

Update on the Radioactive Waste Position in the UK - 9455

J. Dalton, B. McKirdy,
Nuclear Decommissioning Authority, Curie Avenue, Harwell, Didcot, Oxfordshire OX11 0RH
UK

R. Jackson,
Department of Energy and Climate Change, Ergon House, London, SW1 UK

ABSTRACT

With the publication of the Managing Radioactive Waste Safely (MRWS) White Paper in June 2008, a major milestone was achieved in determining future UK Government arrangements for the long term management of higher activity radioactive waste.

This paper explains the MRWS programme that led to publication of the White Paper. This includes the work undertaken by the independent Committee on Radioactive Waste Management (CoRWM) to assess the available options and the consultation undertaken to establish a framework for implementing geological disposal which, together with safe and secure interim storage, was identified as the best approach.

It provides a summary of the higher activity radioactive wastes that the UK expects to have to deal with and will outline the programme for implementing geological disposal. It addresses the necessary regulatory measures that will have to be achieved and how a site will be selected using a voluntarism and partnership approach.

It also provides an update on the latest position on how local communities have responded to the invitation to, make 'without commitment expressions of interest' to host a geological disposal facility.

The paper also provides an update on the progress the NDA's Radioactive Waste Management Directorate (RWMD) has made in planning to implement Government's policy of geological disposal.

INTRODUCTION

This paper provides an update on what has recently happened in the UK with regard to the long-term management of higher activity radioactive wastes. It provides some background to explain the UK Government's Managing Radioactive Waste Safely (MRWS) programme, particularly the consultation undertaken to establish a framework for implementing geological disposal. This built on the work of the independent Committee on Radioactive Waste Management (CoRWM) which led to the publication of the MRWS White Paper in June 2008.

BACKGROUND

The United Kingdom (UK) has been producing radioactive waste since the 1940s and since the Flowers report [1] in 1976 has recognised a need to establish arrangements for its long-term management.

In 2001 Government initiated the Managing Radioactive Waste Safely (MRWS) programme to find a practicable solution for the UK's higher activity wastes that:

- achieved long-term protection of people and the environment

- did this in an open and transparent way that inspired public confidence
- was based on sound science, and
- ensured the effective use of public monies.

The timetable for this programme is shown below in Table I.

Table I – Managing Radioactive Waste Safely (MRWS) Programme

Stage	Work	Timing
1	The MRWS consultation process, consideration of responses, planning for stage 2	2001-02
2	<ul style="list-style-type: none"> • Establishment of CoRWM • Research and public debate, led by CoRWM, involving option evaluation, using best public and stakeholder engagement and the best available scientific knowledge • Government decision on the option(s) to implement 	2002-06
3	Consultation on the Government's framework for implementing its preferred option(s)	2007
4	Implementation of preferred option(s)	2008 onwards

Following the Stage 1 consultation, the independent Committee on Radioactive Waste Management (CoRWM) was established to review options and to recommend a long term solution to managing higher activity radioactive wastes in the UK.

After significant public and stakeholder engagement activities CoRWM produced on 31 July 2006 15 recommendations [2]. On 25 October 2006 the Government accepted CoRWM's principle recommendations of geological disposal, coupled with safe and secure interim storage along with a programme of ongoing research and development as the way forward [3].

The Environment Secretary of State, David Miliband, said in October 2006 that planning and development of geological disposal will be based on the following four pillars:

- The Nuclear Decommissioning Authority (NDA) acting as a strong, effective implementing organisation with clear responsibilities and accountabilities;
- Strong independent regulation by the statutory regulators: the Health and Safety Executive, the environment agencies and the Office for Civil Nuclear Security;
- Independent scrutiny and advice to Government by a successor body, built on CoRWM principles;
- Open and transparent partnerships with potential host communities for disposal facilities.

Following a consultation [4], Government published in June 2008 the MRWS White Paper: A Framework for Implementing Geological Disposal [5]. This confirmed that the Government's framework for managing higher activity radioactive waste was geological disposal, with safe and secure interim storage and underpinned by R&D. In parallel it explained that the Government has invited communities to open without commitment discussions about possible future hosting of a geological disposal facility.

