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Siting Criteria for Low and Intermediate Level Radioactive Waste Disposal in Egypt (Proposal approach)

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ABSTRACT

The objective of radioactive waste disposal is to isolate waste from the surrounding media so that it does not result in undue radiation exposure to humans and the environment. The required degree of isolation can be obtained by implementing various disposal methods and suitable criteria. Near surface disposal method has been practiced for some decades, with a wide variation in sites, types and amounts of wastes, and facility designs employed. Experience has shown that the effective and safe isolation of waste depends on the performance of the overall disposal system, which is formed by three major components or barriers: the site, the disposal facility and the waste form.

The site selection process for low-level and intermediate level radioactive waste disposal facility addressed a wide range of public health, safety, environmental, social and economic factors. Establishing site criteria is the first step in the sitting process to identify a site that is capable of protecting public health, safety and the environment. This paper is concerning a proposal approach for the primary criteria for near surface disposal facility that could be applicable in Egypt.

Keywords, Radiation, cement kiln dust, adsorption, heavy metal ions removal.

1-INTRODUCTION:

Safety is the most important aspect in the applications of nuclear technology and the implementation of nuclear activities in any country. The key to the successful performance of near surface disposal facility is the integration of the various phases of activity (i.e. site selection, site design and development, operation and closure)

The objectives and associated set of internationally agreed upon principles of radioactive waste management clearly state that radioactive waste

has to be dealt with in a manner that protect both human health and the environment, both now and in the future, without imposing undue burden on the future generation [(1)].

The preferred strategy for the management of all radioactive waste is to contain it (i.e. to confine the radionuclides to within the waste matrix, the package and the disposal facility) and to isolate it from the accessible biosphere [(2)].

The present Safety Requirements is concerned with the disposal of certain types of solid or solidified radioactive wastes by emplacement near the surface of the earth. The term 'near surface disposal' encompasses a wide range of options, including disposal in engineered structures on the ground, disposal in simple earthen trenches a few meters deep, disposal in engineered concrete vaults and disposal in rock caverns several tens of meters below the earth's surface.[(3)]

It has to be recognize that in near surface disposal system, the wastes are limited in both concentrations of long lived radionuclides and total inventory.[(4)]

Site stability should be assessed for the period of time over which the activity of the waste decays to safe levels. [(5)]

To carry the work activities in site selection stage, and develop a site selection procedure based on consideration of factors such as geologic properties, surface and subsurface hydrology, demographic issues, land use patterns and socioeconomic concerns. [(5)] Primary criteria for the candidate site should be established.

Ideally, the disposal facility should be sited and constructed to minimize the chance that the waste could contaminate surface water or groundwater. The stability of the ground on which the facility structures are to be erected and the movement of water at the site were basically the conditions that must be met. Geologic features such as rock formation as well as the type of soil present in the studied regions are factors that will affect the way water flows on the surface and through the groundwater, which similarly affects the movement of contaminants. The stability of the ground depends largely on the type of rock and soil present therein. Similarly the likelihood of earthquakes, landslides, subsidence and liquefaction were also taken into account. On the other hand, the movement of water at the site depends on slope, soil and rock type, grain size

and whether fractures, faults or karsts features are present.

The site selection process was conducted by descriptive, overlay and scoring methods, based on the criteria mentioned above.

In Egypt Low –and Intermediate-Level radioactive Waste (LILW) is generated with great amount and it will increase rapidly in the near future due to the Egyptian nuclear program, which about to start. Accordingly securing a disposal site for radioactive waste is considered a very important and urgent national task. According to the definition of the IAEA; disposal is the emplacement of waste in an approval location without the intention of retrieval (this terminology is defined and explained in IAEA safety Glossary) [(6)].

The disposal of radioactive waste in the near-surface repository is part of a practice, as defined by the International Commission on Radiological Protection (ICRP) and in the Basic Safety Standard (BSS) [(7)] , and radiation protection consideration are therefore governed by the concept of justification, optimization and dose limitation. The principles of optimization and dose limitation are applicable [(8)].

And according to the Egyptian nuclear law the low and intermediate level radioactive waste should be disposed off in near surface disposal facility.[(9)]

The process of siting (LILW) disposal facility begins with determine siting criteria, these criteria are intended to ensure that the facility should meet the following safety performance objectives; 1) protect the general population from releases of radioactive material, 2) protect individuals during operations, 3) ensure stability of the disposal site after it is closed, 4) protect individuals who inadvertently intrude.

