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# Building Temperature Set Point

March 2014

Carol Meincke  
Chris Evans



Michael Hazen, Vice President  
Infrastructure Operations

Date Approved:

David Darling, Director  
Facilities Management and Operations Center

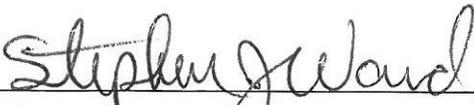
Date Recommended



2/26/2014

Arthur C. Ratzel, III, Director  
Facilities Management and Operations Center

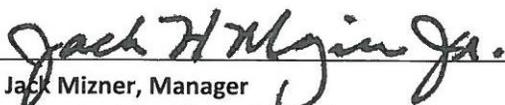
Date Recommended



02/25/2014

Stephen Ward, Senior Manager  
Partnership and Planning

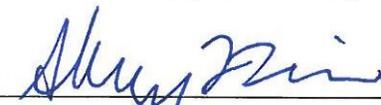
Date Recommended



1/29/2014

Jack Mizner, Manager  
Partnership and Planning

Date Recommended



1/29/14

Anthony L. Liocce, Manager  
Customer Operations Support (South)

Date Recommended



2/3/14

Howard Royer, Manager  
Physical Operations Planning and Studies

Date Recommended



1/29/14

Craig Taylor, Manager  
Facilities Management

Date Recommended

Mary Bultmann

Jerry Gallegos

Dave Rabb

Mike Rocco

Lucille Roybal

Dan Stephens

William Tierney

Doug Vetter

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# 1.0 Introduction

Sandia National Laboratories (Sandia) leads the DOE/NNSA complex in sustainability and energy savings. DOE and NNSA, through the Strategic Sustainability Performance Plan (SSPP), Site Sustainability Plan (SSP) guidance, and other venues, have established ambitious energy goals for the agency and for Sandia. In addition, Sandia has committed to additional aggressive internal goals for energy savings.

For existing buildings, setting, maintaining, and enforcing realistic defensible temperatures presents an opportunity for significant energy savings. Energy modeling shows the following:

- Decreasing summer temperature set points by two degrees Fahrenheit (F) increases energy use by approximately 1%.
- Increasing winter temperature set points by two degrees F increases energy use by approximately 5%.

This white paper provides information and recommendations for an actionable and enforceable corporate policy statement on temperature set points for office and related spaces at Sandia and presents a strategy that balances the need to achieve the energy goals with optimizing employee comfort and productivity.

## 2.0 Problem Statement

In 2012, Sandia established an internal goal of reducing energy use by 25% from a 2011 baseline by the end of 2017. Sandia is reducing energy use but at the current rate will fall short of achieving this goal. Sandia has identified effective temperature control as a major opportunity to save energy. Temperature, especially in office and related spaces, impacts employee comfort. Facilities Building Operations personnel receive many employee comfort complaints in some buildings and responding to temperature-related maintenance requests increases operational costs. Personal heat generating devices used to augment building mechanical systems are inefficient and do not save energy. For instance, space heaters can use up to four times the energy consumed by a desktop computer. To address these issues, Sandia requires a policy for set-point temperature control.

Temperature set points and building operational costs can be quantitatively measured; employee comfort is subjective. Sandia's challenge is to establish realistic and defensible employee comfort parameters, then balance temperature and the resultant energy savings with employee comfort and operational cost effectiveness to achieve optimum mission effectiveness.

### 2.1 Scope

This document considers temperature set points for general office, manager office, administrative, restrooms, and conference room space types. Laboratories are outside the scope of this paper, as most laboratories may have unique temperature requirements. Temperature set points for unoccupied space such as computer rooms and data centers (the Facilities Management and Operations Center [FMOC] does not have control over them), equipment rooms, corridors, storage, space under renovation, and vacant space are also outside the scope of this paper. Most data centers and computer rooms have dedicated thermostats.

### 2.2 Background

Employee comfort is subjective. The FMOC rarely hears when employees are comfortable, only when they are not. Comfort is not just a result of air temperature. Humidity, air speed, radiant temperature, employee activity level, and employee clothing all affect how employees perceive comfort. What is comfortable for one person may not be so for another, and one size does not fit all.

The temperature of an individual room is affected by building mechanical system zoning, the amount of heat-generating (computers, monitors, etc.) equipment in the room, the amount of natural light, and the building's orientation to the sun. In general, people who sit next to windows have more temperature concerns. There is a tradeoff between views, natural light, and temperature control. Employees who work in offices with heat-generating equipment (particularly information technology equipment) may also have comfort issues.

If a space is used for a purpose for which it was not designed, occupants cannot expect comfort. Changing the design basis of a room may require costly modifications and should be carefully considered from a corporate stewardship viewpoint and coordinated with the Building Operations Team before execution. It is not realistic to expect comfortable conditions 24/7. Employees should be comfortable during regular office hours; however, employees should not expect to come to work during nonstandard hours and be perfectly comfortable.

