



U.S. Department of Energy
Office of Inspector General
Office of Audit Services

Audit Report

The Department of Energy's
Opportunity for Energy Savings
Through the Use of Setbacks in its
Facilities



Department of Energy
Washington, DC 20585

July 20, 2009

MEMORANDUM FOR THE SECRETARY

Greg Friedman
FROM: Gregory H. Friedman
Inspector General

SUBJECT: INFORMATION: Audit Report on "The Department of Energy's Opportunity for Energy Savings Through the Use of Setbacks in its Facilities"

BACKGROUND

During 2008, the Department of Energy expended about \$300 million to provide energy to over 9,000 Federal buildings at its facilities. A significant portion of those costs, up to 40 percent, were expended for heating, ventilation and air conditioning (HVAC). Because of its size and scope, operating the Department's existing HVAC systems as efficiently as possible offers the promise of immediate and substantial energy and cost savings. In addition to the "common sense" reasons for efficient and economic energy use, Federal agencies are specifically required to conserve energy by reducing heat or eliminating air conditioning during non-working hours. One of the primary means of achieving these savings is through the use of "setback" controls, both mechanical and software, that decrease the temperature difference between the inside of the building and the outside of the building during non-working hours.

The Department is the Federal agency designated to lead the country to energy efficiency and it has both an opportunity and responsibility to provide direction for smart, efficient energy management. However, as we noted in our recent report on *Department of Energy Efforts to Manage Information Technology Resources in an Energy-Efficient and Environmentally Responsible Manner* (OAS-RA-09-03, May 27, 2009), both Federal and contractor officials had not always taken all necessary steps to advance the Department's energy leadership role.

Recently, the *American Recovery and Reinvestment Act of 2009* (Recovery Act) reemphasized the importance of reducing the country's dependence on foreign oil and, more generally, on fossil fuels, and of conserving the Nation's scarce energy resources. Because of the importance of these objectives, we initiated this audit to determine whether the Department was taking maximum advantage of setbacks as an energy savings/management technique.

RESULTS OF AUDIT

Our testing at Office of Science and National Nuclear Security Administration facilities revealed that the Department either did not use or failed to properly maintain setback systems and equipment in a number of instances. At just the four sites we visited, the

Department had not ensured that setback conservation methods were used for 35 of the 55 (approximately 64 percent) owned or leased buildings included in our review. The buildings that did not use setbacks capabilities to control energy consumption comprised over one million square feet of space. Specifically:

- Although in place or capable of being deployed, officials did not utilize setbacks in 20 separate buildings; and,
- Equipment in 15 other buildings had either never been enabled or had deteriorated and was no longer functional, thus making setbacks impossible.

Typical of the problems we noted, the Y-12 National Security Complex recently leased two buildings that were constructed with setback capability. The property manager for these buildings told us that the setback equipment was not used because the owner of the properties had not purchased the software necessary to enable the capability. In another case, we learned that Los Alamos National Laboratory was not using the setback capability in two buildings because facility operators and tenants had not been trained on operating the setback control system. Finally, the Oak Ridge National Laboratory lost the ability to operate the setback equipment in two buildings when the electronic control system failed in 2008. Laboratory officials told us that they elected not to replace it because they planned to implement campus-wide energy conservation measures in the future.

In spite of its energy conservation leadership role, we found that the Department and its facility contractors did not place adequate emphasis on reducing energy consumption through the application of setbacks. Of particular significance, we found that the Department had not always required the operation of setback capabilities in building lease agreements. This was especially troubling given the expanded use of leased space to house Departmental operations. Despite discussions with several Federal and contractor officials, we could not obtain what we considered to be a satisfactory explanation as to why the Department failed to take advantage of this conservation practice, one that is generally low cost and has limited, if any, adverse impact on operations or building occupants. Consistent with the lack of emphasis in this area, we noted that the Department had not required the four contractors included in our review to develop training requirements or energy policies and procedures governing the use of setback capabilities. Energy consumption reduction goals related to setbacks had also not been established to help incentivize contractor performance in this important area.

