DOWNLOAD PDF GEOLOGICAL DISPOSAL

Chapter 1 : Geological Disposal - Research - Materials Science and Engineering - The University of Sheffie

Geological disposal. Geological disposal involves placing radioactive wastes deep within a suitable rock formation where the rock formation provides long-term protection by acting as a barrier against escape of radioactivity and by isolating the waste from effects at the surface such as climate change.

The current situation at certain sites[edit] Schematic of a geologic repository under construction at Olkiluoto Nuclear Power Plant site, Finland Demonstration tunnel in Olkiluoto. Analysis of several accidents, by DOE, have shown lack of a "safety culture". Between and radioactive waste was placed in storage. The salt dome is in a state of collapse. There was a proposal for an international high level waste repository in Australia [27] and Russia. In The U. Department of Energy began studying Yucca Mountain , within the secure boundaries of the Nevada Test Site in Nye County, Nevada , to determine whether it would be suitable for a long-term geologic repository for spent nuclear fuel and high-level radioactive waste. In Germany, there is a political debate about the search for a final repository for radioactive waste, accompanied by loud protests, especially in the Gorleben village in the Wendland area, which was seen ideal for the final repository until because of its location in a remote, economically depressed corner of West Germany, next to the closed border to the former East Germany. After reunification, the village is now close to the center of the country, and is currently used for temporary storage of nuclear waste. The process of selecting appropriate deep final repositories is now under way in several countries with the first expected to be commissioned some time after Sweden is also well advanced with plans for direct disposal of spent fuel, as its Parliament has decided that this is acceptably safe, using the KBS-3 technology. Unlike other developed countries the UK has placed the principle of voluntarism ahead of geological suitability. When seeking local council volunteers for stage 1 of the MRWS process only Allerdale and Copeland, within the county of Cumbria were volunteered by their councils. The same area that was previously examined and rejected in the s. Stage 2 which was an initial unsuitability screening process was carried out by British Geological Survey BGS in There remains some controversy about this stage following accusations that the criteria were changed between the draft and final versions of this report, bringing the Solway Plain back into consideration, however the criteria were clearly published in the Defra White Paper, entitled Managing Radioactive Waste Safely MRWS 2 years prior to being applied. In June , the independent geologist advising the local West Cumbria MRWS Partnership group named three rock volumes that could be potentially suitable for geological disposal of nuclear waste. The decision on whether to proceed to the next stage was due to be taken in January by a group of seven councillors, forming the Executive of Allerdale and another seven from Copeland. The ten member cabinet of Cumbria County Council had a veto which would prevent the search continuing. In January , Cumbria county council used its veto power and rejected UK central government proposals to start work on a production reactor nuclear waste repository near the Lake District National Park.

Chapter 2 : Deep geological repository - Wikipedia

A deep geological repository is a nuclear waste repository excavated deep within a stable geologic environment (typically below m or feet). It entails a.

