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Site selection for new hazardous waste management facilities

William M. Sloan

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y Ulrik Borgermann, PF/DJ.

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Criteria Used in Site Selection

Screening criteria and exclusionary criteria guide the search for a site. Environmental and health authorities use approval criteria, which are usually contained in their regulations in the licensing of a facility. Criteria that are more stringent than those for final regulatory approval or not used in final approval may nevertheless be needed to assist in choosing the best site.

The factors given here can be used as criteria, but the selection also requires the consideration of the geography of the area concerned. As presented, however, the factors are a guide to evaluation and to mitigatory action in a variety of situations. They are also useful as a checklist for negotiation. For any particular location, modifications to the lists may be required. Further, computer-based geographic information systems of various capabilities can replace conventional mapping in many instances.

Screening criteria

Screening criteria assist in judging the overall suitability of a location and in differentiating candidate sites, but are not necessarily decisive in the choice of location. Values may be expressed as commentary or as a simple rating given in plus or minus marks, for example. The same factors may later be used to judge the ultimate suitability of the final choice.

Screening criteria are not necessarily consistent. For instance, ensuring a minimum haul distance from the site of the arising to the disposal facility normally precludes locating the facility in an area of low population. The choice between a site in an industrial area that may have been injured by a lack of facilities and an entirely new location has a strong subjective element.

The following paragraphs describe a four-step screening process. Additional details, including sample definitions of the screening factors, are given in Annex 2. A search using these factors resulted in the construction of a secure landfill in Baltimore, MD, United States. The list of factors used in the first step could be expanded.

Step 1 is to eliminate generally unsatisfactory areas. These would include:

- coastal areas subject to floods
- coastal wetlands
- areas with limestone deposits

- areas with subsurface mining
- areas critical for aquifer recharge
- lands designated for preservation
- areas of high well yield
- areas including an aquifer that is the sole source of water for human consumption
- areas of reservoir watersheds.

Step 2 is to highlight promising areas, such as:

- industrial areas
- the sites of existing waste management facilities
- compatible public lands
- abandoned properties
- lands with major highway access
- lands near waste generators.

These factors are related primarily to community development.

Step 3 is to assess promising sites in detail. The use of the kinds of areas listed below normally poses risks to health and the environment:

- riverine areas subject to floods
- freshwater wetlands
- areas with flood hazards related to a dam
- coastal waters for shellfish and fishing
- areas with freshwater fishing
- areas upstream of water-supply intakes
- areas with subsurface mining.

The characteristics of the soil and groundwater of each site should also be assessed, as should factors affecting the community. As to the latter, the following should be considered:

- areas of special significance
- the visual corridors of scenic rivers
- existing developed areas
- areas for which nonindustrial development is planned
- agricultural districts.

Step 4 is to evaluate and rank sites. This involves the consideration of factors affecting health and the environment, such as:

- population density

- the response time of rescue squads and emergency services
- whether the sites include critical habitats or areas of potential mineral development
- groundwater and soil characteristics
- slope.

Factors in the community that require assessment include:

- access to sewers
- transport restrictions
- structures along transport corridors
- whether the area contains historic sites
- whether the land is used in ways incompatible with hazardous waste management
- visual impact
- the feasibility of acquisition.

Factors in site differentiation that have an extensive social impact component, including sample definitions of screening factors, are shown in Annex 3. This list is recommended for study in the design of any screening process. A search that used these factors resulted in the designation of a site for a comprehensive facility in Ontario, Canada.

Exclusionary criteria

Exclusionary criteria define areas within which a facility will not be considered. They promote efficiency in the selection process by ruling out inherently unsuitable areas. Since exclusionary criteria preclude development for very general reasons, they must be thoughtfully chosen. The exclusionary factors in Table 2 are recommended for consideration in all cases.

Neither screening nor exclusionary criteria can replace a thorough site investigation. On the one hand, getting through the preliminary stage does not preclude subsequent exclusion. On the other hand, suitable sites may sometimes be found in previously excluded areas, since exclusionary criteria may not apply to every parcel of the land.

