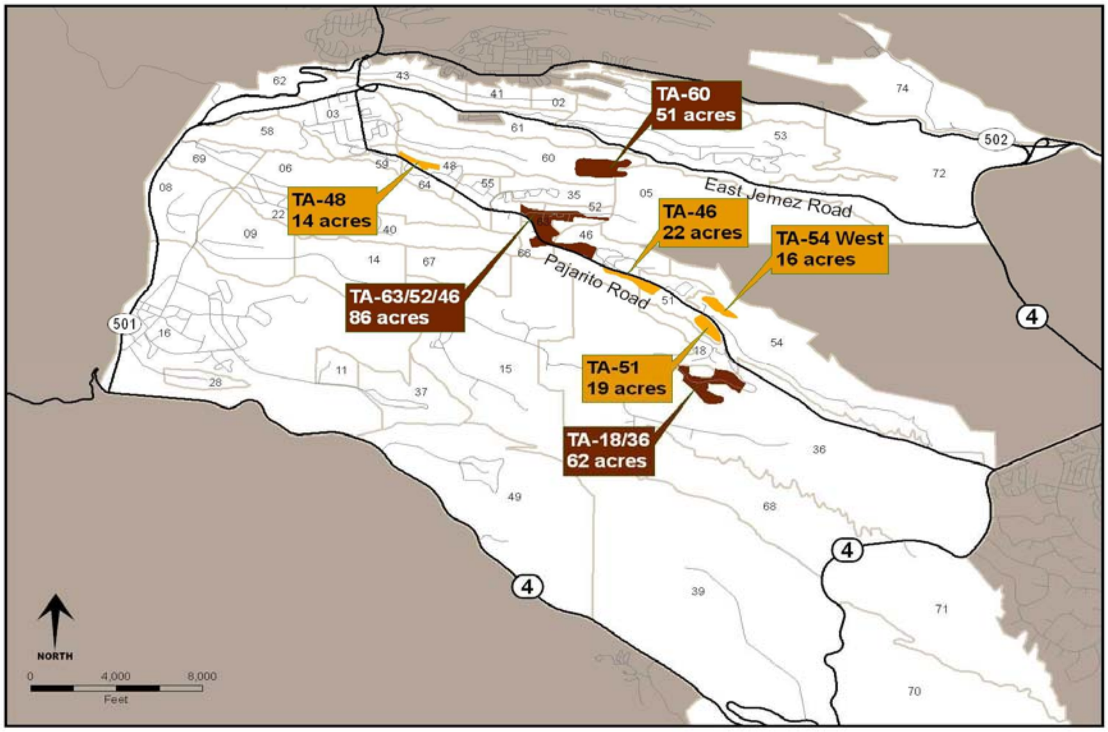
Note: All sizes are preliminary estimates and do not include space dedicated for on-site LLW disposal.

Source: Consolidated Waste Capability Pre-Conceptual Proposal," LA-CP-09-001148, Revision 0, September 2009, p. 14.

TA-18/36 is a 62 acre site located on Potrillo Drive about one mile from where it intersects Pajarito Road at the bottom of a hill. The length is 2,700 feet at its maximum point and its width is 800 feet. It has some blast zone impact on its southwest side, and has some important archeological sites on the southeast section. Access to waste generators is excellent.

The TA-46 site is about 2,900 feet long and only 175 feet wide, with about 22 total acres. The location is across Pajarito Road from TA-46 office buildings.

The TA-48 site is long (2,050 feet) and very narrow (240 feet) site has about fourteen total acres and is located on the north side of Pajarito Road near the west vehicle access portal (VAP). This is the smallest site in the study. Access is via the current entrance to TA-48 at the intersection of Gamma Ray and Pajarito roads. There is a significant downhill slope to the north into Mortendad Canyon for the length of the site



Source: Joan Stockum (IP-SPPI).