With nearly \$300 million in annual utility costs, the Department could realize significant savings by using setbacks in its buildings. We estimate that the Department could save over \$11.5 million in annual utility costs. We developed the estimate based on the observation that approximately 64 percent of the facilities included in our review had not used setbacks. We then conservatively applied a 15 percent energy consumption savings estimate observed by Sandia National Laboratory and savings estimates contained in a study conducted by Pacific Northwest National Laboratory to the 40 percent of utility costs generally recognized as resulting from HVAC operation. Such savings could be

used to fund high priority programs and install additional energy saving features. The consumption savings would be, at today's average residential electricity cost, sufficient to power over 9,800 homes each year.

We recognize that while setbacks can be used in many situations, they are not appropriate for facilities that are continuously operated or those that house delicate equipment that depend on constant temperatures. However, during the course of our audit officials at four of the sites included in our review told us that they recognized the utility of using setbacks for most facilities. At two sites, implementation efforts began almost immediately after we briefed officials on our findings. We also noted that Department Headquarters facilities used setbacks in offices and many common areas.

With over 9,000 buildings in its inventory, the consistent use of setbacks can help the Department significantly reduce its energy consumption and, as noted above, achieve substantial cost savings. Actions related to setbacks that officials began after we initiated our audit are noteworthy and should, if fully implemented, help further reduce energy consumption. However, additional action at sites across the complex is necessary to maximize energy efficient operations and to establish the Department as the leader in this effort in all of the Federal sector. We made several recommendations designed to aid the Department in its effort to increase operational efficiency, save energy and reduce costs.

This is the third in a recent series of energy conservation-related audits. The first of these efforts, *Management of the Department's Data Centers at Contractor Sites* (DOE/IG-0803, October 2008), found that facility contractors had not always taken advantages of opportunities to improve the energy and operational efficiency of data centers. During our second audit in this series, *Department of Energy Efforts to Manage Information Technology Resources in an Energy-Efficient and Environmentally Responsible Manner* (OAS-RA-09-03, May 27, 2009), we found circumstances similar to those we discovered during this review.

MANAGEMENT COMMENTS

Department management generally agreed with our findings and recommendations. Management agreed to take needed corrective actions, including emphasizing the importance of using setbacks as an energy conservation measure to all programs and sites. In separate comments, the National Nuclear Security Administration indicated that it would take a series of actions to enforce the use of setbacks. The Office of Science noted that the Oak Ridge National Laboratory had consistently met its energy conservation goals and that the Laboratory is implementing a broad system of energy conservation measures. Management's comments are included in Appendix 3.

Attachment

cc: Deputy Secretary
Administrator, National Nuclear Security Administration
Under Secretary of Energy
Under Secretary for Science
Chief of Staff

AUDIT REPORT ON THE DEPARTMENT OF ENERGY'S OPPORTUNITY FOR ENERGY SAVINGS THROUGH THE USE OF SETBACKS IN ITS FACILITIES

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ENERGY CONSERVATION THROUGH THE USE OF SETBACKS

Implementation at Federal and Contractor Sites

Our review revealed that the Department of Energy (Department) had not ensured that energy setback capabilities were fully utilized at its facilities. This despite the requirements established in 41 CFR 102-74.185, which require Federal agencies that occupy government-owned and leased buildings to operate heating, ventilation and air conditioning (HVAC) systems in the most energy efficient and economical manner. Agencies must reduce heating temperatures to no higher than 55 degrees Fahrenheit during non-working hours and eliminate air-conditioning during non-working hours, except as necessary to return temperatures to a suitable level for the beginning of working hours.

During our visits to four major Department facilities, we reviewed a sample of 55 separate buildings and determined that they were either now or had originally been capable of using setbacks to conserve energy. Building managers told us that 40 of the 55 buildings we evaluated had functioning systems that could have permitted the use of setbacks. These same officials indicated, however, that they had only adopted programs to take advantage of the savings available through the use of setbacks for half of those 40 buildings. The remaining 15 buildings had originally had the capability to utilize setbacks, but had subsequently lost that functionality because they had not been adequately maintained. Accordingly, 35 of the 55 (approximately 64 percent) buildings included in our review were either not using or had lost their setback capabilities. The following examples discuss buildings where setback capabilities were not being used to control energy consumption to heat and cool over one million square feet of space.

