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Intergenerational Attractiveness, Preparation, and Engagement in Geological Nuclear Waste Management



Geoscience Research and Applications

Erik Webb, Senior Manager

Japan Nuclear Waste Management Organization Public Forum

November 22, 2024



Sandia National Laboratories is a multimission laboratory managed and operated by National Technology and Engineering Solutions of Sandia LLC, a wholly owned subsidiary of Honeywell International Inc. for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525. SAND 2018-4900 PE

SAND2024-14703PE

How do we enhance the attractiveness of and preparation for building a career in geological nuclear waste disposal.

- **Clearly Define Nuclear Waste Disposal as a Career Option**
- **Build Awareness of the Career Opportunity**
- **Explain the Societal Need**
- **Ensure Basic STEM Education**
- **Provide Opportunities for Advanced and Specialized Education**
- **Explain the Philosophy of this Challenge as Different than Any Other Engineering or Science Endeavor**

Clearly Define Nuclear Waste Disposal



Young people give their views on GDF

June 5, 2023



WORLD NUCLEAR ASSOCIATION

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NUCLEAR FUEL CYCLE

Storage and Disposal of Radioactive Waste

UPDATED TUESDAY, 30 APRIL 2024

Radioactive wastes are stored so as to avoid any chance of radiation exposure to people, or any pollution.

The radioactivity of the wastes decays with time, providing a strong incentive to store high-level waste for about 50 years before disposal.

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Bulletin of the Atomic Scientists

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The thorny social problem of permanent nuclear waste storage

By Austyn Gaffney | July 4, 2024



An aerial view of Onkalo, the world's first permanent depository for nuclear fuel waste, during construction. It opens later this year on the Finnish island of Olkiluoto. Tapani Karjanlahti/TVO

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Editor's note: This story was originally published by Grist. It appears here as part of the Climate Desk collaboration.

The world's first permanent depository for nuclear fuel waste opens later



Discuss the US elections, geopolitics, space, and more at Conversations Before Midnight

On November 12, join 250 attendees and members of Bulletin leadership — including those who set the Doomsday Clock — at our annual gathering in Chicago.

- <https://midcopeland.workinginpartnership.org.uk/young-people-give-their-views-on-gdf/>
- <https://world-nuclear.org/information-library/nuclear-fuel-cycle/nuclear-waste/storage-and-disposal-of-radioactive-waste>
- <https://thebulletin.org/2024/07/the-thorny-social-problem-of-permanent-nuclear-waste-storage/>

Build Awareness of the Career Opportunity



A Career as a Nuclear Waste Specialist

Nuclear waste specialists are involved in the safety and day-to-day running of decommissioning nuclear power stations.

The decommissioning process involves a series of specialised operations that involve the removal of highly toxic waste material.

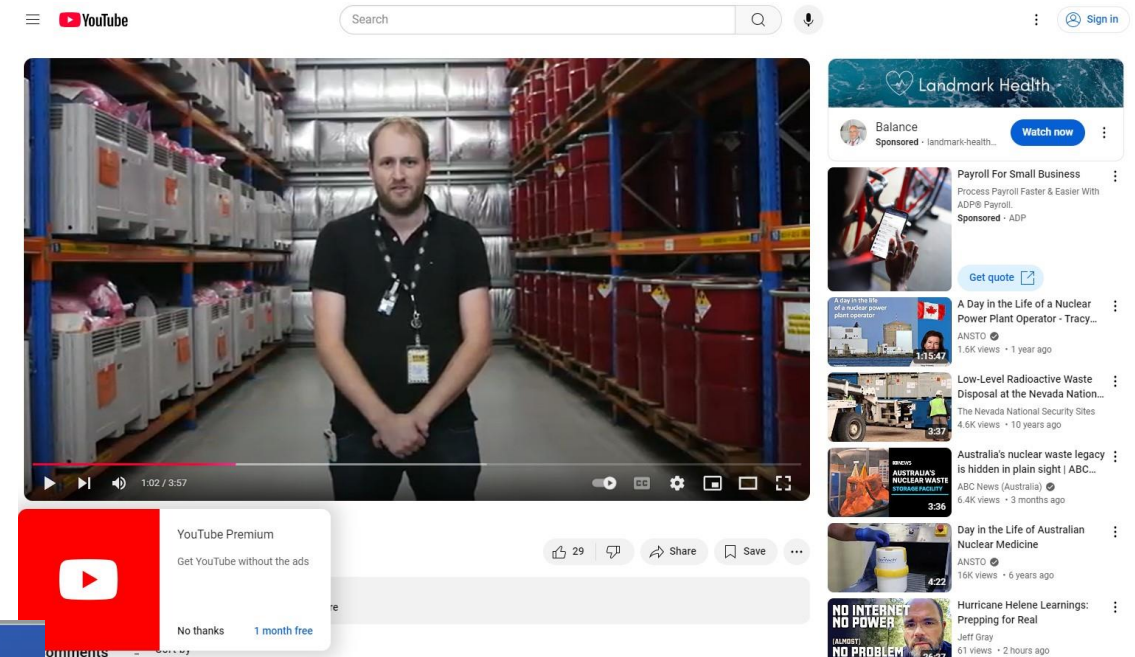
This involves activities from shutdown and removal of nuclear material to the environmental restoration of the site. The whole process is complex and typically takes 20 to 30 years to complete.

