

Geological Disposal

Overview of international siting processes

September 2013



Contents

1.0 Executive Summary	2
2.0 Introduction	3
3.0 Summary of international experiences	4
3.1 Canada – Geological disposal of spent fuel	9
3.2 Kincardine - Low and intermediate level waste deep geologic repository	11
3.3 Finland - Spent fuel geological disposal facility	14
3.4 France - Underground research laboratory and Cigéo – geological disposal facility	16
3.5 Japan - High level waste and transuranic waste geological disposal	19
3.6 Sweden - Spent fuel geological disposal facility	21
3.7 Switzerland - High level waste and low/intermediate level waste repositories	24
3.8 US - Waste Isolation Pilot Plant transuranic wastes	27
3.9 US - Yucca Mountain spent fuel	29
4.0 Conclusions	36
5.0 Conditions of publication	37
6.0 Bibliography	38
7.0 Feedback	38
8.0 Contributors	38

1.0 Executive Summary

The Radioactive Waste Management Directorate (RWMD) of the Nuclear Decommissioning Authority (NDA) has prepared this report to review different national approaches to siting processes for the geological disposal of intermediate level, high level radioactive waste and/or spent fuel. This report focuses on:

- how each country undertook, or is undertaking, the siting process for geological disposal facilities (GDFs)
- the roles of local decision making bodies, national governments and the body responsible (the developer) for implementing a GDF
- the level and timing of payment of benefits to local communities.

The countries covered in this report have defined waste management processes for deep GDF's for the disposal of intermediate, high level radioactive waste and /or spent fuel. The experiences of different countries show a range of approaches to finding sites and seeking the involvement of local communities.

- Canada – GDF for spent fuel
- Canada – low and intermediate level waste disposal in the Municipality of Kincardine
- Finland – GDF for spent fuel
- France – underground research laboratory and GDF for long lived high level and intermediate level wastes
- Japan – geological disposal of high level waste and some types of transuranic waste
- Sweden – GDF for spent fuel
- Switzerland – GDF for high level, low level and intermediate level waste
- US – the Waste Isolation Pilot Plant (WIPP); a GDF for defence-related waste containing long-lived radionuclides
- US – Yucca Mountain; a GDF for spent fuel and high level waste.

The experiences described in this report encompass a spectrum of approaches to identifying suitable sites for hosting a geological disposal facility.

RWMD gathered the information in this report in cooperation with the radioactive waste management organisations (RWMOs) in each country and it has been checked for accuracy with each RWMO.

The main messages from the report are:

- the programmes in each country reflect the political and cultural circumstances in each country
- some siting processes faced setbacks in the early stages; before then proceeding with a revised process
- local government is always involved as the representative of the community and, with the exception of Switzerland, has a decision making role in the process
- the elected representatives of the community closest to where the disposal facility will be built (the local municipality) tend to be the local decision maker in the siting process
- engagement with the issues, understanding and support at a local level is often higher than it is at a regional or national level
- the benefits associated with a GDF which are made available to potential host communities vary from country to country in their approach, scope, amount and when they become available. In a number of countries, these benefits are scheduled to be made available in advance of the facility being constructed.

2.0 Introduction

The Radioactive Waste Management Directorate of the Nuclear Decommissioning Authority (NDA) has prepared this report to help to review different national approaches to siting processes for the geological disposal of intermediate level, high level radioactive waste and/or spent fuel.

The countries covered in this report have defined waste management processes for deep geological disposal facilities for the disposal of intermediate, high level radioactive waste and/or spent fuel. The experiences show a range of approaches to finding sites and seeking the involvement of local communities. The countries reviewed are:

- Canada – GDF for spent fuel
- Canada – low and intermediate level waste disposal at a site in the Municipality of Kincardine
- Finland – GDF for spent fuel
- France – underground research laboratory and geological disposal facility for long lived high level and intermediate level wastes
- Japan – geological disposal of high level waste and some types of transuranic waste
- Sweden – GDF for spent fuel
- Switzerland – GDF for high level waste and low and intermediate level waste
- US – the Waste Isolation Pilot Plant (WIPP); a geological disposal facility for defence-related wastes containing long-lived radionuclides
- US – Yucca Mountain, GDF for spent fuel and high level waste.

The experiences described in this report encompass a spectrum of approaches to identifying suitable sites for hosting a geological disposal facility. The approaches in each country depend on the political and cultural circumstances and the geology.

The report is structured as follows:

- An overview of the processes in each country
- A narrative providing more detail for each country considering:
 - the siting process
 - local decision making
 - the role of government
 - the role of the developer
 - benefits
 - steps in the process
- An analysis of the key themes across each of the countries considered
- The conclusions that can be drawn from the experiences in the different countries.

3.0 Summary of international experiences

The following table shows key information for each country covered in this report of national approaches to the selection and siting of a geological disposal facility (GDF).

Country	Population	Volunteer community population	Waste	Process	Local decision maker	Local Veto	Benefits
Canada	34.5 million Density 3.4 per km ²	Unknown - site not identified (though a number of potentially interested communities have come forward)	Spent fuel	Volunteer first. Nuclear Waste Management Organisation (NWMO) has identified Canada has a range of suitable rock types. More detailed evaluation takes place after a community decides to participate.	Municipal Council - the most local level of Canadian government. Plus a commitment to involve surrounding communities and representation of the "First Nations", Inuit and Métis peoples in the decision making process.	Yes	Socio-economic from jobs and impact on local supply chains. Any funding will come from NWMO - the developer.
Canada - Kincardine	34.5 million Density 3.4 per km ²	Kincardine: 11,173 Density 20.8 per km ²	Low and intermediate level waste	Volunteer first, then a high level study in 2003/2004 looked at options. Deep geological repository (DGR) regulatory process ongoing.	Municipal Council of Kincardine representing the most local level of government in Canada below federal and provincial.	Yes	Total package - C\$35 million (around £21 million) with an initial lump sum and then payments over 30 years, inflation linked. Funding from Ontario Power Generation (OPG).

Country	Population	Volunteer community population	Waste	Process	Local decision maker	Local Veto	Benefits
Finland	5.4 million Density 17 per km ²	Eurajoki: 5,900 Density 17.2 per km ²	Spent fuel	Geology first. Much of Finland has suitable rock types.	Municipal council - representing the local level of administration in Finland.	Yes	Property tax that goes to the municipality with no restrictions on use. In addition financial support has been provided for the provision of a care facility for older people. This funding comes from the waste producers via Posiva - the developer.
France	65 million Density 120 per km ²	Meuse: 192,198 Density 31 per km ² Haute-Marne: 194,873 Density 31 per km ²	Underground research laboratory (URL) and Cigéo - high level waste and long lived intermediate level waste	Volunteer first followed by geological screening. Départements with potentially suitable types of geologies were then consulted and decided whether to participate further.	Départements which are the local level of administration in France below national and prefectural/regional.	No, but local support essential	€9.1m (around £7.8 million) per year from 1999 to 2006 at both Meuse and Haute-Marne. Now €30 million (around £26 million). Match funding is required. Funding comes from waste producers through taxes on nuclear installations.
Japan	128 million Density 337 per km ²	Unknown - site not identified	High level waste and some types of transuranic waste	Volunteer first. More detailed evaluation would take place after a community decides to participate.	The municipality representing the most local level of administration in Japan below national and prefectural government.	Yes	Socio-economic from jobs and impact on local supply chains. Impact of move of NUMO - the developer's HQ to the area. Around ¥2.9 billion(around £19 million) of property tax revenue per year.