National Nuclear Security Administration Facilities

Data provided by contractor officials and our testing revealed that the Y-12 National Security Complex (Y-12) had not taken action to improve energy efficiency through the use of setbacks. As part of a modernization effort, Y-12 recently occupied the Jack Case Center and New Hope Center under a lease arrangement. The lessor of these facilities provides Y-12 with almost 550,000 square feet of administrative and public space. The cost of the utilities for these two facilities is reimbursed by the Department through a portion of its lease payments.

Although both facilities were built with HVAC systems capable of accommodating setbacks, the property manager reported that setbacks were not being used.

We also identified a number of other facilities where conservation efforts were not complete. Contractor officials at Y-12 told us that there were other facilities at the site where setbacks were not being used even though the HVAC systems had the requisite capability. As a result of our audit, officials told us that they planned to begin implementation of setbacks in four buildings and pursue setbacks in another. Additionally, we identified seven other buildings owned by the Department at Y-12 that had been capable of using setbacks but had lost this functionality. Two large buildings, for example, had been constructed with the ability to use a setback mode. Over the years, however, the mechanical systems had deteriorated and were not repaired. As a result, electronic setback controls were no longer functional.

At the Los Alamos National Laboratory, two facilities we visited had setback capabilities but they had not been activated. Building managers for two major facilities at the site, the National Security Sciences Building and the Nonproliferation and International Security Center, had not taken action to ensure that setbacks were used as required. The potential energy savings for these two buildings could be significant given that they comprise over 450,000 square feet. According to building managers, the setback capabilities had not been used because facility operators and tenants had not been trained on the use of setbacks.

Office of Science Laboratories

Similar to the national security sites, we found that there were opportunities for energy savings through the use of setbacks at the Oak Ridge National Laboratory (ORNL). The Multipurpose Research Facility and the Research Office Building, for example, were not using setbacks. The offices and laboratories within these facilities, comprising about 286,000 square feet, were built with HVAC setback capability. Facility engineers, for example, reported that setbacks were initially used at the Research Office Building; however, the use was discontinued when it was determined that setbacks adversely affected the pressure in the building. Building management reported that doors became difficult to open in the morning when the setback

capability was used. ORNL management officials told us that based on our audit they had worked on options to address the issues associated with maintaining proper pressure in the buildings that would permit the use of setbacks to be resumed.

Certain systems at ORNL had deteriorated and were no longer capable of providing setbacks. For example, we identified eight facilities that previously were capable of using setbacks, but could no longer operate in this mode due to equipment deterioration. Until 2008, buildings 4501 and 4505, for example, used a Direct Digital Control system that was capable of regulating temperatures during non-working hours. Since the system stopped working in 2008, the buildings are no longer capable of using setbacks to control temperatures during non-working hours. ORNL is in the process of executing an Energy Savings Performance Contract that it hopes will improve the use of setbacks in its facilities.

At the Department's Pacific Northwest National Laboratory (PNNL), four leased facilities were not, at the time of our site visit, operating in setback mode. These facilities account for about 145,000 square feet of office space. PNNL officials told us that, as a result of our audit, they had identified setback capabilities at these facilities and had begun working with the property owner to implement these energy saving techniques. After completion of our audit field work, management informed us that nine of ten PNNL leased buildings had begun to use setback capabilities (the one building not using setbacks did not have the capability to do so).

**Setback
Implementation
Issues**

In our judgment, the Department and its facility management and operating contractors need to place greater emphasis on reducing energy consumption through the application of setbacks. Although we found that facility contracts for the sites we visited had formal provisions which required the implementation of setbacks, the actual execution was spotty, suffering from a lack of specific policies or procedures establishing a regime using thermostat setbacks as an effective energy conservation tool. We noted, as well, that the Department had not required the contractors included in our review to maintain HVAC systems in a condition to fully utilize setbacks. Finally, we found that specific energy consumption reduction goals related to

setbacks had not been established to incentivize contractor performance in this area. Due to the recent emphasis on leased space for Federal operations, we evaluated the inclusion of setback capabilities in lease agreements. We found that this was not done in a number of such agreements entered into by the National Nuclear Security Administration (NNSA) and the Office of Science. For example, at Y-12, certain lease agreements did not include the use of setbacks even though the Department paid the utility costs. As a result of our audit, officials at Y-12 informed us that they are working with the property manager to enable setback capability. The lease agreements at PNNL also did not require use of setbacks. To its credit, however, PNNL incorporated setback requirements into the service agreements for the Biological Sciences Facility and the Computational Science Facility, two new facilities under construction.