So this work amid to establish the primary site selection criteria which will be the first step towards this target. These criteria will be based on the IAEA recommendation, the previous experiences of different countries and the literature review of the previous work about the environment and geology of Egypt.

2-Safety Objectives for the Disposal Facility:

The fundamental safety objective is to protect people and the environment from harmful effects of ionizing radiation. This is achieved by setting requirements on the site selection and evaluation and design of a disposal facility, and on its construction, operation and closure, including

organizational and regulatory requirements.

The disposal site performance objectives establish the minimum overall level of safety that the disposal facility is required to meet. Operation within these levels will provide protection of public health, safety and the environment.[1,10-11]

2-1 General safety requirements for waste disposal

The IAEA Safety Fundamentals publication Fundamental Safety Principles [1] sets out the fundamental safety objective and safety principles that apply for all facilities and activities in radioactive waste management, including the disposal of radioactive waste. These safety objective and criteria apply regardless of national boundaries.

The disposal facility shall be sited, designed, operated, closed and controlled after closure so that reasonable assurance exists that exposures to individuals are within the requirements established in the proposal performance objectives as follow;

2-1-1 Protection of the general population and environment from the releases of radioactivity.

The Safety Fundamentals state that: "Radioactive waste shall be managed in such a way as to provide an acceptable level of protection of the environment" [1].

The dose limit for members of the public for doses from all planned exposure situations is an effective dose of 1 mSv in a year [7]. To comply with this dose limit, a disposal facility (considered as a single source) is so designed that the calculated dose or risk to the representative person who might be exposed in the future as a result of possible natural processes affecting the disposal facility does not exceed a dose constraint of 0.3 mSv in a year or a risk constraint of the order of 10^{-5} per year.

Concentrations of radioactivity materials which may be released to the general environment in ground water, surface water, air, soil, plants or animals may not result in an annual dose exceeding an equivalent of 25 millirems to the whole body, 75 millirems to the thyroid and 25 millirems to any other organ of any member of the public; (based publication of the IAEA the recommendation of the ICRP) [7]. Releases of radioactivity in effluents to the general environment shall be as low as reasonably achievable and within the most restrictive national and international regulations and standards which are

applicable.

2-1-2 Protection of individuals during operation;

Operation at the disposal facility shall be conducted in compliance with the applicable standards for radiation protection, except for the release of radioactivity in effluents from the disposal facility, which shall be related to protection of the general population and environment from the releases of radioactivity. Effort shall be made to maintain radiation exposures as low as reasonably achievable.

No releases of radionuclides, or only very minor releases (such as small amounts of gaseous radionuclides), may be expected during the normal operation of a radioactive waste disposal facility and hence there will not be any significant doses to members of the public [(2)].

2-1-3 Stability of the disposal site;

The disposal facility shall be sited, designed, used, operated and closed to achieve long term stability of the disposal site and to eliminate to the extent practicable the need for ongoing active maintenance of the disposal site following closure so that only surveillance , monitoring or minor custodial care are required.

Recently the ICRP has recommended that a value of no more than about 0.3 mSv in a year would be appropriate for the public in the phase of post closure [(11)].

2-1-4 Protection of individuals from inadvertent intrusion;

Design, operation and closure of the disposal site facility site shall ensure protection of the individuals from inadvertent intruding into the disposal site and occupying the site or contacting the waste after active institutional controls over the disposal site have been removed. A suitable disposal site must have long-term stability and attributes that will enable the waste to be isolated so that there is no unacceptable risk to people or the environment either while it is operating or after the site has closed. Criteria for site selection include natural physical characteristics as well as socioeconomic, ecological and land-use factors.

2-2 Geological Siting requirements

The requirements for siting a low-level radioactive waste disposal facility in Egypt should be satisfy the safety requirements and ensure that the

site will be meet the objective performance requirements addressed in the previous paragraph.

The objective of the site selection is to ensure that the site has natural properties to provide adequate confinement of radianuclides from the human environment in conjunction with the engineered barriers in the repository. If repository barriers fail and there is a release of radionuclides from the disposal system, the site characteristics should provide sufficient barriers to keep the radiological impact within acceptable levels.