Country	Population	Volunteer community population	Waste	Process	Local decision maker	Local Veto	Benefits
Sweden	9.5 million Density 20.6 per km ²	Östhammar Municipality: 21,389 Density 6.1 per km ² Oskarshamn Municipality: 26,235 Density 11 per km ²	Spent fuel	Volunteer first. Geological studies showed much of Sweden to have suitable rock forms.	Municipal council.	Yes	A 2 billion SEK (around £197 million) Added Value Programme. 75 per cent of which is available to the site not hosting the GDF. Of the remaining 25 per cent, 20 per cent is available from site selection to construction (2011-2019). The remaining value is available once construction has begun. Funded directly by waste producers, not by waste fund.
Switzerland	8 million Density 189 per km ²	Geologically suitable regions have been identified by Nagra. Specific sites in these regions will be identified later.	High level waste and spent fuel, intermediate and low level waste	Geology first. Site selected based on suitability of rock forms. Communities then consulted to identify a specific surface site.	Cantons and communes participate. Federal government makes a decision at the end of every stage and is leading the process.	No	A detailed package has yet to be confirmed. The Federal Council (government) will make this decision once planning permission is granted. Waste producers will fund through Nagra.

US - WIPP	316.6million Density 34.2 per km ²	Carlsbad, New Mexico: 26,138 Density 353.2 per km ²	Transuranic waste, defence-related waste containing long-lived radionuclides	Geology first – investigations initiated at Carlsbad due to an invite by the Mayor to see if local salt beds were suitable for hosting a facility.	Local mayor the county administration (county is the local level of administration in the USA below state and federal level).	No ¹	Socio-economic including improved community and education facilities as well as a technology transfer programme. State-level infrastructure improvement support provided \$20 million annually for 14 years only. Local jobs and impact on the local supply chain. Extra \$3 million per year made available for several years to reflect a temporarily faster rate of waste emplacement signalling closure before stated time. Funded by Congress via Department of Energy.
-----------	--	--	--	--	---	-----------------	--

¹ The DOE National Security and Military Applications for Nuclear Energy Authorization Act of 1980 (Public Law 96-164) prevented New Mexico from having veto power over the site. Instead a formal Consultation and Cooperation Agreement was put in place.

Country	Population	Volunteer community population	Waste	Process	Local decision maker	Local Veto	Benefits
US - Yucca Mountain	316.6million Density 34.2 per km ²	Nye County: 43,946 Density 0.93 per km ²	Spent fuel and other high level waste	Geology first. Process currently under review. New process is expected to be based on voluntarism and local community support.	Under review.	Under review	No package approved but federal law contains provision for state and county level benefits. Expectation is this will be funded by waste producers.
UK – England, Wales and Northern Ireland	58 million 203 per km ²	Unknown - site not identified	Long-lived low level waste, intermediate level waste, high level waste and spent fuel	Volunteer first. More detailed evaluation will take place after a community decides to participate. Process now under review.	Local authority - District and/or County. Under review.	Yes	Socio-economic from jobs and impact on local supply chains. Community benefits package yet to be agreed. To be funded by UK Government.

3.1 Canada – Geological disposal of spent fuel

Siting process

The Canadian Nuclear Waste Management Organization (NWMO) has stated that across Canada a range of geological environments could be suitable for a waste GDF. Between 2002 and 2005 the NWMO reviewed information about the Canadian Shield and sedimentary rock and concluded that, without further study, it was difficult to exclude areas of the Canadian Shield and that sedimentary rock also has potential. The siting process is designed to focus future studies on areas where communities have expressed interest.

The NWMO invited expressions of interest from communities to learn more about the project. Once a community has expressed interest and asks for initial screening, the geology of the area is assessed against known information. If the initial screening identifies no obvious conditions that would prevent further consideration of the area, the community is eligible to proceed to the next step in the site selection process.

Social, economic and cultural studies then take place with the community and as the process progresses it will involve communities in the surrounding area, including the First Nations and if appropriate Inuit or Métis (collectively known as Aboriginal peoples). The siting process includes respect for rights of Aboriginal peoples, supporting Aboriginal engagement and including Aboriginal traditional knowledge to be shared with the NWMO.

Local decision making

Decisions are taken at a local level by the municipal council. This is the local council authority, which also provides local services, facilities, safety and infrastructure for the community. Commitment is also made to involving surrounding communities and Aboriginal communities in decision making as the site selection process advances.

Role of Government

Government approval is required as part of the regulatory review process. Regulatory review will formally, independently and publicly assess and confirm that the project can be safely implemented at the site. The review process will take place over a number of successive steps, from site preparation and construction, to operation and then closure. The safety of the project will be assessed and confirmed at each step.

The NWMO works with provincial governments and the federal government.

Role of developer

The NWMO facilitates the siting process by engaging communities and surrounding areas to understand their objectives. It works with the interested community to conduct the assessment, involve community members in learning and involve neighbours in the process. It also identifies and selects the specific preferred site.

The NWMO is responsible for providing information on its activities and briefing the public at large, provincial governments, the Government of Canada, national and provincial Aboriginal organisations, and regulatory agencies. The NWMO is also responsible for preparing the material required for the regulatory review process and for ratifying a formal agreement with a community.

Benefits

Discussions have focused on jobs and wealth creation. The NWMO commissioned an independent report in 2010 that provides a discussion on possible economic benefits to generic communities within generic economic regions within a host province.

Steps in the process

Date	Event ²
Getting Ready	The NWMO publishes the finalised siting process, having briefed the relevant levels of government, Aboriginal organisations and regulatory agencies. These briefings will continue throughout the siting process
Step 1	The NWMO initiates the siting process with a broad programme to build awareness and answer questions which will be ongoing throughout the siting process
Step 2	Communities identify their interest in learning more, and the NWMO provides detailed briefing. At the request of the community initial screening is carried out
Step 3	For interested communities, a preliminary assessment of potential suitability is conducted
Step 4	The NWMO will work collaboratively with interested communities, Aboriginal and provincial government to engage potentially affected surrounding communities. Detailed site evaluations are completed
Step 5	Communities with confirmed suitable sites decide whether they are willing to accept the project and propose the terms and conditions on which they would want the project to proceed
Step 6	The NWMO and the community with the preferred site enter into a formal agreement to host the project. The NWMO selects the preferred site, and the NWMO and community ratify a formal agreement
Step 7	Regulatory authorities review the safety of the project through an independent, formal and public process and, if all requirements are satisfied, give their approval to proceed
Step 8	Construction and operation of an underground demonstration facility proceeds
Step 9	Construction and operation of the facility with NWMO continuing to work in partnership with the host community throughout the entire lifetime of the project

² See http://www.nwmo.ca/sitingprocess_thesteps for a detailed account of activities.

3.2 Kincardine - Low and intermediate level waste deep geologic repository

Siting process

In 2001, the Municipality of Kincardine expressed an interest in the plans of Ontario Power Generation (OPG) for the management of low level waste (LLW) and intermediate level waste (ILW) arising from its operations at the Bruce nuclear site.

Following an independent assessment, Kincardine Council passed a resolution (in 2004) indicating that it preferred the deep geologic repository (DGR) because:

- it provides the highest level of safety of any option
- is consistent with best international practice
- there will be a rigorous environmental assessment and the regulatory process includes opportunities for public input before construction is approved
- the DGR (referred to as a GDF in the UK) will permanently isolate the low and intermediate level waste stream, much of which is already stored on site
- it provides significant economic benefit to the residents of the municipality
- no high level waste or used nuclear fuel would be allowed in the facility.

A detailed four-year “Geoscientific Site Characterisation Program” began in 2006 to verify the suitability of the DGR site.

Local decision making

The municipality, the local decision making body, approached Ontario Power Generation (OPG) about hosting a facility and signed a hosting agreement saying it would support development of the disposal facility.

The Municipality of Kincardine and OPG signed the DGR Hosting Agreement in 2004. The agreement included a requirement for Kincardine to conduct a community consultation to obtain the views of residents regarding the project. A telephone poll of all Kincardine residents aged 18 and over and a mail follow-up identified 60 per cent support for the project.

Role of Government

The Government, through the federal nuclear regulator, is the final decision-maker.

Role of developer

OPG, a provincially owned electricity utility that owns 20 nuclear reactors, runs the DGR project. The facility will be for LLW and ILW only from OPG-owned facilities – eight of the 20 reactors are leased by Bruce Power from OPG.