At selected sites, we found that systems capable of using setbacks were not maintained. Several buildings at Y-12 had not been maintained at the level required to support setback capability. Buildings 9113 and 9119, for example, were no longer capable of setback due to the condition of the mechanical equipment. Our findings were consistent with remarks in an Energy Savings Performance Contract proposal in which a bidder noted that most of the heating, ventilation and cooling control systems at these two buildings were inoperable. The majority of the fan controls in the buildings had failed, thereby preventing building controls systems from operating efficiently.

Despite a number of interviews and significant document research at all four sites, we could find no plausible reason for the lack of interest in setbacks. Some officials suggested that there were funding implications which made implementation of setbacks problematic. A few officials suggested that it was logistically difficult to implement a setback program in a building where sensitive equipment is working on a 24-hour continuing basis and/or the work force maintains irregular hours. Others told us that the setback issue was simply not a priority given all of the other operational challenges.

We recognize all of the challenges and other issues associated with an aggressive setback program. Nonetheless, we concluded that the importance of energy efficiency and conservation in the Department setting is so

important that these challenges can be overcome and that the reward, in terms of energy savings, will be well worth the cost.

Energy Savings

With nearly \$300 million spent on annual utility costs, the Department could save over \$11.5 million in annual utility costs by aggressively using setbacks. We developed the estimate based on the observation that approximately 64 percent of the facilities included in our review had not used setbacks, and by conservatively applying a 15 percent energy consumption savings estimate observed by Sandia National Laboratory (Sandia) and a study conducted by PNNL to the 40 percent of utility costs generally recognized as resulting from HVAC operation. The consumption savings, at today's average residential electricity cost, would be sufficient to power over 9,800 homes per year. In addition to energy savings, the PNNL study concluded that the use of setbacks reduces unnecessary wear and tear on equipment and associated maintenance costs. Significant energy savings can be achieved if setbacks are incorporated into building operations. Sandia, through a recent building upgrade involving replacement of the operational control system and installation of equipment to regulate an air supply fan, reported savings ranging from 8,000 to 14,000 kWh per month (18 to 40 percent).

It was quite clear to us that the Department would have been better served if there had been a more consistent commitment to temperature setbacks throughout the complex as a means of conserving energy and reducing operating costs.

RECOMMENDATIONS

We recommend that the Under Secretary for Science, and the Under Secretary for Nuclear Security, require Federal Site Managers to:

1. Begin using setbacks at each of the Department's owned or leased facilities, to the maximum extent practicable;
2. Ensure site contractors develop and implement policies and procedures requiring that setbacks be used at all Departmental facilities, as appropriate;
3. Require future lease agreements to incorporate setback clauses;

-
4. Train building operations personnel and occupants on the use and benefits of setbacks; and,
 5. Ensure that required maintenance is performed on HVAC systems capable of setbacks.

We also recommend that the Under Secretary of Energy reemphasize the importance of using setbacks as an energy saving and conservation technique to all of the Department's programs and sites.

MANAGEMENT REACTION

Department management generally agreed with our finding and recommendations. Management agreed to take needed corrective actions, including emphasizing the importance of using setbacks as an energy conservation measure to its programs and sites.

In separate comments, the NNSA indicated that it would take a series of actions to enforce the use of setbacks. In particular, NNSA indicated that it would take actions to validate the use of setbacks; require contractors to develop and implement policies and procedures requiring the use of setbacks; incorporate setback clauses in future lease agreements; perform energy awareness training; and continue to consider HVAC system maintenance as part of its overall priority system.

The Office of Science noted that the ORNL had consistently met its energy conservation goals which are much broader than the use of setbacks. Science officials also noted that the Laboratory is implementing a broad system of energy conservation measures through an Energy Savings Performance Contract that will achieve energy consumption reductions exceeding those available from the use of setbacks alone.

AUDIT RESPONSE

Management's comments are responsive to our finding and recommendations. We are encouraged by the Office of Science's plans to implement an Energy Savings Performance Contract at the ORNL. The inclusion of energy conservation measures such as setbacks in such contract should, if properly implemented, help reduce energy use and costs at the Laboratory.

