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United States Government Accountability Office
Washington, DC 20548

January 19, 2007

The Honorable Jon C. Porter
House of Representatives

Subject: *Yucca Mountain Project: Information on Estimated Costs to Respond to Employee E-mails That Raised Questions about Quality Assurance*

Dear Mr. Porter:

In March 2005, the Department of Energy (DOE) reported the discovery of a series of e-mail messages written in the late 1990s by U.S. Geological Survey (USGS) employees working under a contract with DOE on the Yucca Mountain Project. These e-mails alerted DOE that USGS workers may have falsified records for scientific work on the project and may have been disdainful of the project's quality assurance program and its requirements. In March 2006, we reported that DOE was engaged in a detailed review of these and other project e-mails and was reworking technical documents to ensure the credibility of the USGS's scientific analyses, particularly its conclusions on water infiltration.¹ At your request, we undertook follow-on work to determine the estimated costs incurred in DOE's response, which also included additional management and quality assurance training for project personnel. We briefed you and your staff on October 23, 2006, on the results of this work. As you requested, we also briefed you and your staff on the estimated cost of completing the Yucca Mountain Project, based on DOE's new schedule for receiving a license and opening the nuclear waste repository by 2017. Enclosure I provides slides that we used in our briefing to you and your staff.

To respond to your request, we collected data provided by DOE; USGS; the Nuclear Regulatory Commission; the DOE and the Department of the Interior (DOI) offices of the Inspector General, both of whom have examined aspects of these matters; as well as other DOI offices, the Nuclear Waste Technical Review Board, and various contractors working on the Yucca Mountain Project. We also conducted interviews with staff from these organizations. Given the time constraints, we did not independently verify the cost data provided to us. We conducted this work from September 2006 through October 2006 in accordance with generally accepted government auditing standards.

¹GAO, *Yucca Mountain: Quality Assurance at DOE's Planned Nuclear Waste Repository Needs Increased Management Attention*, [GAO-06-313](#), (Washington, D.C.: Mar. 17, 2006).

With respect to the review of project e-mail and other relevant documents to determine the extent and nature of problems similar to those suggested by the USGS e-mails, the agencies estimated that their efforts cost nearly \$4.2 million. The scientific rework related to the USGS water infiltration analysis cost an estimated \$16 million, while additional management and quality assurance training for project personnel cost about \$340,000. All three estimates were for expenditures in fiscal years 2005 and 2006. In fiscal year 2007, DOE plans to spend another \$5.1 million on scientific rework. DOE's preliminary cost estimate to complete and open the repository to begin receiving wastes by 2017 is about \$23 billion (expressed in fiscal year 2006 dollars), \$12.1 billion of which was spent from fiscal year 1983 through fiscal year 2005. DOE expects to revise its cost estimate for completing the project in 2007.

We provided DOE with a draft of this report for review and comments. In its written response, DOE agreed with our overall cost numbers and stated that it expects to provide updated cost estimates for overall program costs in 2007. (See encl. II.) DOE also provided technical comments, which we incorporated as appropriate.

As arranged with your office, unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days from the report date. At that time, we will send copies of this report to interested congressional committees and members, the Secretary of Energy, the Secretary of the Interior, and other interested parties. We will also make copies available to others on request. In addition, this report will be available at no charge on the GAO Web site at <http://www.gao.gov>.

If you or your staff have any questions concerning this report, please contact me at (202) 512-3841 or by e-mail at wellsj@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. Key contributors to this report include Richard Cheston, Raymond Smith, Jon Ludwigson, Lee Carroll, and Kris Massey.

Sincerely yours,



Jim Wells
Director, Natural Resources
and Environment

Enclosures

Yucca Mountain Project: Information on Project Costs

Briefing to the Chairman of the Federal Workforce
and Agency Organization Subcommittee, the
Committee on Government Reform, U.S. House
of Representatives
October 23, 2006

Background

DOE leads federal effort to assess and build a nuclear waste repository at Yucca Mountain in Nevada

In 1982, the Congress passed the Nuclear Waste Policy Act and determined that the United States should build a national nuclear waste repository

In 2002, the Congress approved Yucca Mountain, Nevada as the site for the repository
Department of Energy (DOE) is responsible for assessing the safety and performance of the future repository

- DOE has been conducting scientific studies of the long-term storage of nuclear waste, such as how water moves through the soil, rock, and other layers of the mountain

DOE work at Yucca Mountain uses contractors including

- Bechtel SAIC Company (BSC) and
- U.S. Geological Survey (USGS)

DOE is required to obtain a license from the Nuclear Regulatory Commission (NRC) before starting construction and operating the repository

- DOE is developing the license application, including supporting scientific assessments of long-term repository safety
- NRC is to evaluate the license application and DOE must meet NRC standards
- Nuclear Waste Technical Review Board (NWTRB) reviews scientific basis of repository

Background (cont.)

USGS scientists' e-mails raised concerns about compliance with quality assurance requirements

USGS scientists' e-mails indicated that they may not have adhered to quality assurance requirements

- DOE's announcement in March 2005 of the discovery of e-mails from USGS personnel involved in scientific work developing the water infiltration model for the Yucca Mountain Project (YMP) revealed that these employees may not have complied with quality assurance requirements, including the potential falsification of data
- Agencies reviewed employee e-mails to determine extent and nature of the potential problems

E-mails raised questions about quality assurance associated with the USGS water infiltration model

- Infiltration model simulates the top layer of the mountain and how water moves through that layer
- Infiltration model plays an important role in scientific analysis of how water moves to and through other layers of the mountain (which are simulated using other models), including waste storage tunnels
- Water that reaches the storage areas may affect the integrity of waste packages

Background (cont.)

USGS scientists' e-mails raised concerns about compliance with quality assurance requirements

E-mails resulted in investigations and scientific rework

- DOE initiated a projectwide review of e-mails to determine if the attitudes and behaviors seen in certain USGS employees were seen elsewhere in the project
- DOE is overseeing the process of reperforming the technical work and preparing supporting scientific documentation associated with the infiltration rate estimates
- DOE required staff associated with the YMP to complete training on proper use and handling of e-mails

DOE has delayed its application to the NRC for licensing the Yucca Mountain nuclear waste repository and announced that the projected best available opening date is now expected to be 2017

Objectives

1. Identify the estimated cost of various reviews resulting from the discovery of the USGS emails
2. Identify the estimated cost of reworking scientific research, data, and associated technical documents to ensure that conclusions about water infiltration are correct and supportable
3. Identify the cost of additional management and quality assurance training for project personnel resulting from the discovery of the e-mails
4. Identify the estimated total cost to complete the Yucca Mountain repository based on DOE's new licensing schedule and revised 2017 opening date

Scope and Methodology

Relied on interviews, reports, agency cost estimates

Relied primarily on interviews and review of reports, testimonies, and other documents identified in interviews

Interviews included:

- Senior YMP officials
- Senior NRC officials responsible for monitoring the license application process
- Senior officials from DOE and Department of the Interior (DOI) Inspectors General
- Private contractors that undertook substantial work including, Bechtel SAIC Corporation (BSC) and Booz Allen Hamilton, Inc. (BAH)

Scope and Methodology (cont.)