Roles and responsibilities

The MRWS White Paper [5] sets out the roles and responsibilities for those parties involved in the implementation of geological disposal as follows:

- **Government** is responsible for the policy, will take final decisions and engage with stakeholders to ensure that the objectives of the MRWS programme are met
- **The NDA** is the implementing organisation, responsible for planning and delivering the geological disposal facility and, as part of this process, will engage with communities and other stakeholders.
- **Communities** with a potential interest in hosting a geological disposal facility will have the opportunity to work with the NDA and others in a partnership approach during the process.
- **Local government** will be fully engaged in a partnership approach and will play a part in local decision-making during the site selection process.
- **Independent regulators** will ensure robust, independent regulation in relation to statutory responsibilities for ensuring that national, EU and international safety, security and environmental legislation and standards are met.
- **Committee on Radioactive Waste Management (CoRWM)** will provide independent scrutiny and advice to Government on the plans and programmes for delivering geological disposal including interim storage.

INVENTORY OF HIGHER-ACTIVITY WASTES

The higher activity radioactive wastes to be managed in the long-term through geological disposal are those that:

- cannot be managed under the “Policy for the Long-term Management of Solid Low Level Radioactive Waste in the United Kingdom” published in March 2007 [6]
- are not managed under the Scottish Executive’s (SE’s) policy for higher activity waste, currently interim near-surface, near-site storage as announced on 25 June 2007 [7].

Higher activity waste is composed of all radioactive material that has no further use. It includes the following categories of radioactive waste:

High Level Waste (HLW)

Wastes in which the temperature may rise significantly as a result of their radioactivity, so this factor has to be taken into account in the design of waste storage or disposal facilities. Initially HLW comprises nitric acid solutions containing the waste products of reprocessing spent nuclear fuels.

Intermediate Level Waste (ILW)

Wastes exceeding the upper boundaries for LLW that do not generate sufficient heat for this to be taken into account in the design of waste storage or disposal facilities. The major components of ILW are metal items such as nuclear fuel casing and nuclear reactor components, graphite from reactor cores, and sludges from the treatment of radioactive liquid effluents.

Higher activity waste also includes a small fraction of the following type of waste:

Low Level Waste (LLW)

These are wastes not exceeding specified levels of radioactivity. Overall, the major components of LLW are building rubble, soil and steel items such as framework, pipe work and reinforcement from the dismantling and demolition of nuclear reactors and other nuclear facilities and the clean up of nuclear sites.

In addition to existing wastes, there are some radioactive materials that are not currently classified as waste, but that may need to be managed through geological disposal. These include:

Spent fuel: Fuel that has been used to power nuclear reactors is not currently classified as waste, because it still contains large amounts of uranium (and some plutonium) which can potentially be separated out through reprocessing and used to make new fuel.

Plutonium: Plutonium is created in nuclear reactors as a result of irradiating the uranium in nuclear fuel. Like uranium it can be extracted from the spent fuel after it leaves the reactor by means of reprocessing.

Uranium: Uranium is found naturally in many parts of the world. UK stocks of uranium, which are not classified as waste, come mainly from refining uranium ore (to make fuel), and from reprocessing spent fuel.

As part of its work the Committee on Radioactive Waste Management (CoRWM) put together a “Baseline Inventory” of higher activity wastes [8] for geological disposal using data from the 2004 UK Radioactive Waste Inventory (UKRWI) [9]. CoRWM took a prudent approach including the total amounts of radioactive wastes and other materials that could, possibly come to be regarded as waste in the future.

Using information from the 2007 UKRWI [10] the Baseline Inventory has been updated in Table II.

Table II: 2007 Radioactive Waste and Materials Inventory

Materials	Notes	Packaged volume		Radioactivity (At 1 April 2040)	
		Cubic Metres	%	Terabequerels	%
HLW	1, 2, 3, 5	1,400	0.3%	36,000,000	41.3%
ILW	1, 2, 5	364,000	76.3%	2,200,000	2.5%
LLW (not for LLWR)	1, 2, 5	17,000	3.6%	<100	0.0%
Spent nuclear fuel	1, 4, 5	11,200	2.3%	45,000,000	51.6%
Plutonium	1, 4, 5	3,300	0.7%	4,000,000	4.6%
Uranium	1, 4, 5	80,000	16.8%	3,000	0.0%
Total		476,900	100	87,200,000	100

