

SAND REPORT

SAND 2005-6807
Unlimited Release
Printed December 2005

Pollution Prevention Opportunity Assessment for the SNL/NM Cafeterias

Samuel A. McCord

Prepared by
Sandia National Laboratories
Albuquerque, New Mexico 87185 and Livermore, California 94550

Sandia is a multiprogram laboratory operated by Sandia Corporation,
a Lockheed Martin Company, for the United States Department of Energy's
National Nuclear Security Administration under contract DE-AC04-94AL85000.

Approved for public release; further dissemination unlimited.



Sandia National Laboratories

Issued by Sandia National Laboratories, operated for the United States Department of Energy by Sandia Corporation.

NOTICE: This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government, nor any agency thereof, nor any of their employees, nor any of their contractors, subcontractors, or their employees, make any warranty, express or implied, or assume any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represent that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government, any agency thereof, or any of their contractors or subcontractors. The views and opinions expressed herein do not necessarily state or reflect those of the United States Government, any agency thereof, or any of their contractors.

Printed in the United States of America. This report has been reproduced directly from the best available copy.

Available to DOE and DOE contractors from
U.S. Department of Energy
Office of Scientific and Technical Information
P.O. Box 62
Oak Ridge, TN 37831

Telephone: (865)576-8401
Facsimile: (865)576-5728
E-Mail: reports@adonis.osti.gov
Online ordering: <http://www.osti.gov/bridge>

Available to the public from
U.S. Department of Commerce
National Technical Information Service
5285 Port Royal Rd
Springfield, VA 22161

Telephone: (800)553-6847
Facsimile: (703)605-6900
E-Mail: orders@ntis.fedworld.gov
Online order: <http://www.ntis.gov/ordering.htm>



**SAND 2005-6807
Unlimited Release
Printed December 2005**

**Pollution Prevention Opportunity
Assessment for the SNL/NM Cafeterias**

**Samuel A. McCord
Pollution Prevention Group
Sandia National Laboratories
PO Box 5800
Albuquerque, NM 87185**

Abstract

This Pollution Prevention Opportunity Assessment (PPOA) was conducted for the two Sandia National Laboratories/New Mexico cafeteria facilities between May and August 2005. The primary purpose of this PPOA is to assess waste and resource reduction opportunities and issue Pollution Prevention (P2) recommendations for Sandia's food service facilities. This PPOA contains recommendations for energy, water and resource reduction, as well as material substitution based upon environmentally preferable purchasing. Division 3000 has requested the PPOA report as part of the Division's compliance effort to implement the Environmental Management System (EMS) per DOE Order 450.1. This report contains a summary of the information collected and analyses performed with recommended options for implementation. The SNL/NM P2 Group will work with Division 3000 and the respective cafeteria facilities to implement these options.

ACKNOWLEDGEMENTS

The author thanks Matthew Brito, Dave Castillo, John Davis, Richard Dramer, Ina Frazier, Christopher Goke, Gregory Kolb, Jack Mizner, Anthony Ortiz, Patrick Ortiz, Courtney Pompa, Matthew Shain and Linda Stefoin for their participation in the interdisciplinary team that was responsible for evaluating processes and generating the pollution prevention (P2) opportunities identified in this report.

CONTENTS

1. Executive Summary.....	7
2. Acronyms.....	8
3. Introduction.....	9
4. Resources	
4.1 Water.....	12
4.2 Energy.....	17
4.3 Chemicals.....	23
5. Waste Streams	
5.1 Waste and Pollution.....	24
5.2 Recyclables.....	27
6. Opportunity Review and Ranking	
6.1 Division 3000 Top Opportunities.....	31
6.2 Facilities Top Opportunities.....	33
7. Conclusion.....	35
Attachment 1. Buildings 861 and 960 Electricity and Natural Gas Consumption with Annual Temperature Charts.....	36
Attachment 2. 1999 Energy Simulation Results, Building 861, Cafeteria Renovation....	42
Attachment 3. Chemical Inventory Review.....	54
Attachment 4. Dumpster Volume Assessment Data: 2005 and 2002.....	56
Attachment 5. Pallet Removal Procedure.....	61
Attachment 6. Replacement Options for Open-Faced, Self-Service Refrigerators.....	63

FIGURES

Figure 1. Pollution Prevention Opportunity Assessment Process.....	10
Figure 2. Thunderbird Cafeteria (Building 861) Facility Process.....	11
Figure 3. Building 861 Water Consumption Over One Week.....	12

TABLES

Table 1. Building 861 Historic Energy Consumption.....	17
Table 2. Conversion of Weights to Revised Formula.....	25
Table 3. Building 861's Carbon Dioxide Contribution to the Atmosphere.....	26

MARGIN GRAPHICS



Actions implemented due to the PPOA.