Pre-decommissioning

- Development of a decommissioning plan
- Involvement of the public (in democracies)

Job Categories

Administration
Coatings
Commercial
Construction



- <https://nuclear-careers.com/career-nuclear-waste-specialist>
- https://energy.ec.europa.eu/system/files/2019-11/2.2_gordon_iaea_web_0.pdf
- <https://www.youtube.com/watch?v=Vy0LEeli84w>

Explain the Societal Need

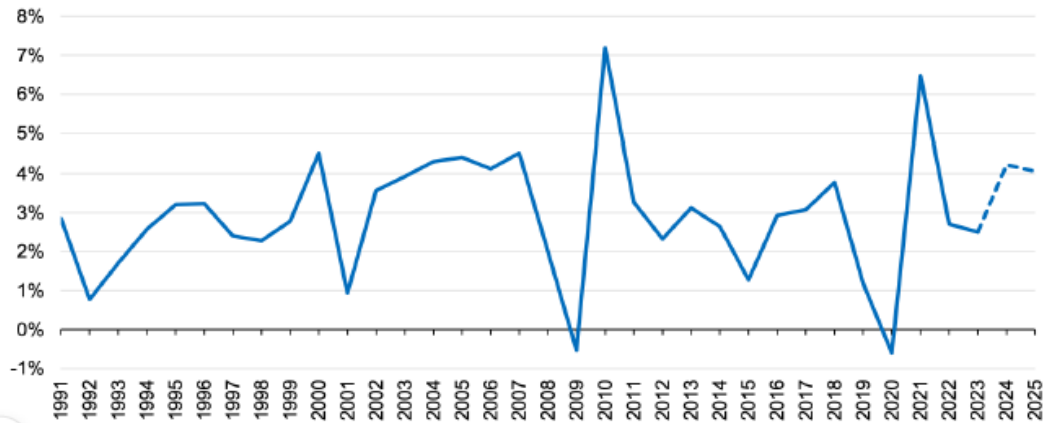


ENERGY TRANSITION

Global electricity demand set for 'strong rise' – plus other top energy stories

Aug 13, 2024

Year-on-year percent change in global electricity demand, 1991-2025



IEA. CC BY 4.0.

Nuclear power produces much fewer carbon emissions compared using (gCO₂/kWh):

- Coal 1,050
- Gas 450
- **Nuclear power: 15–50**
- Solar 6
- Wind 4

Explain the Societal Need

HOME > NEWS > THE CRITICAL POWER CHANNEL

Google CEO: We're working on 1GW data centers, seeing money going into SMRs

But still no word on the company's own nuclear strategy

September 23, 2024 By: Sebastian Moss [Have your say](#)



Google and Alphabet CEO Sundar Pichai has confirmed that the company is building data centers that will consume more than 1GW of power.

Pichai also mentioned small modular reactors (SMRs) as a potential energy source, but did not confirm whether Google was planning on using any.

Speaking at Carnegie Mellon University's Pittsburgh campus, Pichai said that Google was one of the first companies to set a 24/7 carbon neutral energy goal for 2030.

