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Use of strategic environmental assessment in the site selection process for a radioactive waste disposal facility in Slovenia

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ABSTRACT

The benefits of strategic environmental considerations in the process of siting a repository for low- and intermediate-level radioactive waste (LILW) are presented. The benefits have been explored by analyzing differences between the two site selection processes. One is a so-called official site selection process, which is implemented by the Agency for radwaste management (ARAO); the other is an optimization process suggested by experts working in the area of environmental impact assessment (EIA) and land-use (spatial) planning. The criteria on which the comparison of the results of the two site selection processes has been based are spatial organization, environmental impact, safety in terms of potential exposure of the population to radioactivity released from the repository, and feasibility of the repository from the technical, financial/economic and social point of view (the latter relates to consent by the local community for siting the repository). The site selection processes have been compared with the support of the decision expert system named DEX. The results of the comparison indicate that the sites selected by ARAO meet fewer suitability criteria than those identified by applying strategic environmental considerations in the framework of the optimization process. This result stands when taking into account spatial, environmental, safety and technical feasibility points of view. Acceptability of a site by a local community could not have been tested, since the formal site selection process has not yet been concluded; this remains as an uncertain and open point of the comparison.

1. Introduction

Radioactive waste should be disposed of in a way that guarantees its isolation from the biosphere; release of potentially harmful substances – radionuclides – must be prevented or limited to levels that do not harm human health or the environment (IAEA, 1994). In selecting a site that has natural, i.e. geological, hydrological, seismic, morphological, ecological and human induced e.g. urbanisation, agricultural, characteristics that will not allow exposure of the population, the site selection process is a critical step of the overall site acquisition process. In terms of the four-step process presented in Fig. 1 (IAEA, 1994), stage one deserves special attention and consideration.

The first site selection process for a low- and intermediate-level (LILW) disposal facility in Slovenia, performed in 1991–1993, was unsuccessful due to public resistance and lack of political support (Kontić et al., 1999). Approximately 10 years later a second site selection process was started. The Agency for radwaste management in Slovenia (ARAO) designed the site selection process in such a way that its first two steps combined hydrogeological suitability with eliciting a preliminary consensus[1] of the local community for the site investigation to take place (ARAO, 2000). ARAO termed this a "combined process", meaning that it combines expertise/knowledge about a site's natural characteristics perceived to be important for disposing radioactive waste (hydrogeological conditions) (GeoZS, 1997a, b) with a democratic approach taking into account diversity of opinions, attitudes and perceptions of different stakeholders as regard to risks, societal development, environmental protection, health, etc. (i.e. consent of the local community). In this relation Kontić et al. (2006) demonstrated a participatory decision-making process

Abbreviations: LILW, Low- and intermediate-level radioactive waste; ARAO, Agency for radwaste management in Slovenia; NIMBY, Not in my backyard; IAEA, International atomic energy agency; TRIGA, Reactor centre of the Jožef Stefan Institute; GIS, Geographic information system; DEX, Decision EXpert: a methodology for multi-attribute decision-making; DEXi, A computer program for the implementation of DEX methodology; EIA, Environmental impact assessment; SEA, Strategic environmental assessment; LUP, Land-use planning.

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[1] A preliminary consensus means a positive response by a local community to the invitation/request of the ARAO for checking – by means of site investigations – whether hydrogeological conditions at a particular site are consistent with the situation as previously determined/assessed by desk studies.

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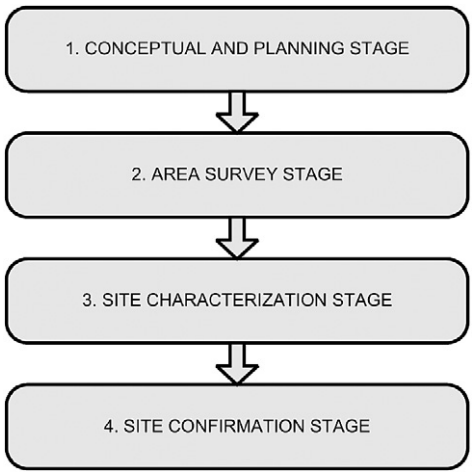

Fig. 1. Steps in the site selection process (summarized from IAEA, 1994).