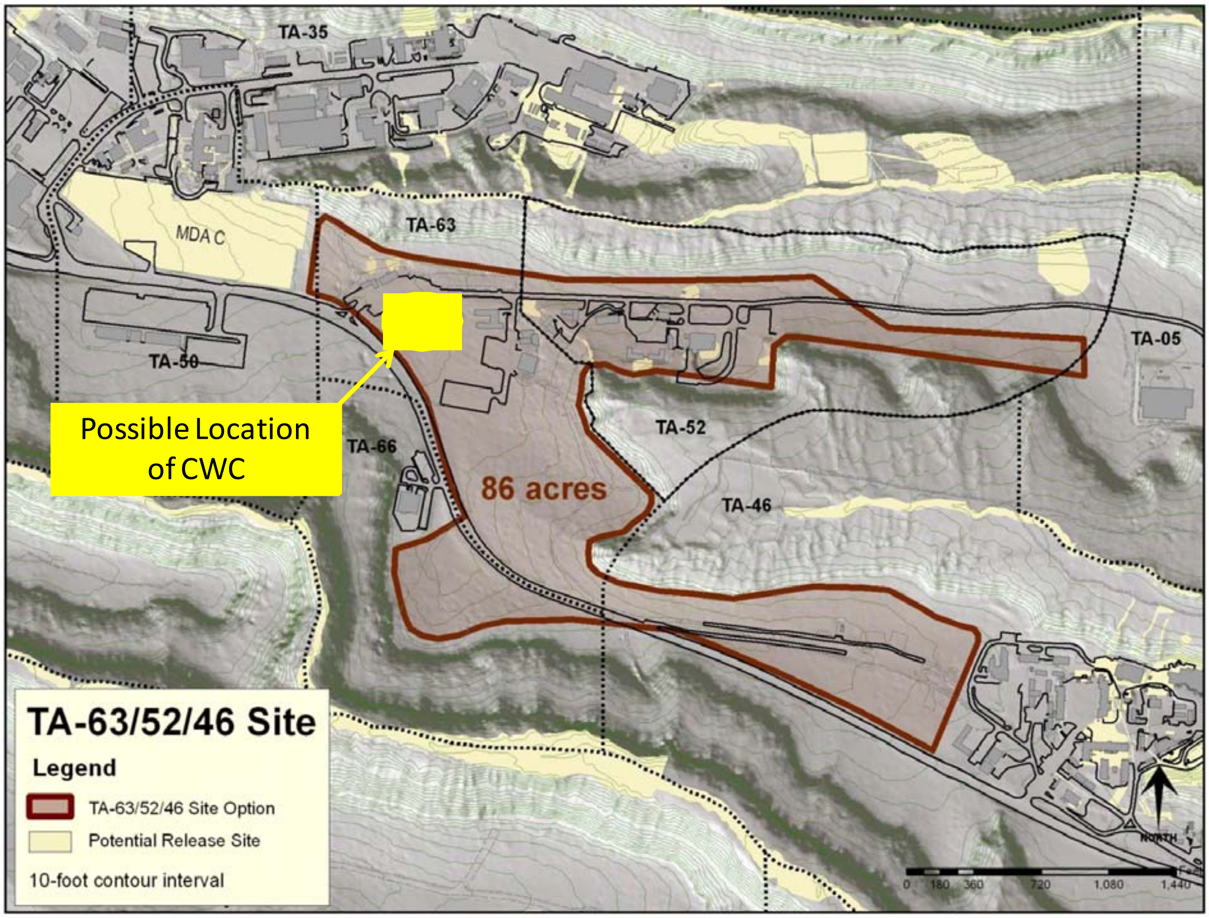
Figure 1. Seven CWC siting alternatives were analyzed: three large sites (shown in brown) and four smaller sites (orange).

TA-51 is a small site (nineteen acres) is 1,700 feet by 600 feet, and is located on the south side of Pajarito Road at the top of the hill above TA-18. The site has a steep drop off to the south and east, but the immediate topography is relatively flat. This site would be suitable for the CWC without the LLW disposal option. There are two power line corridors. It is located near the current entrance to the TA-54 waste site at Mesa del Buey Road.

TA-54 West is located just north of the entrance to TA-54 at Pajarito and Mesa del Buey roads, and is close to MDA G Zone 4. Its sixteen acres are behind a large water storage tank. Although it is close to the San Ildefonso Pueblo property line, there may be adequate set-back for sight screening.

TA-60 is located at the end of Eniwetok Road east of TA-3, and is about 50 acres in size. It is relatively long and narrow, measuring 2,600 feet by 1,000 feet. This is the one alternative that is at the base of a fifty foot-deep ravine rather than on a mesa top.

