

**MEDIA USED BY U.S. NUCLEAR REGULATORY
COMMISSION IN CONVEYING INFORMATION TO
THE PUBLIC**

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QUALITY OF DATA, ANALYSES, AND CODE DEVELOPMENT

DATA: All CNWRA-generated original data contained in this report meet the quality assurance requirements described in the Geosciences and Engineering Division Quality Assurance Manual. Sources for other data should be consulted for determining the level of quality for those data.

ANALYSES AND CODES: No scientific or engineering software was used in the analyses contained in this report.

MEDIA USED BY U.S. NUCLEAR REGULATORY COMMISSION IN CONVEYING INFORMATION TO THE PUBLIC

The U.S. Nuclear Regulatory Commission (NRC) Yucca Mountain public outreach program began in 1999 with the purpose of conveying information to stakeholders and the public in an open, transparent way. The public outreach team was drawn from NRC and Center for Nuclear Waste Regulatory Analyses (CNWRA[®], or the Center) staff members engaged in other Yucca Mountain-related technical projects who could contribute to public outreach. The first public meetings were held in Las Vegas and Beatty, Nevada, on March 23 and 25, 1999, and discussed the proposed 10 CFR Part 63 rule. During these meetings, the public outreach team encountered a lack of trust and suspicion among the members of the public. One attendee at the Beatty meeting was quoted as saying, "I hear what you're saying, but I don't believe you."¹ The staff realized that there were many misconceptions and barriers that needed to be overcome to create a relationship of trust. The team began efforts to develop educational tools to help NRC convey its messages in a clear and trustworthy way. Recognizing that each audience is different and that there are a variety of learning styles, the team utilized a number of different media. The development of these tools was a learning process, and the team continually improved its approaches and added products to its collection of resources. The main types of media included Microsoft[®] PowerPoint[®] presentations, posters, fact sheets, and a brochure, a slideshow, and a 3D model. This report summarizes the media used in the public outreach program and discusses the perceived success of these types of media.

During the first public meetings in 1999, NRC came prepared with PowerPoint presentations and copies of the Federal Register notice. Presentations for the outreach program were usually about 30 minutes or less in length and covered a single specific subject. The presenter was typically a technical expert for the subject matter or worked on a team that considered the particular topic (Figure 1). While PowerPoint presentations remain a staple form of media used by the public outreach program, initially they were not used to best advantage, nor were they well tailored to the audiences to which they were presented. Over time, however, as the outreach program grew in sophistication, every presentation went through individual and team reviews before each public meeting. These reviews ensured that the content fit the audience and context of the meeting, accurately represented factual information, adequately met legal requirements, and was clear and easy to understand. Authors learned to use a mix of text, pictures, and occasionally video on the slides, being careful to keep the slides uncrowded and easy to view from a distance. Presentations were sometimes made available ahead of time to meeting participants via email or the NRC website, or were printed to distribute at the meetings. Afterward, presentations were archived into the NRC Documents Access and Management System and often posted to the NRC Website. Separate from presentations at public meetings, two oral presentations utilizing PowerPoint were also made at the Geological Society of America (GSA) convention in fall 2009 as a public outreach effort.

As a result of the 1999 public meetings, the staff recognized that additional visual aids would be helpful. The public outreach team began quickly developing three posters for use at an upcoming meeting.

¹J. Kotra, personal communication, November 10, 2010.



Figure 1. A Technical Staff Member Gives a PowerPoint Presentation at a Public Meeting in Tecopa, California

The first poster was titled "Protecting Public Health and Safety at the Proposed Geologic Repository at Yucca Mountain, Nevada." The poster shows the roles of federal agencies involved in the licensing process (Figure 2). The second poster, titled "U.S. NRC Oversight of the Proposed Repository at Yucca Mountain: Opportunities for Public Involvement," depicted the steps in the licensing process and suggested ways for the public to be involved in these steps (Figure 3). Among the ideas that NRC wanted to convey in these two posters was the independence of NRC and the large role that NRC plays in the licensing process. Size and placement of the NRC representation in the graphics was carefully considered to stress the agency's importance. Special attention was also given to the colors, fonts, and shapes used in the posters to avoid visual cues that might be negative or alarming. The third poster explained the CNWRA technical capabilities and its role in assisting NRC in the licensing decision (Figure 4). The content of the poster included more text and several photographs of investigative activities, including laboratory and field work. These three posters were displayed on easels at the meeting and served as focal points for discussions with meeting attendees.

