

U.S. Department of Energy
Office of Civilian Radioactive Waste Management

Software Qualification Status and Software Issues

Presented to:
DOE/NRC Quarterly QA Meeting

Presented by:
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June 13, 2001

**YUCCA
MOUNTAIN
PROJECT**

Legacy 10000-701

Software Qualification Goal

- **The original goal was to qualify at least 80% of software used in the PMRs and their supporting AMRs at the time Rev 1 of the PMRs was submitted to DOE.**
- **The goal was met for Rev 0 PMRs (and ICN updates) as well as supporting AMRs for TSPA-SR, Rev 0, ICN 1**

Presentation Organization

- **Current status of software qualification**
- **Software issues arising recently and in the past**

Software Status Topics

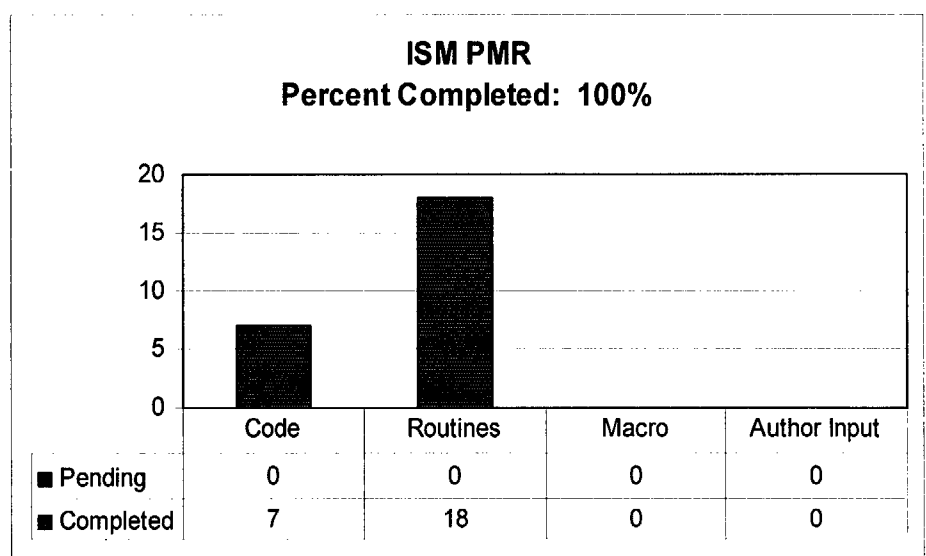
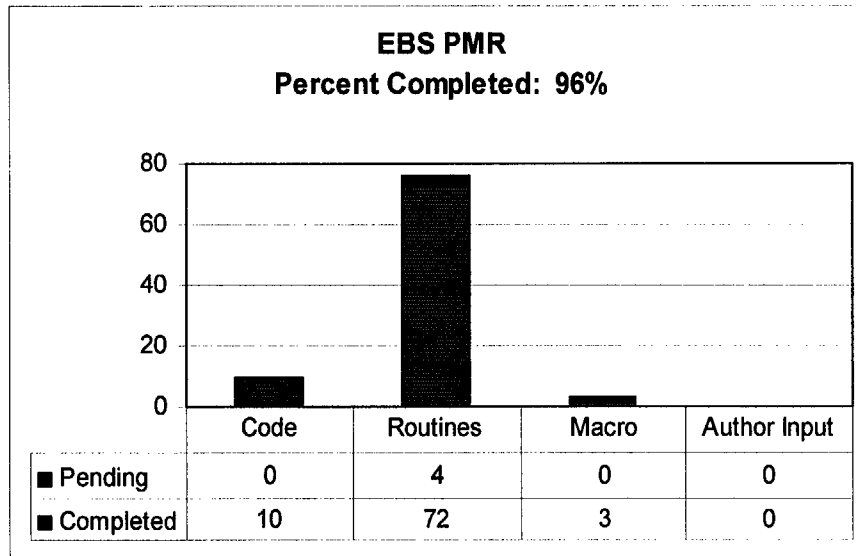
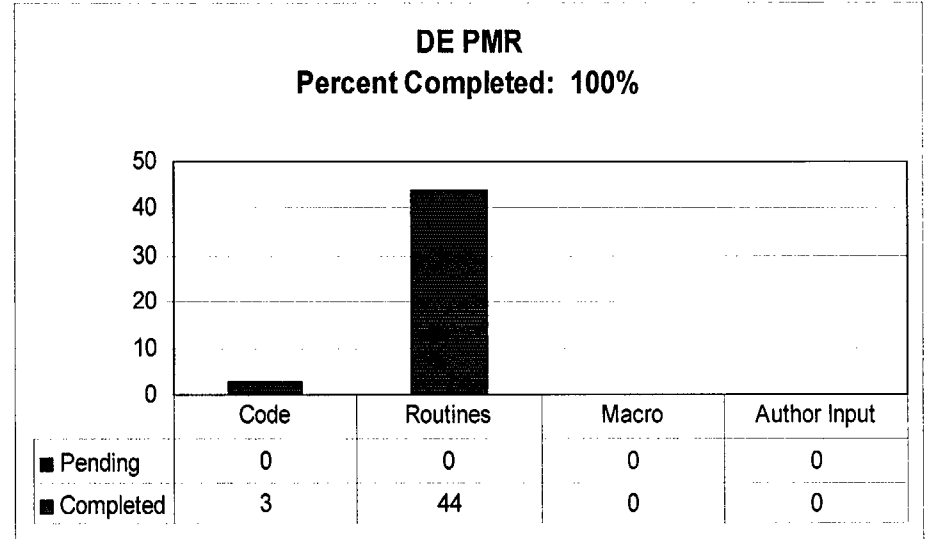
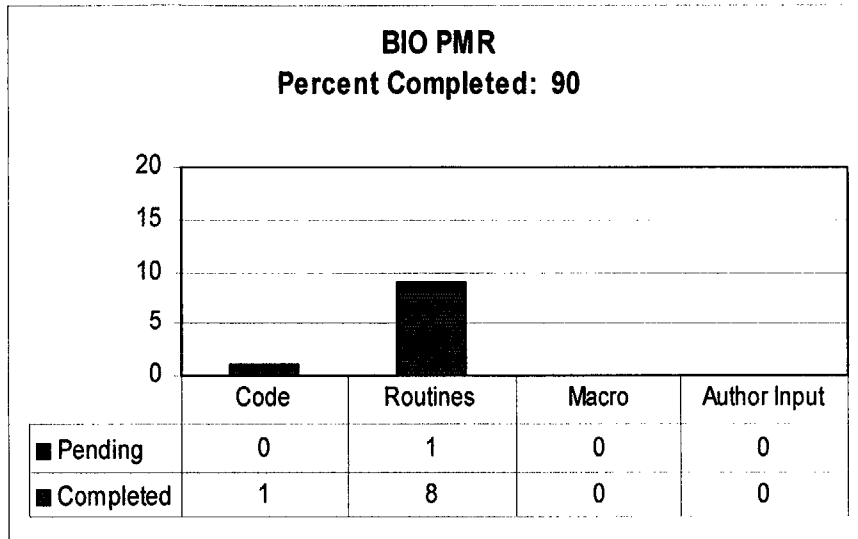
- **Software Qualification Applicability**
 - **Software supporting PMRs and related AMRs for TSPA-SR**
- **Software Qualification Percentage by PMR**
- **Software Qualified by PMR**
- **Unique Unqualified Software Codes**
- **LMVO-00-D-039 on Software Routines**