Notes:

1. Quantities of radioactive materials and wastes are consistent with the 2007 UK Radioactive Waste Inventory [10].
2. Packaging assumptions for HLW, ILW and LLW not suitable for disposal at the existing national LLWR are taken from the 2007 UKRWI. Note that they may change in the future.
3. The HLW packaged volume may increase when the facility for disposing the canisters, in which the vitrified HLW is currently stored, has been implemented.
4. Packaging assumptions for plutonium, uranium and spent nuclear fuels are taken from the 2005 CoRWM Baseline Inventory [8]. Note that they may change in the future.

5. Radioactivity data for wastes and materials was derived using the 2007 UK Radioactive Waste Inventory. 2040 is the assumed start date for the geological disposal facility.
6. It should be noted that at present the Baseline Inventory is based on UK Inventory figures, and as such, currently contains waste expected to be managed under the Scottish Executive's policy of interim near-surface, near-site storage as announced on 25 June 2007 [7].

These figures are calculated on a number of detailed assumptions and can only be taken as indicative because legacy waste amounts will change over time due, for example, to changes in planned operations and ability to reduce the amounts of waste for disposal through application of the waste hierarchy¹. In practice, there may also be some types of waste – for example, the graphite cores from Magnox nuclear reactors – where alternative management options could alter the inventory of waste destined for geological disposal. NDA competitions will introduce international expertise in decommissioning and waste management that could lead to other options being proposed and implemented in due course.

Changes in the UKRWI, and hence the Baseline Inventory, will occur. The estimated quantity and the types of waste to be consigned to a disposal facility needs to be visible and regular UKRWI updates will ensure transparency and indicate the nature of these changes. Any final agreement with a community on a preferred site for the geological disposal facility will need to address possible changes to the Inventory in future years.

GEOLOGICAL DISPOSAL

Geological disposal involves isolating radioactive waste deep inside a suitable rock formation to ensure that no harmful quantities of radioactivity ever reach the surface environment. It is a multi-barrier approach, based on placing wastes deep underground, protected from disruption by man-made or natural events. Geological disposal is internationally recognised as the preferred approach for the long-term management of higher activity radioactive waste and is the policy adopted by the UK Government.

The MRWS White Paper [5] sets out how geological disposal of higher activity radioactive waste will be implemented, including safe and secure interim storage up until disposal. It also acknowledges the need for ongoing research and development to support safety case development and explains the generic design features that a disposal facility would need to include.

The NDA will engage with stakeholders and the public throughout the development and implementation process. Some of the more detailed aspects of facility design will have to be addressed in more detail over future years and could depend to a degree on discussions with potential host communities.

It is recognised that a robust programme of interim storage will play an integral part in implementing geological disposal. The Nuclear Decommissioning Authority (NDA) is reviewing UK waste storage arrangements. The regulators and Government are closely involved in this work and the results will be reflected in the next NDA Strategy.

Some of the waste to be placed in a geological disposal facility will remain radioactive and thus potentially hazardous for hundreds of thousands of years. The principle of geological disposal is to isolate the waste deep inside a suitable rock formation to ensure that no harmful