Protecting Public Health and Safety

at the Proposed Geologic Repository at Yucca Mountain, Nevada

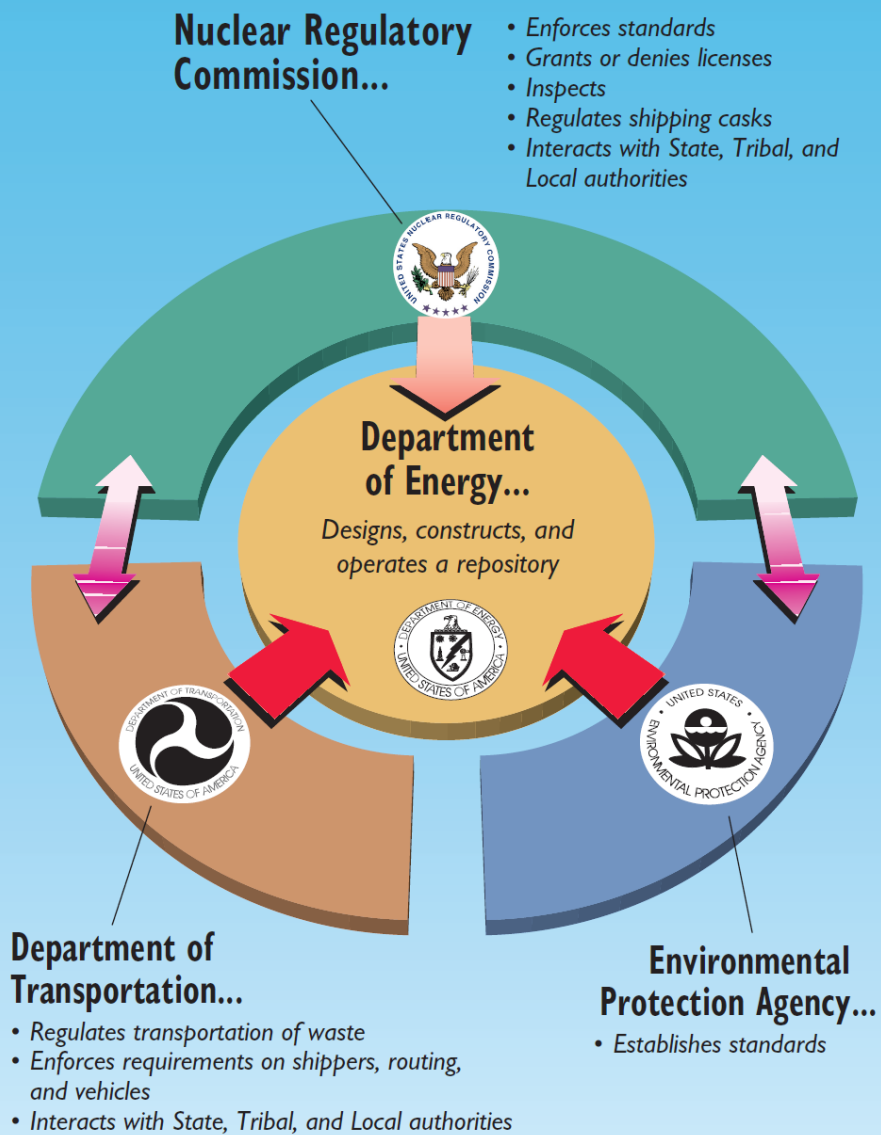


Figure 2. One of the First Public Outreach Posters, “Protecting Public Health and Safety at the Proposed Geologic Repository at Yucca Mountain, Nevada”