Page erative decision making. In virtually all countries, some period of interim surface storage to allow decay of radiation and heat generation has always been recognized to be necessary or valuable. This interim storage is often at a centralized location, but can also be at individual facilities. More extended storage has been accepted as unavoidable because of delays in implementing disposal for both HLW and spent nuclear fuel. However, public and political opposition to these activities is not necessarily less than that to geological disposition. Long-term storage will require continued funding for maintenance. This funding must be either from a continuation of nuclear power or by commitments from governments Dejonghe, Extended surface storage as an option has not yet been objectively addressed through performance assessment of likely scenarios see Sidebar 7. For both scenarios the spent fuel and the HLW are kept at 77 existing utility and DOE sites stored in above-ground concrete modules or below-ground storage vaults. In scenario 1, facilities are repaired in and replaced every years. Costs for this scenario are quite high. In scenario 2, facilities are repaired in , maintenance stops in , and memory of the purpose of the facilities is assumed to be lost. These scenarios include the three types of waste that are of greatest concern to the U. The Continuing Societal and Technical Challenges. The National Academies Press. The DOE analysis begs the practical question of the longevity of the operations at the 77 sites themselves; it simply assumes that funds are available to support the activities specified in each scenario. The proponents of surface storage do not argue that surface storage would be a permanent solution, as implied by the DOE EIS analysis scenarios, but rather that it should be examined as an interim approach that might be in place for one to perhaps several centuries. It is this alternative of one to several centuries of delay that requires detailed, objective analysis. The repository would remain open, and authorized access to the waste would be possible, for example, for inspection or retrieval. Permanent geological disposal would result from closing and sealing the repository. Both options require control by responsible societies and institutions until permanent disposal is achieved. For the geological disposal option, long-term safety is provided by the geological characteristics of the site and the protection afforded by engineered barriers that are part of the repository design. The main features, events, and processes feps, see Sidebar 6. The main uncertainties in assessing future repository system behavior arise from uncertainties in these feps, for example, groundwater movement in fractured rock, permeability changes induced by movements in existing faults, temperature-dependent kinetics of groundwater-host rock physicochemical interaction, and long-term changes in population density Laverov, b. These are issues that the technical community believes do not pose insurmountable difficulties for geological repositories. Achieving safety and security over decades, centuries, or millennia involves a different mix of uncertainties for surface or near-surface storage than for a geological repository. In contrast, physical and chemical conditions deep underground are relatively stable and predictable, even on geological time scales. The behavior of future human societies will be critically important for surface storage. Human access will be much easier for a surface facility than for a geological repository. Surface storage involves uncertainties in whether future generations will continue to provide the resources to assure safety and security. Performance of a geological repository involves uncertainties in the geological setting and in the changes that may occur over time in engineered barriers, as well as the possibility of deliberate or inadvertent human intrusion. Surface storage has many proponents who stress that such storage would be protective of public health and safety for several centuries. For example, according to T. If surface storage is intended as a long-term alternative, the waste management strategy should address the effectiveness of controls to restrict access and assure containment integrity and the degree of confidence that can be placed in these controls. The preceding chapters especially Chapter 4 , Chapter 5 and Chapter 6 describe the status of current national programs to accomplish siting, licensing, and construction of geological repositories. The pace of development was much slower than was anticipated when these national programs were established. The lack of public support for repositories, which has been largely responsible for the delays, is not likely to change rapidly. Even if repository programs do resume the planned schedules, the scheduled pace for waste emplacement assures that a substantial surface storage capacity will be needed for at least 50 years in the United States and even longer in some other countries. The committee does not believe that societies have to make a final choice now. Surface storage has been advanced by many proponents as an interim measure for the order of a century or two. Irrespective of the planned duration of surface storage, the committee recommends that 2 About years is a reasonable period for which waste facilities can be kept under societal control IAEA, Page Share Cite Suggested Citation: The decision as to whether to implement this option, the timing, and the detailed technical choices in implementing geological disposal should be made, at an appropriate time and after appropriate deliberation, by the political leadership of each country with a responsibility for HLW. While the societal choice remains open, steps can be taken to increase knowledge: The discussion below gives the concept underlying each alternative, its advantages, and its limitations. Thus this option should be considered a supplement to, but not a substitute for, continued surface storage or geological disposition. Any intense source of neutrons, such as a light-water reactor, a liquid metal reactor, a fast reactor as in the U. Integral Fast Reactor [IFR] , or an accelerator-driven subcritical reactor, can