2009

BACKGROUNDER

nwmo

NUCLEAR WASTE MANAGEMENT ORGANIZATION

SOCIÉTÉ DE GESTION DES DÉCHETS NUCLÉAIRES

Status of National Used Fuel / High-Level Radioactive Waste Management Programs

Many countries are developing plans for, or proceeding with, long-term management of used nuclear fuel or high-level radioactive waste. Several countries have advanced programs regarding the siting of long-term management facilities.

Canada

WASTE AGENCY: NWMO

OPERATIONAL NPPS: 20

% NUCLEAR ELECTRICITY: 16

NATIONAL DECISION FOR UF/HLW MANAGEMENT: geological repository

POTENTIAL ROCK TYPE(S) FOR REPOSITORY: crystalline & sedimentary

RESEARCH PROGRAM	SITING PROCESS FOR UF/HLW	PLANNED REPOSITORY OPERATION
» R&D to support development of the siting process and to advance technology for long-term used fuel management » Social research program on best practices for citizen engagement, community impacts and dialogue » Technical research program on geoscience, safety assessment and repository engineering » Co-operation agreements with national radioactive waste management organizations: SKB (Sweden), Posiva (Finland), Nagra (Switzerland) and Andra (France) » Active participant with international research organizations: NEA and IAEA	» Collaboratively developing a process to select a site with interested individuals and organizations under Adaptive Phased Management » Siting proposal being developed in 2009 and the possible start of siting implementation in 2010 » Feasibility studies in potential candidate areas followed by more detailed studies in potential host communities » Selection of a preferred site for a deep geological repository (DGR) followed by an Environmental Assessment and licensing approval process	» Earliest possible date for DGR operation is likely in the late 2030s » Currently, for conservative cost estimating purposes, the assumed date for DGR operation is 2035

China

WASTE AGENCY: CNNC

OPERATIONAL NPPS: 11

% NUCLEAR ELECTRICITY: 2.3

NATIONAL DECISION FOR UF/HLW MANAGEMENT: geological repository

POTENTIAL ROCK TYPE(S) FOR REPOSITORY: crystalline

RESEARCH PROGRAM	SITING PROCESS FOR UF/HLW	PLANNED REPOSITORY OPERATION
China National Nuclear Corporation (CNNC) developing transportation and repository technology for used fuel and HLW	Siting process started in 1985 Preliminary site characterization activities at a potential site (Beishan region, Gansu province in the Gobi desert in NW China) for a site-specific URL and future geological repository Site drilling program began in 2000 Siting program consists of 3 phases: » Phase 1: Site Selection and Confirmation (2001 – 2005) followed by further detailed studies (2006 – 2010) » Phase 2: URL Construction & In-situ Tests (2015 – 2030) » Phase 3: Repository Construction (2030 – 2050)	DGR operation by 2050

Finland

WASTE AGENCY: Posiva

OPERATIONAL NPPS: 4

% NUCLEAR ELECTRICITY: 25

NATIONAL DECISION FOR UF/HLW MANAGEMENT: geological repository

POTENTIAL ROCK TYPE(S) FOR REPOSITORY: crystalline

RESEARCH PROGRAM	SITING PROCESS FOR UF/HLW	PLANNED REPOSITORY OPERATION
» Joint R&D program with SKB (Sweden) and other national organizations including NWMO (Canada)	» Siting process started in 1980s	» DGR construction licence by 2012
» Demonstration of underground technology at Äspö HRL in Sweden	» Site identification from 1983 to 1985	» DGR operation by 2020
» Development and demonstration of copper used fuel containers	» Preliminary site characterization and feasibility studies at 5 potential sites from 1986 to 1992	
» Construction of ONKALO underground characterization facility started in 2004 and will end in 2011	» Detailed site characterization and feasibility studies at 2 nuclear sites (Olkiluoto and Loviisa) from 1993 to 2000	
» Confirming site suitability at Olkiluoto	» Posiva proposed Olkiluoto site in 1999	
	» Host municipality approved Olkiluoto site in Jan 2000	
	» Finnish government approved siting decision-in-principle in Dec 2000	
	» Finnish parliament ratified siting decision-in-principle in May 2001	