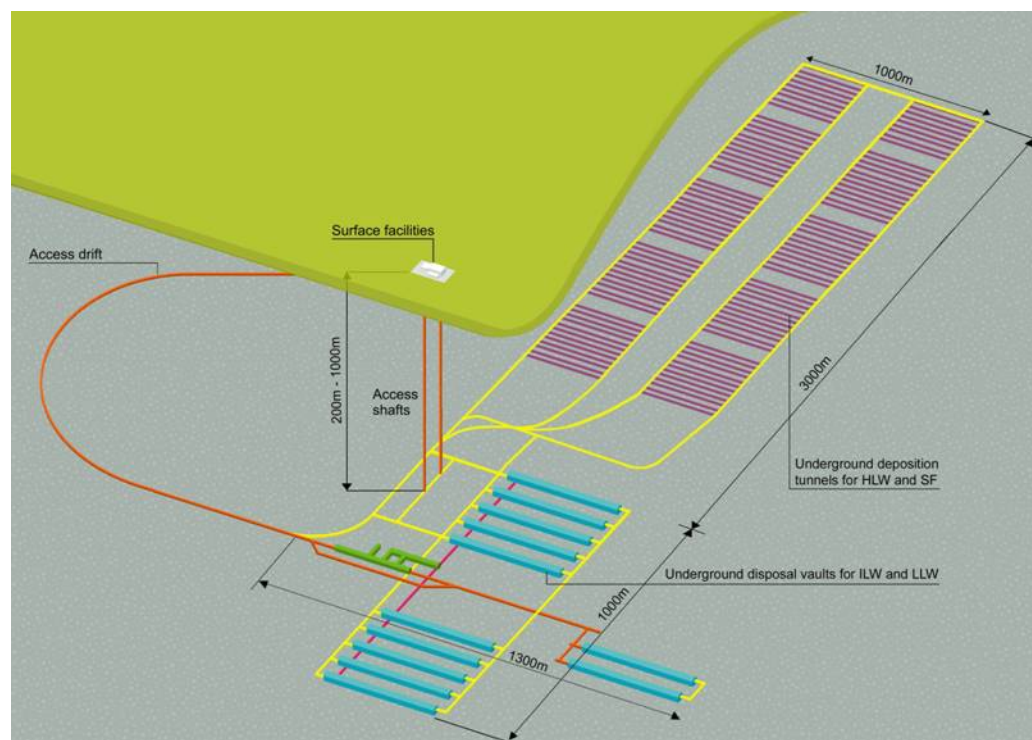
¹ This is the use of a hierarchical approach to minimise the amounts of waste requiring disposal. The hierarchy consists of; non-creation where practicable; minimisations of arisings where the creation of waste is unavoidable; recycling and reuse; and, only then disposal.

quantities of radioactivity reach the surface environment. Meanwhile the process of radioactive decay will continue reducing the hazard of the waste until it eventually presents no further danger.

To achieve this, the waste will be placed in an engineered underground containment facility - the 'geological disposal facility'. The facility will be designed so that natural and man-made barriers work together to minimise the escape of radioactivity. It is inevitable that some radioactivity from the facility will eventually reach the surface. But the disposal facility will be designed to ensure that risks arising from such release would be insignificant compared to the levels of radioactivity all around us in the environment from natural background sources. The natural process of radioactive decay over time will assist this aim.

The detailed layout and design of the basic geological disposal facility, both above and below ground, will be tailored to the Baseline Inventory and the geography and specific geological characteristics at the site in question. An illustrative co-located facility structure is shown in Figure 1 (it should be noted that the underground areas need not necessarily be constructed on a single level but can be layered to take account of the most advantageous local geology).

Figure 1 – An Illustrative Co-located Facility



The need for more research and development has been recognised. The NDA has statutory responsibility under the Energy Act 2004 for carrying out research to support the activities for which it is responsible. The NDA will undertake further research during the geological disposal facility development process to, for example: refine facility design and construction; improve understanding of the chemical and physical properties and interactions of emplaced waste; address specific issues raised by regulators; and support the development of site-specific safety cases.

The NDA's Radioactive Waste Management Directorate already has a focused research and development programme in support of geological disposal and a document setting out these proposals has been issued for wide-ranging review [11]. This sets out the key drivers, a

proposed programme and potential arrangements for carrying out the work. A revised R&D Strategy is expected to be published by the end of March 2009.

IMPLEMENTATION ARRANGEMENTS

In the MRWS White Paper the Government has given responsibility for planning and implementing geological disposal to the NDA, so as to enable the NDA to take an integrated view across the waste management chain, with both long and short term issues addressed in planning and strategy development. Since then the NDA has established a new Radioactive Waste Management Directorate (RWMD), incorporating resources from the former United Kingdom Nirex Ltd, which it will develop into an effective delivery organisation to implement geological disposal.

It is envisaged that RWMD will evolve under the NDA into the 'NDA's delivery organisation'. This organisation will be responsible for the delivery of the geological disposal facility and in due course its ownership can be opened up to competition in line with other NDA sites. Further dialogue with Government, the regulators and the supply chain will be required before this step is taken to determine whether this is the appropriate implementation approach.