involving the authorities at local level, experts, and the public, with a strong potential for achieving agreement between the parties involved. A weak point in the ARAO's combined process is that a significant number of hydrogeologically suitable areas may be lost after the second stage of the process if local communities reject proposals for site investigations on their territory. This loss of potential sites from further consideration actually happened during the second site selection process, resulting in only a few candidate sites (territories). Speaking from the site selection process point of view, it is important to note that such an approach can easily result in the final selection of a site which has the consent of the local community but is less suitable from a number of other points of view, e.g. economic, land-use (agricultural, residential, recreational, etc.), nature protection, etc. In such a case, the resulting site may not be optimized in terms of applied suitability criteria, i.e. environmental, economical, technical, spatial (land-use) and safety (Watson, 1981). In order to check this hypothesis we designed a study to explore Slovenian territory in the context of its suitability for disposing LILW, taking into account all the above-mentioned criteria. The resulting suitable sites were compared with the sites that resulted from the ARAO site selection process. The comparison has been performed as a pre-stage of the strategic environmental assessment (SEA) associated with the plan for constructing a LILW repository in Slovenia. The reason for such an approach was the ambiguity in the formal SEA procedure in Slovenia which does not explicitly require prior, early planning stage comparison of site alternatives for the implementation of a plan/policy/programme, as is the praxis in other countries, e.g., Denmark, UK, Netherlands, USA (Morrison et al., 1996; The League of Women Voters Education Fund, 1993; Therivel, 2004).

The two sets of sites were compared using DEX (Bohanec, 2003, 1995). DEX enables an analyst to be systematic, comprehensive, and scientifically sound, maintaining clarity and transparency of the overall process for the purpose of subsequent auditing by any stakeholder. More about DEX is available in Appendix 1.

2. Site selection processes

2.1. The ARAO combined process

The key steps of this process are:

a) A preliminary assessment of hydrogeological conditions of the Slovenian territory in the context of constructing a LILW disposal facility (ARAO, 2002). The result of this step is a map of potentially suitable areas (Fig. 2).
b) The next step is involvement of a local community in the process by establishing a "local partnership" with the ARAO. The latter provides a request to local communities to allow site investigations and an invitation to participate in the process of further confirming the suitability of sites. The invitation to start a local partnership is sent to communities in all identified areas from step one.
c) Preliminary consideration of safety, social, and economic aspects for all the sites where responses by the local communities in the previous step were positive. The result of this consideration is selection of a small number of sites for detailed investigations, that are to be performed in the next (final) step.
d) Detailed site investigations. More detailed investigations follow (check of geological properties, analysis of construction feasibility, evaluation of environmental characteristics, etc.) at the sites where local partnership was successfully established and where preliminary safety, social and economic aspects confirmed the suitability of the sites.

The preliminary safety, social and economic considerations were carried out at 12 potential sites in 5 communities (ARAO, 2005). Of these five communities, three concluded local partnerships with the ARAO. Later on, one community withdrew its consent due to public resistance and disagreement between citizens and politicians (mayor and municipality council were in favor of the partnership with the ARAO, while the citizens were against). Only two communities are involved in the siting process, having valid local partnerships with the ARAO. The partnership provides financial compensation of around € 2.3 million annually for the community to compensate for willingness and actual work in the context of collaboration with the ARAO in further investigation of the sites that are situated on the municipality's territory. These two communities are in the municipalities of Krško and Brežice. Eventually, two sites were identified as suitable sites for the repository – see Fig. 3.

2.2. The optimization process

This alternative process builds on environmental impact assessment (EIA) (strategic level) and land-use planning expertise. The key steps are:

a) Step one – approach: The whole Slovenian territory is checked for LILW disposal facility site suitability (Dermol, 2006). The evaluation is based on environmental vulnerability, spatial attractiveness and spatial suitability modeling that makes a framework of the Slovenian land-use planning process (Koblar et al., 1997; Marušič, 1993, 1997; Marušič et al., 2004; Mlakar and Marušič, 2000). The main advantage of the approach is that it can provide guidelines for allocating activities and act as a controlling instrument for development proposals. The approach of analyzing and combining environmental vulnerability and spatial attractiveness into spatial suitability has been practiced in Slovenia since the early 1990s. The concept is that it is possible to evaluate the attraction of a certain piece of land for a particular activity together with the vulnerability of a particular environmental component on the very same piece of land to the impact of the same activity. By superimposing these two values we obtain an indication as to which piece of land is *better or worse/more or less suitable* for the allocation of a particular activity. When making this analysis using GIS it is easy to identify geographically better and worse sites. The approach is now standardized in the framework of LUP in Slovenia – see Fig. 4. According to the structure