We relied on interviews, reports, agency cost estimates

Reviewed documents including:

- Reports from YMP
- Reports from Inspectors General
- Prior GAO reports

Reviewed cost estimates provided by:

- DOE (Office of Civilian Radioactive Waste Management, Office of the Inspector General)
- DOI (Office of the Inspector General, USGS, and other offices)
- NRC
- Private contractors working on the YMP

Work completed September through October 2006 according to generally accepted government auditing standards

Limitations

Because of time constraints

- We relied on DOE, DOI, USGS, NRC, and contractor estimates of cost and our review of documents they identified during interviews
- We did not verify agencies' cost estimates
 - In most cases, agencies estimated time and costs incurred
 - *Limited data on actual time and expense*
 - *No specific accounting or budget codes for some work*
 - Estimates may reflect work that otherwise would have occurred
 - We had limited opportunity to independently evaluate whether other activities should be included in the cost estimates

Limitations (cont.)

- We requested that the agencies provide estimates of fully burdened costs (e.g., including salaries, benefits, and overhead), but we did not evaluate or verify their methodologies
 - *Not certain whether agencies' estimates reflected department overhead (e.g., recruitment), imputed costs, or indirect costs (e.g., rent and utilities)*
- Not all agencies were willing or able to provide estimates for all activities
 - *Department of Justice (DOJ), Federal Bureau of Investigation, and USGS*
- We did not evaluate methodology used for selecting and reviewing e-mails
- We did not evaluate decisions, or basis for, scientific rework

Summary

Review of e-mail and other documents to determine extent and nature of problem cost nearly \$4.2 million (fiscal years 2005-2006)

Scientific rework related to USGS infiltration model cost about \$16 million (fiscal years 2005-2006)

Summary (cont.)

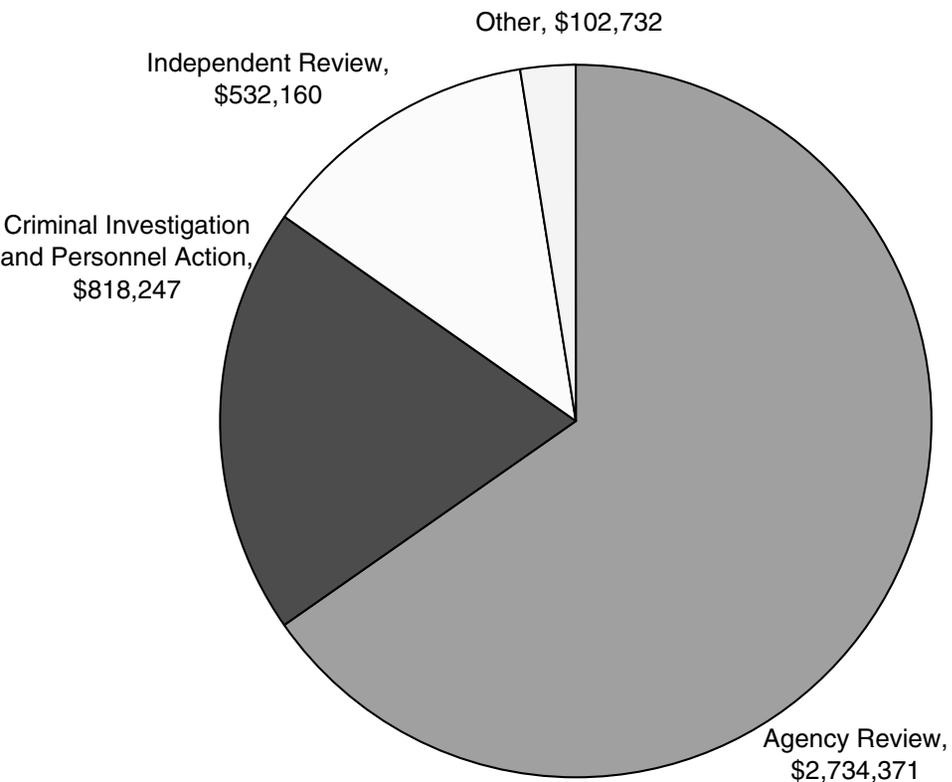
Training and other activities to improve the focus on quality assurance cost about \$340,000 (fiscal years 2005-2006)

Preliminary DOE estimate to meet new licensing schedule and revised opening in 2017 is about \$23 billion (fiscal year 2006 dollars)

- \$12 billion spent from fiscal years 1983 to 2005
- \$11 billion estimated for fiscal years 2006 to 2017
- DOE expects to provide updated estimates in fiscal year 2007

Review of E-mails

In total, reviews and investigations estimated to have cost about \$4.2 million (FY 2005-2006)