The Nuclear Waste Management Organization (NWMO) assists OPG by providing technical support and other services in seeking regulatory approval for site preparation and construction of the DGR. OPG has also contracted with NWMO to manage the construction of the DGR once a site preparation and construction licence has been obtained.

OPG negotiated the hosting agreement and benefits package with the Municipality of Kincardine.

Benefits

OPG and the Municipality of Kincardine formally signed the Kincardine Hosting Agreement. OPG also received letters of support for the agreement from each of the four municipalities that would also receive benefits.

The financial part of the hosting agreement provides CAN\$35 million package (around £21 million) indexed to inflation over 30 years, to Kincardine and the four adjacent municipalities. This is split into lump sum and annual payments over 30 years and is subject to meeting key milestones.

The local municipalities and First Nations and Métis organisations also receive additional funds to conduct peer reviews and for community engagement activities.

If required, a property value protection scheme will compensate owners of property that loses value as a consequence of building the DGR. This covers an 8-km radius from the centre of the DGR.

In Kincardine, there is support for a nuclear centre of excellence, trades and vocational schools and international tours. Kincardine is already well established as a centre of nuclear power development.

One-off payments associated with the Kincardine DGR development.

Date	Milestone	Community				
		Kincardine	Saugeen Shores	Huron-Kinloss	Arran Elderslie	Brockton
2005	Community support established	\$2.9m ~£1.2m	\$500k ~£216k	\$140k ~£60.4k	\$80k ~£34.5k	\$80k ~£34.5k
~2013	DGR construction licence granted	\$1.3m ~561k	\$500k ~£216k	\$140k ~£60.4k	\$80k ~£34.5k	\$80k ~£34.5k

Annual payments (adjusted for inflation) will also be made to the municipalities between 2005 and 2034 as follows:

Community				
Kincardine	Saugeen Shores	Huron-Kinloss	Arran-Elderslie	Brockton
\$650k ~£280.5k	\$250k ~£108k	\$70k ~£30.2k	\$40k ~£17.3k	\$40k ~£17.3k

Steps in the process

Date	Event
2001	The Kincardine Municipality expressed interest in discussing long-term plans for the management of low and intermediate level waste
2002	Memorandum of Understanding signed by community and OPG
2002 – 2004	Independent assessment to jointly review options for the long-term management of low and intermediate level waste
Apr 2004	Kincardine Council passed a resolution that requested OPG to pursue the deep geologic repository (DGR) option at the Bruce site
Oct 2005	OPG and Kincardine entered into a hosting agreement. Agreement includes confirmation of support of Kincardine residents
Jan – Feb 2005	Telephone poll conducted to determine community support for the project. 60 per cent were in favour of the development
Nov 2005	OPG filed a project description with the Canadian Nuclear Safety Commission, which initiated the Environmental Assessment (EA) process under the Nuclear Safety Control Act and the Canadian Environment Assessment (EA) Act. This is expected to take 6 to 8 years
2006	EA scoping hearing & site investigations initiated
2007	EA track approved
2009	EA Guidelines issued January 2009
2011	Environmental Impact Study, Preliminary Safety Report and supporting licensing documents submitted to Regulatory Body
2012	Joint Review Panel appointed and public comment period
2013	Possible public hearing
2014	Site preparation and construction licence (anticipated). It will take five to seven years to construct the DGR
2019	OPG receives operating licence to accept waste packages at DGR

3.3 Finland - Spent fuel geological disposal facility

Siting process

In 1983 Teollisuuden Voima Oyj (TVO), the Finnish nuclear power operator, drew up a list of 101 potential sites for hosting a GDF and undertook a consultation process with the affected communities. This resulted in TVO's identification in 1987 of five potential sites for more detailed investigations.

In 1992, TVO announced that further investigations would only be carried out at Romuvaara in Kuhmo, Kivetty in Äänekoski and Eurajoki (near to the Olkiluoto nuclear site,) where two of the country's four nuclear power stations are located. Interim reports on the sites were produced at the end of 1996.

The plans for the GDF include disposal of spent fuel from all of Finland's nuclear reactors with the exception of Fennovoima's new plant which is the subject of negotiation to find a solution for disposal of its spent fuel.

Local decision making

The municipal council, representing the local level of administration, had to express its willingness to participate in the site selection process.

Finland has what is called the Decision in Principle (DiP) process. Under the requirements of the law, a positive decision by the local municipality and supporting statement by the regulator, based on its preliminary safety appraisal of the disposal concept, are required before a government decision on whether to build a GDF in an area.

The councils of the volunteer sites had the right of veto and to decide whether to support the development of the GDF. Eurajoki Council took its final decision after Posiva, the developer, had submitted the application for the Decision in Principle to the Government. This happened before the construction of the underground characterisation facility ONKALO at Olkiluoto.

Role of Government

The final requirement of the process was the ratification by the Parliament of the Decision in Principle. This occurred in 2001.

The Ministry of Employment and the Economy is responsible for permissions and regulations.

Role of developer

TVO and then Posiva were responsible for assessing and choosing the preferred site. Posiva is responsible for construction and operation.

Benefits

In Eurajoki, Posiva loaned money to the municipality for it to construct a new, purpose-built home for elderly people who had previously occupied an historic mansion in the town. Posiva also partially financed the restoration of the mansion, along with the municipality and the European Union. The historic building is now partially used as Posiva's offices. (Posiva moved its head office to Olkiluoto) The rest of the building is open to the public and is used as a local resource. Posiva has rented the mansion for 40 years and will pay all the rent over the first 20 years. The municipality will cover its loan from Posiva with the rental income.

No incentives or compensation are paid directly. However, nuclear facilities pay a local property tax at the highest rate of 2.85 per cent while the average rate is 0.4 to 1.0 per cent.

This property tax is seen as the most obvious benefit for the local community. The money goes straight to the municipality with no restrictions on its use.

Steps in the process

Date	Event
1983 to 1985	Screening study of Finland
1986 to 1992	Preliminary site investigations
1993 to 2000	Detailed site investigations and an environmental impact assessment was carried out for sites in Romuvaara in Kuhmo, Kivetty in Äänekoski and Olkiluoto in Eurajoki
1997	Posiva organised several open discussion events in all candidate municipalities
1997 to 1999	Posiva completed an environmental impact assessment for the disposal of spent nuclear fuel
2000	Eurajoki Council decide to host the facility
May 2001	Parliament ratified the Government's positive Decision-in-Principle
2002 – 2012	Positive site investigations at Olkiluoto, construction of ONKALO
December 2012	Posiva submitted its Construction Licence Application for a GDF for Spent Nuclear Fuel to the Government
Around 2020	Final disposal should be able to begin

3.4 France - Underground research laboratory and Cigéo – geological disposal facility

Siting process

Following a failed site selection process in the 1980s that did not involve or consult local communities, the 1991 Bataille Act on nuclear waste research and development established a clear political decision making process with a 15-year R&D phase before any decision about long-term management.

Under the Act, Christian Bataille, a Member of Parliament, acted as a mediator to carry out a dialogue with local authorities and representatives of business, industry and social organisations. He established three objectives: information provision to the public, open dialogue, and decision facilitation.

As Bataille recommended, the process required the départements (local councils) to vote in favour of preliminary surface investigations before being included in a list of volunteering départements and potential sites in these départements was submitted to the government.

Andra (the National Radioactive Waste Management Agency) and the Bureau de Recherches Géologiques et Minières (BRGM), the French geological survey, reviewed the geological data for communities that had expressed an interest in the project.

A report by Bataille in December 1993, confirmed by the Minister for Industry, also recommended:

- supporting an organised debate by establishing a local information committee, with a budget of €150,000, in each département
- establishment of an economic development scheme in each département with an annual budget of €900,000
- underground research laboratories (URL's) should work with local universities and R&D organisations in the départements on related scientific and technological projects.

In May 1996, Andra was authorised by Ministers to file applications for the installation and operation of URLs at three sites. Public hearings at the sites ran from January to May 1997. In December 1998, the Government confirmed that two sites would be investigated: the Bure site and a granite site; however a granite site was not identified. Consequently the study of a granite environment has been carried out at international granite underground research laboratories supported by the bibliographic geological data available in France.