The Government has also set in place revised governance arrangements for the NDA. The Waste Management Steering Group (WMSG) has been established to augment existing arrangements. The Group is made up of officials from:

- Department of Energy and Climate Change (DECC), Welsh Assembly Government (WAG) and Department of the Environment Northern Ireland (DoENI) (as sponsors of the MRWS programme)
- HM Treasury
- Scottish Executive (SE)
- NDA

It monitors all of the NDA's long-term waste management planning and development programmes to ensure a coherent approach to the management of all radioactive wastes, including both higher activity and low level waste.

REGULATION

Robust, effective and independent regulation is vital for public confidence in a geological disposal facility programme which meets high safety, security and environmental standards based on comprehensive risk assessment and management.

The UK Government is committed to achieving this with strong and effective control and regulation of the geological disposal facility development process. This will be enforced in the following way:

- The NDA and its delivery organisation will comply with the appropriate regulatory and planning processes
- Government will look to early and continued involvement of the safety, environmental, security, transport and nuclear safeguard regulators throughout the MRWS implementation programme
- The regulators will make clear their regulatory requirements to the NDA's delivery organisation at an early stage
- Government will expect the NDA's delivery organisation, in discussion with relevant planning authorities and the regulators, to develop a coordinated strategy for seeking

the necessary planning permission and regulatory approvals, with roles, responsibilities and any 'hold-points' clearly identified

- Environmental impact and sustainability issues will be assessed through application of the Strategic Environmental Assessment (SEA), Sustainability Appraisal (SA) and Environmental Impact Assessment (EIA) processes
- Regulatory processes for granting any necessary licences or authorisations will provide opportunity for input and assessment of public and stakeholder views
- Regulatory reviews will be published, and regulatory decision-making processes will be open and transparent while taking account of necessary issues such as national security and commercial confidentiality.

The UK has a strong and effective regulatory regime delivered principally through the following bodies:

- Health and Safety Executive (HSE)
- Office for Civil Nuclear Security (OCNS)
- Environment agencies (the Environment Agency, and the Environment and Heritage Service of the Department of the Environment, Northern Ireland)
- Department for Transport (DfT).

Regulatory bodies will work closely together to ensure the regime as a whole is coherent, effective and efficient. Individual aspects of regulation will be carried out in accordance with the statutory responsibilities of each regulatory body and will be clearly delineated. Implementation of the geological disposal facility programme by the NDA will comply fully with relevant UK and international legislation and conventions.

The NDA's delivery organisation will meet all relevant regulatory requirements in its delivery of the geological disposal facility. It will be the responsibility of the delivery organisation to ensure that its programme is appropriately coordinated as part of a staged application and approval process to ensure that permissions are obtained in the right order. The geological disposal facility will comply fully with the requirements of the independent regulators, who will work closely together. The environment agencies will be providing updated guidance on the requirements for authorisation of geological disposal facilities.

Planning arrangements

In May 2007, the UK Government published the Planning White Paper, "Planning for a Sustainable Future" [12]. This proposed the introduction of a new single consent regime and an independent commission to determine applications for nationally significant infrastructure projects in England. Whilst not having yet taken a final decision, Government is currently inclined to look towards applying the new planning system if the location of geological disposal facility is in England.

Environmental impacts

European legislation requires that certain plans and programmes likely to have significant effects on the environment are subject to a process of 'strategic environmental assessment' (SEA). It is good practice to integrate SEA within a wider sustainability appraisal (SA) which also considers social and economic factors. European legislation also requires 'environmental impact assessment' (EIA) of certain individual projects.

Public and stakeholder engagement

NDA and its delivery organisation will work in partnership with potential host communities throughout the process of geological disposal facility siting, development and operation. This will enable engagement with those stakeholders and members of the public who would be most affected by development of a geological disposal facility. It is also likely that some high level engagement with Host Communities and their Decision Making Body/ies will need to be led by central Government.

The NDA has set out a proposed framework for public and stakeholder engagement and communication [13]. Stakeholders have provided comments and views on what they want from; engagement with the NDA, the timing of that involvement and their preferred means of engagement. The resulting strategy, which must be agreed by Government, is due to be published in 2009.

Public consultation is also a requirement both of the planning permission process, where the public will be consulted on the planning application and the accompanying environmental statement, and as part of the environmental regulator's decision on whether to grant an authorisation to dispose of radioactive waste. The SEA, SA and EIA processes will also provide opportunities for public engagement.