The TA-63/52/46 site has a total of about 86 acres to the north of Pajarito Road, with access via Puye Road (see Figure 2). It is close to waste generators at TA-55 and TA-50, and has easy non-public road access. Part of this site was proposed for the original TRU Waste Project several years ago. A significant amount of data has been collected already for this site because of its proximity to MDA C to the west, and it is a brown field site. Potential conflicting operational issues at TA-63 are 1) the need for lay-down space during Chemistry and Metallurgy Research Building (CMR) Replacement project construction and 2) occupied offices along Puye Road.



Source: Joan Stockum (IP-SPPI).

Figure 2. Map of TA-63/52/46 CWC location. Possible area within the site that would be appropriate for a CWC is noted.

DECISION ANALYSIS

This study evaluates the potential sites against criteria related to operational and economic feasibility. The methodology used is multi-attribute decision analysis, applied via a commercial software package called Criterium Decision Plus[3] to build an analytical hierarchy process (AHP) model and calculate the results.

During the first step of the process, "Brainstorming," the goal of the model (*Select CWC Site*) is defined and possible evaluation criteria are considered. Each criterion must be defined to make it independent of the others.

After narrowing the list of criteria, the hierarchy is built as shown in Figure 3. The goal of selecting a site is on the left side; next are listed the five top-level criteria that help attain the goal: Environment/Physical, Socio/Political, LANL Operations/Land Use, Permitting and Safety, and Economic. Some of these criteria are further divided into sub-criteria to provide more data fidelity. The right side of the hierarchy has seven sites to be evaluated.

Primary drivers for site selection are cost, Resource Conservation Recovery Act (RCRA) permitting per 40-CFR-270, facility safety requirements, and National Environmental Policy Act (NEPA) and related law for consideration for wildlife and archeological impacts.

Environment/Physical Sub-Criteria Definitions

The *Geology and Soils* sub-criterion considers site stability and soil suitability for waste management activities. Included are seismic faults and related folds, and lineaments.

Water drainage patterns, ponding, runon and runoff potential, and flooding of the facility are considered by the *Topography and Drainage* sub-criterion. This focuses on negative impacts to CWC operations rather than contamination to water, which is described by the next two sub-criteria.

Surface Water considers wetlands, proximity to watercourses and flood plains, and recharge of groundwater aquifers from the surface. The focus here is on potential contamination release to water resources. From this perspective, preferred sites are remote from protected wetlands where surface water can be controlled and/or diverted from the site.

Ground Water considers the distance to the water table and the projected depth to fractured media, such as basalt, and the presence of protective media, such as tuff and clays. Proximity to municipal drinking water wells is included. From this perspective, low permeability soil is preferred.

Air Quality includes site attributes that minimize air quality impacts in terms of violations of the Clean Air Act and National Emissions Standards for Hazardous Air Pollutants (NESHAP). This focuses on hazardous emissions rather than nuisance conditions such as dust, which are captured under the Proximity to Population criterion. Although not a major discriminator among sites, it is included for completeness.

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[3] Infoharvest, Inc., Seattle, WA, www.infoharvest.com.