Agencies' review of e-mail and other documentation cost about \$2.7 million

Criminal investigation and associated personnel actions cost about \$820,000

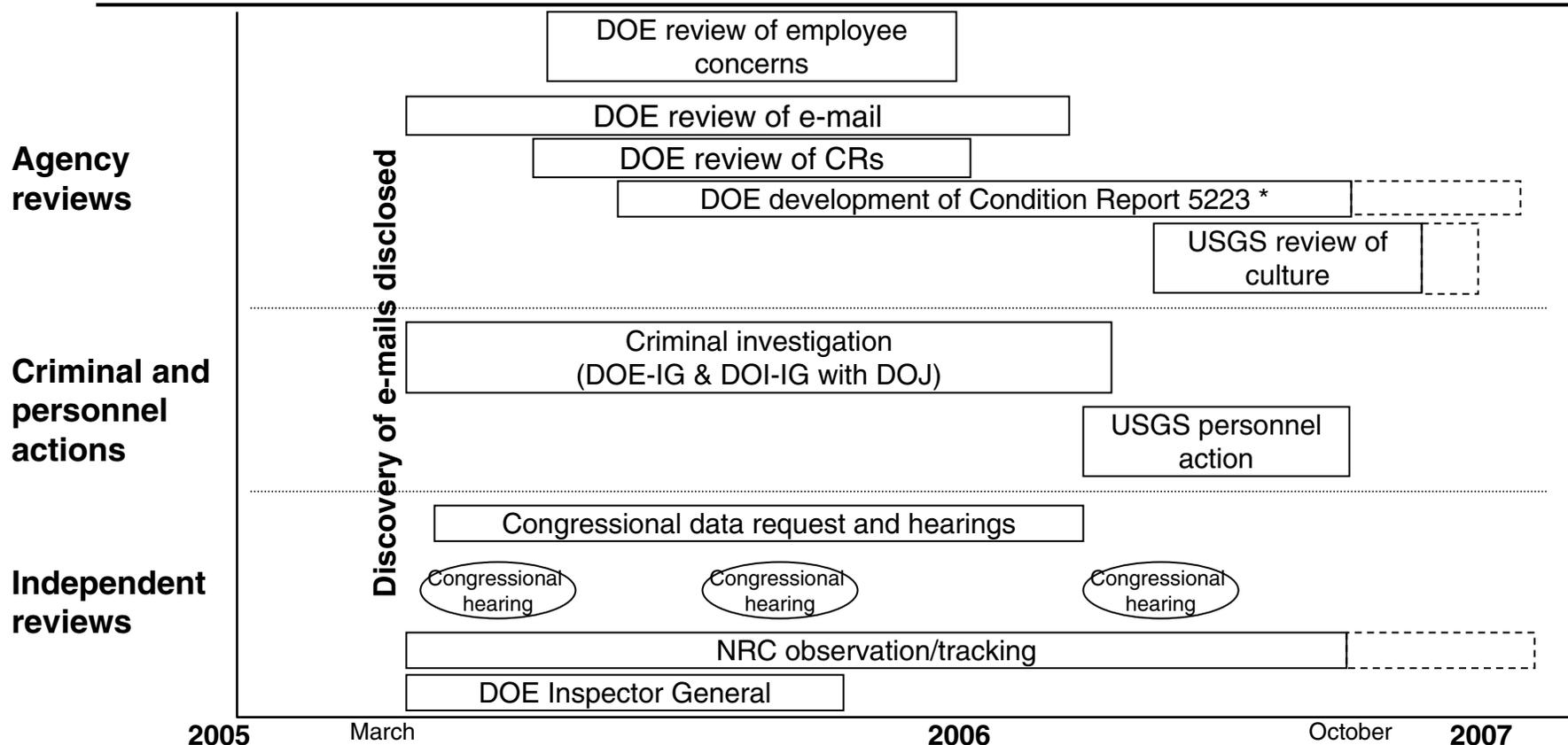
Independent review of agencies' efforts cost about \$530,000

Other efforts, such as responses to media inquiries, cost about \$100,000

Source: GAO analysis of estimates provided by DOE, DOI, USGS and NRC

Review of E-mails

Three categories of actions spanned 2005 through 2007

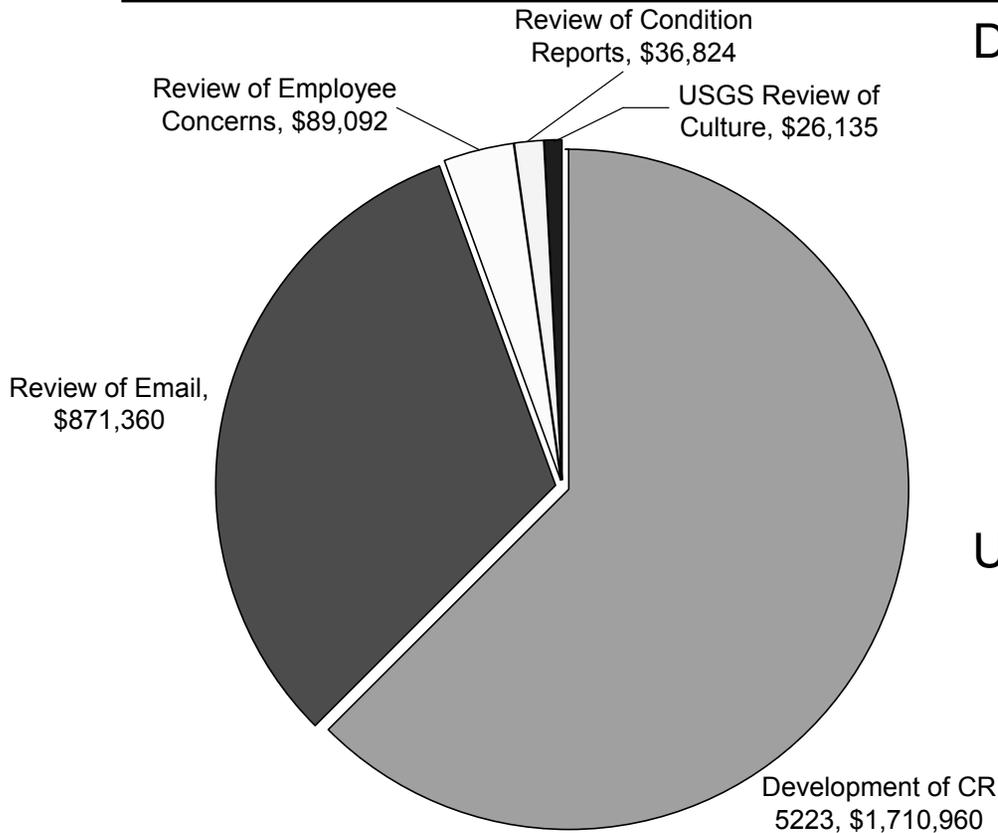


Source: GAO analysis of information provided by DOE, DOI, USGS and NRC

*Issuance of report has been extended to February 2007

Review of E-mails

Agency review processes estimated to have cost about \$2.7 million



Source: GAO analysis of estimates provided by DOE and USGS

DOE

- Preparation of formal Root Cause and Extent of Condition Report (CR) 5223 cost about \$1.7 million
- Review of e-mails cost about \$870,000
- Review of employee concern reports cost about \$89,000
- Review of other condition reports cost about \$37,000

USGS

- USGS is in the process of interviewing employees about workplace culture and attitudes toward quality assurance, which has a cost of about \$26,000

Review of E-mails

DOE conducted three types of e-mail reviews

E-mail review included three broad types of reviews

- Evaluated e-mails identified as “relevant” to license application process
- Evaluated e-mails sent by persons in key positions not identified as relevant (“nonrelevant”)
- Evaluated all e-mails using statistical sampling