Independent scrutiny

The UK Government and the devolved administrations' statement of October 2006 [3] made clear that Government will ensure strong independent scrutiny of the proposals, plans and programmes to deliver geological disposal.

Accordingly, the Committee on Radioactive Waste Management (CoRWM) has been reconstituted, with modified terms of reference and expertise. The Committee will provide independent scrutiny and advice to UK Government and devolved administration Ministers on the long-term radioactive waste management programme, including storage and disposal. CoRWM will undertake its work in an open and consultative manner.

VOLUNTARISM AND PARTNERSHIP

Government believes that an approach based on voluntarism and partnership is the best means for siting a geological disposal facility. Government does not wish to be over-prescriptive about the way that the voluntarism and partnership arrangements should work at the outset as individual local circumstances differ and, to a degree, a tailored approach to any discussions will need to be taken. However, this does not apply to the way in which technical issues, such as geology, are assessed, where there will be objective and consistent assessment.

'An approach based on voluntarism' means one in which communities voluntarily express an interest in taking part in the process that will ultimately provide a site for a geological disposal facility. Initially communities will be invited to express an interest in finding out more about what hosting a geological disposal facility would mean for the community in the long-term.

Participation up until late in the process, when underground operations and construction are due to begin, will be 'without commitment' to further stages, whether on the part of the community or Government. If at any stage a community or Government wished to withdraw then its involvement in the process would stop. In practice, development could also be halted by the independent regulators at any point in the process through a refusal to grant authorisations for the next stage of work.

The MRWS White Paper [5] identifies three types of community;

- **Host Community** - the community in which any facility will be built. This will be a small geographically defined area and include the population of that area and the owners of the land. For example, it could be a town or village.
- **Decision Making Body** – the Local Government decision-making authority for the host community.
- **Wider Local Interests** - other communities that have an interest in whether or not a facility should be built in the Host Community. Such as the next village, a neighbouring district or a community on the local transport routes to the Host Community.

All three levels of community, will need to liaise closely with one another as the process is taken forward. Both Government and the NDA will engage with all three ‘communities’.

By a partnership approach Government means the setting up of a formal Community Siting Partnership such that the Host Community, Decision Making Bodies and Wider Local Interests will work with the NDA’s delivery organisation and with other relevant interested parties to achieve a successful outcome. This could be by ensuring that questions and concerns about the geological disposal facility siting, construction, operation, closure and post-closure are addressed and resolved as far as reasonably practicable and that the project contributes to a community’s further development and well-being.

The Right of Withdrawal (RoW) is an important part of the voluntarism approach intended to contribute to the development and maintenance of community confidence. Up until a late stage, when underground operations and construction are due to begin, if a community wished to withdraw then its involvement in the process would stop. As with other key local decisions in the siting process, the Decision Making Body will be responsible for exercising the RoW, based on advice and recommendations from the Community Siting Partnership.

All parties in a Community Siting Partnership should work positively to seek to avoid the need to exercise the RoW. This will be particularly important following a surface-based investigation programme, when considerable investment will have already been made.

To help avoid the need to exercise the RoW late in the process, it is proposed that the stated objectives of a Community Siting Partnership include seeking to develop partner and local community confidence that:

- there is a good prospect for developing an acceptable environmental safety case
- the potential development is likely to be able to address the planning requirements of the planning authority.
- a Community Benefits Package will be agreed such that the overall balance of benefits and any perceived detriments will reflect the needs of local communities and their future generations
- the question of potential retrievability of wastes has been adequately considered taking account of regulatory constraints.