It is essential that a near surface repository site be located in an area of favorable characteristics so that the waste, once buries will be adequately isolated from the human environment. The characteristics of the disposal site, its location and design of the disposal facilities will determine the type, quantity and any conditioning of waste necessary for acceptance. Any releases of radionuclides to the environment from the disposal site must not exceed the radiological protection criteria for members of the general publics recommended by national regulation.

The hydrological characteristics of a disposal site are usually the main factors controlling the movement of radionuclides, as water is the most likely natural medium for off-site transport of radionuclides. Where hydrogeological characteristics are less than ideal it is often possible to provide engineered means to enhance confinement. It would be desirable for the area surrounding the repository to have characteristics that might increases the suitability of the site. [(12)]

It is unlikely that any site will be found that incorporates all the desirable factors. Neither is this necessary. The acceptance or rejection of the site will inevitable involves a balance between the desirable and less desirable factors. What is essential is that the long term safety requirements are satisfied and, to ensure this, all the confinement factors, natural and constructed, should be included in safety assessment procedures.

A comprehensive list of major site selection factors for near-surface repositories is given in an International Atomic Energy Agency Publication [(13)].

The favourable siting characteristics, not necessarily in order of importance, may be summarized as:

- an arid climate,

- deep groundwater table at least 5 meters below the base of the repository, with groundwater not suitable for human consumption;
- geologic structure with high absorption/ion exchange properties which retard radionuclide migration;
- geologic strata of low permeability;
- simple geologic structure to permit modelling of groundwater and radionuclide migration patterns;
- located away from any known or anticipated seismic, tectonic or volcanic activity;
- suitable geochemical and geotechnical properties;
- area free from flooding.
- low wind and water erosion rates;
- no potentially valuable mineral deposits or construction materials unique to the local area;
- topography suitable for easy movement of heavy machinery;
- low population;
- land unsuitable for agriculture;
- absence of special environmental attractiveness;
- absence of any known rare species or ecosystems;
- absence of sites of special cultural or historical significance;
- convenient distance from a major highway, railway siding or shipping terminal and not too remote from a population centre with accommodation, workshops and supplies.

2-3 Evaluation of the Natural Characteristics of Potential Sites in Egypt

A number of factors need to be investigated to evaluate the characteristics of potential sites as described in the following sections.

2-3-1-Meteorology:

Egypt situated between latitudes 22˚ and 32˚ N, it lies for the most part in the temperature zone, with less than a quarter of its area south of the tropic of Cancer. the whole country forms part of the great desert belt that stretches eastward from the Atlantic across the whole of north Africa onward through Arabia; and like all other lands laying within this belt, it is characterized by

warm and almost rainless climate.

The air temperature in Egypt frequently rises to over 40˚C in the daytime during summer and seldom falls as low as 0˚C even during the coldest nights of winter. The average rainfall over the country as a whole is only about 1 cm a year. Even along the Mediterranean littoral, where most of the rain occurs, the average yearly precipitation is less than 20 cm and the amount decreases very rapidly as one proceeds inland [(14)].

The amount of precipitation will influence the amount of surface erosion, the occurrence and depth of groundwater, leaching and transport of radionuclides from buried waste materials, and the rate of evapo-transpiration in the area. Wind directions and velocities should be considered because of their influence on erosion. Some possible consideration may have to be given to possible future changes in the climate. So in general averages and extremes for regional climatic and site-specific metrology characteristics, such as temperature, precipitation, humidity, air flow patterns, pressure system and frontal movements should be described and evaluated to determine potential effects on a potential suitable site.

Generally the potential site should be located in arid area with low rain fall and high evaporation and away from potential extreme climatic phenomena.

2-3-2-Geomorphology:

Topographic factors affect the surface hydrology, the size and shape of contributing drainage area, the gradient of land surface, the density of the drainage network and the slope of the major stream channels. Areas of topographic extremes may increase erosion, affect access, and influence the nature and orientation of trenches, or, in the extreme, may prevent trenches from being used.

It is fact that Egypt has especial morphological nature; the Nile River divides Egypt into two distinct morphological regions. The region to the east consists of a dissected plateau draining to the river, while the region to the west consists of a series of unconnected depressions. Different conditions affected the land on either side of the Nile, though the river is not everywhere the boundary between the two regions. The Western Desert of about 681000 km2, that is more than two-third of the whole area of Egypt. It is essentially a plateau desert with vast expanses of rocky ground and numerous extensive and closed-in depressions. It attains its greatest altitude in the extreme southwest corner of

the country where its general plateau character is distributed by the great mountain mass of Gebel Uweinat lying just outside Egypt; but the northeastern flanks of the mountain are within the borders of Egypt.