Software Qualification Percent By PMR and Associated AMRs

- BIO 90%
- DE 100%
- EBS 96%
- ISM 100%
- NFE 99%
- SZ 89%
- UZ 98%
- WF 100%
- WP 100%

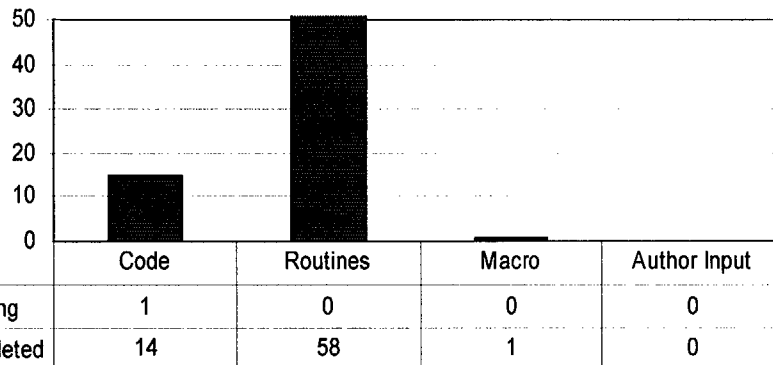
Note: The number of software packages varies as analyses mature and are revised.

Software Qualified by PMR

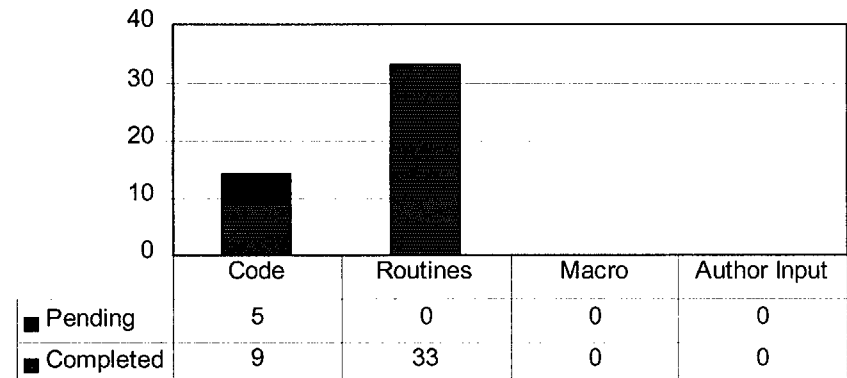


Software Qualified by PMR (Continued)

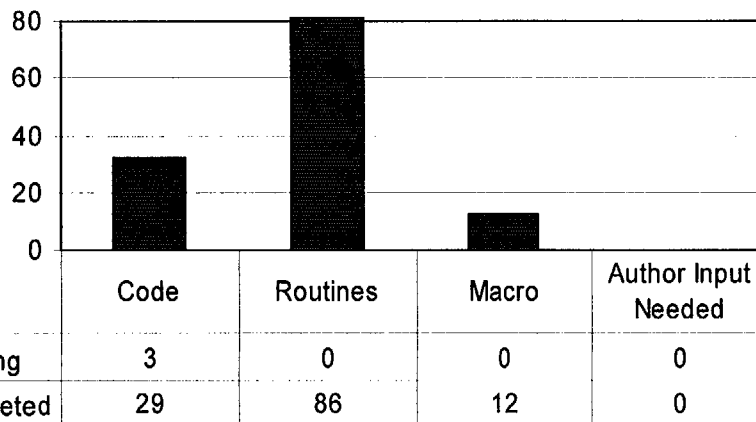
NFE PMR
Percent Completed: 99%



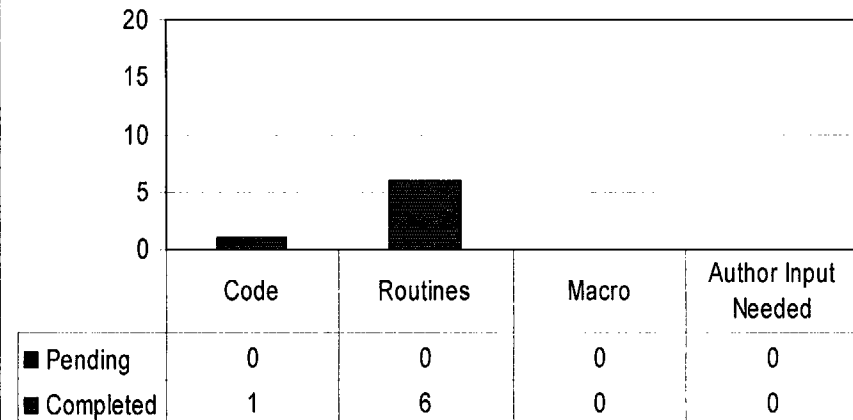
SZ PMR
Percent Completed: 89%



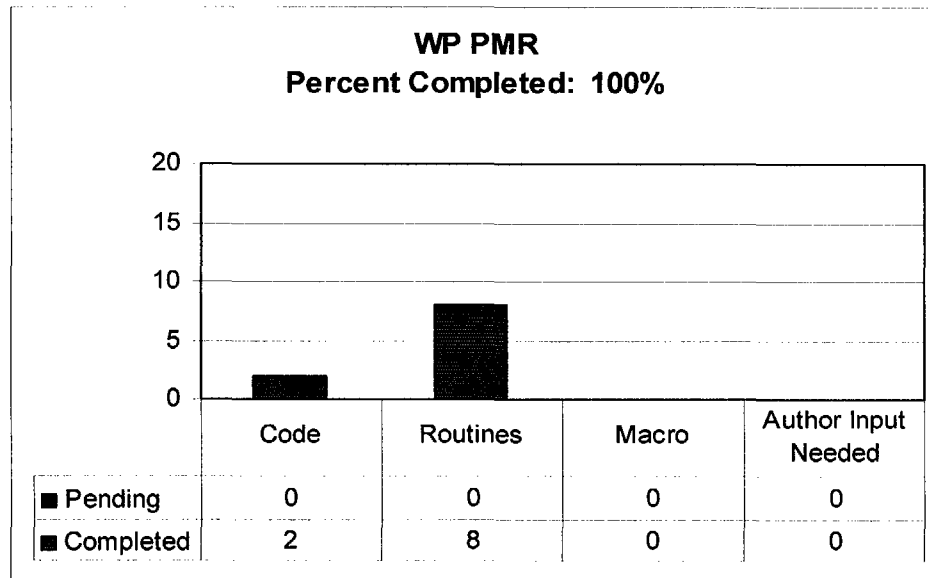
UZ PMR
Percent Completed: 98%



WF PMR
Percent Completed: 100%



Software Qualified by PMR (Continued)



TSPA?