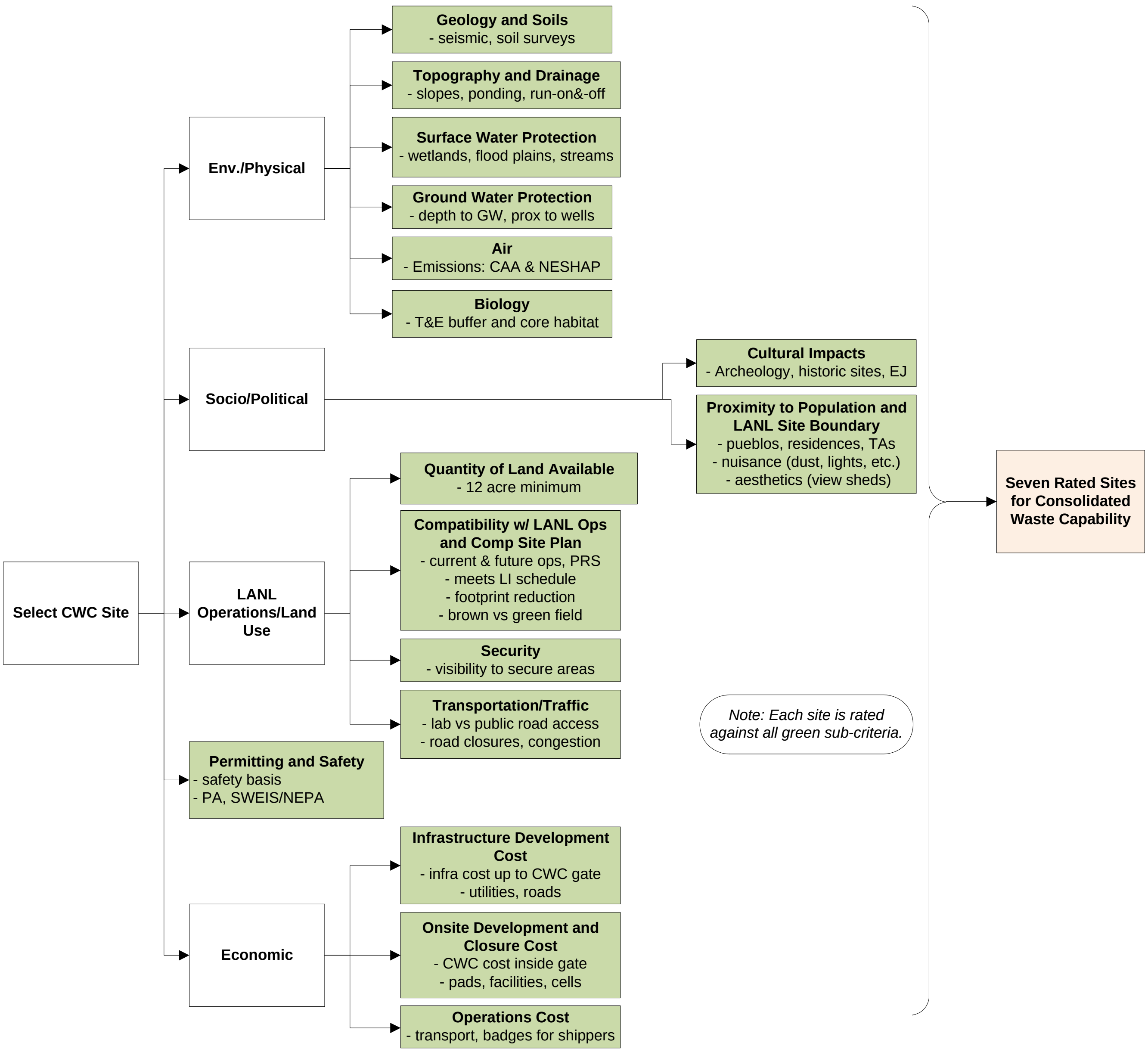

Figure 3: Hierarchy of the decision analysis model shows the fifteen sub-criteria and one top-level criterion (in green) that are used in scoring the seven sites.

Biology considers how the construction and operation of a CWC will impact known federally protected threatened and endangered (T&E) species or their habitat. Possible impacts include noise, light, vegetation removal, and habitat destruction at or near the CWC site.

Socio/Political Sub-Criteria Definitions

Culture considers the presence of prehistoric and historic resources including those associated with ancestral pueblo, homestead, and Manhattan Project eras. Any possible environmental justice issues also are included here.

How close the site is to technical areas, residential areas, and the town site is the focus of the *Proximity to Population and LANL Site Boundary* sub-criterion. Proximity to pueblo lands is included even though those areas may not be actually populated. Also included are nuisance conditions (dust, noise, lights, and odors) and aesthetic impacts (view shed sightlines and possible visual screening provided by vegetation and topography).

LANL Operations/Land Use Sub-Criteria

The *Quantity of Land Available* sub-criterion considers site size. The minimum acreage for a consolidated site is twelve acres. Larger sites score better because of added flexibility in the placement of facilities.