The Eastern Desert consists essentially of backbone of high rugged igneous mountains running parallel to and at a relatively short distance from the cost. These mountains are flanked to the north and west by intensively dissected sedimentary plateaus. [14] The rate and types of erosion are directly related to the nature and the morphology of the land, as well as the climatic conditions which affect the area.

Rates of erosion should be determined to establish that the waste will not be exposed by natural processes within a period of the order of one thousand years. Two different conditions of erosion should be considered: the wind and water erosion that is typical of the area and is primarily dependent on the topographic and climatic conditions, and changed erosion rates possibly produced by the disturbance engendered by the facility's implementation or even as a result of climate change. In Egypt the water erosion unlikely happened due to the nature of the climate except in few regions in the Eastern desert during the rainy season, and the heavily seasonal rain fall restricted to the shore and away from the arid desert. It is also related to high topographical features, which usually located in the eastern desert along the Red Sea.

So the site should be located in an area with low relief and simple topographic feature to minimize the erosion and facilitate the access to the repository.

2-3-3- Demography and land use:

Potentially suitable sites should not be located where nearby facilities, activities, population or development will mask monitoring of the disposal site or affect the disposal site's compliance with the performance objectives.

So the candidate site should be located in an area of low population density where the potential for future population growth is estimated to be quite limited.

The average density of population in habitable part of Egypt is more than 1500 person/ km^2 while there is only one inhabitant /6 km^2 in the vast desert areas. The scanty rainfall of Egypt accounts for the fact that the greater part of Egypt consists of barren and desolate desert [14]. But the knowledge about the existing and the future development in the region around the potential

suitable sites should be evaluated to determine the effects of the proposed site location will have on these projected future conditions.

2-3-4-Geology:

(i) Stratigraphy and Structure

Detailed knowledge of the geological structure of the repository area and the stratigraphy of various geological formations, together with their spatial and age relationships, are fundamental to understanding the flow of water through the area. The water pathway, in turn, strongly controls the potential direction and rate of potential transport of radionuclides from emplaced waste. Ideally, the area should have a relatively simple geological structure and uncomplicated stratigraphy so that the resultant hydrogeology can be defined easily and be modelled with a reasonable degree of confidence.

Near surface facility usually on/or below the surface of the earth within the upper strata which is belong to the Quaternary and recent sediments in Egypt. These sediments of Egypt have recently been subjected to intensive studies. [15-24]

In the desert which will be considered in the disposal site selection process, the Quaternary sediments are varied and complex. They are varied from sand dunes, sand sheet, fluvial deposit to inverted wadis. Depending on the localities of each type, these sediments should be evaluated to determine their effect on the suitability of the disposal site during the construction and after the closer.

(ii) Lithology and Mineralogy

The mineralogy of a geological stratum is important for near-surface repositories. It will dictate how the waste may interact chemically with the formation rocks and soil, as well as control the chemistry of the groundwater. The ability of soil and rock to adsorb, or otherwise immobilise, waterborne waste constituents, or to retard their movement, is a principal reason why some environments are preferred for the disposal of radioactive waste. Chemical reactions between waterborne radionuclides and minerals in soil and rock are influenced profoundly by the chemical characteristics of the water. For these reasons, knowledge is required of the groundwater chemistry at the repository site and its effects on possible chemical reactions between the radionuclides and local earth material and water.

Generally the potential suitable sites should be within the recent

sediments which consist of sands and clay; excluding the limestone and carbonate rocks, which could adversely affect the presence of radioactive waste disposal facility.

(iii) Geotechnical Properties

Soil and rock mechanics studies of the repository area will provide information on the physical and structural properties of the soil and bedrock materials to ensure that a particular repository design can be developed at the site. These studies provide information not otherwise obtained by stratigraphic and petrographic observations.

The data are needed for input to the design of the engineering aspects and engineered barriers of the disposal system.