The Bure site in Meuse Département is now Andra's underground research facility. It is used to:

- study the feasibility of the reversible geological disposal of high level and long lived intermediate level radioactive waste.
- carry out experiments on technical demonstrations, such as drilling and lining a 100m borehole for horizontal disposal of high level vitrified waste.

In 2010, and following extensive stakeholder engagement, the French government approved the location for underground disposal facilities. Disposal of high level waste and long-lived intermediate-level waste will be in this Callovo-Oxfordian clay formation. In 2012, Andra successfully drilled and lined a 100-metre borehole for horizontal disposal of vitrified high level waste. An environmental monitoring and data/sample bank facility is being built and will be commissioned in 2013.

Since 2010 Andra has led an engagement programme on the siting of installations on the surface and underground. A formal national public consultation on this is taking place from May to December 2013.

This consultation refers to Cigéo, the name of the French GDF. It will be a GDF for highly radioactive long-lived waste from France's current nuclear power plants, as well as from reprocessing spent fuel from these plants.

Local decision making

The main local decision-makers are départements (local councils).

Consultative votes at all local and regional levels of government were part of the licensing process for the URL: and the same will happen for Cigéo (the GDF). Although, only “consultative”, winning local support with these votes is considered essential for the government to progress.

During the URL licensing process in 1997, as well as the départements, the 33 communes (similar to a parish) within 10km of the URL's main shaft were also entitled to vote as well as the two regional councils.

Role of Government

France has a centralised and complex political administrative system. Decision making on radioactive waste management is organised so that national, regional and local levels can be appropriately involved.

A public inquiry process results in government decrees which direct Andra to undertake particular work. The Government has a decision making role throughout.

Role of developer

Andra, the national disposal agency, is responsible for all radioactive waste in France. Andra is mandated to conduct studies on the deep disposal of high level waste (HLW) and intermediate level long-lived waste (ILLW). This led to the creation of the URL and to scientific experiments and technological tests to demonstrate the feasibility of deep disposal.

In 2005, Andra reported that deep disposal was feasible for HLW and ILLW. This resulted in the 2006 Planning Act, stating that deep geological disposal is the preferred solution for long-term management of HLW and ILLW waste.

Benefits

Since 2006, some 312 communities in the Bure area have received benefits from the URL. Meuse and Haute-Marne each received €9.1 million (~£6.2 million) a year from 1999 to 2006 for their Public Interest Group. From 2007 until a decision about whether to implement deep disposal in the area is made (licence application to be filed in 2014-15 with a decision expected in 2018-19) each Public Interest Group will receive up to €30 million. The 2006 Planning Act lays down that two thirds of the budget should be devoted to promoting the local economy and employment and scientific and technological development and training around one third. The 2006 Act also stated that about 14 per cent of the budget dedicated to economic development will be allocated to communities within 10 km of the perimeter of the laboratory. The communities will be free to spend this money as they wish.

The Public Interest Groups manage this budget. There are strict rules under which the community benefits can be spent. Each community receiving funding for a project has to provide 50 per cent matched funding for any proposed project. This ensures that the allocation of funds around the Bure site is assessed in terms of the “leverage” that a project or activity can bring to the area in jobs created, number of businesses affected or other socio-economic benefits.

When the decision is made to build a GDF, the facility will be classed as a "basic nuclear installation" and will be subject to the special tax system for that type of facility.

Additional benefits focus on the creation of new infrastructure and resources in the Bure area by large waste producers, for example at EDF's national archive centre. The nuclear industry has also supported local businesses by helping them to develop projects and apply for grants from the Public Interest Groups.

Steps in URL and Cigéo Geological Disposal Facility process

Date	Event
1991	Andra established
1992	Work on GDF design and identification of knowledge to be acquired
1993	30 volunteer sites identified
1994-96	Geological survey work on two clay sites (Meuse/Haute-Marne and Gard) and one granite site (Vienne)
1998	Government selection of Meuse/Haute-Marne site. URL experimental programme defined including selection of a range of technical solutions
1999-2001	Start of laboratory shaft sinking
2000	The underground research laboratory (URL) built in Bure comprising surface installations (administrative offices, workshops, laboratories, reception building) and more than one kilometre of underground tunnels excavated into the Callovo-Oxfordian layer at a depth of 445 to 490 metres)
2002	Revision of scientific programme for 2002-2005 and selection of GDF concepts (waste packages and disposal cells)
2003-2004	Borehole drilling on and around the laboratory site
2004/5	Further drift experimentation
2006	2006 Planning Act passed containing the objectives and time-scales for disposal of radioactive waste
2007	Perennial Observatory of the Environment (OPE) created to investigate the environment around the future site of the Industrial Centre for Geological Disposal (Cigéo) to identify any long-term changes
2011	The Industrial Committee: a new Andra advisory body created to focus on Cigéo
December 2011	Andra granted the licence to operate its URL and to continue its research activities at the Meuse/Haute-Marne facility until 31 December 2030
2013	Public consultation, followed by Government site selection/confirmation
2014	Filing of the GDF licence application
2015 - 2018	Public consultation
2015 - 2018	Review of the Cigéo GDF licence application (ASN, CNE)
2019	GDF licence is granted - Cigéo construction begins
2025	Commissioning (disposal of the first waste package)

3.5 Japan - High level waste and transuranic waste geological disposal

Siting process

The site selection process has three stages as set out in the "Final Disposal Act". The stages are; the selection of Preliminary Investigation Areas (PIAs), the selection of Detailed Investigation Areas (DIAs) and the selection of a GDF construction site.

The Nuclear Waste Management Organization of Japan (NUMO), the developer, is asking municipalities to volunteer so it can use existing information to carry out a desk-based study for the selection of PIAs. After confirming that volcanic activity, active faults or other geological phenomena do not make the area unsuitable for siting a GDF, more detailed site investigation and selection will then proceed.

In January 2007, Toyo town in Kochi Prefecture, became the first municipality to agree to a desk-based study. However, in April 2007 it withdrew its application as a volunteer area. NUMO continues to work to attract other municipalities.

Reflecting the lessons learnt GDF workshops and engagement throughout Japan were led by the Agency for Natural Resources and Energy (ANRE) of the Ministry of the Economy, Trade and Industry (METI). NUMO has also held workshops and other activities aimed at raising the level of understanding around a GDF.

Local decision making

The government has stipulated that, when approving each stage of the site selection process, the opinions of the municipality mayors and the prefecture governors concerned must be taken into account. The municipality is the most local level of local government in Japan.

Where the prefecture or municipality opposes a disposal facility, the area will not be considered for siting studies..

Role of Government

Overall decision maker.

Role of developer

NUMO was established in 2000 to prepare for and implement geological disposal of "specified" radioactive waste – vitrified high level waste (HLW). Some types of transuranic waste resulting from the reprocessing of spent fuel from commercial nuclear power plants will be included.

Benefits

During the desk-top survey period there would be public benefits of ¥1 billion (around £7.2 million) per year per site up to a maximum of ¥2 billion (around £14.4 million) per site. Expected socio-economic benefits associated with GDF construction and operation will include direct jobs from the facility, jobs created by moving NUMO's headquarters to the area, orders placed with the local supply chain and additional jobs associated with this, as well as multiplier effects in the wider economy. There will also be a property tax revenue of around ¥2.9 billion (£19 million) per year. The amount for the Detailed Investigation Area period is not yet fixed.

As part of these socio-economic benefits, NUMO specifically proposes:

- transfer of its operational headquarters to the municipality
- promotion of regional employment and utilisation of regional industry, actively employing local workers and using related regional industry
- creation of business opportunities and supporting local companies, such as buying local materials/services for the construction and operation of the GDF
- development of regional industries with the transfer of GDF operational and management know-how to the municipality.