accomplish transmutation of long-lived radionuclides. The physical requirements for neutron intensity and the energy requirements to achieve such intensity make it necessary to partition, or separate, the long-lived radionuclides to be transmuted from the uranium, the fuel rod cladding, and other components in SNF Page Share Cite Suggested Citation: Partitioning is essentially the same as reprocessing spent fuel to recover plutonium and uranium, except that the goal includes separating long-lived fission products such as iodine and technetium as well as plutonium and other actinides. Very high separation factors are required if the residue from partitioning is to be low enough in radioactivity to avoid being classified as long-lived waste requiring the same isolation as HLW. To achieve these very high separation factors, much more advanced and sophisticated reprocessing technologies than those available today are required. The STATS report concluded that removal of the actinides might allow four to five times as much waste to be emplaced in a given area of a repository and that removing the cesium and strontium could increase repository capacity by a factor of 10 to 40 NRC, b, p. HLW repository can be eliminated: In , the U. ATW, if successful, on the first repository program, could reduce potential long-term radiation doses from repository wastes by a factor of about 10; however, a repository is still Page Share Cite Suggested Citation: If a successful program can remove The improvement is about a factor of five after 20, years DOE, a, p. The Department of Energy should consider removal of actinides as one option in its broader systemic evaluation of the thermal strategy for Yucca Mountain. This should include explicit consideration of the optimum recovery of various radionuclides. This development should be closely coordinated with development of the ALMR [Advanced liquid-metal reactor] and its attendant nuclear fuel cycle. The design of the repository should incorporate features that would allow spent fuel to be readily retrieved and reprocessed and the resulting HLW to be emplaced at a higher effective density. However, at least in some countries, even if the goals were to be met, a geological repository or ongoing surface storage appears to be needed eventually to handle some radioactive waste, including some from the partitioning and transmutation process. Extraterrestrial Disposal Extraterrestrial disposal is conceptually straightforwardâ€"the waste material is simply given a one-way ride into outer space. Realistically, however, this option is not feasible due to scientific, technical, and economic factors. These include the energy required to boost payloads into space, the failure of launches and their consequences, and the tradeoffs between cost and safety Rice and Priest, Extraterrestrial disposal of HLW would require transport via spacecraft, with extreme attention to safety to avoid release of radioactive materials in the event of malfunction. Placing the waste in space near earth would not be sufficient. Orbits either around earth or around the sun in the inner solar system change over time periods that are short compared to the lifetime of waste components, so that a waste package placed in such orbits conceivably could return to earth. Most discussion of extraterrestrial disposal has therefore involved sending the HLW into the sun, which requires considerably more energy per pound than placing a payload into orbit, that is, larger rockets, and consequently, extremely high cost per pound of waste disposed. Although a technological approach has been described Taylor, , the formidable energy requirements for solar disposal imply that only the most dangerous waste components might warrant such expensive disposal. Geological Alternatives to Mined Repositories: Subseabed and Deep-Borehole Options Approaches for isolating radioactive waste on earth by means other than geological disposition in mined, engineered repositories are discussed briefly in this section. In general, these approaches have about the same advantages and disadvantages as the geological disposition and surface storage approaches discussed in this report, and they have additional technical or legal constraints as noted in each discussion. Emplacement in deep boreholes drilled from the surface is an approach to geological disposition that avoids the mined repository. Deep-borehole disposal at depths much greater than feasible for mined repositories has been studied in Australia, Italy, Russia Khakhaev et al. Retrievability and sealing the boreholes because they may be numerous are greater technical challenges than for mined repositories Juhlin et al. Since deep-borehole disposal is so similar to geological disposal in mined repositories, it involves the same societal issues and long-term technical uncertainties. For large amounts of waste, drilling many deep boreholes from the surface is probably more expensive than a single mined repository. However, this variation of geological disposal may be suitable for countries with small waste inventories. Subseabed disposal would result in waste emplaced tens or hundreds of meters deep in sediments or rock under the seabed, which itself is beneath several thousand meters of ocean. Two emplacement options are considered technically feasible. One option is dropping steel or titanium canisters of waste in missile-shaped penetrators from a ship. Field trials of about penetrators showed that these free-falling devices would bury themselves up to 70 meters deep in seabed sediment. In the second option, waste-filled canisters would be lowered into predrilled boreholes. National Science Foundation, although sealing the boreholes has not been demonstrated. This approach has many technical advantages, including a very stable geological setting, dilution in the event of radioactivity release into a very large body of water, low cost to emplace the HLW, and very low probability of deliberate human intrusion. Retrieval might be possible, but only at a high cost. Such cost and the need for specialized retrieval equipment would discourage clandestine recovery attempts. However, research on seabed disposal has been discontinued as a matter of international policy.

