

U.S. Department of Energy  
Office of Environmental Management

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**GAO Computer Modeling Recommendations**  
**EM Response**  
**EM Path Forward**

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Office of Standards and Quality Assurance

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# GAO-11-143

## DOE Needs a Comprehensive Strategy and Guidance on Computer Models that Support Environmental Cleanup Decisions

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- **GAO Issues Defined through stated Statement of Facts:**
  - **Requirements, Oversight, Management of Computer Models**
    - DOE policies and standards do not specifically provide guidance on ensuring the quality of the computer models used in cleanup decisions. (86)
    - DOE policy requires DOE officials to oversee contractors' development and use of cleanup models and the models' associated software by performing periodic assessments. (84)
    - DOE's Office of Environmental Management lacks overarching guidance for managing its cleanup models. (126)
    - According to a DOE official, the Office of Environmental Management does not have a central coordination point for modeling. (147)
  - Note: EM did not agree with these statement of facts.



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- **Recommendations:**

1. Clarify specific quality assurance requirements for computer models used to analyze the potential effectiveness of cleanup alternatives, assess the performance of selected cleanup activities, and assist in planning and budgeting cleanups.
2. Ensure that the models are assessed for compliance with these requirements.
3. Develop a comprehensive strategy and guidance for the management of computer models to promote consistency, reduce duplication, and ensure sharing of lessons learned.



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- **Logic of EM's Response:**

- EM is compliant with DOE directives specific to the acquisition and development of software including computer models:
  - DOE requirements address software and include Rules and Orders supplemented with Guidance.
  - DOE requirements and guidance are based on industry consensus standards and best practices.
  - A DOE contractor selects a consensus standard to supplement DOE requirements.
  - DOE verifies compliance to requirements through oversight.
  - DOE manages software through the Capital Planning and Investment Process.



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## Requirement Specifics

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- **Location of DOE/EM Software Requirements**
  - Laws
    - DOE 10 CFR 830 Subpart A, *Quality Assurance Requirements*
    - EPA 40 CFR 194.23, *Models and Computer Codes*
  - DOE Orders and Requirements
    - DOE O 414.1C/D, *Quality Assurance*
    - DOE O 200.1A, *Information Technology Management*



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# Requirements Specifics - continued

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- **10 CFR 830 (Energy)**

- Applies to safety of DOE nuclear facilities
- Contains general high-level requirements
- Supplemented by consensus standard
- Applies SQA requirements through common definition of component, module, product, system, unit, and support system
- Enforceable by law



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# Requirements Specifics - continued

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- **40 CFR 194 (Environmental)**

- Applies to waste characterization, environmental monitoring, sampling and analysis activities.
- Requires computer codes to meet requirements in NQA-2a-1990 SP 2.7 (predecessor to NQA-1 SP 2.7).
- Requires description of theoretical basis of model, description of the structure of the computer code, data collection procedures, peer reviews, and user instructions.



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# Requirements Specifics - continued

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- **DOE O 414.1C**

- Is the entry point for general SQA requirements
- Contains high-level requirements
- Applies to all work performed by DOE and its contractors
- Supplemented by other DOE and industry lower-level requirements
- Lower-level requirements, guidance, and/or company procedures are a necessity for implementation



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# Requirements Specifics - continued

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- **DOE O 414.1C (continued)**

- Contractor Requirements Document Sections 2, 3, and 5 apply to software.
- Section 2 requires application of a graded approach, selection of consensus standard, applying activity-specific standards, integration of requirements, and guidance usage.
- Section 3 provides the specific criteria (i.e., the 10 criteria) that must be applied to software.
  - Software is an “item”
  - Software acquisition, development, configuration, etc. are “work”
- Section 5 applies to a subset of software: safety software.



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# Requirements Specifics - continued

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- **DOE O 414.1C** (continued)
  - All contractual requirements must be integrated.
  - DOE O 414.1C states:  
...includes a requirement to *integrate multiple QAP drivers* imposed by QA regulations... [i.e., NRC, EPA].
    - Where a work activity, process or item is specifically identified as within the scope of a QA regulation, that regulation prevails.
    - In the event of a conflict between this Order and any QA regulation, the regulation prevails.

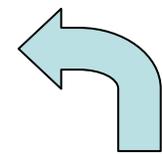
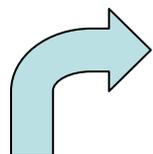


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# Requirements Specifics - continued

- EM Corporate Quality Assurance Program



**code of federal regulations**

10 CFR 830 Subpart A

**Management Expectations**

**1.0 PURPOSE AND OBJECTIVE**  
 The purpose of this document is to describe the U.S. Department of Energy (DOE), Office of Environmental Management (EM) Quality Assurance Program (QAP). The QAP is the EM management system to ensure we "do work correctly." The QAP meets the requirements of DOE O 414.1C, *Quality Assurance*, and 10 CFR 830 Subpart A "Quality Assurance Requirements." It is intended that the requirements of DOE O 414.1C and 10 CFR 830 Subpart A are met by implementing this QAP. The QAP provides EM expectations for implementing quality assurance (QA) across the EM complex. The QAP demonstrates how QA and the Integrated Safety Management System (ISMS) are fully integrated in EM.

