



August 14, 2015

**MEMORANDUM FOR:** Willie E. May, Ph.D.  
Director  
National Institute of Standards and Technology

Richard Cavanaugh, Ph.D.  
Acting Associate Director for Laboratory Programs  
National Institute of Standards and Technology

**FROM:** Andrew Katsaros  
Principal Assistant Inspector General for Audit and Evaluation

**SUBJECT:** Audit of NIST Quality System for Measurement Services—Final  
Memorandum no. OIG-15-038-M

The National Institute of Standards and Technology (NIST) develops, maintains, and disseminates national weights and measures services—a job assigned to the federal government in the Constitution—that include calibration and certified reference material—related services for public and private users. According to NIST’s website, its financial resources in fiscal year (FY) 2014 totaled \$1 billion, with \$850 million of that amount coming from direct appropriations, an estimated \$47.3 million in service fees, and \$107 million from other agencies. The agency operates in two locations, in Gaithersburg, Maryland, and Boulder, Colorado. NIST employs about 3,000 scientists, engineers, technicians, and support and administrative personnel. It also hosts about 2,700 associates from academia, industry, and other government agencies, who collaborate with NIST staff.<sup>1</sup>

## Background

NIST implemented the Quality System for Measurement Services (QSMS) in 2003. The QSMS contains specific policies and procedures established to meet NIST’s technical standards, such as acceptance of requests for measurement services; technical procedures for calibrations; reference material certification measurements; staff qualifications, responsibilities, and training; control of technical records; and document development approval and control. For reference materials, it contains procedures for candidate material selection, identification, preparation, storage, and characterization. The NIST QSMS policies and procedures are based on the International Organization for Standardization/International Electrotechnical Commission

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<sup>1</sup> NIST, “NIST General Information,” [http://www.nist.gov/public\\_affairs/general\\_information.cfm](http://www.nist.gov/public_affairs/general_information.cfm) (accessed April 14, 2015).

(ISO/IEC) 17025<sup>2</sup> and the relevant requirements of ISO/IEC Guide 34.<sup>3</sup> NIST has engaged in a process of continually improving its quality system through internal audits and a formalized process to track non-conformities. Non-conformities and related corrective actions are tracked by NIST management. The QSMS procedures are documented in the NIST quality manual.<sup>4</sup>

In 2013, at the request of the NIST Director, the National Research Council formed the Panel on Review of the Material Measurement Laboratory. The review focused on assessing NIST's technical programs; its portfolio of scientific expertise; the adequacy of its facilities, equipment, and human resources; and the effectiveness of its program outputs.<sup>5</sup> Two divisions included in the assessment were also part of our audit risk assessment sample. The review panel concluded that one of the divisions we sampled is excellent and the other has encountered a few challenges. However, there is a risk in succession planning and a lack of management training among group leaders.

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<sup>2</sup> ISO/IEC 17025:2005, "General requirements for the competence of testing and calibration laboratories," <https://www.iso.org/obp/ui/#iso:std:39883:en> (accessed April 20, 2015) (ISO Docs, Paid Only)

<sup>3</sup> ISO/IEC Guide 34:2009, 3d edition, "General requirements for the competence of reference material producers," <https://www.iso.org/obp/ui/#iso:std:iso:guide:34:ed-3:vl:en> (accessed April 20, 2015) (ISO Docs, Paid Only)

<sup>4</sup> NIST, May 7, 2013. *NIST Quality Manual for Measurement Services*, version 8, NIST-QM-1. Gaithersburg, Maryland: NIST.

<sup>5</sup> For details of the review panel's findings, see National Research Council, 2015, *An Assessment of the National Institute of Standards and Technology Material Measurement Laboratory, Fiscal Year 2014*, Washington, DC: The National Academies Press.

## **Objective, Findings, and Recommendations**

As part of our FY 2015 work plan, we reviewed NIST's QSMS at the Boulder and Gaithersburg locations. The objective of our audit was to determine whether NIST Boulder manages its laboratories and divisions in accordance with QSMS policies and procedures. After assessing risk through documentation reviews, quality system staff interviews, and examinations of responses to questionnaires completed by staff of the four NIST divisions we queried, we did not identify significant risks to the QSMS. Therefore, we are concluding our test work related to this audit assignment. However, we did identify four areas for improvement, as detailed below. (See the appendix to this memorandum for further details regarding our objectives, scope, and methodology.)

### *1. Time Spent on Quality Management is Not Tracked*

NIST employees who are performing specific, discretely identifiable tasks that directly benefit only the implementation and maintenance of the QSMS should record their time spent on these tasks. QSMS verifies and improves NIST employee adherence to NIST quality standards. Examples of some of the QSMS tasks that should be identified are: time related to QSMS meetings, preparation of QSMS quarterly reports, and internal QSMS assessments. The QSMS is integrated with the measurement services throughout the NIST divisions. During our audit, the NIST Division Quality Managers stated that 15 to 20 percent of their work time was spent on the QSMS. However, we could not verify this because their time spent on QSMS activities was not documented. Therefore, NIST management cannot accurately determine the labor costs of the QSMS and thus can neither identify nor implement changes that would reduce QSMS costs, enhance efficiency, and improve NIST quality standards.