Appendix 1

OBJECTIVE

The objective of the audit was to determine whether the Department of Energy (Department) was taking maximum advantage of setbacks as an energy savings/management technique.

SCOPE

The audit was performed between July 2008 and May 2009. We performed our work at the Department of Energy's Headquarters in Washington, D.C.; the Y-12 National Security Complex located in Oak Ridge, Tennessee; Oak Ridge National Laboratory located in Oak Ridge, Tennessee; Los Alamos National Laboratory located in Los Alamos, New Mexico; and, the Pacific Northwest National Laboratory located in Richland, Washington. The scope of the audit included buildings that used systems capable of operating in setback mode.

METHODOLOGY

To accomplish our objective, we:

- Reviewed laws and regulations applicable to requirements for operating buildings in a cost effective and energy efficient manner;
- Reviewed 55 buildings and interviewed building operations personnel at four sites;
- Analyzed Department Orders, Management and Operating Contracts, and leasing agreements for provisions requiring buildings to be operated in a cost effective and energy efficient manner;
- Interviewed officials from the Department's Federal Energy Management Program;
- Reviewed information included in building automation systems;
- Interviewed representatives from the General Services Administration and personnel responsible for operating the Forrestal and Germantown facilities; and,
- Observed the building automation system for the Forrestal and Germantown facilities.

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 finding and conclusion based on our audit objective. We believe that the evidence obtained provides a reasonable basis for our finding and conclusion based on our audit objective. The audit included tests of controls and compliance with laws and regulations related to the Department's use of setbacks as an energy savings technique. 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. Also, we examined the establishment of performance measures in accordance with the *Government Performance and Results Act of 1993*, as it related to the audit objective. The Department sites included in our audit had not established specific performance measures regarding the use of setbacks in its buildings. We did not rely on computer processed data to satisfy our audit objective.

Management waived an exit conference.

PRIOR AUDIT REPORTS

PRIOR OFFICE OF INSPECTOR GENERAL REPORTS

The Office of Inspector General (OIG) has previously reported on energy conservation at the Department of Energy (Department).

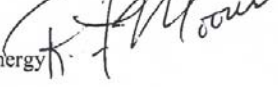
- *Management of the Department's Data Centers at Contractor Sites* (DOE/IG-0803, October 2008). The audit found that facility contractors had not always taken advantage of opportunities to improve the energy and operational efficiency of data centers. In particular, as many as 140 data centers were found at the six sites reviewed that duplicated common services such as e-mail, data storage, and libraries. Furthermore, four of the six sites made only limited use of more efficient hardware technologies that conserve energy and reduce operational costs. The OIG estimated that \$2.3 million per year for these six sites could be saved through the use of more efficient hardware technologies allowing for the consolidation of servers and be more energy-efficient.
- *Department of Energy Efforts to Manage Information Technology Resources in an Energy-Efficient and Environmentally Responsible Manner* (OAS-RA-09-03, May 27, 2009). An audit was conducted to determine if the Department managed information technology resources in an energy-efficient and environmentally responsible manner. The audit found that the Department did not take advantage of existing, low or no cost built-in energy management features on a significant percentage of its computers and peripherals.

DOE F 1325-8
(08-93)

United States Government

Department of Energy

memorandum

DATE: July 14, 2009
REPLY TO
ATTN OF: Richard Moorer, Associate Under Secretary of Energy 
SUBJECT: Response to the Draft Report on "The Department of Energy's Opportunity for Energy Savings Through the Use of Setbacks in its Facilities"
TO: George W. Collard, Assistant Inspector General for Performance Audits

The Office of the Under Secretary of Energy is in general agreement with the recommendation that the Under Secretary reemphasize the importance of using setbacks as an energy saving and conservation technique to all of the Department's programs and sites. The Office of the Under Secretary of Energy is developing a memorandum for distribution regarding the use of setbacks and other energy savings and conservation techniques which will identify actions intended to facilitate implementation of sound, cost-effective energy management practices.