Steps in the process

Below are the steps in the process, in which the milestones are based on the government's final disposal plan:

Date	Event
2002	Open invitation began, known as "open solicitation"
2007	The mayor of Toyo Town officially applied to be part of a desk-based survey
April 2007	A new mayor takes office in Toyo Town, the application is withdrawn
–Mid 2010's	Selection of Detailed Investigation Areas
~ 2030	Selection of the GDF site
Late 2030s	Start of GDF operation

No municipalities have applied as volunteer areas after Toyo town. The Japanese Government started reviewing its siting process in May 2013.

3.6 Sweden - Spent fuel geological disposal facility

Siting process

Sweden's national policy is to dispose of radioactive waste in crystalline bedrock. One task in the initial phase of the siting process was to acquire good knowledge of the Swedish bedrock and what properties the rock must have to ensure safe final disposal of spent fuel.

SKB, the implementer, drilled at 10 sites across Sweden to identify suitable areas. The studies showed that most of Sweden probably has suitable bedrock for a GDF. However, recognising that local support is needed to implement geological disposal, SKB asked for volunteers from across the whole country, except in unsuitable areas identified in the studies of bedrock.

In October 1992, SKB wrote to all 286 municipalities in Sweden to introduce the work of managing and disposing of nuclear waste. SKB sought interest from municipalities that wanted to know more about nuclear waste management or that would allow it to carry out a feasibility study. The letter pointed out that showing interest would not mean a future commitment. It also pointed out that communities could opt out of the process if they did not want to proceed.

Despite discussions with around 20 municipalities, only two municipalities in the north of Sweden agreed to begin discussions and to conduct feasibility studies. However, local referenda in both areas showed the local population did not support continuation of the siting process. After the first attempt to find volunteers failed, SKB decided to focus on existing nuclear communities.

SKB approached municipalities near nuclear facilities to see if they objected to feasibility studies. SKB did not study areas where the community objected.

After the feasibility studies, three areas were prioritised for site investigations: Forsmark in the municipality of Östhammar; an area in the northern part of the municipality of Tierp (neighbour to Östhammar); and the Simpevarp area in the municipality of Oskarshamn. The municipality councils in Östhammar and Oskarshamn consented to further investigations, while Tierp said no. In 2009 Östhammar was chosen as the preferred site.

Local decision making

The municipal council, a local level of Swedish government is responsible for decision making. The municipal councils had the opportunity to object to the initial feasibility studies and voted on whether to allow detailed site investigations. An opinion poll in one community showed 80 per cent support for the investigations.

After the regulatory reviews are completed, and if the Government agrees with SKB's proposals, the Östhammar municipality will be asked if the community accepts SKB's suggested solution. There will need to be a mechanism for establishing whether there is local support for hosting the GDF. The municipal council is considering how it will make that decision and on what basis. It is expected that there will be a vote in the council. That might also be complemented by a local referendum to gauge the opinion of citizens in the municipality.

After regulatory and government approval, the municipal council will be responsible for construction permits for the facility. Planning permission has already been approved.

A similar acceptance is required from the community of Oskarshamn which will host the encapsulation plant. After the government has considered views, the Oskarshamn community will be asked if it accepts SKB's plans for the encapsulation plant.

Role of Government

Government ultimately decides on the permit application, licensing review, research and development and sets parameters for SKB's activities. The government had to endorse SKB's choice of sites for site investigation.

The regulator and the Land and Environment Court will recommend to government whether to grant SKB's applications to build the GDF and the encapsulation plant. Government will make its decision after it consults municipalities, which have a veto.

Role of developer

SKB has the task of managing and disposing of spent nuclear fuel from Swedish nuclear power plants. It is responsible for site investigations, the choice of site and implementing a solution. It was also responsible for negotiating the benefits package.

Benefits

Funding for the municipalities' involvement has been paid through the Nuclear Waste Fund, a fund that nuclear operators contributed to for radioactive waste management and decommissioning. Since 2005, non-profit organisations can also receive money from the fund to participate in the process and undertake research.

During the feasibility studies, each of the eight municipalities involved received two million SEK per year (around £150,000). The studies ran for about four years. During the site investigation studies, Oskarshamn and Östhammar, the two municipalities involved, received 4 million SEK per year (around £300,000). As Oskarshamn was also being considered as host for the encapsulation plant it received an additional 1.5 million SEK a year giving a total of 5.5 million SEK (around £400,000). The communities were accountable for the funds with an annual audit to ensure that the money was spent only to enable involvement in the debate about long-term radioactive waste management.

Community benefits in the region of £197 million are split 75 per cent to Oskarshamn and 25 per cent to Östhammar with the resources set up as a programme to deliver added value³ funded directly by SKB's owners, the waste producers, and not by the Nuclear Waste Fund. Applications for projects that deliver added value are made to the programme committee, which consists of the Mayors of Oskarshamn and Östhammar, SKB and others. Until the GDF is built, the communities can draw up to 20 per cent of this value. There is some flexibility built into the percentage and timescale to allow for variances in the timing of the siting process.

Steps in the process

Date	Event
1992	SKB sends invitation seeking volunteers to all municipalities
1993	Storuman and Malå agree to host feasibility studies
1995 - 1997	1995 Storuman decided to withdraw from the process, 1997 Malå decided to withdraw from the process - the decisions were based on referenda
1995	SKB focuses on existing nuclear communities and seeks volunteers

³ Added value projects funded to date include: a business incubator centre, guaranteed bank loans for new businesses moving into the community, updating local highways and roads and marketing Oskarshamn as a community.

1995 - 1999	Communities volunteer to participate in the feasibility studies (Östhammar took 4 weeks and Oskarshamn took 17 months to decide to volunteer). Some communities were invited to volunteer later in the process (Tierp joined the process in 1998 and Älvkarleby at the beginning of 1999). Other communities investigated were, Nyköping and Hultsfred
1993 - 2000	Feasibility studies at eight sites (including Storuman and Malå), the studies took between two and four years, depending on when the sites entered the volunteer process
Nov 2000	SKB publicly announce the choice of sites for detailed investigation (Oskarshamn, Östhammar and Tierp)
Dec 2001	Östhammar accepts the site investigations
March 2002	Oskarshamn accepts the site investigations
April 2002	Tierp rejects the site investigations
2002 - ~2009	Detailed investigations at two sites (Oskarshamn and Östhammar)
2009	Östhammar chosen
2011	Application for GDF
2011 - ~2019	Review of applications and granting of permissions
~2019	Construction begins

3.7 Switzerland - High level waste and low/intermediate level waste repositories

Siting process

The previous site selection process for the disposal of low level waste (LLW) and intermediate level waste (ILW) ended when the Nidwalden canton rejected the proposal for a GDF. In 1985, Wellenberg, in the canton of Nidwalden, entered the site selection process. In 1993, it came out top of the list of priority sites for LLW and ILW. This was after an initial list of 100 sites was reduced to 20 and then three sites.

In 1994, Wolfenschiessen voted to begin discussions with the cooperative responsible for constructing and operating the GDF, Nuclear Waste Management Cooperative Wellenberg (GNW). Although nuclear issues are regulated at the federal level, the canton voted against GNW developing a GDF in the area. An analysis of the negative vote showed that the safety of the project was not contested, but the GDF concept and the selection process needed substantial changes.

Since then, a new national site selection process to identify two repositories, one for LLW/ILW and one for high level waste (HLW) and spent fuel (SF), based on consultation across the country, has been defined with a sectoral plan. The new process removed any veto by the cantons but they are included in the decision making process. The first stage of the new site selection process, from 2008 to 2011, identified regions that could be suitable for the construction of safe repositories.

The second stage of the process is underway. The aim is to develop projects in the six siting regions, based primarily on safety aspects. Socio-economic criteria are also taken into account once the safety aspects are in place. All six regions are potentially suitable for a GDF for LLW and ILW, three of them for HLW and SF.

Regional participation is a key component of the second stage. Since the beginning of 2012 the regional conferences in the six regions have discussed where the surface facility for the GDF could be located. As a basis for these discussions, in January 2012 the Swiss national waste management organisation (Nagra) proposed potential areas for surface facilities for each region.

