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AUDIT REPORT

MAINTENANCE ACTIVITIES AT THE Y-12 PLANT

U.S. DEPARTMENT OF ENERGY
OFFICE OF INSPECTOR GENERAL
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DEPARTMENT OF ENERGY
Washington, DC 20585

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MEMORANDUM FOR THE ACTING MANAGER, OAK RIDGE OPERATIONS OFFICE

FROM: Terry L. Brendlinger, Manager
Eastern Regional Audit Office
Office of Inspector General

SUBJECT: INFORMATION: Audit Report on "Maintenance Activities at the Y-12 Plant"

BACKGROUND

Department of Energy (Department) policy requires the use of performance measures to assess the efficiency of maintenance operations. The Department recommends that performance measures be developed to evaluate progress toward meeting plant maintenance goals, and that deviations in expected results be analyzed to identify root causes and reported to management for corrective action. The objective of this audit was to determine whether Lockheed Martin Energy Systems (Lockheed Martin) used performance measures to identify and correct inefficiencies in its maintenance program.

RESULTS OF AUDIT

Lockheed Martin did not adequately use performance measures to identify and correct inefficiencies in its maintenance program. Specifically, Lockheed Martin did not adequately apply engineered time standards in estimating jobs, nor did it use variance analysis to resolve deviations from job plans. This condition occurred because Lockheed Martin did not fully implement Departmental guidelines. As a result, Lockheed Martin missed opportunities to improve its performance and cost-effectiveness. If Lockheed Martin were to improve its maintenance labor efficiency at the Y-12 Plant by just 10 percent, it could perform additional maintenance valued at about $3 million annually. The additional maintenance activity could be used to reduce the $11.2 million backlog for plant maintenance projects.

MANAGEMENT REACTION

Management concurred with our finding and recommendations and has initiated corrective actions.

MAINTENANCE ACTIVITIES AT THE Y-12 PLANT

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Overview

INTRODUCTION AND OBJECTIVE

The Y-12 Plant occupies 800 acres spanning 2.5 miles in East Tennessee adjacent to the City of Oak Ridge. The plant includes some 250 buildings, totaling 7 million square feet, and is managed by Lockheed Martin. The Y-12 Plant's missions include manufacturing and reworking nuclear weapon components, dismantling nuclear weapon components returned from the national arsenal, serving as the nation's storehouse of special nuclear materials, and providing special production support to programs.

The Y-12 Plant's Facilities Management Organization (FMO) supports the plant's missions by providing utilities and maintenance services. The mission of the FMO is to provide safe and efficient utilities and maintain the Department's property in a safe, economical, and effective manner. In Fiscal Year (FY) 1998, the FMO maintenance efforts cost over $81.5 million. The FMO is comprised of 7 departments, and employs approximately 750 people in its maintenance effort. The FMO is a service organization that charges hourly rates to its customers for maintenance services.

The Office of Inspector General has not reviewed maintenance activities at the Y-12 Plant in recent years. However, an audit was performed of maintenance activities at the East Tennessee Technology Park (formerly the K-25 Site) in February 1994.[1] The audit concluded that Lockheed Martin (formerly Martin Marietta Energy Systems) had not effectively used engineered performance standards to estimate maintenance hours, and had not adequately analyzed variances between actual and estimated hours to identify and correct maintenance inefficiencies. In that report, we recommended that the contractor use engineered performance standards to estimate maintenance hours and analyze variances between estimated and actual hours to identify and correct inefficient practices. Management concurred with the finding and recommendations.

The objective of this audit was to determine whether Lockheed Martin used performance measures to identify and correct inefficiencies in its maintenance program.

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[1] *Audit of Maintenance Activities at the K-25 Site, Martin Marietta Energy Systems, Inc.*, Audit Report ER-BC-94-01, February 9, 1994.

Lockheed Martin did not adequately use performance measures to

CONCLUSIONS AND OBSERVATIONS

identify and correct inefficiencies in its maintenance program. Specifically, Lockheed Martin did not adequately apply engineered time standards in estimating jobs, nor did it use variance analysis to resolve deviations from job plans. This condition occurred because Lockheed Martin did not fully implement Departmental guidelines. As a result, Lockheed Martin missed opportunities to improve its performance and cost-effectiveness.

An ongoing study determined that, in a major operational area, Lockheed Martin was performing only 25 to 30 percent of the scheduled workload. If Lockheed Martin were to improve its maintenance labor efficiency at the Y-12 Plant by just 10 percent, it could perform additional maintenance valued at about $3 million annually. The additional maintenance activity could be used to reduce the $11.2 million backlog for plant maintenance projects.

The audit identified issues that management should consider when preparing its yearend assurance memorandum on internal controls.