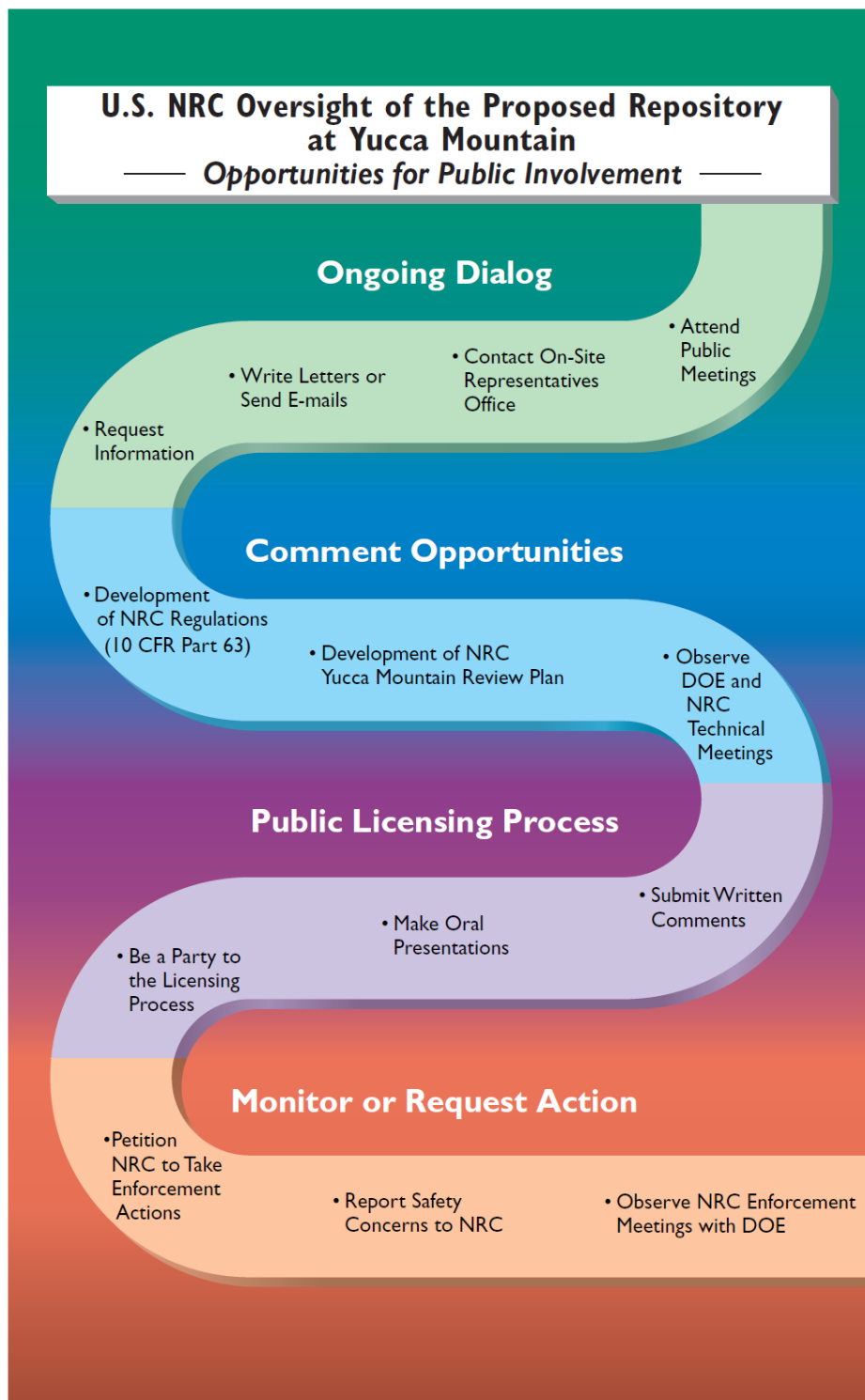


Figure 3. Another of the First Public Outreach Posters, “U.S. NRC Oversight of the Proposed Repository at Yucca Mountain: Opportunities for Public Involvement”

C · N · W · R · A

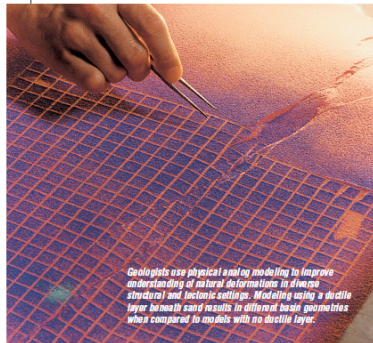
CENTER for · NUCLEAR · WASTE · REGULATORY · ANALYSES

In 1987, the Center for Nuclear Waste Regulatory Analyses (CNWRA) was established at Southwest Research Institute® to assist the Nuclear Regulatory Commission in regulating the public and worker health and safety aspects of the nation's first geological repository for high-level radioactive waste. This role has since expanded significantly, with the CNWRA providing comprehensive technical support to the Nuclear Regulatory Commission's regulatory role in defense waste management, commercial and federal site decommissioning, spent fuel storage and transportation, and uranium recovery programs.

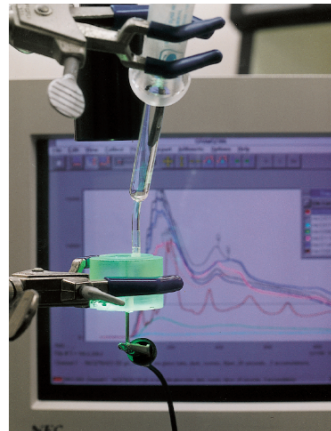
Today, the CNWRA is an internationally recognized center of excellence in earth sciences and engineering, solving complex problems for government agencies and industry in the United States and abroad. As a federally funded research and development center, the CNWRA transfers, as appropriate, leading-edge technology developed under government contract to the commercial sector.



Housed in an 87,000-square-foot facility at Southwest Research Institute, the CNWRA offers sophisticated computational and visualization resources and extensive laboratories to solve diverse scientific and technical problems for government and industry.



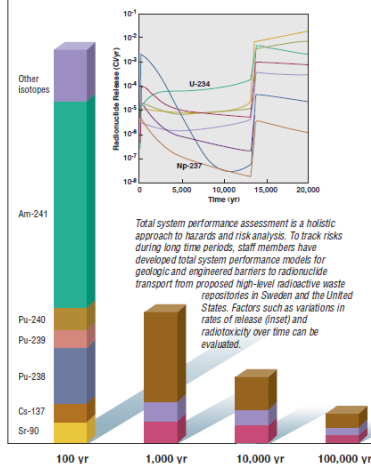
Geologists use physical analog modeling to improve understanding of natural deformations in diverse structural and tectonic settings. Modeling using a ductile layer beneath can results in different fault geometries when compared to models with no ductile layer.



Using laser Raman spectroscopy, CNWRA scientists study the fundamental mechanisms of corrosion under varying conditions that affect the long-term behavior of materials utilized in the manufacture of high-level radioactive waste containers.



Geological, hydrological, and biological data are converted to numerical form and merged with information on manmade features to allow site characteristics analysis. High-precision data integration supports robust CNWRA flow and transport interpretations.



Geoscientists study natural systems, such as the Nopal uranium-mining district in Mexico, to extrapolate possible transport of contaminants from engineered waste disposal sites.