Actions recommended by the PPOA.

1. EXECUTIVE SUMMARY

This Pollution Prevention Opportunity Assessment (PPOA) was conducted for the two Sandia National Laboratories/New Mexico (SNL/NM) cafeterias between May and August 2005. The primary purpose of this PPOA is to assess waste and resource reduction opportunities and issue Pollution Prevention (P2) recommendations for Sandia's food service facilities. This PPOA contains recommendations for energy, water and resource reduction, as well as material substitution based upon environmentally preferable purchasing. Division 3000 has requested the PPOA report as part of the Division's compliance effort to implement the Environmental Management System (EMS) per DOE Order 450.1. This report contains a summary of the collected process data and the P2 analyses with recommended options for implementation. The SNL/NM P2 Group will work with Division 3000 and the respective cafeteria facilities to implement these options.

The largest resource impacts of the cafeteria facilities are water, natural gas and electrical power. Consequently, these resource categories were targeted for reduction. The PPOA team evaluated the resource use and subsequent waste streams and developed fifteen opportunities that were not able to be implemented immediately. The ideas are categorized in *Section 6: Opportunity Review and Ranking* according to the respective group that should implement them: Division 3000 or Facilities. The fifteen P2 opportunities described below are recommended for implementation. Once implemented, these opportunities would result in resource reductions, cost savings, and the implementation of Federal environmentally preferable purchasing goals.

- Opportunity 1: Install a Permanent Water Meter at Building 861
- Opportunity 2: Install a Pressure Reducing Valve at Building 861 set to 65psi
- Opportunity 3: Use Dishwasher in Automatic Mode with Turn-Off set to 1 min.
- Opportunity 4: Install the High-Pressure, Low-Flow Rinse Nozzle
- Opportunity 5: Investigate Dishwasher Graywater Use in Garbage Disposal
- Opportunity 6: Upgrade to Efficient Toilets and Urinals in Building 960
- Opportunity 7: Upgrade Building 861 Urinals to 0.5 gal/flush
- Opportunity 8: Upgrade all Faucets to an Efficient 0.8 gal/min
- Opportunity 9: Seek Funding for Solar-Powered Water Preheating in Building 861
- Opportunity 10: Upgrade both Open-Faced Refrigerators to Efficient Models
- Opportunity 11: Implement Additional Grill Vent Fan Maintenance in Building 960
- Opportunity 12: Upgrade Backdoor to Building 960 Kitchen
- Opportunity 13: Sandia provide Greener Chemicals for Pilot Testing
- Opportunity 14: Update Recycling Signage in Building 861
- Opportunity 15: Sandia provide Greener Service Ware for Pilot Testing

2. ACRONYMS

861	Thunderbird Cafeteria, Building 861
960	Tech Area IV Café, Addition to Building 960
DOE	Department of Energy
F	Fahrenheit
FY	Fiscal Year
kVA	Kilovolt-Amp
kWh	Kilowatt Hour
LED	Light-Emitting Diode
MSDS	Material Safety Data Sheet
NG	Natural Gas
P2	Pollution Prevention
PPOA	Pollution Prevention Opportunity Assessment
ROI	Return On Investment
SNL/NM	Sandia National Laboratories/New Mexico
SSO	Sandia Site Office (Department of Energy)
SWTF	Solid Waste Transfer Facility
TA4	Tech Area IV

3. INTRODUCTION

The Sandia National Laboratories/New Mexico (SNL/NM) Pollution Prevention (P2) staff conducts Pollution Prevention Opportunity Assessments (PPOAs) for organizations within SNL/NM and Sandia National Laboratories/California (SNL/CA). The goal of a PPOA is to identify practical, cost-effective strategies to ensure the following:

- Reduction of overall resource use
- Reduction or elimination of waste generation
- Reduction in waste toxicity
- Increased environmentally preferable purchasing
- Reduction of the line organization's operational costs

The completed PPOA is presented to the organization for implementation. The P2 staff will assist with implementation as much as possible through providing technical and administrative support and seeking funding options when necessary.

Division 3000, which oversees the cafeterias facilities, requested this PPOA in order to comply with the SNL/NM implementation of the Environmental Management System (EMS) per the DOE Order 450.1, *Environmental Protection Program*. Consequently, between May and August of 2005, this PPOA was conducted for the two permanent cafeteria facilities at SNL/NM, the Thunderbird Café (Building 861) and the Technology Area IV (TA4) Café (Building 960).

The primary purpose of the PPOA is to provide recommendations for the implementation of P2 opportunities for the food service facilities. The process used to perform the PPOA is outlined in Figure 1. This report contains a summary of the information collected and the analysis performed with recommended options for implementation. SNL/NM P2 will work with Division 3000 and the respective cafeteria facilities to implement these options.