Considered under the *Compatibility with LANL Operations and Comprehensive Site Plan* sub-criterion are possible conflicts with current LANL operations, probable release sites (PRSs) at or near the site alternative, and future plans for that location as described in LANL comprehensive site plans. Also considered here are land-use guiding principles such as footprint reduction and the use of previously disturbed land rather than undeveloped areas (i.e., “green field” sites). Possible schedule conflicts with the TRU waste facility line item project are counted here.

LANL Security considers potential impacts to LANL security, which is primarily because of inadvertent intruder access to the CWC.

The *Transportation/Traffic* sub-criterion considers the potential for negative traffic impacts at LANL on both public and private roads that are caused by waste movements. Based on current Department of Energy (DOE) waste shipping agreements, TRUPACTs will not be needed for intra-site TRU shipments on public roads. However, moving TRU waste on public roads will require a rolling road closure. This restriction is not required for movements within the LANL-controlled Pajarito Corridor.

Permitting and Safety Criterion Definitions

This is a top-level criterion with no sub-criteria. Site aspects that impact safety basis and RCRA permitting are considered here, such as natural features and location that may impact accident scenarios, hazards, and dose calculations related to the maximum exposed offsite individual (MEOI). It uses similar data to other criteria (e.g., proximity to population), but with a different emphasis. Also considered are site permitting advantages such as having an existing performance assessment (PA) or record of decision, acceptance in the site-wide environmental impact study, or a NEPA review.

Economic Sub-Criteria Definitions

The *Infrastructure Development Cost* sub-criterion includes the cost of installing required infrastructure up to the CWC gate. It includes utilities, roads and intersections to main arterials, water, natural gas, and telephone/communications. If utilities must be relocated to gain adequate access to the site, these costs are included.

On-Site Development and Closure Cost considers the cost of building the CWC, and includes the construction of waste cells, buildings, roads, storage pads, and utility connections inside the CWC gate. Constructability of the site in terms of being level and having sufficient lay-down area and temporary facilities is included. Closure and post-closure costs are included, but will not be much different across site alternatives.

The *Operations Cost* sub-criterion evaluates the costs of operating the CWC. Remote sites will have higher transportation costs. Sites inside security zones will require badged shippers, which may also increase costs. Sites within the Pajarito Corridor are considered to have the same relative transportation cost.

Rating the Hierarchy

The next step in the decision analysis process is to rate the hierarchy, i.e., apply weights to the criteria based on relative importance, and score the alternatives against each criterion. A seven-component score ranging from *Finest* to *Unsatisfactory* is given for each alternative against each criterion. The basic algorithm is to multiply how each alternative scores against each criterion by the relative importance of that criterion (i.e., its weight). Those products are then summed over all the criteria to provide a total decision score, thus serving as a measure of how well each alternative fits the decision model.

A total of seven sites are evaluated. Four small options are: TA-46 (22 acres), TA-48 (fourteen acres), TA-51 (nineteen acres), and TA-54 West (sixteen acres). Three larger sites are: TA-18/36 (62 acres), TA-60 (50 acres), and TA-63/52/46 (86 acres).

The weights of the criteria with respect to the goal were chosen by the siting team based on a descriptive scale with points attached: *Critical* (100 points), *Very Important* (75 points), *Important* (50 points), *Unimportant* (25 points), and *Trivial* (0 points).

A form of sensitivity analysis was completed where three different decision maker perspectives (program, project, and stakeholder) were used to set the weights (see Table 2). Results were then compared under the perspectives to see if the ranking of sites differed. From a program manager's perspective, LANL operations and economics play a larger role in decision making, and so those two criteria are weighted one level higher. The project manager is more concerned with the construction issues related to the site that could cause the project to slip schedule or go over budget. Consequently, the physical environment of the site and economics are given critical weights; socio/political issues are less important. Finally, the public stakeholder will view environmental protection as critical and social/permitting/safety issues as very important; economic factors are not important. The public will also be in agreement with the NEPA direction of infill development and consolidation of waste operations. The weights under these different perspectives are listed in Table 2.

Table 2. Top-Level Criteria Weights for Four Perspectives.