The objective of this QAP is to provide consistent QA implementation across EM while allowing both for grading based on importance to the EM mission and safety, and for site-specific requirements to be addressed (e.g., DOE/RW-0333P, *Quality Assurance Requirements and Description*; Environmental Protection Agency [EPA] requirements; state permit requirements; etc.).

**2.0 SCOPE**  
 The requirements of the QAP are applied in a graded fashion commensurate with the type of work being performed and the importance of the work contributing to safe completion of the EM mission. EM expects applicable requirements will be passed down to subcontractors.

**3.0 APPLICABILITY**  
 The requirements contained within this document apply to EM Headquarters (HQ), EM Field/Project Offices, and EM contractors as applicable to the work being performed by each entity. Each organization will have an organizational-specific Quality Assurance Implementation Plan (QIP) describing how the applicable requirements of this QAP are implemented and/or passed down to lower-tier organizations. This requirement does not alter a contractor's legal obligation to comply with 10 CFR 830 or other regulations

ASME NQA-1-2008  
Revision of ASME NQA-1-2000

**Quality Assurance Requirements for Nuclear Facility Applications**

AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers

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**DOE O 414.1C**

# Requirements Specifics - continued

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- **Use of Consensus Industry Standards**

- DOE O 414.1C requires the use of consensus standards to implement requirements.
- Examples include:
  - ASME NQA-1-2000, *Quality Assurance Requirements for Nuclear Facility Applications* (for nuclear-related activities)
  - ANSI/ISO/ASQ Q 9001-2000, *Quality Management System: Requirements* (for nonnuclear activities)
  - ANSI/ASQ Z 1.13, *Quality Guidelines for Research*, 1999 (for nonnuclear research activities)
  - DOE-RW-0333P, *Quality Assurance Requirements and Description*, Office of Civilian Radioactive Waste Management Program



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# Requirements Specifics - continued

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- **Available Guidance for Software Modeling**
  - DOE's and EM's primary guide for software quality assurance is DOE G 414.1-4.
    - Addresses a subset of software related to safety that requires rigorous software acquisition and development practices.
    - Can be applied to mission critical software, process modeling and software used to support a variety of applications.
    - Identifies in detail the software work practices and provides one acceptable approach for grading those practices.



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# Requirements Specifics - continued

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- **Contractor Implementation of Requirements**
  - Each contractor develops and implements policies and procedures to meet EM's requirements based upon contractual agreements.
  - Contractors must select and use one or more consensus standards to supplement EM's corporate quality requirements.
  - DOE and EM allows flexibility in the selection of consensus standards.
  - EM verifies compliance via audits, reviews, and surveillances.



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- **EM Path Forward: Recommendation 1:**
  - EM to coordinate with additional program offices within the Department because EM it is not charged with writing software quality assurance policy.
    - Office of Corporate Information Technology (CIO): Ensure IT project management requirements are clear.
    - Office of Health Safety and Security (HSS): Ensure software QA policy/guidance is clear.
  - Make needed changes to EM Corporate QA and IT program as necessary.



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- **EM Path Forward: Recommendation 2:**
  - EM will ensure working with the HSS and the CIO that computer models developed in the field and at EM Headquarters comply with the directives of DOE, and relevant national consensus standards.
  - EM will review and, where needed, develop additional software quality assurance oversight criteria to ensure computer models that have been or are to be developed within EM comply with Departmental directives and are implemented appropriately at all DOE EM facilities.



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- **EM Path Forward: Recommendation 3:**
  - EM will ensure that every computer modeling IT investment is documented through the OMB-required Capital Planning and Investment Control process across the EM complex.
  - EM will conduct a survey to ensure that all IT investments are captured.
  - EM will also process the current slate of computer models through its IT Governance process with the goal of streamlining, where appropriate, by December 30, 2011.



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# In Summary

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- EM concurred with all the GAO recommendations however with significant comments.
- EM stated to the GAO that it is in full compliance with Departmental directives.
- EM will work with HSS and the CIO to develop the path forward and any necessary additional Departmental directives.
- EM expects any additional directives will be approved and implemented Department-wide.
- EM will make any necessary changes to its corporate quality program to continue to remain in compliance with Departmental directives.



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