Local decision making

The local authorities do not have a decision making role, but they represent regional interests. Together with the Swiss Federal Office of Energy (SFOE), they were responsible for setting up regional conferences in stage one. The regional conferences' representatives are made up of delegated participants from the communes, representatives from interest groups and political parties, amongst others.

The process aims to involve the regional cantons and local communes at the potential sites through various engagement mechanisms and formal engagement periods and hearings. A cantonal commission, which was established in 2008, will ensure cooperation between central government representatives, the siting cantons and affected neighbouring cantons and countries. An expert group also provides support and advice to the cantons on safety related documentation.

Role of Government

The Swiss Federal Office of Energy (SFOE) is the lead authority. The new Nuclear Energy Act and Nuclear Energy Ordinance have been in force since February 2005 making federal government the final decision-maker. Cantonal licences or permits are no longer required. The

federal government is responsible for the legal framework: its supervisory authorities are responsible for the supervision of nuclear power plants and the disposal of radioactive waste.

The general licence, similar to planning permission in the UK, will be sought when the preferred site(s) is/are identified. Parliament has to approve the general licence which may also have to be approved by the electorate if the option of a national referendum is selected

Role of developer

Nagra's mission is to prepare and implement solutions for waste management and disposal that ensure the long-term safety of man and the environment. Nagra proposed six siting regions in 2008. The federal council confirmed this at the end of stage one in November 2011.

In stage two, Nagra will propose at least two sites each for the disposal of HLW as well as LLW and ILW. This will be based on provisional safety analyses and a safety-based comparison. They are also proposing at least one location for a surface facility in each siting region.

In stage three, the remaining sites will be investigated in depth with a view to site selection and an application for a general licence.

At the end of each stage, the responsible federal authorities are conducting a review followed by a three-month hearing before the federal council makes its decision.

Benefits

There is no basis for compensation. Based on experience within Switzerland and in other countries it is expected that a siting region will receive some financial benefit. The sectoral plan specifies that decisions on any financial benefit should be transparent and not detached from the sectoral plan process.

During stage three the siting region will propose projects for regional development and prepare the background for possible compensation payments, relating to any conflicts between the facility and the local development plan. The Federal Council will make decisions on compensation to be paid by the waste producer, but only when a general licence (planning permission) for the facility is granted.

Compensation will be made to mitigate any negative consequences of the planning, construction or operation of a GDF. A siting region is compensated for a service it performs to solve a national issue. Compensation measures, approved by the SFOE and financed by waste producers, are developed in cooperation with the siting region and cantons.

Steps in the process

Date	Event		
2008	Sectoral plan for GDF's – preparation of conceptual part 1	Approval by Federal Council	
	Sectoral plan for GDF's – Implementation	Procedure according to Spatial Planning Act and Ordinance	Procedure according to Nuclear Energy Act
2008-2011	Stage 1: Selection of geological siting areas	<ul style="list-style-type: none"> • Cooperation • Hearings and participation • Settlement • Decision 	
2011 – 2016	Stage 2: Selection of at least two sites (~5 years)	<ul style="list-style-type: none"> • Cooperation • Hearings and participation • Settlement • Decision 	
2016-2021	Stage 3: Site selection and general licence procedure (~5 years)	<ul style="list-style-type: none"> • Cooperation • Hearings and participation • Settlement 	<ul style="list-style-type: none"> • Preparation and submission of general licence application • Review and approval procedure
By 2021 -2022	Decision of Federal Council (1.5 years)	Approval	Granting of general licence
By 2022 - 2023	Approval of general licence by government (1 year)	<ul style="list-style-type: none"> • Possible national referendum 	

3.8 US - Waste Isolation Pilot Plant transuranic wastes

Siting process

The Waste Isolation Pilot Plant (WIPP), originally intended for disposal of defence transuranic wastes and defence related high-level wastes at a pilot scale, was developed following a siting process involving considerable public concern at a number of other proposed sites. The US National Academy of Sciences had made a landmark recommendation on how to permanently isolate radioactive waste as early as 1957.

A committee of the national Academy of Sciences, primarily focused on high level waste (HLW), recommended disposal in salt as the most effective and cost efficient choice for deep geological disposal. A second choice recommended by that same committee was clay-rich shale. The first geological setting explored was rock salt.

Carlsbad, New Mexico, invited the Department of Energy to develop a facility in bedded salt (Over 600 metres thick) some 300 metres below the surface near to the town. In 1976, drill hole exploration began in the desert, southeast of Carlsbad.

WIPP, in accordance with agreements reached with the state, is mainly used for only defence-related wastes containing long-lived transuranic wastes. The original idea of disposing of some quantities of defence related high level waste was dropped in response to state objections.

The facility, when developed as per current plans, will contain 70 storage rooms located approximately 650 metres underground. Each room is over 90 metres in length. The plant is in its 14th year of operation and is estimated to continue accepting waste for 25 to 35 years.

In addition WIPP provides a suitable very low-dose environment for scientific experiments, including particle physics, GDF science, and studies of low radiation dose effects on organisms.

Local decision making

Decisions were all taken by the mayor and the county without local referenda or other attempts to gauge support. There was intensive lobbying for the facility by the local mayor, with general support from the town as well as the county of which it is a part (Eddy County), and also neighbouring Lea County and its largest city, Hobbs. The County is the first-tier administrative division in a state. The powers assigned to counties arise from state law and so vary widely across the USA. Carlsbad did not have the power of veto. The state stepped in legally and secured a “consultation and cooperation agreement” that specified what would be allowed to be disposed of in the repository.

Role of Government

Congress is responsible for legislation on radioactive waste management and the President has the overall decision making role.

Role of developer

The US Department of Energy (DOE) was responsible for finding, constructing and now operating the GDF.

Benefits

Carlsbad has received social benefits from the WIPP programme, including:

- Carlsbad Environmental Monitoring & Research Center

- Advanced Manufacturing and Innovation Training Center
- environmental/hazardous materials education and training programmes
- grant writing courses, school equipment and curricula and a records centre project
- centre for hazardous waste management excellence
- community giving, with WIPP partners donating hundreds of hours to civic projects
- jobs – the largest economic impact for the area
- local procurement – the WIPP team is committed to using local suppliers as much as possible. It recruits local suppliers, helping them to understand and meet procurement requirements through seminars and training
- \$20 million per year funding from the Land Withdrawal Act (1992) for 14 years (ceased 2006)
- WIPP acceleration funds - as designated by the U.S. Congress, the DOE has provided Carlsbad with approximately \$3 million (~ £1.5 million) in funds per year (now stopped) designed to help offset the acceleration of waste disposal during the past few years, acceleration of waste disposal meant earlier termination of the positive local economic impact
- business development projects
- Technology Transfer Programme - WIPP developed organisational tools, training materials, and software that are available to more than 300 organisations in 50 communities throughout New Mexico.

Steps in the process

Date	Event
1957	National Academy of Sciences recommends salt as a suitable geology for a GDF
1965	Oak Ridge National Laboratory looks at several salt sites
1975	Carlsbad approaches US Department of Energy (DOE) about hosting a GDF
1976	DOE begins studying sites for construction of the Waste Isolation Pilot Plant (WIPP) near Carlsbad, New Mexico
1978	The New Mexico Environmental Evaluation Group (EEG) created to address growing public unrest concerning construction of the WIPP
1979	Congress authorises construction of the facility and the level of waste to be stored in the WIPP from high temperature to transuranic or low level waste
1991	A federal judge rules that Congress must approve WIPP before any waste, even for testing purposes, was sent to the facility
1994	Congress orders extensive evaluation of the facility against the standards set by the Environmental Protection Agency (EPA). Evaluation of the facility continues for four years, resulting in a cumulative total of 25 years of evaluation
1998	EPA concludes that there is “reasonable expectation” that the facility would contain the vast majority of the waste interred there
1999	Waste emplacement starts

3.9 US - Yucca Mountain spent fuel

Siting process

The Department of Energy (DOE) began studying Yucca Mountain in 1978 as the USA's first long-term GDF for spent fuel. In 1987 Yucca Mountain was designated as the preferred site for a spent fuel GDF. The host state, Nevada, had a legal right of veto but Federal Government could override the state. In 2002, Congress passed a law overriding Nevada's opposition that was signed by the President, confirming the site as the GDF's location. Nye County, where the proposed facility would be situated, and other surrounding rural counties, supported the development.