CNWRA engineers use laboratory-determined joint properties to develop small-scale model experiments to investigate tunnel stability under repeated simulated earthquake motions.

Figure 4. Third of the Original Posters, “CNWRA Technical Capabilities and Its Role in Assisting the NRC in the Licensing Decision”

The posters were subsequently heavily used at other meetings and open house events and were displayed at the On-Site Representatives office and at NRC headquarters. Additional posters were added later, including a performance assessment poster and a large map of the Yucca Mountain vicinity featuring locations important to licensing. The three original posters, and later the performance assessment poster, were also printed in an 11 × 17-in size to use as handouts. The team added a page of explanatory text to the back side of these sheets, and these became the first information sheets or fact sheets, the most common form of media used in the NRC public outreach program. The fact sheets were designed to concisely explain a specific legal aspect or regulatory requirement concept. The format of subsequent fact sheets was an 8.5 × 11-in sheet, double or single sided, often in question and answer format (Figure 5). Some fact sheets had a graphical depiction on one side, designed to grab the viewer's attention and introduce a concept, while the text on the other side elaborated on the concept and provided more in-depth information.

Designing the information sheets required thoughtful input and cross-discipline effort. While the technical staff provided most of the technical content, a plain language version of the text was required to make the information sheets useful and understandable to a nontechnical audience. The public outreach team utilized nontechnical NRC staff and support staff, to screen the information sheets for readability. Once the language was modified satisfactorily to accurately convey the intended messages in an understandable way, Office of the General Counsel staff reviewed the materials and ensured that they accurately represented and complied with the legal obligations of NRC.

One of the fact sheets that took considerable effort to put together was the two-sided "Key Technical Issues" fact sheet (Figures 6 and 7). This was particularly challenging because the input was solicited from many technical staff that did not normally work on the public outreach team, and many of the staff found it difficult to condense their task descriptions into plain language. However, once completed, this particular fact sheet was highly successful and was even used in a news interview 2 weeks after its release. Rather than having to summarize the technical subjects, the journalist was able to use language directly from the fact sheet, avoiding loss of accuracy in translation. The effort to put technical terms into lay terms proved to be worthwhile.

An NRC calling card was also developed as a simple, small handout. The size of a business card, the calling card carried basic information about the NRC purpose and how to contact NRC for more information about the program. Figures 8 and 9 show the outside and inside of the card. Because these cards were portable, staff members distributed these cards at meetings, open houses, conferences, and casual events.

The public outreach team conducted multiple workshops for tribal governments and for affected units of local government. Staff prepared notebooks to distribute to workshop attendees. The notebooks contained copies of the fact sheets, printouts of PowerPoint presentations, and small versions of the posters, as well as newly developed glossaries to improve understanding of terminology used during the workshops. Workshop attendees found the notebooks to be useful, and they also served as good resources for staff members for subsequent interactions.

The 10 CFR Part 63 rule played an important role in the licensing of Yucca Mountain and was a crucial aspect to explain to stakeholders and the public. Because staff felt that more information was needed than could be contained in a single fact sheet, the team developed a full color, 20-page brochure entitled "Judging the Safety of a Repository at Yucca Mountain, Nevada." The brochure included discussions about standards and regulations used, multiple barrier



RESPONDING TO PUBLIC CONCERNS AND COMMENTS ABOUT THE FINAL RULES FOR THE PROPOSED REPOSITORY AT YUCCA MOUNTAIN, NEVADA

WHAT ARE THE FINAL RULES?

- The U.S. Nuclear Regulatory Commission's (NRC's) final rules are licensing requirements to ensure protection of the public and the environment, and the safety of workers, near a potential repository at Yucca Mountain.
- The NRC published final rules, Title 10, Part 63 of the Code of Federal Regulations, on November 2, 2001.
- The rules are consistent with Environmental Protection Agency (EPA) final standards issued on June 13, 2001.

HOW DID THE NRC OBTAIN THE PUBLIC'S COMMENTS ON THESE RULES?

- The NRC published proposed rules for comment on February 22, 1999.
- The NRC held public meetings in Nevada to allow people to ask questions and express their comments directly.
- The NRC extended the comment period at the request of many people in Nevada and held additional public meetings to give more people time to convey their comments and concerns.
- The NRC staff carefully reviewed and considered more than 1,000 comments in preparing the final rule.

WHAT WERE THE MAIN COMMENTS?

- The majority of comments from citizens in Nevada urged the NRC to wait for final EPA standards for Yucca Mountain before publishing final NRC rules.
- Commenters also expressed a strong preference for NRC use of standards then under consideration by the EPA.
- Most commenters expressed support for NRC inclusion of additional limits for protection of groundwater.
- Commenters also expressed strong support for NRC retention of a formal hearing process when evaluating a license application for a potential repository.

HOW DID THE NRC RESPOND TO THESE COMMENTS?

- As the NRC promised, and as required by law, the NRC issued final rules consistent with the EPA's final standards.
- The final rules include EPA's numerical limits for individual protection.
- The final rules include EPA's limits for protection of groundwater.
- The NRC also announced its intent to retain a formal hearing process for evaluating a license application for a proposed repository at Yucca Mountain.