959,102 relevant e-mails reviewed two ways

- Randomly sampled and physically read and reviewed
- Keyword search used to identify e-mail content critical of quality assurance and a random sample of those selected for review

About 13 million nonrelevant e-mails reviewed two ways

- 32 of 237 key staff selected and all nonrelevant e-mails randomly sampled and reviewed
- Random sample of all nonrelevant e-mails sent by all 237 key staff reviewed

Population of about 14 million e-mails randomly sampled and reviewed

Review of E-mails

DOE's three types of e-mail reviews examined database of 14 million e-mails and led to seven new issues

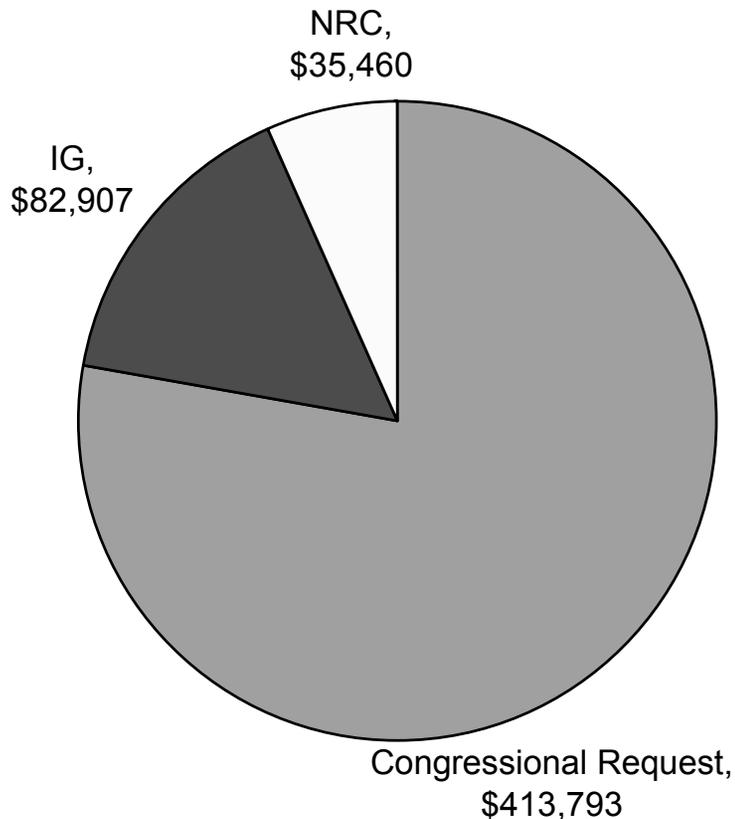
	Universe of e-mails	Population of e-mails sampled	Screening & # identified	Sample read	YMP staff review	Expert review	Disposition
Review of relevant e-mails	About 1 million	959,102 Identified as relevant	N/A	9,000	88	23	<ul style="list-style-type: none"> → No further action: 17 → Covered in existing CR: 6 → New issues or CR: 0
			Keyword search 178,831	20,853	828	179	<ul style="list-style-type: none"> → No further action: 54 → Covered in existing CR: 76 → Referred to employee concerns or litigation: 33 → New issues or CR: 4
Review of nonrelevant e-mails	About 13 million not identified as relevant	237 Key staff 332,447	32 Key staff 69,516 e-mails	695	7	1	<ul style="list-style-type: none"> → No further action: 1 → New issues or CR: 0
				4,500	14	14	<ul style="list-style-type: none"> → No further action: 7 → Covered in existing CR: 4 → Referred to litigation: 2 → New issues or CR: 1
Review of all e-mails	About 14 million	14 million		25,055	198	111	<ul style="list-style-type: none"> → No further action: 96 → Covered in existing CR: 13 → New issues or CR: 2
Totals	About 14 million			60,103^a	1,135	328	<ul style="list-style-type: none"> → No further action: 175 → Covered in existing CR: 99 → Referred for action: 35 → New issues or CR: 7

^aMay include duplicates

Source: GAO analysis of estimates provided by DOE

Review of E-mails

Independent reviews estimated to have cost about \$530,000



Source: GAO analysis of estimates provided by DOE and NRC

Congressional review

- DOE and contractors prepared response to congressional request for documents at a cost of about \$414,000

DOE-IG review

- DOE-IG evaluated the adequacy of DOE's process for reviewing e-mails to identify conditions adverse to quality at a cost of about \$83,000

NRC review

- NRC evaluated the potential impact of e-mail reviews on NRC review activities at a cost of about \$35,000

Review of E-mails

DOE-IG report on e-mail review (DOE/IG-0708) recommended broader e-mail review and need to address issues raised in e-mails

Effort

- Interviewed YMP staff and contractors
- Reviewed project documentation
- Independently reviewed e-mails

Found

- The Archival E-mail Review Team identified and entered no conditions adverse to quality into the project Corrective Action Program as required during the process of identifying e-mails as relevant for inclusion in the Licensing Support Network
- DOE-IG review uncovered e-mails potentially adverse to quality that had not been identified by prior reviews

Recommended

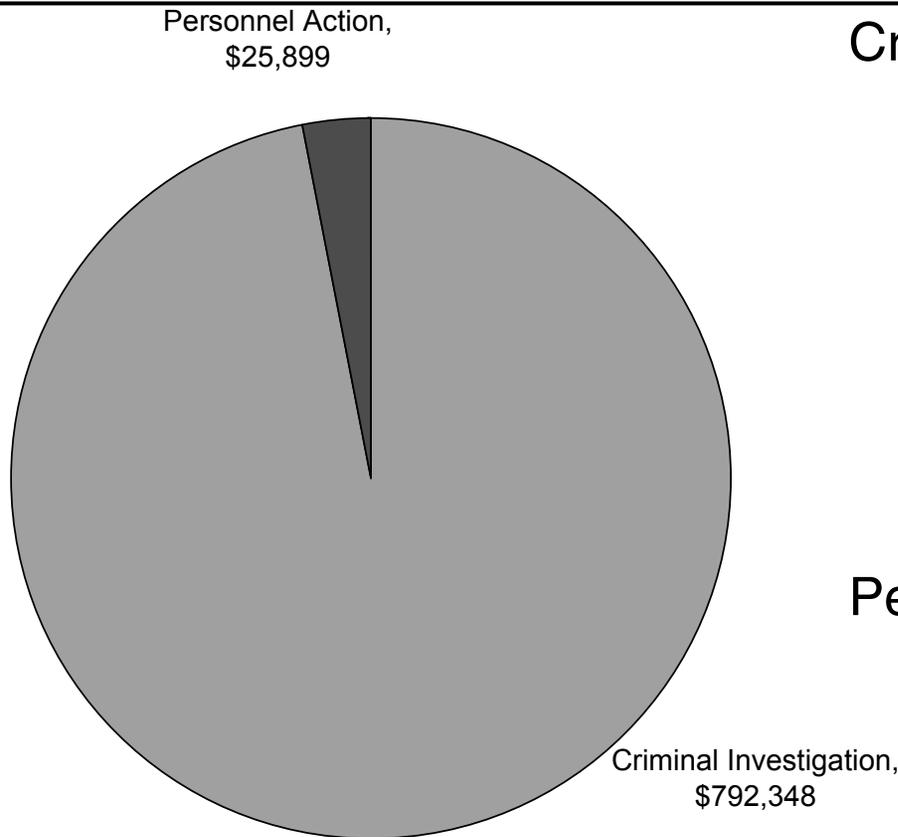
- Expand review of e-mails to include all e-mails
- Ensure that current and future e-mails potentially adverse to quality are addressed
- Ensure YMP personnel are instructed in the appropriate application of the Corrective Action Program