	Weight Descriptors for Different Perspectives			
Top-Level Criterion	**Equal Weights**	**Program**	**Project**	**Stakeholder**
Environment/Physical	Important	Important	Critical	Critical
Socio/Political	Important	Important	Unimportant	Very Important
LANL Operations/Land Use	Important	Very Important	Very Important	Important
Permitting and Safety	Important	Important	Important	Very Important
Economic	Important	Very Important	Critical	Trivial

The weights for all the sub-criteria are equal with the exception of seismic issues. Seismic is potential show-stopper for the CWC because of explicit seismic requirements in RCRA. This indicates that a different weight is needed for this sub-criterion: a higher weight on Geology and Soils (*Very Important*) for the RCRA permitted facilities. See Table 3.

The verbal descriptors of weights are normalized for computation of the results. Table 3 shows how this is done. The normalization takes account of the number of sub-criteria under each top-level criterion. For example, Socio/Political has two sub-criteria that are valued as *Important* and given user scale values of 50 points on a scale of 0 to 100. Each sub-criterion's normalized weight is calculated as 50/(50+50) = 0.5. In a sense, the influence of Socio/Political is divided into two "sub-influences" represented by the sub-criteria. On the other hand, the top-level criterion LANL Operations/Land Use has four sub-criteria. Therefore its influence on the total is split into four components, leading to a weight of 0.25 for each sub-criterion as shown in Table 3.

The AHP software automatically calculates the accumulated weight for each path in the hierarchy that connects alternatives to the goal. This is done by multiplying the top-level criterion's normalized weight by that of the sub-criterion along the path (see Table 3). For example, Biology is a sub-criterion of Environment/Physical. The top-level weight is 0.2 and the sub-criterion weight is 0.15, so the accumulated weight along the path of the hierarchy is 0.2 x 0.15 = 0.03, or three percent. The total of the sixteen accumulated weights is one.

Each sub-criterion is scored with respect to the alternative sites using a descriptive scale ranging from 100 to zero: *Finest* (100 points), *Excellent* (83.3 points), *Above Average*

Table 3. Weights of Sub-Criteria.

Criterion	Descriptor	User Scale Value (0 to 100)	Normalized Scale Value (0 to 1.0) {1}	Accumulated Value {2}
Environment/Physical	***Important***	***50***	***0.20***	
Geology and Soils	Very Important	75	0.23	0.05
Topography and Drainage	Important	50	0.15	0.03
Surface Water	Important	50	0.15	0.03
Ground Water	Important	50	0.15	0.03
Air Quality	Important	50	0.15	0.03
Biology	Important	50	0.15	0.03
Socio/Political	***Important***	***50***	***0.20***	
Culture	Important	50	0.50	0.10
Prox. to Pop and LANL Site Boundary	Important	50	0.50	0.10
LANL Operations/Land Use	***Important***	***50***	***0.20***	
Quantity of Land Available	Important	50	0.25	0.05
Compatibility w/ LANL Ops and Comp. Site Plan	Important	50	0.25	0.05
Security	Important	50	0.25	0.05
Transportation/Traffic	Important	50	0.25	0.05
Permitting and Safety	***Important***	***50***	***0.20***	0.20
Economic	***Important***	***50***	***0.20***	
Infrastructure Devel. Cost	Important	50	0.33	0.07
Onsite Devel. and Closure Cost	Important	50	0.33	0.07
Operations Cost	Important	50	0.33	0.07
Total				**1.00**

{1} The top-level criteria normalized scale values sum to one (0.2 x 5). Within each top-level criterion, the weights of its sub-criteria are normalized by dividing each weight by the total of the weights. For example, Security is 50/(50+50+50+50) = 0.25.

{2} The accumulated value of each sub-criterion is found by multiplying the top-level criterion's normalized weight by that of the sub-criterion. For example, the accumulated value for Biology is 0.20 x 0.15 = 0.03, or a three percent weighting factor. The sum of the accumulated values is one.

(66.7 points), *Average* (50 points), *Below Average* (33.3 points), *Poor* (16.7 points), and *Unsatisfactory* (0 points). The scores for each pass of the model are listed in Table 4.

Results

The weights for the criteria and the scores of the alternatives are combined to create the final results of the decision model. The scores in Table 4 are normalized in a similar fashion to what is done with the weights. That is, the scores of the CWC site alternatives against one sub-criterion are recomputed so that the scores add to unity. For each sub-

Table 4. Criteria Scores for CWC.