Chapter 3 : Deep-Mined Geological Repositories for Radioactive Waste - Elements

Geological Disposal. A Geological Disposal Facility is a world-class solution for the UK's radioactive waste. Find out how it could create new jobs and infrastructure in your area.

The consultations will run until Working with Communities England and Northern Ireland https: Details of the timing and location of the workshops has yet to be finalised, and will be posted on this webpage when they are available. It is however worth noting that the communities consultation proposes that: This smaller area will be based on an assessment of the area affected by the impacts of the development and existing administrative boundaries. Initial interest and discussions can be initiated by anyone within an area, but will need to be opened up to include the wider community at an early stage. A Community Partnership would then be set up which would take forward constructive engagement with the community. Local authorities including both counties and districts in two tier areas will need to be invited on to the Community Partnership but may choose to be directly involved, to observe, or to remain neutral. Both the community and the developer has the right of withdrawal from the process right up to the test of public support. The test of support could be done via a range of methods including a referendum, consultation or representative polling. Much of what is proposed is in line with the White Paper and the discussions of the Community Representation Working Group. However, the consultation document has strengthened the proposed role for local authorities. While stopping short of granting local authorities an absolute veto on progress, if councils both country, unitary or districts decide they no longer wish to support the process proceeding, it is felt unlikely that the Community Partnership will be able to launch or demonstrate a Test of Public Support. This would effectively end progress with the siting process within an area. If any local authority wishes to discuss potential involvement in the siting process with NuLeAF, please contact us on or at geological. Implementation, scrutiny and regulation Government has made the NDA the implementing organisation, responsible for planning and delivering the GDF. The programme for siting a GDF is subject to regulatory scrutiny. Their latest annual report was published in January NuLeAF was also a member of the partnership. The final report of the Partnership was submitted to the three participating councils in July Because, under guidance from DECC, agreement was needed at both levels of local government district and county before any further work can be carried out, this effectively halted the process in West Cumbria. The Energy Secretary issued a statement regarding the councils decisions. International approaches to the management of high level wastes Disposal of higher activity wastes is being investigated by many countries. Click here for a synopsis of what approach is being taken elsewhere.