Cost

- 5 field staff at 1,196 staff hours
- \$82,907 estimated cost

Review of E-mails

Criminal investigation and personnel actions estimated to have cost about \$820,000



Criminal investigation

- DOE and DOI conducted a joint criminal investigation (involving DOE-IG and DOI-IG) of allegations that USGS employees may have falsified data and quality assurance records at a cost of about \$792,000
- DOJ participated in the criminal investigation and evaluated the extent to which prosecutorial action should take place but did not provide costs

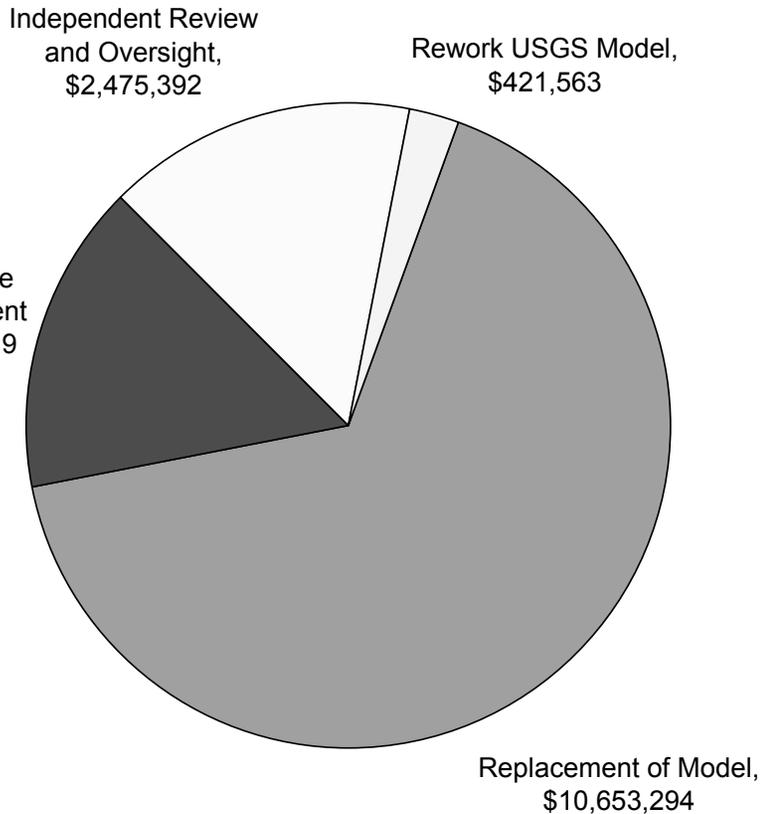
Personnel action

- USGS evaluated extent to which personnel action should be taken at a cost of about \$26,000

Source: GAO analysis of estimates provided by DOE, DOI, and USGS

Scientific Rework

Scientific rework estimated to cost over \$16 million (FY 2005-2006), with an additional \$5.1 million planned (FY 2007)



Replacing the USGS water infiltration model with a new model developed by Sandia National Laboratory (SNL) cost about \$10.7 million

Independent review and oversight cost about \$2.5 million

- Idaho National Lab (INL)
- NWTRB Oversight
- NRC Observation

Assessing and revising models that depend on the water infiltration model cost about \$2.5 million

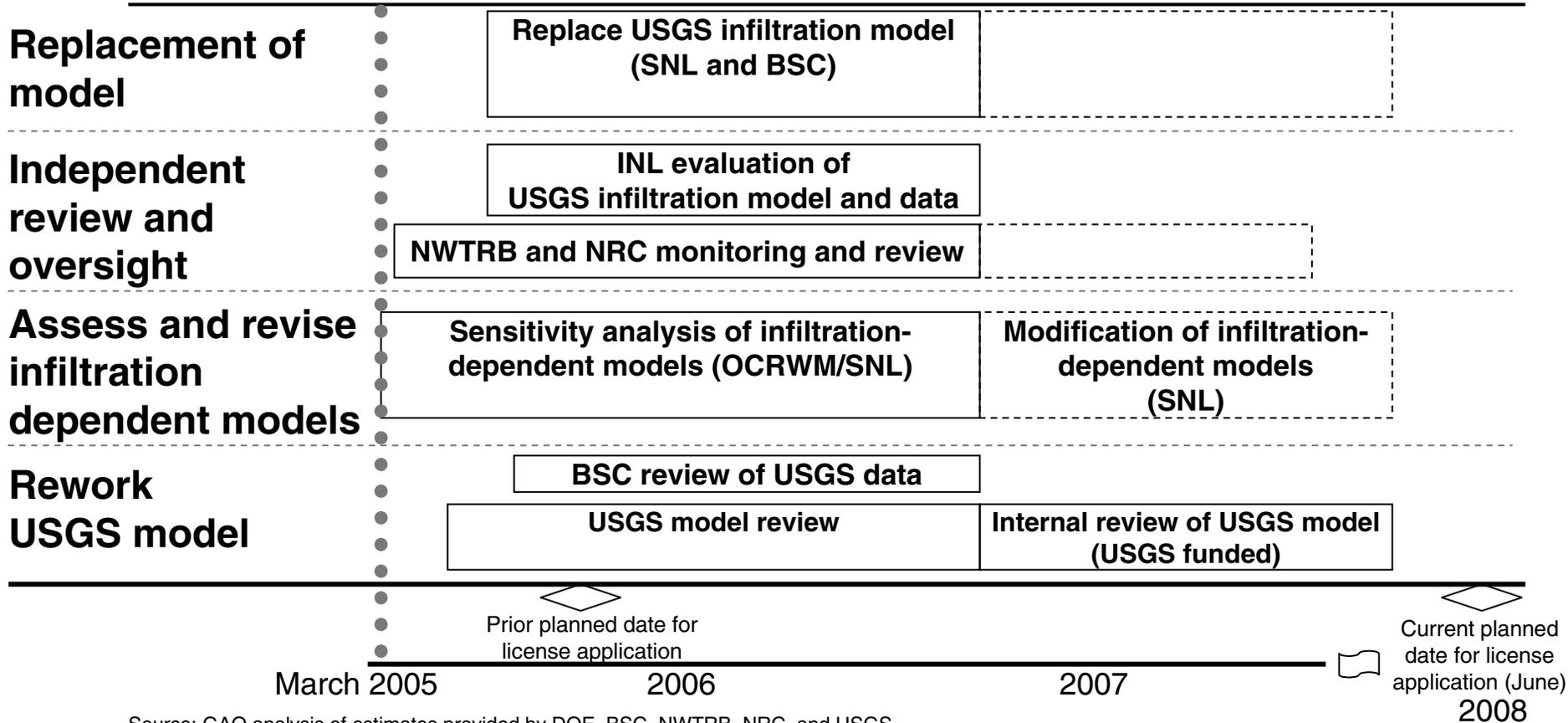
Initial effort to rework the USGS model cost about \$420,000

