Fermilab Measuring and Test Equipment (M&TE) Assessment Report

Office of Quality and Best Practices
Fermi National Accelerator Laboratory
Batavia, IL
November, 2011

Approved By: _____

Jed Heyes
Head, Office of Quality and Best Practices

1.0 **Background**

To determine Fermilab's level of compliance with the Integrated Quality Assurance (IQA) requirements, the Office of Quality and Best Practices (OQBP) is performing a series of assessments of the implementation and effectiveness of QA controls in each Division, Section and Center (D/S/C). This document provides a lab-wide summary and conclusions for Measuring & Test Equipment (M&TE) requirements distilled from individual D/S/C reports.

M&TE assessments were conducted between June and September 2011 by interview, observation of work, and examination of measurement and test equipment, work products, documents, databases and records. Assessment teams interviewed users of M&TE, calibrators of M&TE, and personnel responsible for the management of M&TE across the D/S/Cs.

2.0 **Results & Conclusions**

Overall, Measuring and Test Equipment implementation within Fermilab varies between D/S/Cs as well as between different departments within the Divisions and Sections. M&TE requirements are:

- Met and effective in two sections
- Implemented in one section and 1 division,
- Partially implemented in one division
- Not implemented and not effective in one section and one division
- Not assessed in AD due to resource constraints, but an M&TE program is being implemented

Three divisions (two assessed) had an organization – wide M&TE program. In the other D/S/Cs the scope of the M&TE program was at the department or local organization level or not defined. The effectiveness of these local programs varied from organization to organization. In one section there was no awareness of M&TE requirements.

The following two cross-organizational issues affect most if not all D/S/Cs to some degree:

- Two hundred and seventeen out of 2,272 pieces of M&TE on the ES&H historical list of equipment to be calibrated is categorized as lost. Equipment is categorized as lost after it has been past due for calibration for three consecutive months. The equipment on this ES&H list includes M&TE from all Fermilab D/S/Cs. It is probable that much of the M&TE on this list is not actually lost. It is recommended that the D/S/C Senior Safety Officers (SSOs) investigate the equipment on the list that their D/S/C owns in order to determine its correct status. It is also recommended that the D/S/Cs improve on delivering the equipment on the calibration list to ES&H each month.

- There is some confusion as to whether M&TE calibrated by the Computing Division's Physics Research Equipment Pool (PREP) is traceable to NIST standards. Customers from at least two organizations, (ES&H and AD), expect that equipment calibrated by PREP is being done to NIST traceable standards. However, the PREP organization has stated they do not calibrate to NIST traceable standards. If the M&TE is not being calibrated to NIST Traceable standards, it is suggested that CD modify the following language on the calibration report; "It (the calibrated instrument) has been calibrated using measurement standards traceable to the National Institute of Standards and Technology (NIST) or to NIST accepted intrinsic standards of measurement, or derived by the ratio type of self-calibration techniques." and communicate this fact more clearly to all D/S/Cs that send M&TE to them for calibration.

3.0 **Findings**

Six findings of noncompliance with requirements for M&TE were identified. Six CAPs were issued to address these findings.

- TD-2011-07-08-01: There is no evidence that four Network Analyzers belonging to SRF RF Design and Test Group, and used for RF measurement and tuning of cavities, are controlled in any calibration program. None of these analyzers is listed in any of the calibration databases or lists. Three of these Analyzers have exceeded their calibration intervals and there was no evidence they have ever been calibrated.
- TD-2011-07-08-02: There were many instances of M&TE that had exceeded their TD recommended calibration intervals. For example in the Magnet System Fabrication area more than 33% of sampled M&TE exceeded their intervals; in the Magnet Systems Superconductivity R&D area more than 50% of the sampled M&TE exceeded their intervals, and Standard Leaks (used for leak checking) were found in multiple areas that had exceeded their calibration interval.
- FS-2011-08-29-1: Buffer solutions used as standards by the Central Utilities Building to measure pH and calibrate other instruments were out of tolerance when in use contrary to the requirements in IQA chapter 8. Two solutions were in use on August 01, 2011 beyond the manufacturers expiration dates of February and March 2011. The "PH/ORD" sensor storage solution was stored at 89^{o}F exceeding the manufacturer's recommended upper storage temperature of 86^{o}F.
- PD-2011-09-21-1: In three out of six departments assessed, calibration labels were either nonexistent or out of date. Equipment used for reference only was not labeled as such. This is contrary to the requirements of IQA chapter 8 and "PPD_ADMIN_029 paragraph 4.2 Calibrating M&TE".
- WD-2011-08-01-01: There is no evidence that instruments used as measuring and test equipment (M&TE) during inspection and test of Cosmic Ray Muon Detector (CRMD) components and assemblies are controlled in accordance with IQA requirements.
- CD-2011-10-03-01: Instruments requiring calibration are identified only in a draft ESE Department procedure, and two of four instruments cited in this procedure were out of calibration. Records of calibration for a third could not be readily produced. Current calibration status is not indicated, as numerous instruments have out-of-date or no calibration labeling. There are no procedures in place for calibration outside of the ESE Department. There are no requirements for NIST traceability of calibration standards or traceability of instruments to those which they were used to calibrate.

These findings can be summarized as:

- M&TE not identified/missing calibration stickers/calibration stickers out of date – 6
- M&TE out of calibration/exceeded calibration interval – 3
- M&TE not controlled – 2
- M&TE not calibrated to NIST standards - 1
- Missing M&TE calibration records - 1
- Missing M&TE calibration procedures -1

4.0 **Observations & Recommendations**

Observations and recommendations are written to address opportunities for improvement which are either outside the scope of the assessment or are isolated incidents. Seventeen observations and recommendations were made during the M&TE assessments that are categorized in two major areas – observations regarding the Measuring and Test Equipment itself and observations relative to the M&TE procedures. Because each of these were isolated incidents within assessed organizations they were not classified as findings.

- The equipment observations included no calibration stickers on equipment, equipment past due for calibration, and out of calibration equipment in use.
- The procedure observations included lack of procedures, obsolete procedures in use, and procedures not followed.
- There were nine equipment observations (four in Sections, five in Divisions) and eight procedure observations (four in Sections, four in Divisions).

5.0 **Commendable Practices**

Two commendable practices were noted as follows:

- All superconducting magnet test stands log quench event summaries using e-logs.
- The Calibration Worksheets which combine test, calibration, and maintenance instructions along with areas to record the calibration results are a good method of integrating these two pieces of the calibration process in one place.