Criteria	TA-18/36	TA-46	TA-48	TA-51	TA-54 West	TA-60	TA-63/52/46
Geology and Soils	Above Average	Average	Unsatisfactory	Above Average	Above Average	Excellent	Average
Topography and Drainage	Finest	Above Average	Average	Excellent	Poor	Poor	Finest
Surface Water	Finest	Finest	Excellent	Above Average	Poor	Unsatisfactory	Finest
Ground Water	Average	Above Average	Above Average	Average	Poor	Average	Excellent
Air Quality	Above Average	Average	Above Average	Average	Below Average	Excellent	Excellent
Biology	Average	Average	Finest	Above Average	Excellent	Below Average	Excellent
Culture	Poor	Average	Finest	Above Average	Average	Below Average	Average
Prox. to Pop and LANL Site Boundary	Above Average	Average	Poor	Average	Below Average	Above Average	Average
Quantity of Land Available	Finest	Above Average	Below Average	Average	Average	Finest	Finest
Compatiblity w/ LANL Ops and Comp. Site Plan	Above Average	Unsatisfactory	Finest	Unsatisfactory	Finest	Below Average	Excellent
Security	Excellent	Excellent	Excellent	Excellent	Excellent	Below Average	Excellent
Transportation/Traffic	Average	Finest	Finest	Below Average	Below Average	Poor	Excellent
Permitting and Safety	Average	Above Average	Below Average	Above Average	Above Average	Average	Excellent
Infrastucture Devel Cost	Excellent	Excellent	Above Average	Poor	Excellent	Above Average	Excellent
Onsite Devel and Closure Cost	Excellent	Average	Poor	Average	Poor	Average	Average
Operations Cost	Above Average	Above Average	Above Average	Above Average	Above Average	Average	Above Average

criterion this is done by dividing each alternative's score by the sum of all the model's alternative scores.

The decision score is found by computing the weighted sum of the scores of each alternative. The sum of an alternative's scores against all the sub-criteria multiplied by their appropriate weights is the total score.

The chart in Figure 4 shows the results for three alternative weighting perspectives for the top-level criteria weights. Some of the alternatives have red bars in the chart, which signify a violation of one or more rules in the model. Rules are defined to highlight important sub-criteria where a score of *Unsatisfactory* indicates a possible major problem with that alternative. In this model seven rules are defined, as shown in Table 5. Even though an alternative may score very well against many sub-criteria and have a high total score, a violation of a rule indicates a potential problem exists in developing a CWC at that site. In coloring the score bar red in Figure 4, the reader can see the final score and

Table 5. Rules for Important Sub-Criteria.

Rule Name	Definition
Seismic	**Geology and Soils** must be better than *Unsatisfactory*.
Surface Water	**Surface Water** must be better than *Unsatisfactory*.
LANL Operations	**Compatibility w/ LANL Ops and Comp. Site Plan** must be better than *Unsatisfactory*.
Culture	**Culture** must be better than *Unsatisfactory*.
Proximity to Population	**Proximity to Population and LANL Site Boundary** must be better than *Unsatisfactory*.
Quantity of Land	**Quantity of Land Available** must be better than *Unsatisfactory*.
Infrastructure Development Cost	**Infrastructure Development Cost** must be better than *Unsatisfactory*.

also the fact that a potential "show-stopper" issue exists. TA-60 violates the rule "Surface Water" because a probable release site passes through its center. TA-46 and -51 conflict