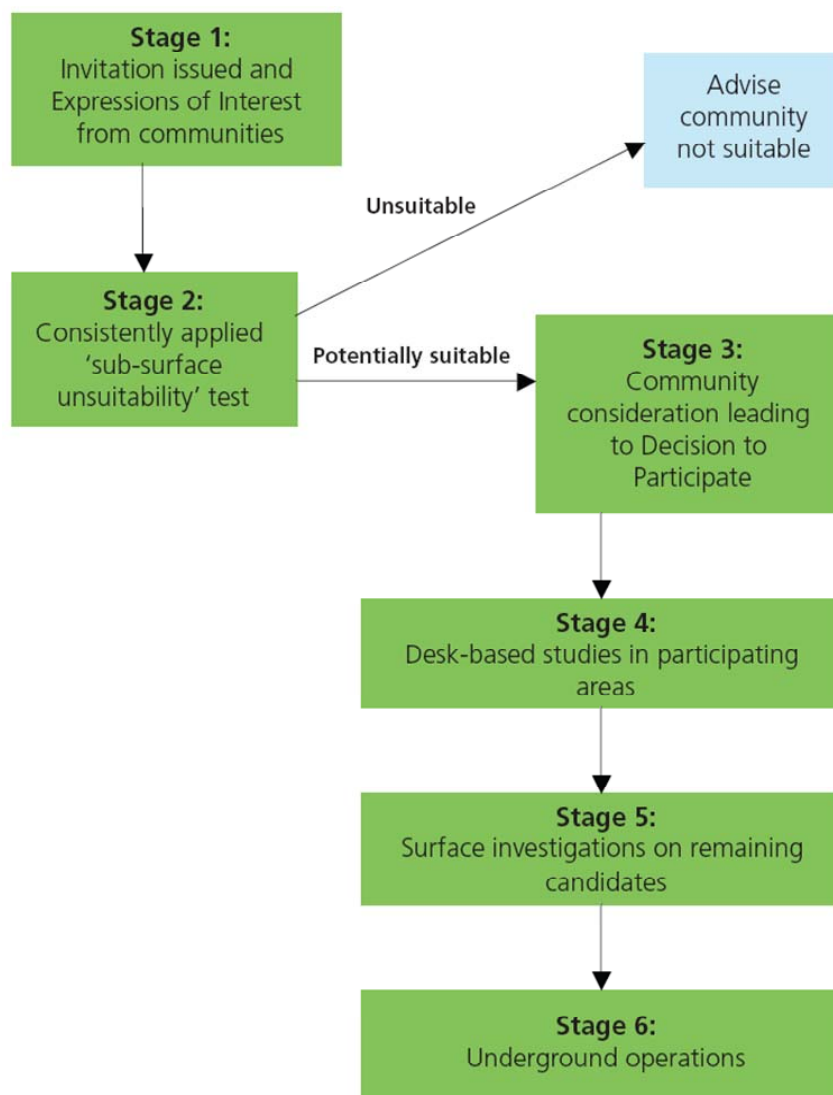
Government has decided that an Engagement Package and a Community Benefits Package will form part of its voluntarism and partnership approach, subject to them being affordable and offering good value for money. This would recognise that a community which expressed an interest in hosting a facility should be enabled to participate in the selection process; and that a community which hosts a geological disposal facility for higher activity radioactive wastes will be volunteering an essential service to the nation. A community will want to ensure that the impact of a geological disposal facility on their long term social and economic prospects is understood and that the needs of future generations are addressed appropriately.

It could be at least a century until final closure of an entire facility is possible and so the development and operation of a geological disposal facility is an intergenerational issue. The local needs arising from the development are also likely to have an inter-generational element.

Site assessment process

The site assessment process will be a staged process, allowing all those involved to take stock before deciding whether or not to move to the next stage at a particular site. Figure 2 below indicates the main stages in the process.

Figure 2 – Stages in the Site Assessment Process



The programme for developing a geological disposal facility needs to be flexible and able to incorporate both robust technical site investigations and ongoing interactions between the project and the Host Community. This may mean accommodating longer discussion periods and more research to address stakeholders' concerns. There is nevertheless, the need to maintain momentum in taking forward this important programme to ensure the safe and secure long-term management of higher activity radioactive waste in the UK.

LATEST POSITION

The Government continues with the siting process for a geological disposal facility based on a voluntarism and partnership approach. The MRWS White Paper published on 12 June 2008 marks a significant milestone. At the same time Government also invited communities to express an interest in opening up without commitment discussions on the possibility of hosting a geological disposal facility at some point in the future.

Since then some progress has been made, Copeland Borough Council in West Cumbria and Cumbria County Council have formally expressed an interest to Government. Another local authority, Allerdale Borough Council also in West Cumbria, is considering their position.

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