Chapter 4 : Radioactive waste - Wikipedia

A guide for communities on how the UK plans to deal with its radioactive waste on a long-term basis and the process for identifying a site for a geological disposal facility.

Links to further information What is the issue? The UK has accumulated radioactive waste from a range of sources including generating electricity in nuclear power stations, using radioactive materials in industry, medicine and research, and from defence-related nuclear programmes. Some of this material is in interim storage, but most still forms part of existing facilities and will only become waste over several decades as these plants are decommissioned and cleaned-up. There are different categories of radioactive waste and it is the higher activity radioactive waste for which we need a secure long-term solution. Higher activity radioactive waste comprises a number of categories; high level waste HLW , intermediate level waste ILW , and some low level waste LLW that is not suitable for near-surface disposal in current facilities. The UK Government is committed to implementing geological disposal for the safe and secure management of higher activity radioactive waste over the long term and favours an approach for selecting a site that is based on working in partnership with communities. What is geological disposal? Geological disposal involves isolating radioactive waste deep inside a suitable rock volume to ensure that no harmful quantities of radioactivity ever reach the surface environment. The waste is contained inside multiple barriers to provide protection over hundreds of thousands of years. It is not a case of simply depositing waste underground. The multiple barriers that provide safety for geological waste disposal are a combination of: Key principles The Government and the developer of a GDF - Radioactive Waste Management Limited will engage with experts and the public to give clarity onthe key issues that people told us were of interest to them, such as: To do this, the developer will draft national screening guidance that will be evaluated by an independent review panel, in an open and transparent manner, before being applied across the UK excluding Scotland. Link here to RWM screening pages. All of this will happen before formal discussions between interested communities and the developer begin, so that any community wanting to engage with the process can do so with more information and greater clarity about the nature of a development. Working with communities and investment - updated 3 March The UK government intends to work openly with experts in the field of community decision making in order to develop the detail of a process for working with communities. The group will be chaired by DECC, as the department responsible for the policy of geological disposal, and will have a core membership comprising the developer Radioactive Waste Management , other relevant government departments, representatives with an insight into local government issues and academia. The CRWG is not a representative group promoting different interests; it is a group of people with expertise and experience to help develop recommendations on processes for working with communities. Regular updates will be given on the progress of the work and a public consultation on the proposals will be held, if necessary. This page will be updated shortly with more information and details of how to get involved. Construction and operation of a GDF will be a multi-billion pound project that will provide skilled employment for hundreds of people over many decades. A GDF will generate an average of direct jobs over the duration of the project, with workforce numbers rising to more than 1, during construction and early operations. The UK Government will also make investment available early on in the siting processs to support communities that engage constructively in the process. More detail on working with communities is available in Chapter 7 of the White Paper. Likely timescales We cannot be certain how long it will take to deliver an operational geological disposal facility, as the driver for the process is a partnership approach with potential host communities and will be dependent on discussions with local communities. But the following diagram is taken from the White Paper and provides an illustration of the likely timescales. An illustration of likely timescales for the project Regulation The Government is committed to strong and effective control and regulation of the geological disposal facility development process. Robust, effective and independent regulation is vital for public confidence in a geological disposal facility programme which meets high safety, security and environmental standards based on comprehensive risk assessment and management. The independent regulators the Office for Nuclear Regulation , and the relevant national environmental regulators: These requirements implement the protection standards established nationally and internationally. The regulators will provide advice and regulatory comment to government, other authorities and the public. They are working together to build a common understanding of the regulatory issues involved in geological disposal. RWM is currently subject to voluntary regulatory scrutiny to ensure its technical work and organisational development meet regulatory expectations. The Environment Agency has published guidance on requirements for authorisation of any future geological disposal facility. The guidance sets out the principles and requirements that a developer would need to address in developing an environmental safety case for a geological disposal facility. Links to further information.

Chapter 5 : Geological disposal - Dealing with our nuclear past, protecting the future

We want your views on proposals for engaging communities in Wales that may wish to host a geological disposal facility (GDF) for radioactive waste. Consultation description A GDF will only be built in Wales if a community is willing to host it.