At least \$5.1 million in additional spending planned for fiscal year 2007

Source: GAO analysis of estimates provided by DOE, USGS, NRC, and NWTRB

Scientific Rework

Four broad categories of scientific rework span fiscal years 2005-2006, additional work expected in fiscal year 2007

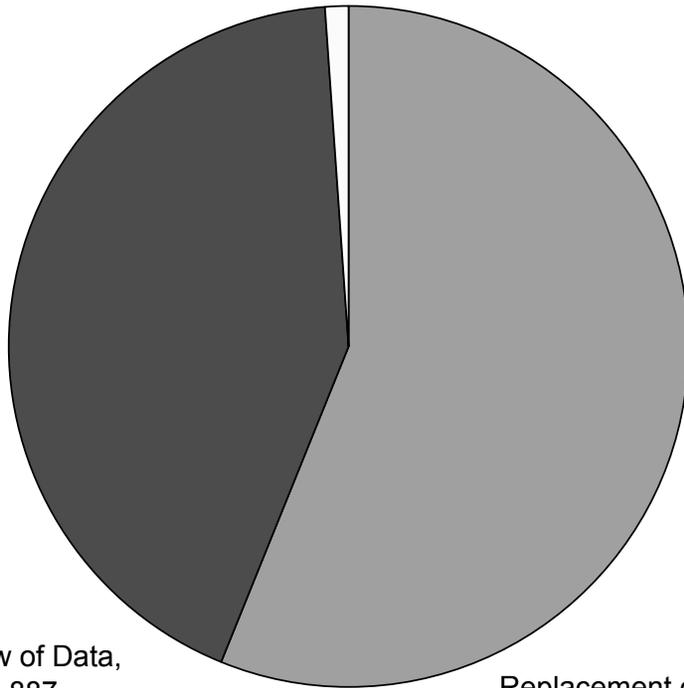


Source: GAO analysis of estimates provided by DOE, BSC, NWTRB, NRC, and USGS

Scientific Rework

Replacing original infiltration model estimated to cost about \$10.7 million (FY 2005-2006) with another \$2.2 million planned (FY 2007)

DOE Technical Project
Management, \$117,210



Replacement of Model,
\$5,989,197

BSC Review of Data,
\$4,546,887

SNL is replacing the USGS model

BSC is reviewing and revising original USGS data for use in the new SNL model

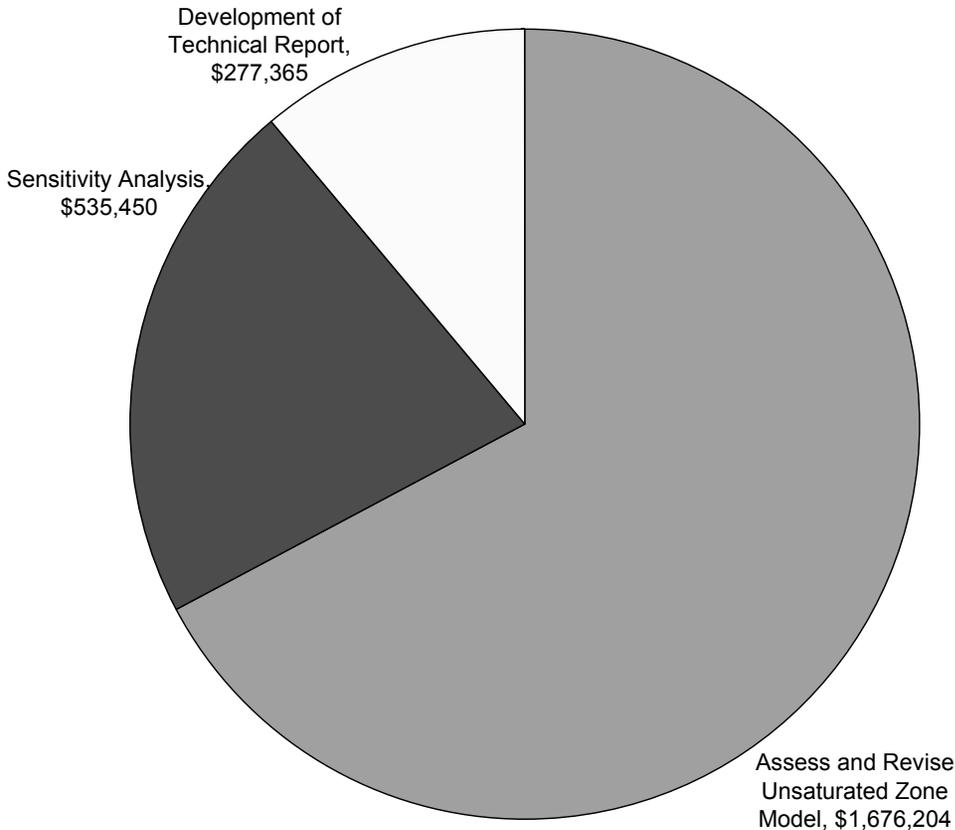
DOE is overseeing the replacement

DOE expects to spend almost \$2.2 million in fiscal year 2007 to complete new model