Appendix 3 (continued)




Department of Energy
National Nuclear Security Administration
Washington, DC 20585



July 14, 2009

MEMORANDUM FOR: George W. Collard
Assistant Inspector General
for Performance Audits

FROM: Michael C. Kane 
Associate Administrator
for Management and Administration

SUBJECT: Comments to the IG Draft Report on Department
Setbacks; Proj. No. A08FR045; IDRMS No. 2008-02243

The National Nuclear Security Administration (NNSA) appreciates the opportunity to provide comments to the Inspector General's (IG) report, the *Department of Energy's Opportunity for Energy Savings Through the Use of Setbacks in its Facilities*. I understand that this audit was initiated to determine whether the Department was taking maximum advantage of setbacks as an energy savings/management technique.

NNSA generally agrees with the report and recommendations. The following actions are being taken with regard to the recommendations:

1. Using setbacks to maximum extent practicable...NNSA will ensure that all Sites Offices, including the Service Center, and contractors are making proper use of setbacks to reduce heating and air conditioning during off hours. NNSA will ask that each Site, including the Service Center, validate that this is being accomplished. Action will be completed by the end of the Calendar Year 2009.
2. Ensure policies and procedures being used at all sites.... NNSA will instruct all Site Offices, including the Service Center, to direct site contractors to develop and implement policies and procedures requiring the use of setbacks, as appropriate. Action will be completed by the end of the Calendar Year 2009.
3. Require future lease agreements.....The Senior Procurement Executive will instruct all Site Offices, including the Service Center, and Site contractors to incorporate setback clauses into future lease agreements. Action will be completed by the end of the Calendar Year 2009.
4. Train building operations personnel....NNSA will instruct all site offices, including the Service Center, and site contractors to perform energy awareness training, and include employee awareness articles within their newsletters, as appropriate. Action will be completed by the end of the Calendar Year 2009.



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Appendix 3 (continued)

5. Ensure required maintenance is performed on HVAC systems....NNSA is currently prioritizing maintenance at the facility and system level. Priority is given to Mission Critical facilities. NNSA reviews the status of maintenance activities routinely and works with the sites in adjusting priorities as necessary. Maintenance for energy efficiency and conservation, including HVAC systems, will continue to be considered in the overall priority system. Action will be completed by the end of the Calendar Year 2009.

If you have any questions concerning this response, please contact Cathy Tullis, Acting Director, Policy and Internal Controls Management, 202-586-3857.

cc: Karen Boardman, Director, Service Center
David Boyd, Senior Procurement Executive
James McConnell, Acting Assistant Deputy Administrator,
Safety & Operations



Department of Energy

Washington, DC 20585

JUL 15 2009

MEMORANDUM FOR GEORGE W. COLLARD
ASSISTANT INSPECTOR GENERAL
FOR PERFORMANCE AUDITS
OFFICE OF INSPECTOR GENERAL

FROM: GEORGE J. MALOSH *George J. Malosh*
DEPUTY DIRECTOR FOR FIELD OPERATIONS
OFFICE OF SCIENCE

SUBJECT: Response to Inspector General's Draft Report, "The Department of Energy's Opportunity for Energy Savings Through the Use of Setbacks in its Facilities"

The Office of Science appreciates the opportunity to review and comment on the subject report. We generally agree with the report and the recommendations, which are shown below:

1. Begin using setbacks at each of the Department's owned or leased facilities, to the maximum extent possible.
2. Ensure site contractors develop and implement policies and procedures requiring that setbacks be used at all Departmental facilities, as appropriate.
3. Require future lease agreements to incorporate setback clauses.
4. Train building operations personnel and occupants on the use and benefits of setbacks.
5. Ensure that required maintenance is performed on HVAC systems capable of setbacks.

The Department has established sustainability goals, two of which are (1) a 30% reduction in energy use and (2) 15% of existing building space meets guiding principles for sustainability, the second principle being optimizing energy performance. Currently, our sites are on track to meet these goals using a variety of energy reduction strategies. We certainly agree that setbacks should be one of those strategies for meeting these goals and should be implemented when cost effective. By the end of this calendar year, we will instruct our site offices to implement the recommendations shown above to the maximum extent possible and summarize that implementation in their annual Executable Plans, which documents each sites overall plan for achieving sustainability goals.

Specific feedback on the report is provided in the Attachment.

Attachment

cc:
Marc Jones/SC-31
John Yates/SC-31.2



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3. What format, stylistic, or organizational changes might have made this report's overall message more clear to the reader?
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