Front end[edit] Waste from the front end of the nuclear fuel cycle is usually alpha-emitting waste from the extraction of uranium. It often contains radium and its decay products. Uranium dioxide UO2 concentrate from mining is a thousand or so times as radioactive as the granite used in buildings. It is refined from yellowcake U3O8 , then converted to uranium hexafluoride gas UF6. As a gas, it undergoes enrichment to increase the U content from 0. It is then turned into a hard ceramic oxide UO2 for assembly as reactor fuel elements. It is stored, either as UF6 or as U3O8. Some is used in applications where its extremely high density makes it valuable such as anti-tank shells , and on at least one occasion even a sailboat keel. These isotopes are formed in nuclear reactors. It is important to distinguish the processing of uranium to make fuel from the reprocessing of used fuel. Used fuel contains the highly radioactive products of fission see high level waste below. Many of these are neutron absorbers, called neutron poisons in this context. These eventually build up to a level where they absorb so many neutrons that the chain reaction stops, even with the control rods completely removed. At that point the fuel has to be replaced in the reactor with fresh fuel, even though there is still a substantial quantity of uranium and plutonium present. In the United States, this used fuel is usually "stored", while in other countries such as Russia, the United Kingdom, France, Japan and India, the fuel is reprocessed to remove the fission products, and the fuel can then be re-used. While these countries reprocess the fuel carrying out single plutonium cycles, India is the only country known to be planning multiple plutonium recycling schemes. Long-lived fission product Activity of U for three fuel types. In the case of MOX, the U increases for the first thousand years as it is produced by decay of Np which was created in the reactor by absorption of neutrons by U Total activity for three fuel types. In region 1 we have radiation from short-lived nuclides, and in region 2 from Sr and Cs On the far right we see the decay of Np and U The use of different fuels in nuclear reactors results in different spent nuclear fuel SNF composition, with varying activity curves. Long-lived radioactive waste from the back end of the fuel cycle is especially relevant when designing a complete waste management plan for SNF. When looking at long-term radioactive decay , the actinides in the SNF have a significant influence due to their characteristically long half-lives. Depending on what a nuclear reactor is fueled with, the actinide composition in the SNF will be different. An example of this effect is the use of nuclear fuels with thorium. Th is a fertile material that can undergo a neutron capture reaction and two beta minus decays, resulting in the production of fissile U The SNF of a cycle with thorium will contain U Its radioactive decay will strongly influence the long-term activity curve of the SNF around a million years. A comparison of the activity associated to U for three different SNF types can be seen in the figure on the top right. This has an effect in the total activity curve of the three fuel types. The initial absence of U and its daughter products in the MOX fuel results in a lower activity in region 3 of the figure on the bottom right, whereas for RGPu and WGPu the curve is maintained higher due to the presence of U that has not fully decayed. Nuclear reprocessing can remove the actinides from the spent fuel so they can be used or destroyed see Long-lived fission product Actinides. Nuclear proliferation and Reactor-grade plutonium Since uranium and plutonium are nuclear weapons materials, there have been proliferation concerns. Ordinarily in spent nuclear fuel , plutonium is reactor-grade plutonium. In addition to plutonium , which is highly suitable for building nuclear weapons, it contains large amounts of undesirable contaminants: These isotopes are extremely difficult to separate, and more cost-effective ways of obtaining fissile material exist e. This is a concern since if the waste is stored, perhaps in deep geological storage , over many years the fission products decay, decreasing the radioactivity of the waste and making the plutonium easier to access. The undesirable contaminant Pu decays faster than the Pu, and thus the quality of the bomb material increases with time although its quantity decreases during that time as well. Thus, some have argued, as time passes, these deep storage areas have the potential to become "plutonium mines", from which material for nuclear weapons can be acquired with relatively little difficulty. Critics of the latter idea have pointed out the difficulty of recovering useful material from sealed deep storage areas makes other methods preferable. Specifically, the high radioactivity and heat 80 C in surrounding rock greatly increases the difficulty of mining a storage area, and the enrichment methods required have high capital costs. Thus plutonium may decay and leave uranium However, modern reactors are only moderately enriched with U relative to U, so the U continues to serve as a denaturation agent for any U produced by plutonium decay. One solution to this problem is to recycle the plutonium and use it as a fuel e. In pyrometallurgical fast reactors , the separated plutonium and uranium are contaminated by actinides and cannot be used for nuclear weapons. Nuclear weapons decommissioning[edit] Waste from nuclear weapons decommissioning is unlikely to contain much beta or gamma activity other than tritium and americium. It is more likely to contain alpha-emitting actinides such as Pu which is a fissile material used in bombs, plus some material with much higher specific activities, such as Pu or Po. In the past the neutron trigger for an atomic bomb tended to be beryllium and a high activity alpha emitter such as polonium ; an alternative to polonium is Pu For reasons of national security, details of the design of modern bombs are normally not released to the open literature. Some designs might contain a radioisotope thermoelectric generator using Pu to provide a long lasting source of electrical power for the electronics in the device. It is likely that the fissile material of an old bomb which is due for refitting will contain decay products of the plutonium isotopes used in it, these are likely to include U from Pu impurities, plus some U from decay of the Pu; due to the relatively long half-life of these Pu isotopes, these wastes from radioactive decay of bomb core material would be very small, and in any case, far less dangerous even in terms of simple radioactivity than the Pu itself. The beta decay of Pu forms Am ; the in-growth of americium is likely to be a greater problem than the decay of Pu and Pu as the americium is a gamma emitter increasing external-exposure to workers and is an alpha emitter which can cause the generation of heat. Naturally occurring uranium is not fissile because it contains Legacy waste[edit] Due to historic activities typically related to radium industry, uranium mining, and military programs, numerous sites contain or are contaminated with radioactivity. In the United States alone, the Department of Energy states there are "millions of gallons of radioactive waste" as well as "thousands of tons of spent nuclear fuel and material" and also "huge quantities of contaminated soil and water. It can be divided into two main classes. In diagnostic nuclear medicine a number of short-lived gamma emitters such as technetiumm are used. Many of these can be disposed of by leaving it to decay for a short time before disposal as normal waste. Other isotopes used in medicine, with half-lives in parentheses, include: Y , used for treating lymphoma 2. Gamma emitters are used in radiography while neutron emitting sources are used in a range of applications, such as oil well logging. After human processing that exposes or concentrates this natural radioactivity such as mining bringing coal to the surface or burning it to produce concentrated ash , it becomes technologically enhanced naturally occurring radioactive material TENORM. The main source of radiation in the human body is potassium 40K , typically 17 milligrams in the body at a time and 0. The sulfate scale from an oil well can be very radium rich, while the water, oil and gas from a well often contain radon. The radon decays to form solid radioisotopes which form coatings on the inside of pipework. In an oil processing plant the area of the plant where propane is processed is often one of the more contaminated areas of the plant as radon has a similar boiling point to propane. Uranium tailings Removal of very low-level waste Uranium tailings are waste by-product materials left over from the rough processing of uranium -bearing ore. They are not significantly radioactive. Mill tailings are sometimes referred to as 11 e 2 wastes, from the section of the Atomic Energy Act of that defines them. Uranium mill tailings typically also contain chemically hazardous heavy metal such as lead and arsenic. Vast mounds of uranium mill tailings are left at many old mining sites, especially in Colorado , New Mexico , and Utah.