Source: GAO analysis of estimates provided by DOE, BSC, and SNL

Scientific Rework

Assessing and revising other models estimated to cost about \$2.5 million (FY 2005-2006), with at least \$2.9 million planned (FY 2007)



Assessing and revising unsaturated zone model cost about \$1.7 million

Initial sensitivity analysis of other models cost about \$535,000

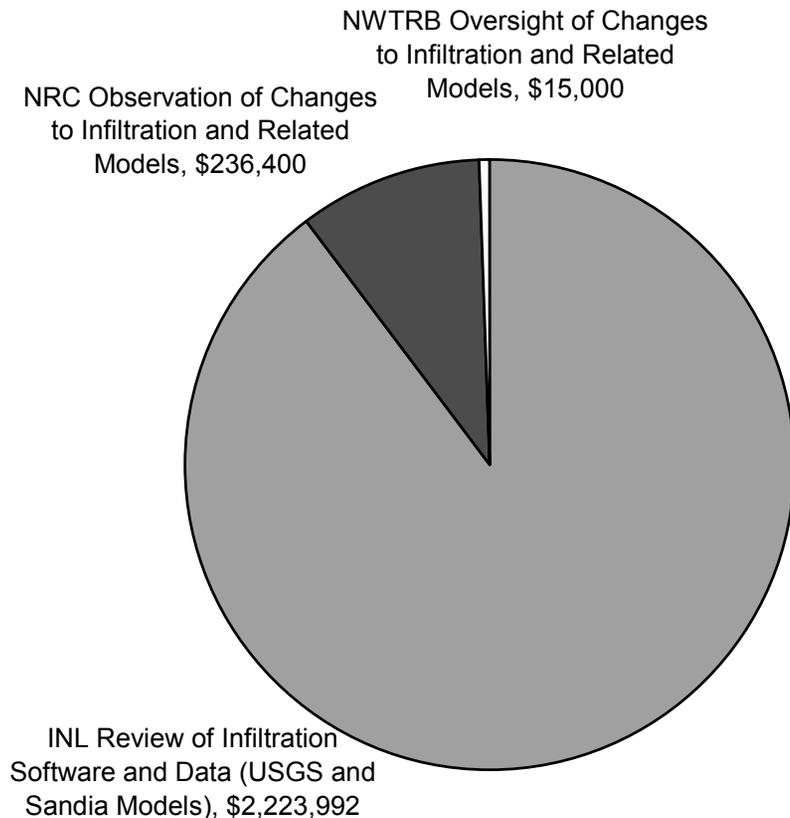
Developing technical report on the implications of changes in the infiltration model on other models cost about \$280,000

DOE expects to spend about \$2.9 million in fiscal year 2007 to finish assessing and revising models dependent on the new infiltration model

Source: GAO analysis of estimates provided by DOE

Scientific Rework

Independent review and oversight estimated to cost about \$2.5 million (FY 2005-2006)



INL review of software cost about \$2.2 million

NRC observation and monitoring cost about \$236,400

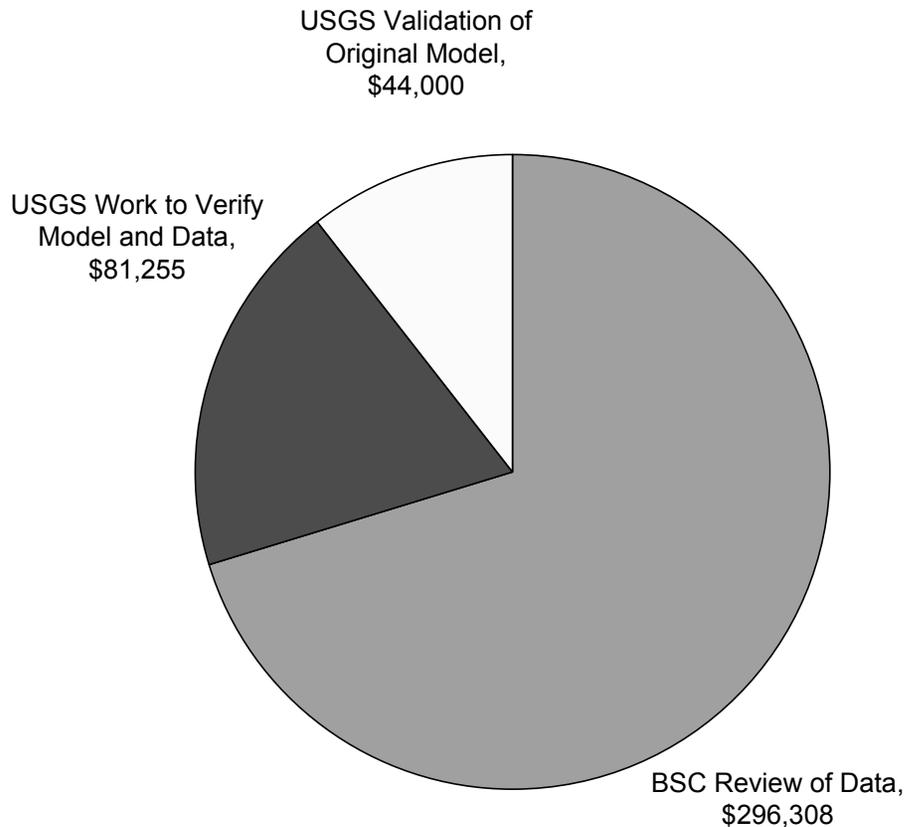
NWTRB monitoring and evaluation cost about \$15,000

NWTRB and the NRC expect to spend additional money in fiscal year 2007 (no estimate)

Source: GAO analysis of estimates provided by INL, NRC, and NWTRB

Scientific Rework

Rework of original USGS infiltration model cost about \$420,000
(FY 2005-2006)