France

WASTE AGENCY: Andra

OPERATIONAL NPPS: 59

% NUCLEAR ELECTRICITY: 78

NATIONAL DECISION FOR UF/HLW MANAGEMENT: geological repository

POTENTIAL ROCK TYPE(S) FOR REPOSITORY: sedimentary

RESEARCH PROGRAM	SITING PROCESS FOR UF/HLW	PLANNED REPOSITORY OPERATION
» R&D program driven by national legislation in 2001	» Planned to develop URLs in crystalline rock and sedimentary rock starting 1991	» Reversibility issue subject to national debate by 2012
» Crystalline studies based on foreign URLs (e.g., Canada, Sweden)	» Sited Bure URL in sedimentary rock in 1994	» Application for DGR construction licence for HLW, used fuel and LL ILW by 2015
» Sedimentary studies at Bure URL	» Law of 2006 requires final repository to be located in same host rock formation as the URL (thus in sedimentary rock near Bure URL)	» DGR operation by 2025
» Study reports and recommendation submitted in 2006	» Siting studies near Bure region started in 2007	
» National law of 2006 gives R&D direction and schedules	» Final site selection for a reversible geological repository by 2015	
» Reprocessing of most used fuel – capacity is about 1,700 t HM/year		
» Assessment of industrial feasibility of partitioning and transmutation by 2012		
» Transmutation pilot facility by 2020		

Germany

WASTE AGENCY: BfS

OPERATIONAL NPPS: 17

% NUCLEAR ELECTRICITY: 33

NATIONAL DECISION FOR UF/HLW MANAGEMENT: geological repository

POTENTIAL ROCK TYPE(S) FOR REPOSITORY: salt & crystalline & sedimentary

RESEARCH PROGRAM	SITING PROCESS FOR UF/HLW	PLANNED REPOSITORY OPERATION
» Research on salt for a DGR started in 1967 at the Asse mine » Federal Office for Radiation Protection (BfS) conducting research for used fuel and HLW management » Co-operative research with other national radioactive waste management organizations	» Siting process started in 1973 » Gorleben salt dome selected for national repository for radioactive waste in 1977 » Site investigations at Gorleben stopped in 2000 » AkEnd Committee issued technical siting process recommendation in 2002 » At least 2 sites required for underground exploration by 2010	» DGR operation by 2030

India

WASTE AGENCY: AEC

OPERATIONAL NPPS: 17

% NUCLEAR ELECTRICITY: 2.6

NATIONAL DECISION FOR UF/HLW MANAGEMENT: geological repository

POTENTIAL ROCK TYPE(S) FOR REPOSITORY: crystalline

RESEARCH PROGRAM	SITING PROCESS FOR UF/HLW	PLANNED REPOSITORY OPERATION
» Atomic Energy Commission (AEC) conducts research on repository development and siting at Bhabha Atomic Research Centre (BARC)	» Siting based on technical process to identify repository site in stages » Focus of siting activities in northwest Rajasthan region	» Not known

Japan

WASTE AGENCY: NUMO

OPERATIONAL NPPS: 55

% NUCLEAR ELECTRICITY: 30

NATIONAL DECISION FOR UF/HLW MANAGEMENT: geological repository

POTENTIAL ROCK TYPE(S) FOR REPOSITORY: crystalline & sedimentary

RESEARCH PROGRAM	SITING PROCESS FOR UF/HLW	PLANNED REPOSITORY OPERATION
» Japan Atomic Energy Commission (AEC) decided on a geological repository for HLW in 1976 » R&D conducted by various organizations: PNC, JNC, JAEA, etc. » Developing URLs in both crystalline rock (Mizunami) and sedimentary rock (Horonobe)	» In 2000, Law on Final Disposal of Specified Radioactive Waste requires geological repository for HLW from reprocessing » NUMO siting process started in 2002 » Open solicitation for candidate sites sent to all municipalities » Siting process based on volunteerism envisions selection of Preliminary Investigation Areas (PIAs), followed by selection of Detailed Investigation Areas (DIA) at candidate sites for underground studies and analyses » Toyo town in Kochi prefecture applied as a volunteer area for feasibility studies in January 2007 » Following a municipal election, Toyo town withdrew its application in April 2007 » Japanese siting process is evolving	» DGR operation by 2035

Sweden

WASTE AGENCY: SKB

OPERATIONAL NPPS: 10

% NUCLEAR ELECTRICITY: 50

NATIONAL DECISION FOR UF/HLW MANAGEMENT: geological repository

POTENTIAL ROCK TYPE(S) FOR REPOSITORY: crystalline

RESEARCH PROGRAM	SITING PROCESS FOR UF/HLW	PLANNED REPOSITORY OPERATION
» Joint R&D program with Posiva (Finland) and other national organizations including NWMO (Canada) » Demonstration of underground technology at Äspö HRL in Sweden » Development and demonstration of copper used fuel containers	» Siting processes started in early 1990s » Feasibility studies in 8 municipalities » Local referenda held in Storuman (1995) and Mala (1997) » Further evaluation of potential host communities » Detailed underground evaluation of 2 potential candidate sites in Östhammar and Oskarshamn from 2002 to 2008 » SKB selected the Forsmark site in Östhammar in June 2009	» DGR operation by 2023