(Signed)

Office of Inspector General

Performance Measures Were Not Used

Lockheed Martin did not adequately use performance measures to identify and correct inefficiencies in its maintenance program. Specifically, Lockheed Martin did not adequately apply engineered time standards in estimating jobs, nor did it use variance analysis to resolve deviations from job plans. Engineered performance standards assist in estimating labor hour requirements and provide benchmarks which enable managers to evaluate and control actions. Variance analysis involves comparing planned performance to actual performance, such as comparing estimated hours to actual hours, identifying the cause of the variance, and applying corrective actions. Lockheed Martin's job estimates were primarily based on the planners' knowledge with only minimal use of engineered performance standards, and were not used by management to evaluate performance. Further, despite large variances between the hours estimated to perform specific jobs and the hours actually charged to the jobs, Lockheed Martin did not analyze variances to identify causes and develop corrective action plans.

The following are examples of FY 1998 maintenance jobs that were not analyzed for inefficiencies:

- A planner estimated that it would take 710 hours to paint 4 rooms and a stairwell; however, the crew actually took 2,530 hours to complete the job. Personnel who performed the work stated that they could not close off the stairwell for painting as planned because the elevator was broken. Also, security procedures restricted the amount of paint allowed in the processing areas. Additionally, the painters had to wait for radiological control technicians to scan equipment before they could leave the rooms. Further, a new permit was required to bring the paint sprayer into a clean hallway. Poor coordination between the parties involved contributed to the inefficiency of this job.

- A planner estimated that it would take 40 hours to paint labels on pipes in a process area, but it actually took 271 hours. Personnel who performed the job stated that many of the pipes were not previously labeled and the painters had to wait for a process engineer or utilities manager to identify the pipes before the labels could be made. According to the crew, this condition caused delays in completing the work.

- A planner estimated that it would take 198 hours to replace the temperature controls in one room. However, the crew actually spent 875 hours upgrading temperature controls in a series of interconnecting rooms at the customer's request. The job estimate was not adjusted, nor was the job package revised to document the change in scope.

- A planner estimated that it would take 16 hours to repair a skip hoist, but the repair actually took 705 hours. The planner's estimate stated "Make minor repairs only. Major repairs require job rescope." Despite this directive, major repairs were apparently performed at the customer's request without revising the job scope.

The planners, crew supervisors, and customers involved in the jobs discussed above were not aware of the actual hours charged to the jobs prior to our interviews. In addition, the personnel interviewed had little or no concern regarding variations between the estimated and actual hours. Once the jobs were planned and scheduled, the planners' work was finished. The crew supervisors were concerned with completing the jobs and keeping the customers happy, and were generally not concerned with the number of hours estimated or incurred. Finally, the customers interviewed were generally not aware of the hours incurred or the reasons jobs were delayed.

Lockheed Martin has known of inefficiencies in maintenance for several years. In April 1996, a self-assessment was conducted on the Y-12 Plant's Enriched Uranium Operations work control process. The assessment team concluded that the work control process lacked the rigor, commitment, and management oversight needed to effectively plan, schedule, and execute maintenance activities that maximize use of resources and available time. The assessment team found, among other things, that work scheduling and coordination difficulties were contributing to low productivity, and there were not enough "ready-to-work" jobs to fully utilize available crafts. A reassessment performed in November 1996 determined that the work control process was basically unchanged and had not progressed despite recommendations made in the earlier assessment.

In October 1998, Lockheed Martin entered into a subcontract with Duke Engineering & Services Federal Group (Duke) in which Duke agreed to assist Lockheed Martin in performing reviews and assessments of its organizations to evaluate the effectiveness and efficiency of

operations, and develop and implement strategies for increasing efficiencies. In December 1998, Lockheed Martin issued a Standard Technical Directive under the subcontract that tasked Duke to facilitate a review on work control processes. With Duke as the facilitator, a project team including maintenance and Enriched Uranium Operations personnel was organized to assess the maintenance work control process in Enriched Uranium Operations. The project team found that maintenance was only performing about 25 to 30 percent of the scheduled workload, and that the growing backlog was evidence of scheduling inefficiencies. The backlog is currently estimated at $11.2 million.

In January 1999, the project team issued a draft charter, stating that the project's purpose is "to streamline the Y-12 maintenance work control process to gain efficiencies so that current resources may be used to accomplish more maintenance work." The project should be completed by May 31, 1999.

Performance Measures Are Required for Maintenance Activities

Departmental Order 430.1, *Life Cycle Asset Management*, requires the use of performance measures, based upon best industry practice, to ensure formal, comprehensive, documented planning and control methods for the maintenance of physical assets. The Department also recommends that a maintenance program regularly provide management with accurate information regarding key maintenance indicators. Such information should be measurable and used to assess maintenance performance and identify areas requiring management attention. The Department further recommends that performance measures be developed to measure progress towards meeting plant maintenance goals. Goals that are typically monitored include:

- rate of activity completion,
- percent compliance to the daily schedule,
- progress against the schedule, and
- expended hours versus planned hours for each craft or work group.

Deviations in the expected results identified in reviews of the performance measures, such as those listed previously, should be analyzed to identify their root causes and should be reported to plant management for appropriate corrective action.

Departmental Guidance Was Not Implemented

Lockheed Martin did not fully implement the Departmental guidance in its maintenance organization. Rather than using engineered performance standards or management indicators to evaluate performance, the maintenance organization usually relied on its customers to assess its performance. Maintenance supervisors indicated that performance was satisfactory as long as the Y-12 Plant customers were satisfied with the quality and timeliness of services provided.