Exceptions

Too stringent criteria can needlessly exclude large areas. Combinations of screening criteria that are reasonable on an individual basis can guide development into certain areas and exclude others that are equally satisfactory, and indicate illogical choices of location or technology.

Table 2. Exclusionary factors in site selection

1. Unstable or weak soils, such as organic soil, soft clay or clay-sand mixtures, clays that lose strength with compaction, clays with a shrink-swell character, sands subject to subsidence and hydraulic influence, and soils that lose strength with wetting or shock
2. Subsidence owing to solution-prone subsurfaces, subsurface mines (for coal, salt and sulfur) and water, oil or gas withdrawal
3. Saturated soils, as found in coastal or riverine wetlands
4. Groundwater recharge, as in areas with outcrops of aquifers of significant or potential use, considering water availability and regional geology (where an impermeable or retarding layer shields the aquifer from the land surface, a specific site analysis should be conducted)
5. Flooding, as in flood plains or hydraulic encroachment, coastal or riverine areas with a history of flooding every 100 years or less, and areas susceptible to stream-channel or storm encroachment (even if not historically subject to flooding)
6. Surface water, which preclude sites above an existing reservoir or a location designated as a future reservoir, or above an intake for water used for human or animal consumption or agriculture and within a distance that does not permit response to a spill based on high-flow (most rapid) time of travel
7. Atmospheric conditions, such as inversions or other conditions that would prevent the safe dispersal of an accidental release
8. Major natural hazards, such as volcanic action, seismic disturbance (of at least VII on the modified Mercalli scale) and landslides
9. Natural resources, such as the habitats of endangered species, existing or designated parks, forests and natural or wilderness areas^a
10. Agricultural or forest land of economic or cultural importance
11. Historic locations or structures, locations of archaeological significance and locations or land revered in various traditions^a
12. Sensitive installations, such as those storing flammable or explosive materials, and airports
13. Stationary populations, such as those of hospitals and correctional institutions
14. Inequity, resulting from an imbalance of unwanted facilities of unrelated function or from damage to a distinctive and irreplaceable culture or to people's unique ties to a place

^a The intention is to prevent not only damage or contamination but also visual, aural or functional encroachment.

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Rigid criteria and numerical scoring can encourage the selection of locations with unforeseen flaws on the one hand, and the denial of deserving projects for minor reasons on the other.

Exceptions to criteria may therefore be justified in certain cases. Making exceptions to or reconsidering the criteria is suggested in three cases. The first is when the results of the search totally preclude the development of a facility for which there is no practical alternative. In general, the absence of a facility poses a greater risk than the modification of criteria. Second, the application of the criteria can lead to an unexpected or illogical result because some of the consequences were unforeseen. Needed facilities may be ruled out for inconsequential reasons, or development may be indicated in unsuitable areas. Third, an exception is appropriate when it is based on the function of the facility, as well as the engineering possibilities. For instance, a hazardous waste transfer facility that is intended to serve shipping will be exposed to marine hazards to some extent. In such a case, safeguards can be designed into the facility.

Additional considerations

Regulations may not cover all significant aspects of facility development. Other standards of or guides to practice, sometimes including independent professional standards of practice, may apply. In addition, norms related to the location or community may provide useful guidance. Locally acceptable noise levels may be higher or lower than professional practice would indicate, for example, and an aesthetic goal is almost by definition governed by the locale. Still other starting points for gauging site acceptability may be the plans made by local or provincial governments or community groups. These are significant, even if they lack force of law. Other nonregulatory considerations could include:

- the development practice of local government
- the planning goals of local or provincial government
- goals set by the community
- norms derived by specialists from local conditions
- government regulations or guidelines on related subjects.

Presenting, Describing and Evaluating a Project

The presentation, description and evaluation of a project to develop a hazardous waste facility should contain certain components. Three types of report are described below: a summary, a project description and a site