### *2. There Is No Designated Backup for the NIST Quality Manager*

NIST does not have a designated backup for the NIST Quality Manager. A designated backup can be kept up to date on QSMS activities and manage the QSMS effectively and efficiently if, for example, the NIST Quality Manager is absent for an extended period of time. Continuity planning is an important aspect of any business process, including quality management.

### *3. NIST Has Not Established a Formal QSMS Training Program*

We observed that NIST has not established a training program related to the QSMS. Quality control training creates a knowledgeable staff that is important to an effective and efficient quality system. To maximize the benefits of its QSMS program, NIST needs to implement a training initiative for its Quality Managers to ensure that an effective and efficient quality system is in place for this important core measurement function.

### *4. Required Internal Audit Has Not Been Performed*

Section 4.62 of the NIST quality manual states that laboratory divisions are required to conduct internal audits once every 2 years. Such audits are essential to maintaining the effectiveness of the QSMS. Among the four divisions we reviewed, one had not conducted an internal audit within the required 2-year timeframe. NIST management stated that informal reviews had been performed for that division but, due to a second reorganization, the correct reporting procedures were not in place. Therefore, NIST does not have actual internal audit reports for

the division. The requirement to conduct and report on internal audits has been reviewed. The division in question is scheduled to perform an internal audit later in the fiscal year.

### **Recommendations**

We recommend that the NIST Director and the Acting Associate Director for Laboratory Programs

1. Create a code in the time-and-attendance system to track time spent on QSMS activities and add language to NIST quality manuals making this a requirement.
2. Formally appoint a backup for the NIST Quality Manager in case the manager is not available to facilitate the QSMS responsibilities.
3. Establish a formal NIST quality training program for the staff who engage in QSMS activities.
4. Ensure that all QSMS laboratories perform internal audits every 2 years as required.

We have summarized your agency's response in this memorandum and included the formal responses as appendix B. The final report will be posted on OIG's website pursuant to section 8M of the Inspector General Act of 1978, as amended.

In accordance with Department Administrative Order 213-5, please provide us with your action plan within 60 days of the date of this memorandum. Thank you for the courtesies extended to my staff during this review. If you have any questions or concerns about this memorandum, please call me at (202) 482-7859 or Kenneth Stagner, Regional Inspector General for Audit, at (303) 312-7650.

### **Attachment**

cc: Robert Celotta, Ph.D., Director, Center for Nanoscale Science and Technology, NIST  
Kent Rochford, Ph.D., Director, Communications Technology Laboratory, NIST  
Howard Harary, Ph.D., Director, Engineering Laboratory, NIST  
Charles Romine, Ph.D., Director, Information Technology Laboratory, NIST  
Laurie Locascio, Ph.D., Director, Material Measurement Laboratory, NIST  
Robert Dimeo, Ph.D., Director, Center for Neutron Research, NIST  
James Olthoff, Ph.D., Director, Physical Measurement Laboratory, NIST  
Sally Bruce, Quality Manager, NIST  
David Swanson, OIG and GAO Liaison, NIST

## **Summary of Agency Response and OIG Comments**

On July 8, 2015, OIG received NIST's comments on the draft memorandum, which we include as appendix B of this final report. Based on NIST's review of the draft and subsequent discussions, we have made some suggested changes to the memorandum.

NIST generally accepted our report's findings and recommendations. In its comments, NIST noted that it will take steps to better track time spent on quality management (recommendation 1); assign a member of its Assessment Review Board to serve as Deputy Quality Manager (recommendation 2); record regular training meetings for quality managers as training events in the Commerce Learning Center (recommendation 3); and review its quarterly quality reports to ensure that internal audits are conducted within the required timeframe. Regarding recommendation 3, NIST clarified that it does conduct periodic training, but agreed with the intent of our recommendation and in the future will enter such training into the Commerce Learning Center and track attendance.

## Appendix A: Objectives, Scope, and Methodology

The objective of our audit was to determine whether NIST manages its laboratories in accordance with the quality management system policies and procedures. To accomplish our objective, we:

- evaluated NIST quality system practices against relevant policies and procedures, including the NIST administrative manual, NIST quality manuals, and GAO's *Standards for Internal Control in the Federal Government*,<sup>6</sup>
- judgmentally selected and reviewed 4 of the 16 divisions of NIST laboratories located in Gaithersburg, Maryland, and Boulder, Colorado. Specifically, we reviewed the Materials Science and Engineering Division, the Applied Chemicals and Materials Division, the Time and Frequency Division, and the Quantum Measurement Division within the Materials Measurement and Physical Measurement laboratories,
- reviewed quality management documentation, such as quarterly quality reports, internal assessment reports, organization charts, job descriptions, calibration reports, and work order procedures for the period 2013–2014, and
- interviewed and sent questionnaires to NIST officials responsible for managing and performing calibration tests in the laboratories.