However, he cautioned, that was before the AI power boom. "We are now working on over 1GW data centers, which I didn't think we would be thinking about just two years earlier," he said.

This will cause challenges in the short term, he admitted, but steered clear of saying whether it would mean the company will miss its 2030 goal.



— Sebastian Moss

Whitepapers [> More](#)



Designing a Consent-Based Siting Process
Summary of Public Input
Final Report
December 29, 2016



Community and youth engagement the key for future radioactive waste disposal

Published date: 26 October 2022 |

[Belgium](#) [Deep geological repository \(DGR\)](#) [Education](#)



The Forum on Stakeholder Confidence held a workshop in October 2022 to discuss best practices for community and youth engagement around the topic of radioactive waste disposal.

- <https://www.energy.gov/sites/prod/files/2016/12/f34/Summary%20of%20Public%20Input%20Report%20FINAL.pdf>
- https://www.oecd-nea.org/jcms/pl_74912/community-and-youth-engagement-the-key-for-future-radioactive-waste-disposal
- <https://www.lastenergy.com/blog/smrs-colocation-data-centers>

Ensure Basic STEM Education

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The power of mentoring young talent
21h ago

DOE names four companies to split \$2.7 billion in future HALEU enrichment contracts
Fri, Oct 18, 2024, 8:40AM

United Kingdom's nuclear waste progress described in report
Fri, Oct 18, 2024, 6:00AM

A message from The I.C.E. Service Group
At A Glance: The I.C.E Service Group

General Atomics releases FUSE—an open-source fusion power design tool
Thu, Oct 17, 2024, 2:01PM

DOE plans removal of naval prototype reactor, opens public comment period
Thu, Oct 17, 2024, 11:00AM

DOE to award \$900 million for milestone-based SMR deployment projects
Thu, Oct 17, 2024, 8:49AM

A message from Electrical Builders, Inc.
America's Top Performing Nuclear Plants Rely on Electrical Builders, Industries to Expand and Extend the Life of Their Critical Electrical Assets

Setting the nuclear theme
Thu, Oct 17, 2024, 6:01AM

A message from PYRAGON and SOR Controls Group

The Advantage of Upgrading



A message from H3D

GammaTrend Monitoring of Reactor Coolant using Pixelated CZT Spectrometers
[Learn More](#)

INDUSTRY

WM Symposia announces STEM Champions Challenge

Mon, Feb 6, 2023, 2:00PM | [ANS Nuclear Cafe](#)



EDUCATION & OPPORTUNITY
IN RADWASTE MANAGEMENT
A NON-PROFIT ORGANIZATION

Waste Management Symposia (WMS), which hosts the annual Waste Management Conference in Phoenix, Ariz., is launching a new effort along with Longenecker & Associates to support science, technology, engineering, and mathematics (STEM) education efforts to attract and build the next-generation nuclear workforce. The engineering, environmental, and nuclear services company Spectra Tech is joining the initiative by matching Longenecker & Associates' contributions to the program.

← ↻ 🏠 <https://www.wmsym.org/students/stem/> A ☆ ⌂ ⌕ ⌕ ⌕



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STEM

Students



Welcome to WM STEM!

WM is devoted to fostering STEM K-12 engagement. To develop and maintain a pipeline that delivers our future workforce, we must work together to support STEM initiatives for younger students. Our nuclear industry relies on STEM disciplines for sustainment and advancement.

- <https://www.wmsym.org/students/stem/>
- <https://www.ans.org/news/article-4714/wm-symposia-announces-stem-champions-challenge>

Provide Opportunities for Advanced and Specialized Education

International Collaboration Activities in Different Geologic Disposal Environments

Fuel Cycle Research & Development

Prepared for
U.S. Department of Energy
Used Fuel Disposition
Jens Birkholzer
Lawrence Berkeley National Laboratory
September 2016

With Contributions from Boris Faybishenko, Liange Zheng, and Jonny Rutqvist (LBNL), Paul Reimus and Hari Viswanathan (LANL), Carlos Jove-Colon and Yifeng Wang (SNL), Mavrik Zavarin (LLNL)



FCRD-UFD-2016-000077
LBNL-1006321

Office of Used Nuclear Fuel Disposition International Program

Strategic Plan
April 2012



NEFC Knowledge Management Project

ISSUE: POTENTIAL LOSS OF EXPERTISE

Expertise and critical knowledge in the field of Nuclear Waste Management (NWM) is a serious problem worldwide.