Switzerland

WASTE AGENCY: Nagra

OPERATIONAL NPPS: 5

% NUCLEAR ELECTRICITY: 40

NATIONAL DECISION FOR UF/HLW MANAGEMENT: geological repository

POTENTIAL ROCK TYPE(S) FOR REPOSITORY: sedimentary

RESEARCH PROGRAM	SITING PROCESS FOR UF/HLW	PLANNED REPOSITORY OPERATION
» Nagra has been conducting research on developing a deep geological repository for used fuel and HLW since 1972 » R&D program examined DGR feasibility in crystalline rock (e.g., Grimsel URL) and sedimentary rock (e.g., Mont Terri URL) » Co-operative research with other national radioactive waste management organizations » R&D focus on sedimentary rock	» Siting process started in 1972 » Initial siting focus was on crystalline rock (Project Gewähr 1985); only 2 potential candidate areas were identified » Recently, siting focus has been on sedimentary rock (Project Opalinus Clay, 2002) » Zürcher Weinland has been identified as a potential siting region for a DGR » In 2005, Swiss government issued the Nuclear Energy Act and requested Nagra to identify other alternative siting regions » In 2007, Swiss Federal Office of Energy issued draft Sectoral Plan for Geological Repositories for public review » In 2008, Swiss Federal Council approved the strategic part of the Sectoral Plan for Geological Repositories. Potential sites are being evaluated in a step-wise process.	» DGR operation by 2040

United Kingdom

WASTE AGENCY: NDA

OPERATIONAL NPPS: 19

% NUCLEAR ELECTRICITY: 20

NATIONAL DECISION FOR UF/HLW MANAGEMENT: geological repository

POTENTIAL ROCK TYPE(S) FOR REPOSITORY: crystalline

RESEARCH PROGRAM

- Nuclear Decommissioning Authority (NDA) responsible for R&D program previously conducted by NIREX (Nuclear Industry Radioactive Waste Executive)
- Co-operative research with other national radioactive waste management organizations
- Committee on Radioactive Waste Management (CoRWM) issued recommendation for phased deep geological disposal in 2006
- Conducting a Managing Radioactive Waste Safely (MRWS) programme

SITING PROCESS FOR UF/HLW

- Siting process started in 1979 and was terminated in 1981 with a suspension of a decision on HLW disposal for 50 years
- In 2007, NDA established the Radioactive Waste Management Directorate (RWMD) to devise a geological disposal solution for HLW
- In 2007, Department of Environment, Food and Rural Affairs (Defra) issued framework document for implementing geological disposal in 5 stages for broad public consultation and dialogue:
  - Stage 1: Invitation issued and expressions of interest from communities
  - Stage 2: Consistently applied “sub-surface unsuitability” test (identify potentially suitable/ unsuitable sites)
  - Stage 3: Desk-based studies on remaining candidates
  - Stage 4: Surface investigations on remaining candidates
  - Stage 5: Underground investigations and construction at preferred site
- In June 2008, NDA issued an R&D strategy on radioactive waste management for public comment
- In June 2008, UK government invited communities for “no commitment” discussions on hosting a DGR

PLANNED REPOSITORY OPERATION

- To be decided

United States of America

WASTE AGENCY: DOE

OPERATIONAL NPPS: 104

% NUCLEAR ELECTRICITY: 19

NATIONAL DECISION FOR UF/HLW MANAGEMENT: geological repository

POTENTIAL ROCK TYPE(S) FOR REPOSITORY: volcanic tuff

RESEARCH PROGRAM	SITING PROCESS FOR UF/HLW	PLANNED REPOSITORY OPERATION
» Department of Energy (DOE) disposal R&D focussed on DGR designs and site characterization activities in unsaturated volcanic tuff at Yucca Mountain, Nevada » Developing corrosion-resistant used fuel containers and drip shields » Reprocessing used fuel ended in 1977 (civilian) and 1992 (defence) » Recycling part of 2008 Global Nuclear Energy Partnership (GNEP) R&D program	» Siting process started in 1980s » National screening of 9 candidate sites reduced to 3 sites from 1983 to 1986 » Congress directed DOE to study only 1 site, Yucca Mountain, in 1987 » Yucca Mountain is located near US nuclear weapons test site in Nevada, about 160 km north of Las Vegas » Secretary of Energy recommended Yucca Mountain to the President in 2002 » Governor of Nevada submitted notice of disapproval in 2002 – overridden by Congress » President approved Yucca Mountain site in 2002 » State of Nevada have strongly opposed Yucca Mountain Project » In June 2008, DOE submitted DGR licence application to NRC » In February 2009, the US administration indicated that Yucca Mountain is no longer an option	» To be decided

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