WHAT OTHER OPPORTUNITIES WILL THE PUBLIC HAVE TO COMMENT ON NRC RULES AND DOCUMENTS ON YUCCA MOUNTAIN?

- If NRC amends any rules for Yucca Mountain, the public will be offered a chance to comment, and the NRC will give careful consideration to those comments.
- Details of how the NRC will implement its rules for Yucca Mountain in reviewing a potential license application are described in a Yucca Mountain Review Plan (YMRP).
- NRC staff will continue to hold public meetings in Nevada to discuss and answer questions about NRC's regulation of a potential high-level waste repository at Yucca Mountain.

*For more information on NRC's program to review Yucca Mountain, visit us on the Internet at
<http://www.nrc.gov/waste/hlw-disposal.html>*

May 2003 #6

Figure 5. Single-Sided Fact Sheet "Responding to Public Concerns and Comments..." in Question-Answer Format



KEY TECHNICAL ISSUES

Keys to Judging the Safety of a Proposed Repository at Yucca Mountain

The staff of the U.S. Nuclear Regulatory Commission (NRC) identified nine key technical issues to organize its review of the U.S. Department of Energy's (DOE) site characterization program at Yucca Mountain. These topics, posed as questions below, are the issues most important to understanding the long-term capability of a repository at Yucca Mountain to protect public health, safety, and the environment. **These key technical issues, or KTIs,** are integrated in the NRC's standards and requirements applicable to Yucca Mountain. The KTIs also form the basis for the NRC staff's draft licensing guide referred to as the Yucca Mountain Review Plan. If the DOE applies to the NRC for a license to construct a repository at Yucca Mountain, the DOE will need to show that the repository complies with NRC's regulations and it will have to address these issues:

- (1) UNSATURATED AND SATURATED ZONE FLOW UNDER ISOTHERMAL CONDITIONS —**
How does water move above and below a potential repository at Yucca Mountain?
- (2) THERMAL EFFECTS ON FLOW —** How does temperature affect the movement of water in the immediate area of the potential repository?
- (3) CONTAINER LIFE AND SOURCE TERM —** How long do we expect the containers and waste forms to last and what will happen to the waste as the containers and waste forms wear away over time?
- (4) EVOLUTION OF THE NEAR FIELD ENVIRONMENT —** How do water and heat affect the chemical environment of the containers, waste forms, and the immediate area around the repository?
- (5) RADIONUCLIDE TRANSPORT —** How do radioactive elements released from degraded waste move away from the repository?
- (6) REPOSITORY DESIGN AND THERMAL MECHANICAL EFFECTS —** How do engineering design, construction, and operation of a repository affect short- and long-term repository safety?
- (7) STRUCTURAL DEFORMATION AND SEISMICITY —** How do geologic features and events, such as fractures and earthquakes, affect repository safety?
- (8) IGNEOUS ACTIVITY —** How likely is it that volcanic eruptions or igneous intrusions will disrupt the repository and what would be the potential consequences to people and the environment?
- (9) TOTAL SYSTEM PERFORMANCE ASSESSMENT AND INTEGRATION —** How will the entire system of engineered and natural barriers work together to retain waste, so that the proposed repository at Yucca Mountain will comply with safety and environmental standards?

(continued)

April 2004-KTI

Figure 6. Key Technical Issues Fact Sheet, Front and Back Sides

FREQUENTLY ASKED QUESTIONS

WHY DOES THE STAFF OF THE U.S. NUCLEAR REGULATORY COMMISSION (NRC) MEET WITH THE U.S. DEPARTMENT OF ENERGY (DOE) BEFORE IT HAS SUBMITTED A LICENSE APPLICATION?

The Nuclear Waste Policy Act provides for NRC interaction with the DOE before the DOE is ready to file a license application. During preclicensing interactions with the DOE, the NRC staff continually stresses that, to prepare a high-quality license application, the DOE will have to address the **key technical issues**, or **KTIs**. The NRC conducts public technical exchanges to gain a better understanding of how the DOE is addressing the KTIs.

CAN THE PUBLIC ATTEND THESE MEETINGS?

Yes. These technical exchanges are open to all stakeholders, including representatives of the State of Nevada, Tribal governments, affected units of local governments, and interested members of the public. We conduct these technical exchanges in a public forum to increase public awareness of the issues and the transparency of the interaction process.

WHY DOES THE NRC WANT THE DOE TO RESOLVE THE KTIs?

The NRC wants to assure that enough information is available on each KTI to enable the NRC to begin a review of the license application if the DOE decides to submit it. Once the NRC accepts the license application for review, it has 3–4 years, by law, to complete its review.

WHAT DOES IT MEAN TO SAY AN ISSUE IS RESOLVED?

An issue is resolved when the NRC staff has no further questions or comments about how the DOE is addressing that issue. It should not be viewed as any sort of prejudgment of the outcome of the NRC staff's safety evaluation of that issue once a license application is under review. Relevant new information (for example, changes in design) could raise more questions or comments about a previously "resolved issue."