Unique Unqualified Software Codes

- There are currently fourteen codes being managed in accordance with AP-SI.1Q Revision 3, Section 5.10 “Interim Use of Unqualified Software...”.

ERMA SITEGEOLOGIST	Version 6.0.1
FEHM	Version 1.99
FEHM	Version 2.10
INFIL	Version 2.0
INFIL	Version A2.a1
LAGRIT	Version 1.0
NETPATH	Version 2.13
PEST	Version 2.0
PETROSYS	Version 7.60d
STO-UNSAT	Version 1.0LV
TOUGH2	Version 1.3
TOUGH2	Version 3.4.3
TOUGHREACT	Version 2.3
UDEC	Version 3.0

Open Deficiency Report - DR-039

- **LVMO-00-D-039: Issued 02/15/2000**
- **Brief Description:**
 - Inaccurate documentation and validation of software routines and macros
- **Issue:**
 - Some software routines documented as part of the Analysis Model Reports (AMRs) are not adequately documented per AP-SI.1Q. Issues include missing test information, missing source code, and lack of version control
- **Solution:**
 - Correct/Amend AMR documentation to ensure reproducibility and defensibility of software routines. AMRs that are not revised will have their record packages appended to include missing information
 - Issue new Software Management Procedure
 - Raise Management Awareness

DR 39 Status 05/30/01 - Software routines have been classified and placed in Bins

- A comprehensive review of 123 AMRs that support the 9 PMRs was conducted. AMR software routine documentation classified into bins.
- **Definition of Bins:**
 - Bin 1: No single use routines/macros developed in AMR (Current Status: 31 AMRs).
 - Bin 2: All software used in AMR were adequately documented in the AMR (Current Status: 31 AMRs).
 - Bin 3: Commercial software (i.e. Built in-functions, math operators, or formulas) were not adequately documented inside the AMR (Current Status: 41 AMRs).
 - Bin 4: Developed software (i.e. routines developed in C, FORTRAN, BASIC) including some use of commercial software were not adequately documented in the AMR (Current Status: 20 AMRs).
- **Working with authors/developers to resolve issues.**
- **Required corrections/additions are being made to AMRs or AMR Record Packages.**
- **Commitment to close DR on or before 9/18/01**

DR-039 Status 05/30/01

Current BSC Status

- **Total affected AMRs: 61, Bin 3: 41, Bin 4: 20 -- working with Author/Developer to resolve issues**
 - 38 Complete No issues (OQA has verified)
 - 23 working with Author/Developer to resolve issues
 - 61 Total AMRs
- **Multi-Use Software Routines and Macros**
 - Software Routine(s) Total 171 as of 6/04 Complete No issues 159
 - 12 Software Requirements Reviews have issues and will be resolved as Software Deficiency Notices with DR-099
 - 171 Total SRRs
- **Ongoing reviews for DIRS items supporting potential SR technical bases documents and SDDs**

SOFTWARE QUALIFICATION ISSUES

- **Software CAR**
- **Software DRs Outstanding/Pending**
- **Extent of Documents Affected Currently Being Assessed**

Software CAR Summary

- **Procedural compliance difficulties as indicated by failed installation tests documented in DR-099**
- **Failure to withdraw and/or Use Codes from Software Configuration Management (SCM)**
- **Lack of effective software process control, particularly in software development**
- **Lack of training, management oversight and communication, again, primarily in software development**

OUTSTANDING/PENDING DEFICIENCY REPORTS

- **LVMO-00-D-099 (Open)**
 - **Qualified software added to software baseline failed to load during SCM installation verification**
 - **This is a reproducibility issue in Configuration Management.**
- **BSC-01-D-068 (Pending)**
 - **WAPDEG**
 - **FEHM**
 - **Version control issues**

Actions Taken

- **Assignment of Project Manager to facilitate resolution of issues**
- **BSC Management has requested a team of specialists from outside the project to assist in Root Cause Analysis and recovery**
- **Stand-Down of software development and modification during recovery**
- **Extent of Condition evaluation has begun**
- **Root Cause Analysis team has been formed**
- **Root Cause Analysis began on Monday, June 4, 2001**

Actions Planned

- **Recommendations to be developed and evaluated from Root Cause Analysis**
- **Actions to preclude recurrence will be developed to insure that deficiencies noted will not recur**