In March 2009, the Energy Secretary stated that Yucca Mountain site was no longer considered an option for storing reactor waste. In March 2012 the DOE proposed a motion to withdraw its license application from the Nuclear Regulatory Commission (NRC), which was not approved by the NRC's administrative hearing board. In August 2013 a federal appellate court issued an order requiring NRC to continue review of the license application.

In January 2012, the Blue Ribbon Commission on America's Nuclear Future (BRC) issued its final report containing recommendations for legislative and administrative action to develop a new strategy to manage nuclear waste. In January 2013 the US Administration endorsed these recommendations to:

- deliver a new consent-based approach to siting nuclear waste management facilities
- establish a new organisation dedicated solely to implementing the waste management programme and given the authority and resources to succeed
- provide access to the funds from nuclear utility ratepayers for nuclear waste management
- prompt efforts to develop one or more GDFs
- prompt efforts to develop one or more consolidated storage facilities
- prompt efforts to prepare for the eventual large scale transport of spent nuclear fuel and high level waste to consolidated storage and disposal facilities when they become available
- continue support for US innovation in nuclear energy technology and for workforce development
- drive active US leadership in international efforts to address safety, waste management, non-proliferation, and security concerns.

Over the next 10 years, building storage capabilities will be accompanied by actions to engage in a consent-based siting process and preliminary site investigations for a GDF.

Congress has recently adopted a nuclear waste disposal plan introduced as the Nuclear Waste Administration Act of 2013 (NWAA). The Act would create a new and independent Nuclear Waste Administration to manage nuclear waste, construct an interim storage facility(s) and site a permanent GDF through a consent-based process. All of this would be funded by ongoing fees collected from nuclear power ratepayers (the Nuclear Waste Fund). The future of the NWAA is unknown at present. It has not been placed on the agenda for either house of Congress to debate, nor is it likely to be for some time.

Local decision making

In the USA, a county is the first-tier administrative varying widely in size and powers. However, the state often has the final say on developments. The local mayor and county are likely to be the local decision-making body. However, their decisions would need to be in accord with the position taken by the state. Under the BRC's recommendations as implemented in the proposed NWAA, a consent-based process is to be followed in future repository siting activities that would require the developer to engage with states, tribes⁴, local governments, key stakeholders and the public.

Role of Government

Congress is responsible for legislation pertaining to radioactive waste management the President has the overall decision making role as head of the Executive branch of the US Government.

Role of developer

The Department of Energy (DOE) is responsible for finding a site, construction and the operation of a GDF.

Benefits

The 1987 Amended Nuclear Waste Policy Act (NWPA) contained provisions for benefits to be paid to host communities, at both a county and state level. However, in the case of Yucca Mountain the State of Nevada would not enter into negotiations, claiming that this would legitimise the siting decision, which it opposed.

Under the NWPA, the government charges utilities \$0.001 for each kilowatt-hour of electricity sold from nuclear power plants in exchange for agreeing to accept and permanently dispose of used nuclear fuel. Fees collected total approximately \$750 million per year. This income is credited to the Nuclear Waste Fund. In addition, about 30 per cent of the repository volume, though only 10 per cent of the activity is to be for defence related wastes, for which the US government would pay. The current balance of the fund is estimated at \$28 billion.

Nye County received benefits from the DOE associated with the Yucca Mountain project. The county received various "payments equivalent to taxes" from the DOE, which supported road and infrastructure projects.

The administration plans to implement a programme, with the appropriate authorisations from Congress that contains the following milestones:

- 2021 – site, design and licence, construct and begin operations of a pilot facility with an initial focus on accepting used nuclear fuel from shutdown reactors
- 2025 – site and licence a larger interim storage facility with sufficient capacity to provide flexibility in the waste management system and allow for acceptance of enough used nuclear fuel to reduce expected government liabilities
- 2048 – make demonstrable progress on the siting and characterisation of GDF sites to facilitate the availability of a GDF by 2048.

⁴ The relationship between federally recognised tribes and the United States is one between sovereigns, that is, between a government and a government. Furthermore, federally recognised tribes possess both the right and the authority to regulate activities on their lands independently from state government control.

Steps in the process

The following chronology relates to the Yucca Mountain Project (YMP)

Date	Event
1983	Nine candidate sites identified (including Yucca Mountain)
1986	Five sites nominated by Secretary of Energy as suitable for characterisation of which three sites recommended to the President. Yucca Mountain, Nevada, Deaf Smith County, Texas and Hanford, Washington were selected <i>Note: investigations at 12 potential sites had been planned for a second GDF, but postponed for cost reasons</i>
1987	NWPA Amendments Act passed: only Yucca Mountain to be investigated Independent Nuclear Waste Technical Review Board (NWTRB) established
1993	Congressional dissatisfaction with the Yucca Mountain Project (YMP) in the intervening years resulted in a comprehensive reassessment of activities, stakeholder expectations, schedules and accomplishments
1994	YMP refocused and targets set: <ul style="list-style-type: none"> • evaluation by 1998 of Yucca Mountain technical suitability • statutory site recommendation and EIS to the President by 2000 • licence application to National Regulatory Commission (NRC) by 2001
1996	Programme funding cut by 40 per cent by Congress which required refocusing of programme, including deferment of 1994 targets. DOE issues Draft Revised Program Plan for YMP
1997	New milestone from plan The Viability Assessment by 1998 enacted in law
1998	DOE issue Program Plan Rev.2: <ul style="list-style-type: none"> • submit Yucca Mountain Viability Assessment to Congress in December 1998 • re-set the Secretary's site recommendation date for 2001 • submit licence application by 2002
1999	Draft Environmental Impact Statement (EIS) submitted
2001	Yucca Mountain Science & Engineering report <ul style="list-style-type: none"> • Supplement to Draft EIS / NAS Study • Preliminary site suitability evaluation

Date	Event
2002	Site selection review stage <ul style="list-style-type: none"> • Final EIS • Site recommendation from Secretary of Energy to President based on “sound science” and “compelling national interest” • President recommends Congressional approval that Yucca Mountain is qualified for a construction permit application • State of Nevada objects (vetoes) • Congress approves and overrides veto – puts decision on Yucca Mountain with NRC
2003	US\$4.6bn spent to end of FY 03 (September) on YMP Other HLW related costs takes the amount to US\$7.6bn YMP Budget for 2003. \$350m
2004	The total Office of Civilian Radioactive Waste Management (OCRWM) budget request for FY 04 is \$590m July – court decisions on YMP objections
2008	Licence application for operation submitted to Nuclear Regulatory Committee The Omnibus Spending Bill, the Yucca Mountain Project's budget was reduced to \$390 million although exploratory work continued Promise made in the presidential campaign to abandon the Yucca Mountain project
2009	Congress restricts funding to licence application work only Senate told that the Yucca Mountain site is no longer considered an option for storing reactor waste Congressional Research Service produces report on alternatives to Yucca Mountain
2012	Blue Ribbon Commission releases its final report. It expressed urgency to find a consolidated GDF, but also that any future facility should have input from the citizens around it, therefore, consideration is being given to the process for finding a site aligned to a volunteerism approach
2013	January 2013, US DOE publishes the Strategy for the management and disposal of used nuclear fuel and high-level radioactive waste
2013	The Nuclear Waste Administration Act of 2013 is introduced which would create a new and independent Nuclear Waste Administration to manage nuclear waste, construct an interim storage facility(s) and site a GDF through a consent-based process. The Act has yet to be passed by Congress

Analysis

This section outlines some of the common themes across the countries reviewed in this document.