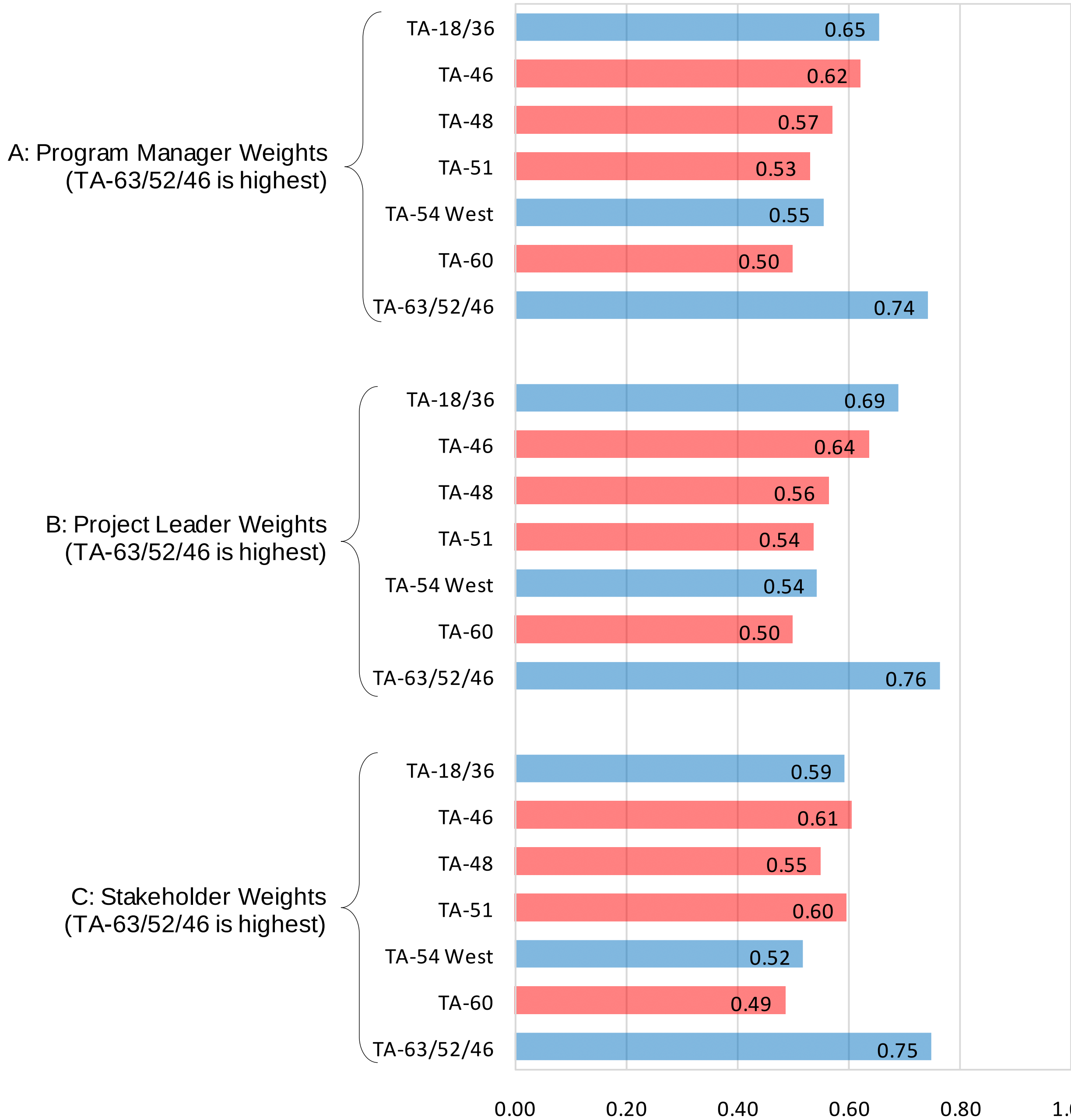

Figure 4. Results using three different decision maker perspectives on the top-level criteria weights demonstrate that the model is relatively insensitive to weights. Program manager weights are higher for LANL Operations and Economics; project leader weights are higher for Environment/Physical and Economics; stakeholder weights emphasize Environment/Physical, Socio/Political, and Permitting and Safety. This gives confidence that the top-ranked site is a robust answer.

with on-going LANL projects, and consequently violate rule “LANL Operations.” TA-48 has seismic issues that may preclude permitting a CWC at the site.

One site (TA-63/52/46) is the clear winner for all three weighting perspectives, and the second place alternative (TA-18/36) is also stable in its relative ranking. This demonstrates the robust result that TA-63/52/46 is a good choice for the CWC.

RECOMMENDATIONS

In the relative ranking of the sites under different weighting perspectives, TA-63/52/46 is consistently the best option for a CWC. TA-18/36 is the only valid second choice.

For construction of the first CWC facility—the new TRU waste facility—the high score for TA-63/52/46 relative to other sites indicates that a portion of it (specifically in the TA-63 portion of the site near the intersection of Puye and Pajarito roads) should be strongly considered as the optimal location.