It is desirable from the repository construction standpoint for the overburden to permit easy excavation of disposal trenches with conventional earth moving equipment. Ideally, the texture of the overburden should permit the excavation of relatively steep-sided trenches, not requiring support. The depth of the overburden should preferably be thick enough to provide five meters of natural earth materials between the bottom of the disposal trench and the water table. In addition, the soil should be non-cracking (non-shrinking) and have non-tunnelling characteristics.

(iv) Tectonics and Seismicity

Areas of high seismicity and those in the immediate vicinity of active faults should not be considered when locating near-surface repositories.

An earthquake could conceivably damage the engineered or natural structures of the repository, provoke collapse or failures of the confining barriers and thereby increase the potential rate of migration of the waste back to the surface. Earthquakes can also produce fissures and faults in the geological formations. Such features could possibly impair the site's capacity for confinement by increasing the permeability of rocks or by modifying the water table elevation and characteristics of groundwater flow. Seismic activity can also trigger landslides and thereby modify the surface water and the groundwater regimes.

So information about the regional and local tectonic activities must be known to evaluate the factors that may influence the stability of the repository during construction and after closing. And the site should be excluded in case of

unaccepted tectonic or seismic activities around the potential site.

2-3-5-Hydrology:

The principal natural means for the potential migration of radioactivity away from the repository and into the environment is by water flow, either from surface water or from groundwater. A good knowledge of the characteristics of the water systems in the immediate vicinity and in the area around the repository is essential in order to assess the confining capacity of the site. Generally approximately 95% of the Egyptian landscape is desert area. [14]

(i) Surface Hydrology

Although the site for a repository in Egypt is likely to be in an arid region it is very important to understand the potential stream and lake networks in the vicinity of a repository site and to know their characteristics, such as potential flow rates and drainage patterns. This knowledge of the surface water movement is necessary for many reasons, which usually include one or more of the following:

- evaluation of the flooding potential;
- evaluation of the potential of erosion and sediment transport and possible changes in runoff channels;
- identification of the recharge and discharge areas for the underlying aquifer(s);
- evaluation of the use of the rehabilitated site as a resource for human use;
- evaluation of surface water drainage paths for potential as monitoring points for site releases.

(ii) Subsurface Hydrogeology

In nature, there are no known regions where the ground is devoid of water.

In arid areas, it is possible to find closed hydrogeological systems in which the hydrological balance is at steady state, the evapo-transpiration balances the water supply so that there is no lateral flow of water and no outlet except towards the atmosphere. Such situations are generally advantageous for near-surface disposal. However, it may be difficult to predict climatic changes and consequently the stability of the system for the period of concern.

In Egypt the main aquifer is the Nubian aquifer in the Western desert,

which considered the most important for the future development in Egypt. Several studies have been done concerning the Nubian aquifer, to determine its recharge and discharge. Nubian aquifer is recharged by a regional groundwater movement from southern or southwestern areas and that the groundwater reservoir is in steady state [24-27]. According to Said (1990), the regional movement exists, but the Nubian aquifer was formed mainly by local infiltration.[14]

Consequently, wherever the repository is sited, the hydrogeological environment must be studied and understood in detail to permit prediction of the potential pathways of migration of radionuclides and their interaction with the groundwater and rock materials. For this reason the regional hydrogeology must be carefully considered at the early stages of site investigations. The required information related to hydrogeology for repository site investigations is summarized in table (1) from reference 16.

The long term stability of the conditions of the partially saturated zone and the groundwater must be considered for the period during which the waste remains a potential source of unacceptable exposure. This stability can be influenced by factors such as changes in the climatic conditions, changes in the regional base level of streams which can produce a modification of erosion rate, artificial modifications of the stream regimes resulting from seasonal runoff, building dams, increased water abstraction, etc.

It is easier to predict the movement of groundwater for homogeneous strata with an intergranular porosity than for fractured rocks. Consequently, safety analysis and monitoring are simpler to perform and are more reliable in the homogeneous strata. From this standpoint, favourable strata are homogeneous with low permeability.

Favourable geohydrological conditions for a near-surface repository would, in general, include high cation/anion exchange and adsorption characteristics, an individualized and limited groundwater system, having no connection with other aquifers, and possessing a limited number of well-known outlets that are easy to monitor and control.

Where determinable, the ‘age’ of groundwater in any existing aquifers or abstracted from bores should be determined, this will help in quantifying recharge and movement rates for the natural setting.