We obtained an understanding of laboratory quality management procedures, operations, and management functions through policy review, laboratory tours, and interviews. While we identified and reviewed laboratory internal controls, no incidents of fraud, illegal acts, violations, or abuse were detected during our review. We did not rely on computer-processed data. We conducted audit risk assessment fieldwork in January 2015. We did our risk assessment fieldwork at the NIST laboratories located in Gaithersburg, Maryland, and Boulder, Colorado. Based on our audit risk assessment results, we determined it was not necessary to continue to the audit fieldwork phase.

We conducted this performance audit in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions, based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives. We performed our work under the authority of the Inspector General Act of 1978, as amended, and Department Organization Order 10-13, dated April 26, 2013.

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<sup>6</sup> U.S. General Accounting Office, November 1999, *Standards for Internal Control in the Federal Government*, no. GAO/AIMD-00-21.3.1 (Washington, DC: GAO, 1999).

## Appendix B: Agency Response

Note: NIST's response to the draft report has been edited to remove personally identifiable information. These redactions are indicated by square brackets.

**From:** Swanson, David  
**Sent:** Wednesday, July 08, 2015 6:11 AM  
**To:** [OIG]  
**Cc:** Fletcher, Catherine  
**Subject:** RE: NIST Lab Memo-Language Change

[OIG]:

The attached document contains NIST proposed edits/input to the revised OIG QSMS document.

In general, NIST accepts the revised document. NIST additions are included and with specific NIST actions identified.

Thank you for the opportunity to review and comment on this important work product.

**David Swanson**  
OIG and GAO Liaison  
Management and Organization Division  
Director's Office  
National Institute of Standards and Technology  
[ ... ]

[Attachment to Email]

### 1. Time Spent on Quality Management Is Not Tracked

NIST employees who are performing specific, discretely identifiable, tasks that directly benefit only the implementation and maintenance of the QSMS should record their time spent on these tasks. QSMS verifies and improves NIST employee adherence to NIST quality standards. Examples of some of the QSMS tasks that should be identified are time related to QSMS meetings, preparation of QSMS quarterly reports, and internal QSMS assessments. The QSMS is integrated with the measurement services throughout the NIST divisions. During our audit, the NIST Division Quality Managers stated that 15 to 20 percent of their work time was spent on the QSMS. However, we could not verify this because their time spent on QSMS activities was not documented. Therefore, NIST management cannot accurately determine the labor costs of the QSMS and thus can neither identify nor implement changes that would reduce QSMS costs, enhance efficiency, and improve NIST quality standards.

*NIST will add a section to the quarterly quality report template wherein quality managers will report the amount of time spent on specific QS meetings, reports and audits. QS training time will be logged in the Commerce Learning Center records as indicated in Response #3 below.*

### 2. There Is No Designated Backup for the NIST Quality Manager

NIST does not have a designated backup for the NIST Quality Manager. A designated backup can be kept up to date on QSMS activities and manage the QSMS effectively and efficiently if, for example, the NIST Quality Manager is absent for an extended period of time. Continuity planning is an important aspect of any business process, including quality management.

*NIST will assign on a rotating basis a member of the Assessment Review Board to serve as Deputy Quality Manager. This provision will be included in the next update to the NIST Quality manual document QM-1.*

### **3. NIST Has Not Established a Formal QSMS Training Program**

We observed that NIST has not established a training program related to the QSMS. Quality control training creates a knowledgeable staff that is important to an effective and efficient quality system. To maximize the benefits of its QSMS program, NIST needs to implement a training initiative for its Quality Managers to ensure that an effective and efficient quality system is in place for this important core measurement function.

*The NIST QM does conduct regular training meetings for quality managers and occasional specific training for quality system assessors. These events will now be entered as training events in the Commerce Learning Center for attendees to register their attendance.*

### **4. Required Internal Audit Has Not Been Performed**

Section 4.62 of the NIST quality manual states that laboratory divisions are required to conduct internal audits once every 2 years. Such audits are essential to maintaining the effectiveness of the QSMS. Among the four divisions we reviewed, one had not conducted an internal audit within the required 2-year time frame. NIST management stated that informal reviews had been performed for that division but, due to a second reorganization, the correct reporting procedures were not in place. Therefore, NIST does not have actual internal audit reports for the division. The requirement to conduct and report on internal audits has been reviewed. The division in question is scheduled to perform an internal audit later in the fiscal year.

*The NIST QM will review quarterly quality reports to ensure that internal audits are conducted within the required timeframe.*