BSC investigation of model and underlying data cost about \$300,000

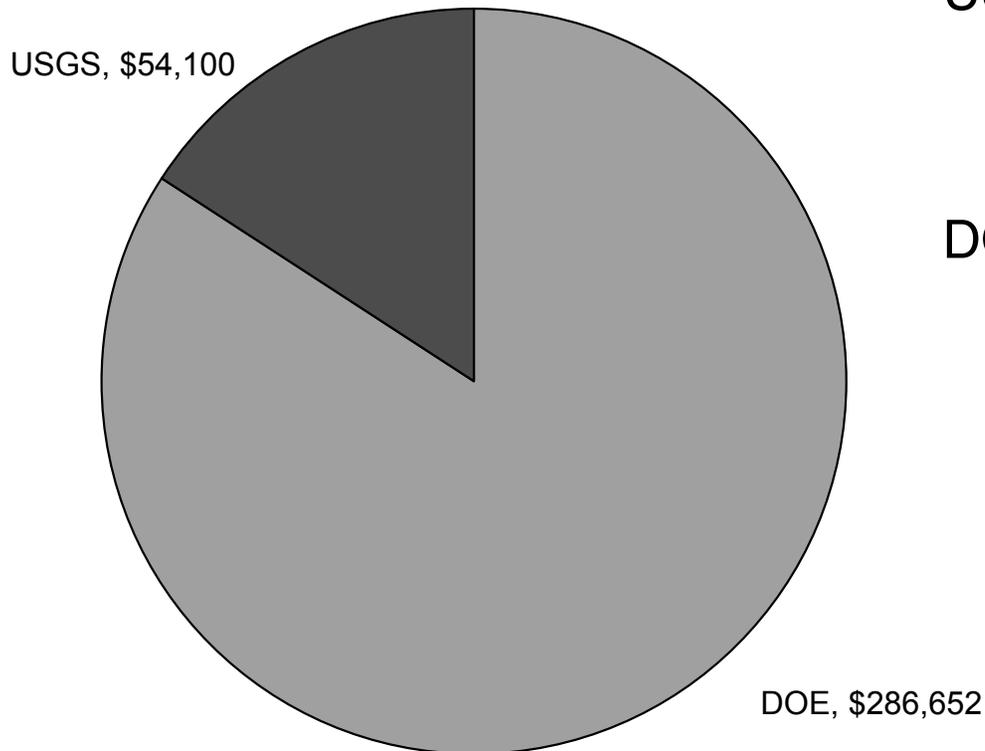
USGS effort to verify original infiltration model and supporting data cost about \$81,000

USGS validation of the original model for its own use cost about \$44,000

Source: GAO analysis of estimates provided by BSC and USGS

Additional Training Costs

DOE and USGS spent about \$340,000 (FY 2005-2006)



USGS

- One-day seminar on quality assurance cost about \$54,000

DOE

- Communication with all YMP employees regarding proper handling of e-mails cost about \$76,000
- Development of e-mail template and training on how to use it cost about \$210,000

Source: GAO analysis of estimates provided by DOE and USGS

Total Estimated Cost of Project

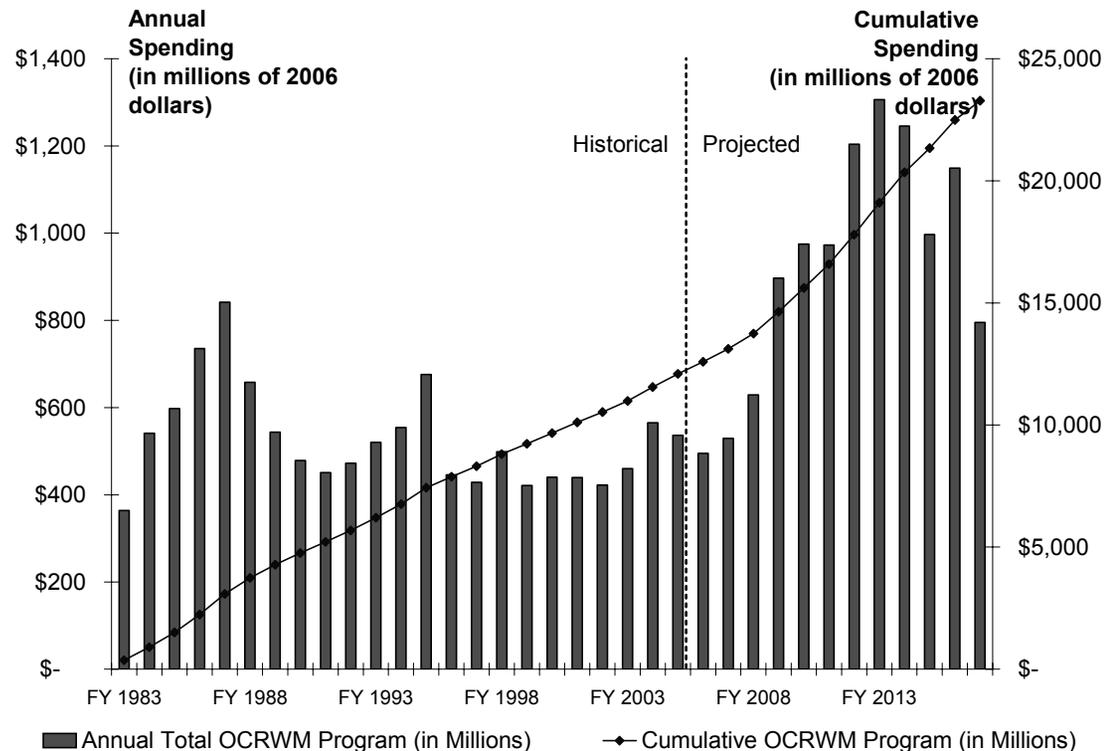
DOE's best current estimate to complete Yucca Mountain with a 2017 opening date is about \$23 billion (FY 2006 dollars)

Historical cost, FY 1983-2005: \$12.1 billion (in FY 2006 dollars)

Estimated future cost, FY 2006-2017: \$11.2 billion (in FY 2006 dollars)

DOE plans to release updated estimates in 2007

- Cash flow analysis expected mid-to-late November 2006
- Integrated project plan expected early 2007
- Life-cycle cost analysis expected early to mid-2007



Source: GAO analysis of data and estimates provided by DOE

Comments from the Department of Energy



Department of Energy

Washington, DC 20585

JAN 11 2007

Mr. Raymond Smith
Assistant Director
National Resources and Environment
Government Accountability Office
Washington, DC 20548

Dear Mr. Smith:

The Department of Energy (DOE) Office of Civilian Radioactive Waste Management (OCRWM) has received and reviewed the presentation materials, entitled *Yucca Mountain Project: Information on Estimated Costs to Respond to Employee Emails that Raised Questions about Quality Assurance* (GAO-07-297R), which you prepared for Representative Porter and subsequently forwarded to DOE on December 18, 2006. We have verified that the overall cost numbers you have reported are consistent with the data DOE previously provided when members of our staffs worked together in October 2006.

DOE expects to provide updated cost estimates for the overall program costs in 2007.

I appreciate the opportunity to review these presentation materials and provide comments which we believe will clarify or correct points of information for your final report.

Thank you for the opportunity to provide comments.

Sincerely,

A handwritten signature in black ink, appearing to read "E. Sproat, III".

Edward F. Sproat, III, Director
Office of Civilian Radioactive
Waste Management

Enclosure



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