Groundwater monitoring wells can present a route for vertical

movement of contaminants and attention should be given to the use of high quality grouting to prevent the vertical movement of water between layers and aquifers at different levels.

In general the water table must be at sufficient depth (more than 5 meters) below the planned disposal structure and the hydrogeological setting is such that large fluctuations in water table are unlikely. Simple hydrological pattern will be preferable to permit modelling of the groundwater and enable prediction of radionuclides migration.

Table (1): Summarize for The Required Information for Repository Site.

1-	Geological structural and stratigraphy.
2-	Identification of lithologies with high and low permeability, their thickness, homogeneity and extent.
3-	Water table or peizometric (water pressure) contours of all significant aquifers.
4-	Well hydrographs (water flows) and maximum water table fluctuations.
	Relationship between groundwater and surface water, the positions of groundwater and surface water use, positions of springs on land or underwater, areas of recharge and drainage.
5-	Flow in perennial and intermittent streams adjacent to the repository
6-	Ratio of precipitation to pan evaporation and the seasonal distribution of precipitation.
7-	Detailed measurement of physical and chemical properties of aquifers in the laboratory, and physical properties measured by pumping or injection test. Important aquifer properties include transmissivity, water content, effective and total porosity, dispersion coefficient, grain size and pore size distribution.
8-	Relationship and degree of hydraulic continuity between aquifers.
9-	Detailed hydrogeochemical and physical investigations of the unsaturated and saturated zones to determine migration rates of various solutes
10-	Seasonal variations in soil moisture tension.
11-	Field and laboratory tests for radionuclide sorption in various lithologies.

2-3-6- Natural Resources:

In Egypt the main natural resources can be represented by; mineral deposits, petroleum, water resources, natural preservations and historical areas.

Potential suitable sites may not be located near;

- Well or spring which is used as a public water supply.
- Either side of a stream or impoundment upstream of a surface water intake for a public water supply.

- National park, national forests, wildlife preservation, historical sites…etc
- Area including natural resources such as; oil, natural gas wells, agricultures areas, or promising land for future projects, areas over active or inactive mines.
- Historical area that may attract other human activities.

The candidate sites for waste disposal should be away from any natural resources and historical features that may attract possible activities for now or in the future.

2-3-7- Transportation:

The site for the facility should be located in region which has reasonable access for transport of materials and equipment during construction and operation, and for the transport of waste to the site. It would be evaluated with respect to potential hazards for transportation, total travel distance between a potentially suitable site and points of exit from existing interstate or limited access highways. Existing and projected access roads from the potential suitable sites should be identified and evaluated with respect to safety transportation of the waste.

CONCLUSION

The presented site disposal criteria can be considered as the first trail towards our aim to establish national criteria related to the nature of our country.

As we know Egypt has especial geological characteristics, which would be suitable for disposal low and intermediate level radioactive waste. The favourable site selection criteria to isolate the radioactive waste and to achieve the safety performance objectives are based on the IAEA recommendation and the previous experiences of other countries; as well as the previous studies about the geology and environment of Egypt.

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إن الهدف من الدفن النهائى للنفايات المشعة هو عزل هذه النفايات بشكل لائق لا يمثل خطورة (التسرب الإشعاعى) على الإنسان و البيئة. و الشكل الملائم للدفن يمكن أن يتحقق من خلال الطرق المختلفة للدفن معتمد على معايير مناسبة للإختيار. من خلال التجارب السابقة ثبت أن الكفاءة و العزل الآمن للنفايات يعتمد على نظام الدفن ككل و الذى يتمثل فى ثلاث أجزاء رئيسية و هى الموقع و مبنى الدفن و الشكل النهائى للنفاية.

وعملية إختيار الموقع لدفن النفايات المنخفضة و المتوسطة الإشعاع يتعلق بالعديد من النقاط الهامة ومنها : صحة الإنسان و البيئة و عوامل الأمان و العامل الإجتماعى و العامل الإقتصادى أو التكلفة المادية لهذا الموقع .

تعتبر عملية تحديد معايير إختيار الموقع الخطوة الأولى فى عملية إختيار موقع دفن قادر على حماية الإنسان و البيئة المحيطة.

هذا البحث يتعلق بتقديم إقتراح للمعايير المبدئية و التى تجب توافرها عند إختيار موقع لدفن النفايات المشعة فى مصر.