Chapter 6 : Siting a Geological Disposal Facility :NuLeAF

Romney Marsh Partnership is a quango. It was set up in to lead the delivery of the Romney Marsh Socio-Economic Plan. As an unelected quango with no mandate it has been briefed on the Geological Disposal Facility (GDF) (Nuclear Dump).

Radioactive Waste Management Updated April Nuclear power is the only large-scale energy-producing technology that takes full responsibility for all its waste and fully costs this into the product. The amount of waste generated by nuclear power is very small relative to other thermal electricity generation technologies. Used nuclear fuel may be treated as a resource or simply as waste. Nuclear waste is neither particularly hazardous nor hard to manage relative to other toxic industrial waste. Safe methods for the final disposal of high-level radioactive waste are technically proven; the international consensus is that geological disposal is the best option. Like all industries, the generation of electricity produces waste. Whatever fuel is used, the waste produced in generating electricity must be managed in ways that safeguard human health and minimise the impact on the environment. For radioactive waste, this means isolating or diluting it such that the rate or concentration of any radionuclides returned to the biosphere is harmless. To achieve this, practically all radioactive waste is contained and managed, with some clearly needing deep and permanent burial. From nuclear power generation, unlike all other forms of thermal electricity generation, all waste is regulated â€" none is allowed to cause pollution. Nuclear power is characterised by the very large amount of energy produced from a very small amount of fuel, and the amount of waste produced during this process is also relatively small. However, much of the waste produced is radioactive and therefore must be carefully managed as hazardous material. All parts of the nuclear fuel cycle produce some radioactive waste and the cost of managing and disposing of this is part of the electricity cost i. All toxic waste needs be dealt with safely â€" not just radioactive waste â€" and in countries with nuclear power, radioactive waste comprises a very small proportion of total industrial hazardous waste generated. Radioactive waste is not unique to the nuclear fuel cycle. Radioactive materials are used extensively in medicine, agriculture, research, manufacturing, non-destructive testing, and minerals exploration. Unlike other hazardous industrial materials, however, the level of hazard of all radioactive waste â€" its radioactivity â€" diminishes with time. Types of radioactive waste Radioactive waste includes any material that is either intrinsically radioactive, or has been contaminated by radioactivity, and that is deemed to have no further use. Government policy dictates whether certain materials â€" such as used nuclear fuel and plutonium â€" are categorised as waste. Every radionuclide has a half-life â€" the time taken for half of its atoms to decay, and thus for it to lose half of its radioactivity. Eventually all radioactive waste decays into non-radioactive elements. The more radioactive an isotope is, the faster it decays. LLW does not require shielding during handling and transport, and is suitable for disposal in near surface facilities. LLW is generated from hospitals and industry, as well as the nuclear fuel cycle. To reduce its volume, LLW is often compacted or incinerated before disposal. Due to its higher levels of radioactivity, ILW requires some shielding. ILW typically comprises resins, chemical sludges, and metal fuel cladding, as well as contaminated materials from reactor decommissioning. Smaller items and any non-solids may be solidified in concrete or bitumen for disposal. As a result, HLW requires cooling and shielding. HLW contains the fission products and transuranic elements generated in the reactor core. There are two distinct kinds of HLW: Used fuel that has been designated as waste. HLW has both long-lived and short-lived components, depending on the length of time it will take for the radioactivity of particular radionuclides to decrease to levels that are considered non-hazardous for people and the surrounding environment. If generally short-lived fission products can be separated from long-lived actinides, this distinction becomes important in management and disposal of HLW. HLW is the focus of significant attention regarding nuclear power, and is managed accordingly. The waste is therefore disposed of with domestic refuse, although countries such as France are currently developing specifically designed VLLW disposal facilities. Where and when is waste produced? Radioactive waste is produced at all stages of the nuclear fuel cycle â€" the process of producing electricity from nuclear materials. The fuel cycle involves the mining and milling of uranium ore, its processing and fabrication into nuclear fuel, its use in the reactor, its reprocessing if conducted , the treatment of the used fuel taken from the reactor, and finally, disposal of the waste. Where the used fuel is reprocessed, the amount of waste is reduced materially. Mining through to fuel fabrication Traditional uranium mining generates fine sandy tailings, which contain virtually all the naturally occurring radioactive elements found in uranium ore. The tailings are collected in engineered dams and finally covered with a layer of clay and rock to inhibit the leakage of radon gas, and to ensure long-term stability. In the short term, the tailings material is often covered with water. Strictly speaking these are not classified as radioactive waste. It is refined then converted to uranium hexafluoride UF6 gas. As a gas, it undergoes enrichment to increase the U content from 0. It is then turned into a hard ceramic oxide UO2 for assembly as reactor fuel elements. Some DU is used in applications where its extremely high density makes it valuable, such as for the keels of yachts and military projectiles. Electricity generation In terms of radioactivity, the major source arising from the use of nuclear reactors to generate electricity comes from the material classified as HLW. Highly radioactive fission products and transuranic elements are produced from uranium and plutonium during reactor operations, and are contained within the used fuel. Where countries have adopted a closed cycle and reprocess used fuel, the fission products and minor actinides are separated from uranium and plutonium and treated as HLW see below. In countries where used fuel is not reprocessed, the used fuel itself is considered a waste and therefore classified as HLW. Reprocessing of used fuel Any used fuel will still contain some of the original U as well as various plutonium isotopes which have been formed inside the reactor core, and U Several European countries, as well as Russia, China, and Japan have policies to reprocess used nuclear fuel. Reprocessing allows for a significant amount of plutonium to be recovered from used fuel, which is then mixed with depleted uranium oxide in a MOX fabrication plant to make fresh fuel.

Chapter 7 : Deep-Mined Geological Disposal of Radioactive Waste Archives - Elements

Final disposal of nuclear waste involves geological disposal of a variety of waste types deep under the ground. Due to their radioactive nature, these wastes must be stored for > , years, until the radioactivity has reduced to the original activity of the UO2 ore from which it originated.

Read our stories here What is radioactivity? Radioactivity is a process in which atoms spontaneously break down and emit energy. Materials that do this are called radioactive. Some of the energy released is in the form of heat. What is nuclear power? Nuclear power is a way of generating electricity by using the heat given off by radioactive materials to produce steam that can drive turbines. What is radioactive waste and where does it come from? Radioactive waste is radioactive material for which we have no further use. Most comes from the generation of electricity using nuclear power but it is also a by-product of many medical and industrial processes, research and defence activities that make use of radioactivity and radioactive materials. What waste is destined for geological disposal? The GDF will take higher activity waste. For planning purposes, we consider wastes from existing uses of radioactive materials, as well as wastes that would be generated from new nuclear power stations. We also include various nuclear materials in our planning that are not currently classified as waste, since these would need to be managed through geological disposal if it were decided at some point that they had no further use. Where is the waste now? Radioactive wastes that will be disposed of in the GDF are currently being packaged in specially engineered containers and stored at over 20 nuclear sites around the country, with the majority at Sellafield in Cumbria. The stores are designed to withstand severe weather and earthquakes. They need to be continually monitored to keep the waste secure and periodically refurbished to prevent the waste from being exposed to the effects of the weather. Eventually, they will need to be replaced, or the waste moved elsewhere. Surface storage is therefore less safe than geological disposal, and would end up being much more labour intensive and costly in the long run. We have the skills, expertise and technology to implement geological disposal now, and should not put off doing so. When will the GDF be built? Construction will only start when a suitable site is identified, all the necessary consents and permits have been obtained and the host community has indicated its willingness to host the facility through a test of public support. For planning purposes, we assume that the GDF will be available to receive the first waste in the s. Filling the GDF with waste and then closing it, once full, will then run into the next century. Who will build it? We will appoint contractors who have the necessary specialist skills to support us in our work. When will the siting process for the GDF officially launch? The siting process will launch once all the preparatory work has been completed. We currently expect that this will be sometime in Who will communities speak to? There will be brochures and videos which will explain what a GDF is, what makes it safe and why it could be sited in their region. There will also be ways to raise your questions directly with RWM. All the information on this page is available in Welsh If you have any questions, please contact us at gdfenquiries nda.