Several countries including France, Japan, Sweden, Switzerland and the US faced set-backs in their processes for siting geological disposal facilities. This has included local, regional, and, in the US, national political opposition to potential disposal sites. Each country has modified its site selection process to various extents to enable progress.

A range of geologies are potentially suitable to host a GDF. Some countries have developed a preference for a particular geology due to operational preferences, the proposed inventory for the site in question, and regulatory requirements.

The experiences described in this report encompass a spectrum of approaches to identify suitable sites for hosting a GDF. The approaches in each country depend on the political and cultural circumstances and the geology. For example, Sweden and Finland have similar geology across most of the country whereas Japan has more complex geology. The approaches across the countries reviewed include:

- volunteer first processes, inviting communities to volunteer then evaluating their geological setting (UK and Japan)
- a national consideration of geology to show that volunteers could be sought from across the country then asking communities to volunteer (Canada and Sweden)
- identifying the preferred geology and then seeking volunteers (US/WIPP, France)
- national site identification based on geology followed by volunteerism (Finland)
- national process to identify sites based on safety and geology with communities being consulted, but not having a decision making role (Switzerland).

Finland launched a successful national siting process in the early 1980s. However, similar approaches launched at the same time failed in the UK and France because of local opposition.

More recently the US has reviewed its plans for geological disposal and is considering a new siting process that is expected to be based on voluntarism.

Some countries, such as Canada and Sweden, because of their comparatively uniform geology, undertook high level geological screening across the whole country before they asked communities to express interest in the siting process. In this way, waste management organisations were able to establish that a facility could be built in a number of places across the country. It was only after communities had volunteered that their geology was evaluated in detail.

Local decision making

The political systems in each country vary, affecting roles in the site selection process. With the exception of Switzerland, in all of the countries covered by this report, local government has a key decision making role in the siting process.

The local decision makers in the siting process tend to be the elected representatives of the community closest to where the disposal facility will be built (the local municipality). Wider-

area or regional levels of local government are also involved in the siting process through various engagement mechanisms, but do not usually have a decision making role.

In some countries, Finland, Japan and Sweden, for example, the local municipality has a legal right of veto with respect to the siting of a disposal facility.

In Canada, for the low and intermediate level waste facility at Kincardine, an agreement was signed between the developer and the municipality outlining that, for the project to proceed, there needed to be local support, demonstrated through an opinion poll.

In Switzerland and the US (Yucca Mountain), regional opposition has delayed progress with implementing a geological disposal facility. Compared to the wider area or regional level, support for hosting a disposal facility is generally higher at the local level because the community closest to a proposed site tends to be more engaged in the development and has a greater understanding of it and the potential benefits it could bring to their community.

In Switzerland the siting process has changed to remove the regional government from the decision making process and put the final decision with the national government.

Role of Government

In all the countries considered, the final decision on whether a facility should be built rests with the national government. In Canada the decision is made by the regulatory authority. In France and Switzerland the parliament has to approve the site for a disposal facility. In other countries the government department responsible for geological disposal will make the final decision.

In France and Switzerland the Government is also responsible for setting the benefits package associated with the disposal facility.

Role of developer

In all the countries reviewed the national waste management organisation is responsible for developing and implementing geological disposal including identifying and assessing the suitability of potential sites. In Canada and Sweden the waste management organisation is also responsible for negotiating the benefits package with the local community.

Benefits

The countries considered in this report exhibited a range of approaches to supporting local communities. Many of the countries have provided resources (similar to the engagement funding provided in the UK) to the communities considering hosting a disposal facility to enable them to participate in the siting process and to contribute their views.

In the US, money for the benefits package comes from a waste fund that waste producers contribute to.

In Sweden the developer provides money for an added value programme.

The benefits available are also varied; including energy subsidies, national capital investments, as well as investments in infrastructure and community funds. In some cases benefits have been explicitly set down at an early stage in the siting process, in others they will be set out later.

In Finland, there are no explicit local benefits beyond those flowing directly from the project. In Carlsbad in the US (WIPP) most of the benefits have related to developing research and

training centres in the area, whereas in Japan there are potentially benefits available of over £19 million per year in taxes, plus local jobs and supply chain contracts.

Benefits become available at different times in different countries. In some cases they are directly linked to progress in the site selection process, for example in Canada (Kincardine) and start to be paid prior to construction of the disposal facility.

In Sweden, 20 per cent of the benefits package can be spent prior to construction of the facility now that the preferred site has been identified. Another unique element of the Swedish benefits package is that a second community who had volunteered to host the facility, but was not successful, will receive 75 per cent of the benefits package with 25 per cent going to the host community.

In a number of cases, benefits accrue directly to local residents as well as to communities, such as through the provision of subsidised energy. If required, in Kincardine in Canada, there is a property-value protection scheme to mitigate against any potential direct effects on individuals and communities.

Steps in the process

An analysis of the chronology for each country shows that there are a variety of approaches to developing and implementing site selection processes for a GDF.

4.0 Conclusions

The experiences described in this report encompass a spectrum of approaches to identifying suitable sites for hosting a geological disposal facility. The approaches in each country depend on the political and cultural circumstances and the geology. There are some common themes that can be drawn out across the countries. The main messages from the report are:

- the programmes in each country reflect, and are closely linked to, the political and cultural circumstances in that country
- some siting processes faced setbacks in the early stages before proceeding with a revised process
- local government is always involved as the representative of the community and, with the exception of Switzerland, can veto or has a decision making role in the process
- the elected representatives of the community closest to where the disposal facility will be built (the local municipality) tend to be the local decision maker in the siting process
- engagement with the issues, understanding and support is often higher at a local level than it is at a regional or national level
- the benefits available to the local community vary from country to country in approach, scope, amount and when they become available.

These common themes, often appearing particularly prevalent with those most successful in progressing their GDF processes, indicate that any successful volunteer process needs to take into account not only these elements but also its own political situation, community needs and decision making structures.

5.0 Conditions of publication

This report is made available under the NDA Transparency Policy. In line with this policy, the NDA is seeking to make information on its activities readily available, and to enable interested parties to have access to and influence on its future programmes. The report may be freely used for non-commercial purposes. However, all commercial uses, including copying and re-publication, require permission from the NDA. All copyright, database rights and other intellectual property rights reside with the NDA. Applications for permission to use the report commercially should be made to the NDA Information Manager.

Although great care has been taken to ensure the accuracy and completeness of the information contained in this publication, the NDA cannot assume any responsibility for consequences that may arise from its use by other parties.

© Nuclear Decommissioning Authority 2013. All rights reserved.

6.0 Bibliography

If you would like to see other reports available from NDA, a complete listing can be viewed at our website www.nda.gov.uk, or please write to our Communications department at the address below.

7.0 Feedback

Readers are invited to provide feedback to the NDA on the contents, clarity and presentation of this report and on the means of improving the range of NDA reports published. Feedback should be addressed to:

Dr Elizabeth Atherton

Head of Stakeholder Engagement and Communications

Radioactive Waste Management Directorate

Nuclear Decommissioning Authority

Building 587

Curie Avenue

Harwell Oxford

Didcot

OX11 0RH

UK

8.0 Contributors

We thank the following overseas organisations and colleagues for their contributions to this assessment of national approaches to siting processes for deep geological disposal of intermediate or higher activity radioactive waste or spent fuel:

Canada – Nuclear Waste Management Organization, Jo-Ann Facella, Kevin Orr, Kathryn Shaver, Angelo Castellan

Finland – Posiva Oy, Timo Seppala

France – National Agency for Radioactive Waste Management (Andra), Nicolas Solente, Bernard Faucher

Japan – Nuclear Waste Management Organization, Reiki Nunome

Swedish Nuclear Fuel and Waste Management Co (SKB), Ann McCall, Erik Seltzman

Switzerland – National Cooperative for the Disposal of Radioactive Waste (Nagra), Pascale Jana Künzi, Philip Birkhaeuser

US Department of Energy (DOE), Abe Van Luik, Deb Gill, Susan Scott, Roger Nelson