What happens when people take matters into their own hands? Space heaters, fans, frequent hot/cold calls, open windows, blocked vents, hanging things on the thermostats to artificially change temperature,

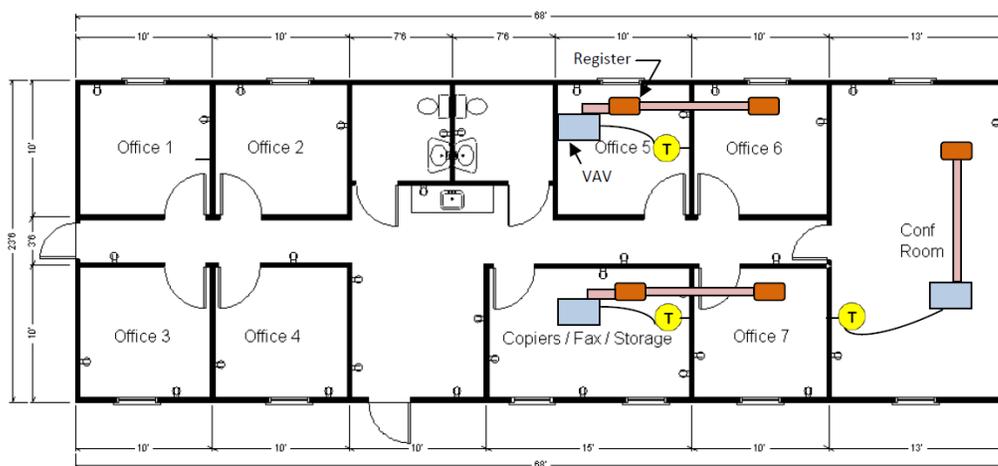
and the like may provide short-term comfort, but ultimately result in an inefficient heating, ventilation, and air conditioning (HVAC) system, increased maintenance and repairs, reduced equipment life, and high energy costs.

## 3.0 Discussion

Sandia currently controls office and related space types as follows:

- Sandia conditions occupied office and related space types from 6:00 a.m. to 6:00 p.m., Monday through Friday (standard working hours) in most buildings.
- Buildings controlled by the building automation system (BAS) are managed at the zone level. A zone is comprised of one or more rooms controlled by a single sensor located in a “typical” room. See Figure 1. This means the sensor location can make a difference in employee comfort within the zone. If the sensor is located in a nontypical (that is, high-equipment load) room that generates heat higher or lower than other rooms in the same zone, it may cause a problem for the other occupants.

Figure 1



- Sandia does not control humidity in office or related spaces.
- Sandia controls zone temperatures between 70° F and 76° F. These parameters apply to buildings where Sandia has zone-level control with the BAS.
- In many buildings Sandia Facilities has installed occupancy sensors that control both the lighting and the HVAC when spaces are vacant. As a result, Sandia has achieved impressive energy savings. Temperature set points for office and related space types (such as conference rooms, common areas, and the like) vacated for more than thirty minutes may vary between 64° F and 82° F during standard working hours. When the space is reoccupied, the temperature control will go back to its normal mode.
- During nonstandard hours (nights, weekends, holidays), Sandia shuts down HVAC systems in office spaces. Employees can manually activate the HVAC system for a two hour period. The HVAC system will turn on when the zone temperature exceeds 90° F or falls below 55° F.
- Sandia conducts periodic building energy audits to catch malfunctions such as closed or inoperable dampers and BAS problems.

## 4.0 Recommendations

- Develop and implement a corporate policy approved at the executive leadership level that communicates building operational parameters and employee comfort expectations to members of the workforce who occupy office and related spaces.
- Enforce temperature controls and operational hours of building mechanical systems.
- Use American National Standards Institute (ANSI)/American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) Standard 55-2010, *Thermal Environmental Conditions for Human Occupancy* and ASHRAE Standard 90.1-2010, *Energy Standard for Buildings Except Low-Rise Residential Buildings*, nationally recognized industry standards, to define employee comfort and set temperature ranges.
  - Set, operate, and maintain office space at 69° to 79° F from 7:00 a.m. to 5:00 p.m. Monday through Friday.
  - Achieve 80% employee comfort satisfaction rating per building.
- Require individuals to be responsible for their own comfort, within reason. It is reasonable to ask employees to wear sweaters and layers of clothing, and make clothing adjustments.
- Allow space heaters if the building mechanical system cannot provide the set temperature range for an individual work space, or there is an approved medical need. If space heaters are needed, they must be the corporate approved space heater (400 watt “Cozy Legs”).
- If testing indicates an individual work space meets the established temperature set point range for a minimum of one month, existing space heaters will be removed by management.
- Continue to install HVAC sensors to turn off HVAC in unoccupied space.
- Continue to evaluate how buildings are zoned as part of the energy audit process. Understanding that it is difficult to change zoning in a building once built, design basis changes over time may justify the cost.
- When possible, consider locating employees appropriate to their individual temperature preferences.
- The FMOC will monitor reported issues and work with appropriate Line Management to address them using these recommendations.