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Chapter 8 : Radioactive Waste Management | Nuclear Waste Disposal - World Nuclear Association

A geological disposal facility (GDF) is a major infrastructure project that will provide a permanent solution to the legacy of higher-activity waste that has been accumulating in the UK since the.

Geological disposal Managing highly radioactive long-lived waste Final disposal solutions exist for two of the five categories of radioactive waste: It should be possible to find a solution for low-level long-lived waste. Attention therefore focuses on ultimate waste from the nuclear industry: The proposed solution is deep geological disposal in a purpose-built repository. The containment barrier formed by a deep-lying geological formation combines with the two barriers respectively created by the waste package in which the radioactivity is confined and by the structure in which the waste package is placed. These barriers impede any migration by radioactive atoms. There is worldwide consensus regarding the need for such repositories at some point in the future. What types of ground are suitable for such repositories? How can we ensure that no radioactivity escapes for a very long time? Deep repository operating principle This diagram shows the layout of a hypothetical deep geological repository. High-level waste packages that release heat must be placed some distance apart. Intermediate-level waste ILW does not release heat and may therefore be arranged differently. ANDRA In a geological repository, an underground rock layer serves, if not as a strong-box, at least as an obstacle to movement by such waste, which includes spent fuel assemblies and containers of vitrified waste. In the light of research conducted at an underground laboratory in Bure, France has opted for a million year-old, m thick layer of clay deep underground in the Paris Basin as the site for its CIGEO repository, on the boundary between the Meuse and Haute-Marne departments. The harmfulness of radioactive atoms should not be exaggerated. Apart from one fleeting instant when they emit a ray, they behave like any other atom. Buried far beneath our feet, they would be no more likely to make their way to the light of day than an ordinary atom in the ground. In the absence of human activity, the only natural vector that might expose buried atoms is water. Clay is notable not only for its plasticity but also for its ability to retain water that enters it. Due to this compartmentalised structure, there is almost no circulation of water. Atoms imprisoned within this structure move only very slowly. It would be an extremely long time before any buried atoms returned to the living world. Hesitant, spatially limited return to the surface No water flows through the underground clay rock layer. Atoms trapped in this structure move only very slowly, hesitantly and in all directions. Radioactive atoms in a waste container will move in the same way as ordinary atoms. They should not travel any further than those of our ancestor Lucy, who has not moved for the past two or three million years. Any atoms that did rise to the surface would follow very variable routes and arrive at very different times. IN2P3 More than the scientific basis for such repositories, what will matter is what we place in them and when. ILW-LL waste could be buried immediately. In the case of high-level waste, the heat initially released is more problematic than its radioactivity. Because of this heat release, packages must either be spaced out or else allowed to cool prior to disposal. This is one of the reasons why such repositories are still at the project stage. In principle, the oldest waste will be buried first. Waste package designs is likely to change, to implement improvements arising out of ongoing research into high-level waste processing and conditioning. Such issues deserve to be properly debated. Unfortunately, rational approaches to this debate are met with passion and in some cases wilful ignorance. Julius Caesar is reputed to have called the Gauls undisciplined and quarrelsome. In the United States, the project to build the Yucca Mountain repository in tuff under the Nevada desert was abandoned. If the CIGEO repository is built, France would be the first country to begin operating such a facility, in or around Only Sweden and Finland would be as advanced. Construction and opening dates in other countries are much further off: Go to page in French.

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disposal and the management of long-lived wastes allocated to deep geologic disposal, particularly those developments that have arisen since the formulation of the Collective Opinion. The primary sources of input to the study are the *answers to a questionnaire provided by the.*