HOW WILL THE NRC DECIDE WHETHER AN ISSUE IS RESOLVED?

The NRC staff reviews information provided by the DOE and evaluates that information relative to what is required by acceptance criteria that are based on requirements in our rule.

WHAT ARE ACCEPTANCE CRITERIA AND WHERE ARE THEY DOCUMENTED?

Acceptance criteria are the measure by which the NRC staff judges the acceptability of DOE information for a possible license application. An example acceptance criterion is "data are sufficient for model justification." These criteria and their bases were developed over several years, and are described in a series of publicly available reports. A final Yucca Mountain Review Plan, published in July 2003, organizes these criteria in one document. The final review plan reflects input from the public and has been approved by the Commission.

For more information on NRC's program to review Yucca Mountain, visit us on the Internet at <http://www.nrc.gov/waste/hlw-disposal.html>

Figure 7. Key Technical Issues Fact Sheet, Front and Back Sides

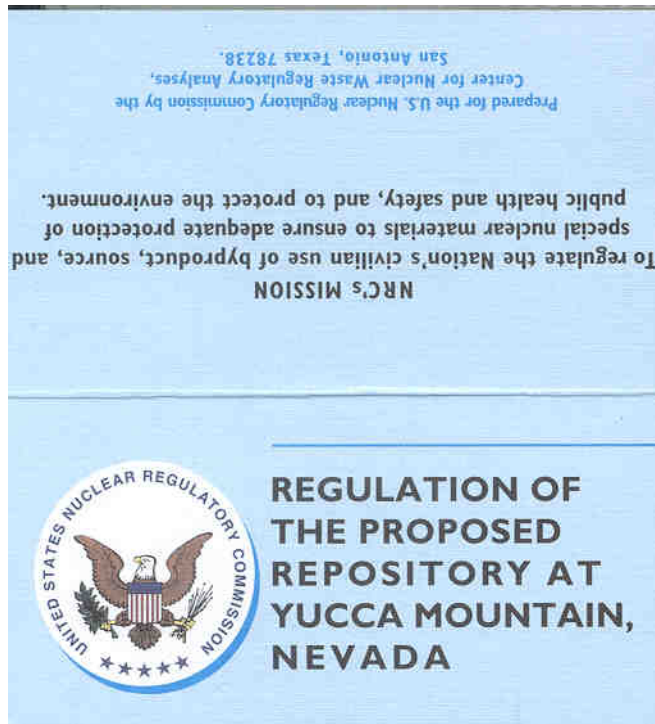


Figure 8. Exterior of the NRC Calling Card. The Card Was Folded in Half to Form a Regular Business Card Sized Handout.

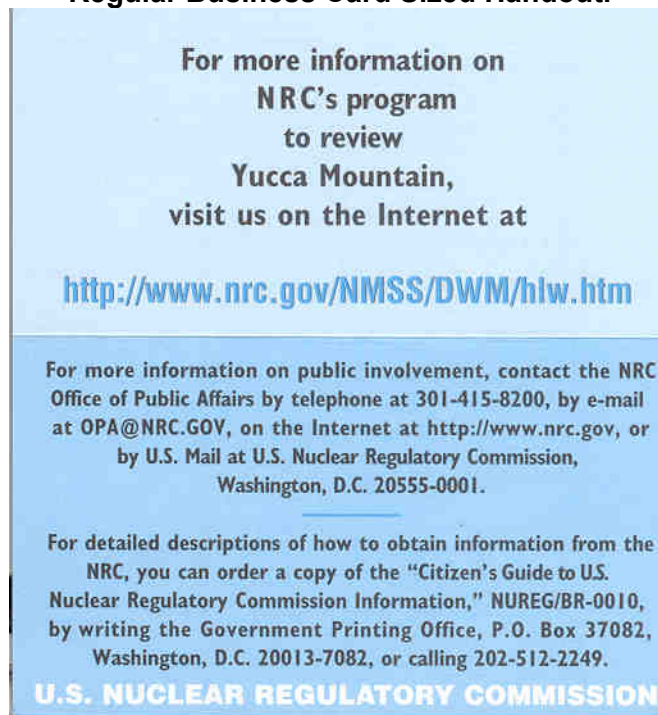


Figure 9. Interior of the NRC Calling Card. The Card Was Folded in Half To Form a Regular Business-Card-Sized Handout.

requirements, what makes a repository safe and postclosure activities. It also included a glossary drawn from the notebooks used for tribal workshops and a postage-paid feedback card. While the brochure was widely distributed and received significant praise from the recipients, none of the feedback cards were returned.

A self-contained computer slide show was another form of media used to convey information about the NRC partnership with CNWRA. The slide show, which ran automatically on a continuous loop, was approximately 8.5 minutes long and had an instrumental soundtrack. The slides presented the CNWRA technical capabilities, including computer modeling, laboratory investigations, field studies, and performance assessment. Each of the nine key technical issues was presented, including appropriate visual representations of experiments or models. The slide show ran during NRC Open House events and the annual reviews at the Center. The slide show highlighted the work that the Center did to support the NRC independent review. The slide show was well received at these events: participants at the meetings stopped to watch the presentation video and made positive comments. The slide show was also intended for use at a kiosk at future conference events, but the opportunity for use in those venues did not arise.