NEFC estimates an average 10-15 year turnover rate for NWM staff.

Supported by DOE-NE and Sandia Leadership

Active HLW Disposal project in the US since the Yucca Mountain project was halted in 2010

Subject Matter Experts (SMEs) in disposal research retiring without effective means to transfer their experience to new or less experienced staff

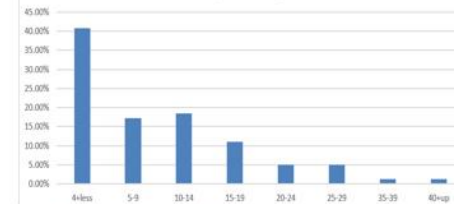
Efforts needed to maintain staff competence and share information across the generations

NUCLEAR WASTE PROJECT EXPERIENCE

Most staff have little or no experience working on an active nuclear waste management project



Nuclear Energy Fuel Cycle Program
% of Population by Years Service



>75% of Population has little or no NWMP experience

<25% of Population has some amount of NWMP experience

NWMP: Nuclear Waste Management Project; Data as of 2021

- <https://www.energy.gov/ne/articles/office-unf-disposition-international-program-strategic-plan>
- DOE 2012, Office of Used Nuclear Fuel Disposition International Programs, Strategic Plan April 2012
- Meachem, J, Knowledge Management Project, Nuclear Energy Fuel Cycle Program, SAND2022-10112PE

Explain the Philosophy of this Challenge as Different than Any Other Engineering or Science Endeavor

https://atomicinsights.com/really-necessary-deep-geologic-repository-used-nuclear-fuel/

Atomic Insights The Atomic Show About Archives

ATOMIC POLITICS | NUCLEAR WASTE | POLITICS OF NUCLEAR ENERGY

Is it really necessary to have a deep geologic repository for used nuclear fuel?

By Rod Adams • September 5, 2014


Though I have often received quizzical, almost uncomprehending looks from my type 'A' colleagues on submarines and in my other jobs, I've often been guided by a simple principal of decision-making – "If it's too hard, quit."

Please don't think that means I'm the type of person who can never get anything done or who gives up easily. What it normally means for me is that I tend to only take on the projects that I believe are different, both in the sense of being novel and in the sense of being challenging.

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It's time to c nuclear fue accomplish



Assessment of Disposal Options for DOE-Managed High-Level Radioactive Waste and Spent Nuclear Fuel



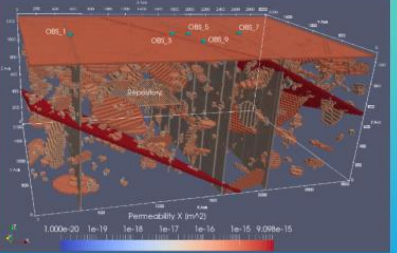
October 2014

U.S. DEPARTMENT OF ENERGY Office of NUCLEAR ENERGY Spent Fuel and Waste Science and Technology (SFWST)

This paper describes objective technical results and analysis. Any subjective views or opinions that might be expressed in the paper do not necessarily represent the views of the U.S. Department of Energy or the United States Government.

SAND2022-2763C

Clean. Reliable. Nuclear.

Nuclear Waste Disposal in Salt: International Collaborations

ICGR 2022 Meeting
4-8 April 2022
Helsinki, Finland

Rick Jayne
Sandia National Laboratories

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- <https://www.energy.gov/ne/articles/assessment-disposal-options-doe-managed-high-level-radioactive-waste-and-spent-nuclear>
- https://www.reddit.com/r/NuclearPower/comments/1cu3fiu/deep_geological_disposal_ground_water/?rdt=58059
- Jaynes, R., 2022 Spent Fuel and Waste Science Technology (SFWST) ICGR 2022 Meeting, Helsinki, Finland, Aug 20-22, 2022.

My Personal Journey