Lockheed Martin did have some performance measures related to overall maintenance activities. Specifically, it established targets for its general maintenance rate, preventive maintenance schedule adherence, distribution of work (i.e., hours charged to preventive maintenance, corrective maintenance and maintenance-related activities), and the overall maintenance backlog. However, these performance measures were not applicable to specific maintenance activities and were not used to assess job performance. These performance goals and standards were not readily measurable and, therefore, could not be used to measure actual results as required by the Government Performance and Results Act of 1993.

Opportunities for Improving Performance and Reducing the Backlog Were Missed

Because it lacked meaningful performance measures, Lockheed Martin has missed opportunities to identify and correct inefficiencies, and thus improve cost-effectiveness. A project team determined that, in a major operational area, the maintenance organization was performing only 25 to 30 percent of the scheduled workload. In FY 1999, maintenance labor is over $30 million. If Lockheed Martin were to improve its maintenance labor efficiency at the Y-12 Plant by just 10 percent, it could perform additional maintenance valued at about $3 million annually. The additional maintenance activity could be used to reduce the $11.2 million backlog for plant maintenance projects.
Lockheed Martin agreed that maintenance had been operating inefficiently and provided a corrective action plan. The plan includes actions to correct (1) the lack of performance measures, (2) maintenance crews performing more work than included in the work package scope, and (3) the failure to apply standards-based estimates.

RECOMMENDATIONS

We recommend that the Acting Manager, Oak Ridge Operations Office, direct Lockheed Martin to:

1. Formalize and implement the draft corrective action plan initiated during the audit, and ensure that performance measures are developed and used to identify and correct operating inefficiencies; and

2. Complete the study on the maintenance work control process and implement the corrective actions identified.

MANAGEMENT REACTION

Management concurred with the finding and recommendations. Management agreed that Lockheed Martin had not implemented the use of performance measures as a basis for analysis and identification of root causes of inefficiencies to the extent necessary to adequately effect improvements in work efficiency. Management is vigorously pursuing the action plan advocated in Recommendation 1, and has established a target date of September 1, 1999. The study of the maintenance work control process described in Recommendation 2 is underway, and scheduled for completion by May 31, 1999, with implementation of the corrective action identified to follow.

Management stated that Lockheed Martin had used engineered performance standards to estimate jobs through the use of Naval Facilities standards, and that the majority of Lockheed Martin planner-estimators were trained on the use of these standards. Management agreed, however, that the degree of use of these standards is less than desired and that Lockheed Martin has not, in recent years, followed a formal system of variance analysis to resolve deviations.

Management questioned the sampling of maintenance jobs used as the basis of conclusions regarding gross deviations between estimates and actual time charged, and stated that the jobs cited in the report represented a small segment of work typically performed by the FMO.

Finally, management stated that the report did not bring a balanced perspective on the use of performance measures relative to maintenance activities at Y-12, and focused on a single weakness. Management stated that, due to emphasis on environmental, safety, and health compliance issues, along with the focus on production restart, attention has been focused on areas other than purely job efficiency. As the site returns to a re-started production mode, attention will be refocused on maintenance efficiency.

We consider management's actions to be responsive to our

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recommendations. Although we agree that the FMO performed a greater number of small jobs (i.e. jobs estimated to take less than 16 hours) versus large jobs, we found no measures of efficiency at any job level.

We disagree with management's statement that the report did not bring a balanced perspective on the use of performance measures. The scope of our audit was limited to a review of performance measures related to efficiency of operations. We do not believe that efficiency of operations should be compromised as other issues arise.

Appendix

SCOPE

The audit was performed from October 7, 1998, through March 26, 1999, at the Operations Office and the Y-12 Plant. The scope of the audit included maintenance job requests closed during FY 1998, and was limited to building maintenance jobs. The FMO closed over 17,000 building maintenance job requests in FY 1998.

METHODOLOGY

To accomplish the audit objective we:

- Reviewed Federal laws and Departmental regulations and standards related to maintenance operations;
- Reviewed performance measures used by the FMO;
- Selected and reviewed a judgmental sample of Y-12 Plant maintenance work requests;
- Interviewed personnel responsible for requesting, planning, and performing the sampled jobs; and
- Compared estimated hours to actual hours for maintenance jobs performed in FY 1998.

The audit was performed in accordance with generally accepted Government auditing standards for performance audits and included tests of internal controls and compliance with laws and regulations to the extent necessary to satisfy the audit objective. Accordingly, the assessment included reviews of Departmental and contractor policies, procedures, and performance measures related to the management and control of maintenance activities. Because our review was limited, it would not necessarily have disclosed all internal control deficiencies that may have existed at the time of our audit.

We did not rely on computer-generated data in the maintenance system, and did not assess the reliability of the data. During the audit, we determined that the database information generated by the maintenance division's computer system was often inconsistent with other information available. Lockheed Martin is in the process of replacing and upgrading that system.

We held an exit conference with the Oak Ridge Operations Office's Maintenance Manager on April 14, 1999.

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