The NRC website served as another form of media for public outreach. Use of this resource was somewhat limited, however, due to heavy administrative constraints on the format and content. Also, because a separate organization controlled updates to the website, public outreach team members could not work on the site themselves. The rigorous approval process requiring multiple levels of authorization also slowed down the process of updating the website, making it difficult to post timely information. Because of these limitations, the website mostly functioned to distribute basic information in the form of text rather than having a variety of pictures, graphics, videos, or interactive tools and was a one-way street with no opportunity for direct user interaction. Feedback on the website has been limited, but much of the feedback has reflected a need for a more user-friendly interface and a less stilted structure.

The public outreach team developed a booth for use at a GSA conference. Booth development was partially motivated by the meeting location (Reno, Nevada) and partially by the audience, as GSA meetings are the largest formal gatherings of geoscientists. NRC and Center staff hosted the booth, talking with hundreds of visitors over several days and distributing copies of the fact sheets and posters. Visitors to the booth included advisory board members, employees of the U.S. Department of Energy, professors, students, and researchers. The booth exhibit contained the large previously developed posters (Figures 10 and 11). The primary messages discussed (i) that, NRC is the independent regulator and (ii) how NRC would evaluate safety through performance assessment. The booth also featured a poster promoting other talks that NRC staff were presenting on Yucca Mountain-related issues at the conference. Feedback on the booth was very positive, and NRC staff members were often asked at subsequent conventions whether they had a booth again.

Lastly, the team developed a three-dimensional (3D) model of a cross section of Yucca Mountain as a visualization tool (Figure 12). The model measured about 3 ft tall, 2 ft across, and 1 ft wide. Representative layers of the underground, including the various layers of tuff, the saturated zone, and the repository horizon, were carefully scaled. A mock drift was added in the center to show placement and also at the side of the model as a cutaway to show placement of the waste packages (Figure 13). To make the model interactive, small light-emitting diode lights and a soundboard were added with prerecorded informational sound bites. If one of the buttons was pushed, a light would come on at the appropriate location and a sound bite describing the feature would play. This model was displayed at public meetings, at



Figure 10. Photo of the Booth at the Geological Society of America Meeting

the On-Site Representatives office and at NRC headquarters. While it proved difficult to transport, it was a useful focal point and received significant attention from viewers.

Most public outreach products were designed for a broad, nontechnical audience. However, a few additional posters and fact sheets were created that targeted a more technically knowledgeable audience. These fact sheets were generally used at conventions, technical exchanges, or visits to the NRC headquarters or On-Site Representatives office. Additionally, the materials developed for the public outreach program gained much wider usage throughout the agency by providing preapproved text and graphics that could be easily copied and pasted into other documents or presentations. Several other forms of media were considered for the public outreach program but were not utilized. First, the team drafted a storyboard concept for computer visualization tool. This visualization tool would have been an animated, narrated video distributable via website or CD-ROM explaining the Yucca Mountain biosphere, the process by which water travels through Yucca Mountain, and how radionuclides might be transported to the surrounding environs. Because of decreased funding, lower time allotments, and other staff commitments, this project was not developed past the initial draft. Another form of media considered but not used was holographic images.



Figure 11. Visitors at the Geological Society of America Booth Talking With NRC and CNWRA Staff

The holograms are visualization tools that could have depicted various aspects of Yucca Mountain, similar to a 3D poster. These tools were not used, primarily because of the prohibitive expense, but also because of the limited portability and use and because additional supporting materials such as posters would also have been required. Lastly, the public outreach staff discussed the use of podcasts and weblogs to distribute information about the Yucca Mountain hearings. Because the hearings never took place, these tools were not developed past the initial brainstorming phase.

Overall, the media used in public outreach have been designed with two major purposes in mind: (i) convey a key idea in a clear, concise way and (ii) create products with a long shelf life that could be usable in a variety of applications, so that a library of resources could be built for future use. This approach was very successful. The simpler and more clear the material, the wider the audience it could serve. Adding additional technical information and complicating layers was not helpful if the message was lost. As the program progressed, fact sheets underwent periodic, minor revisions to ensure currency and accuracy, and a few sheets were closed out, but for the most part the materials produced became a permanent part of the repertoire and the newer material supplemented the older material. Furthermore, this approach helped relieve the stressful schedule often associated with developing new products. Because

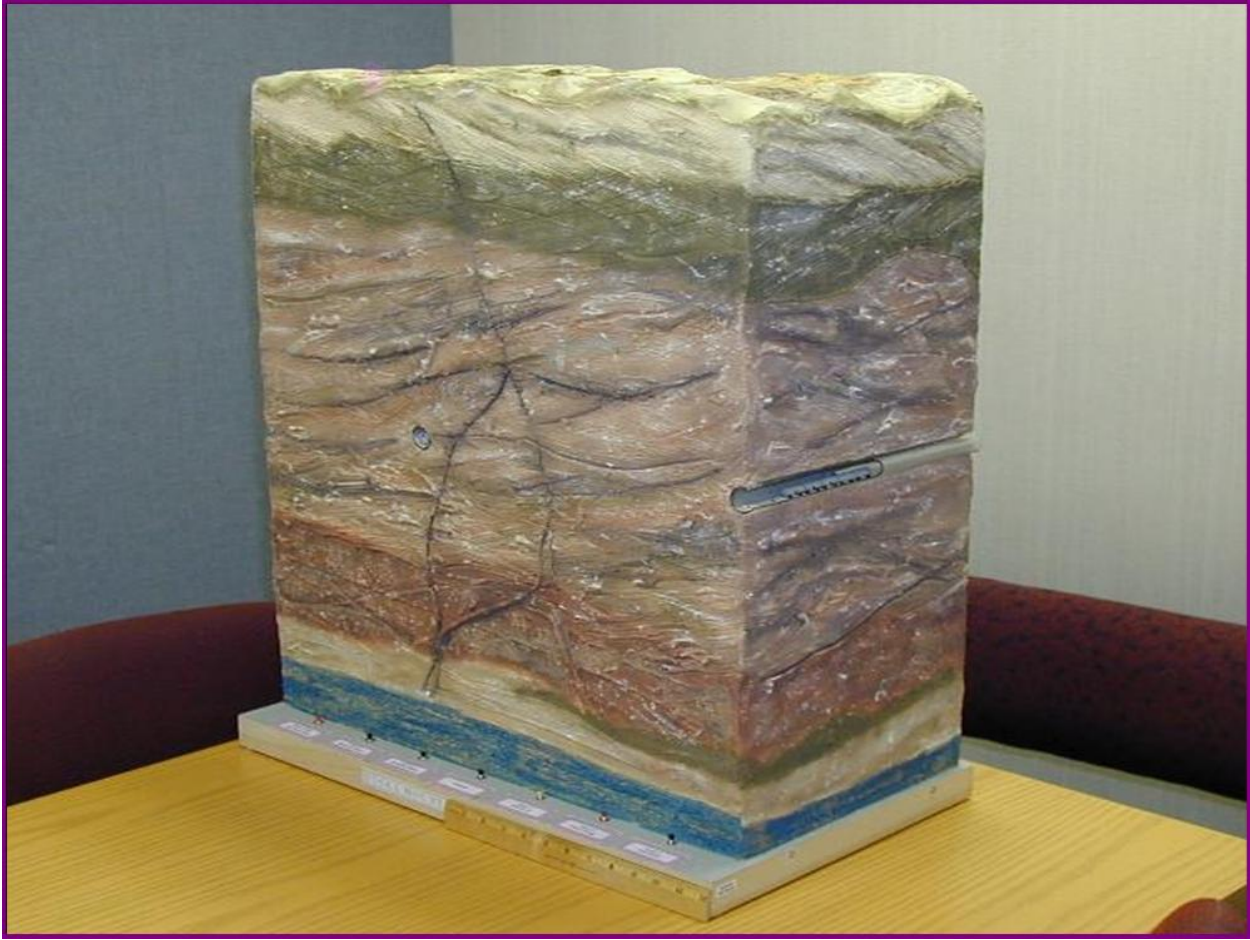


Figure 12. The 3D Model of Yucca Mountain Showing a Cutaway View of the Underground Repository Area

there was often a very short lead time before public meetings or events, new materials had to be developed on a compressed timeline. The short schedule was complicated by the large amount of input required from various offices and all of the public outreach staff working only “part time” on the project while actively engaged in other departments. Early in the program, the staff realized the benefit of having a set of materials that could apply to a wide variety of audiences and that did not expire quickly.

The public outreach staff learned four important lessons that applied to all media types. First, accessibility and portability made media easier to utilize. Keeping a library of presentations, fact sheets, and brochures on hand facilitated quick preparation for meetings or visits. Posters could be posted at sign-in tables, handed out as information sheets, sent as mailers, put into notebooks, or posted on the NRC website. The larger 3D model and booth materials were more difficult to transport and were used less often and with fewer audiences. Second, staff tried to adapt to stakeholder needs rather than expecting the stakeholders to adapt to the agency. While still introducing new materials that conveyed information that the staff deemed important,



Figure 13. A Cutaway Area of a “Drift” on the 3D Model Showing Model Waste Packages and the LED Indicator Lights

media were particularly well received when they were presented as a direct response to stakeholder input because the public and stakeholders felt they were being heard. Third lesson learned was the importance of having a diverse public outreach team. Having a variety of technical and nontechnical backgrounds helped ensure that the materials produced were understandable to the broadest possible audience. The nontechnical team members were most adept at providing a perspective on the transparency of the information and ensuring plain language was used.

Fourth, the development of the media used for public outreach has been a continual and positive learning process for the staff. These tools explain the NRC role at Yucca Mountain for stakeholders and the general public in a clear and transparent way. Feedback on the materials may not necessarily have been verbal or written, but the tools allowed a longer, more focused dialogue with stakeholders that strengthened positive relationships and opened avenues for more effective communication. The experience gained through the public outreach program is not only useful and applicable to future repository programs, but also to other programs throughout NRC.