The PPOA team consisted of waste management, P2, facility managers and operations personnel. This inter-disciplinary team was responsible for evaluating processes, resource use and waste streams displayed in Figure 2, and for generating the pollution prevention (P2) opportunities identified in this report. Information was collected through interviews with facility personnel, site visits, measurements of resource use and evaluation of waste disposal. A temporary water meter was installed and dumpster volumes were assessed over periods of one week and one month respectively. The data was used to establish a baseline against which to compare opportunity implementation impacts and to evaluate effectiveness of current utility/service fee structures. This PPOA process consisted of brainstorming ideas, screening ideas and conducting technical and cost analyses on the screened options.

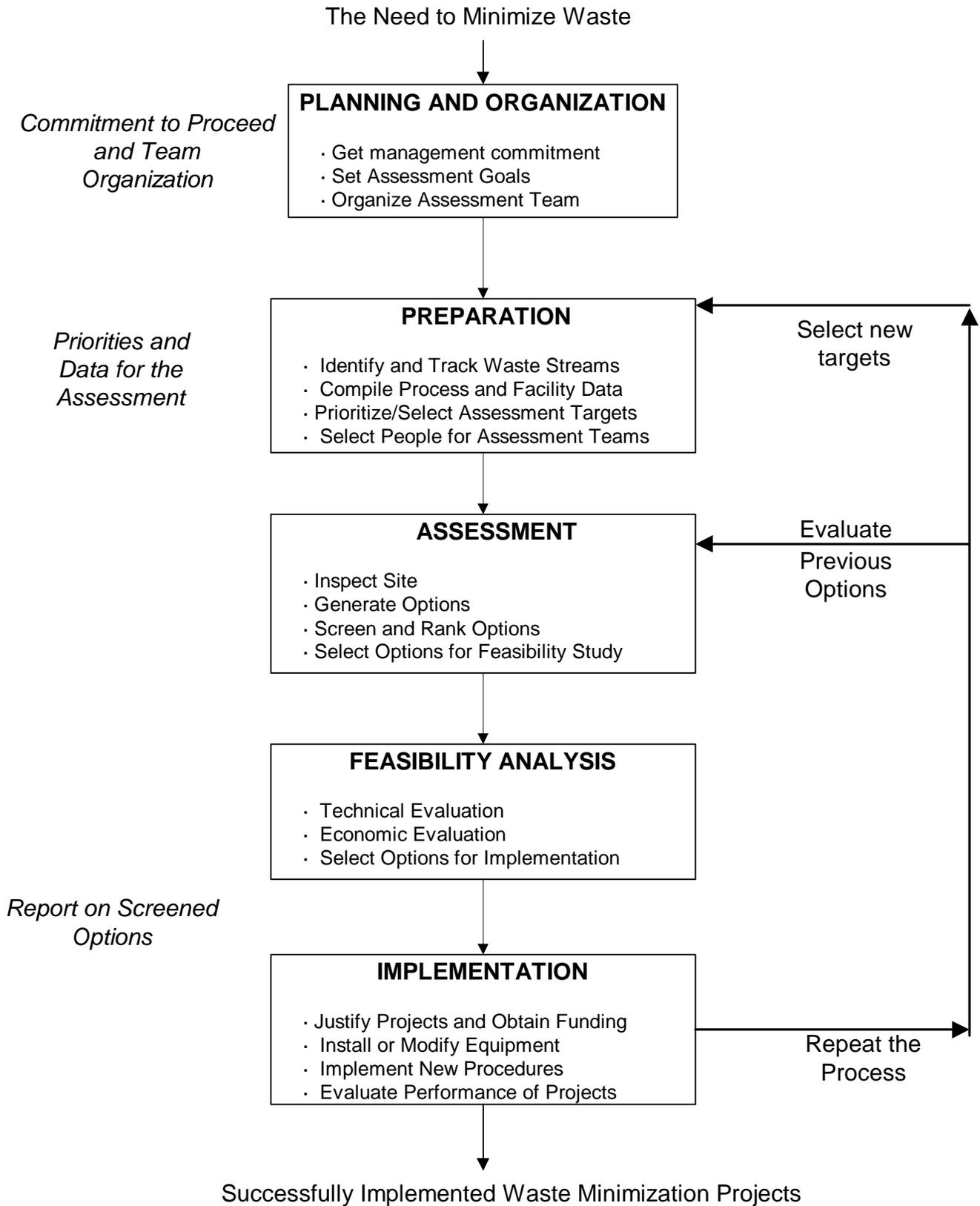


Figure 1. Pollution Prevention Opportunity Assessment Process

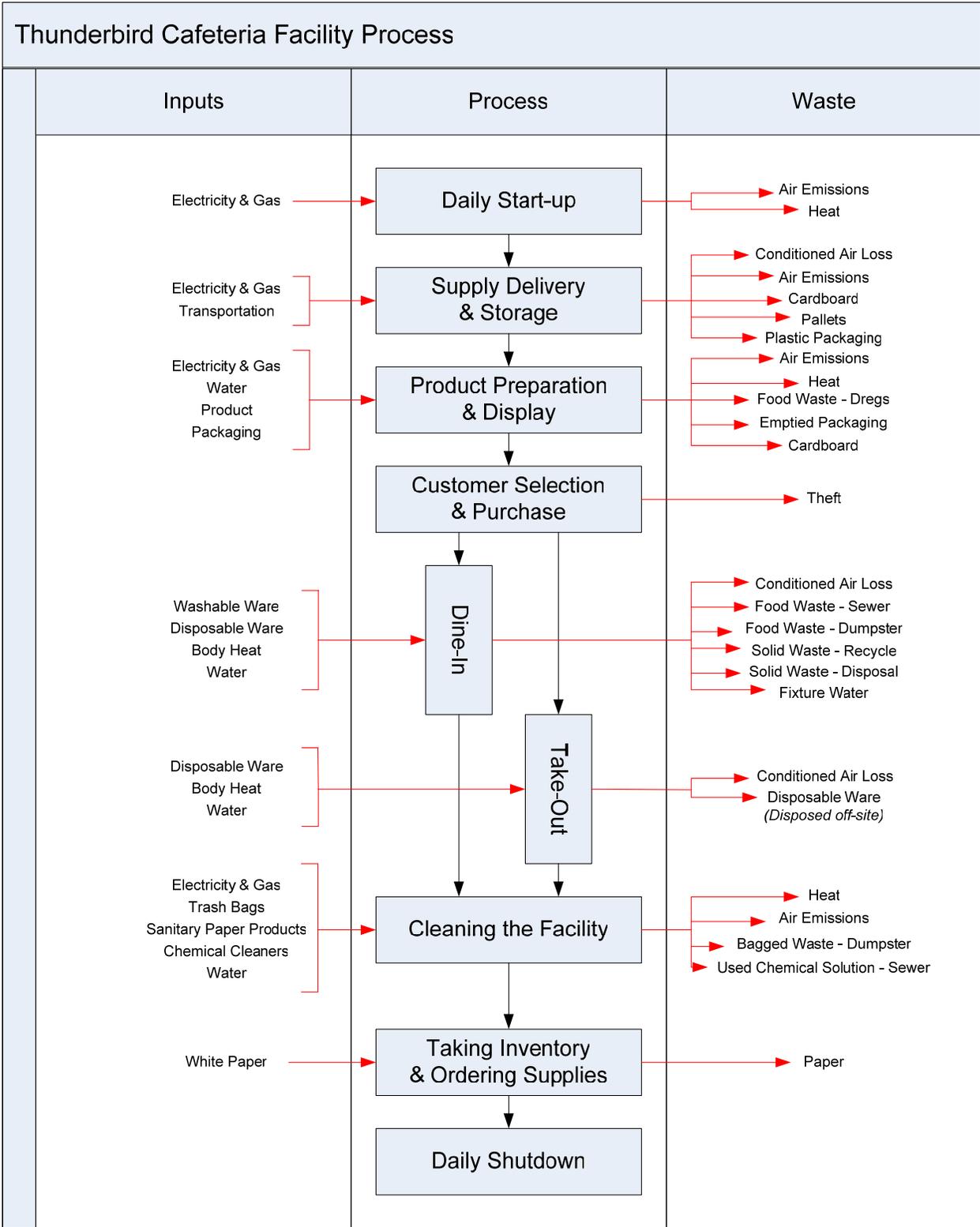


Figure 2. Thunderbird Cafeteria (Building 861) Facility Process

4.1. WATER

Water is the primary resource used in the cafeterias with the majority consumed in Building 861. Building 861 operates an industrial automatic dishwasher and has public restrooms visited by up to 900 people per day, though not every customer will stop at the restrooms when visiting. Both locations do engage in food and drink preparation services to some extent.

METERING

Building 960 is metered for water, but separate data for the small café is not available. However, Building 861 was built at a time when individual building water metering was not considered advantageous or too expensive. Though this is no longer the case and newly constructed buildings do have individual water meters installed, many buildings on site have not yet been retrofitted with water metering technology.

In order to obtain an accurate determination of water usage, the PPOA team requested that SNL Facilities monitor and record the volume of water usage. Building 861 was able to be attached to a temporary meter for one week at the end of July. For each day of operation, it sustained a consumption rate of approximately 4,000 gallons of water per day.

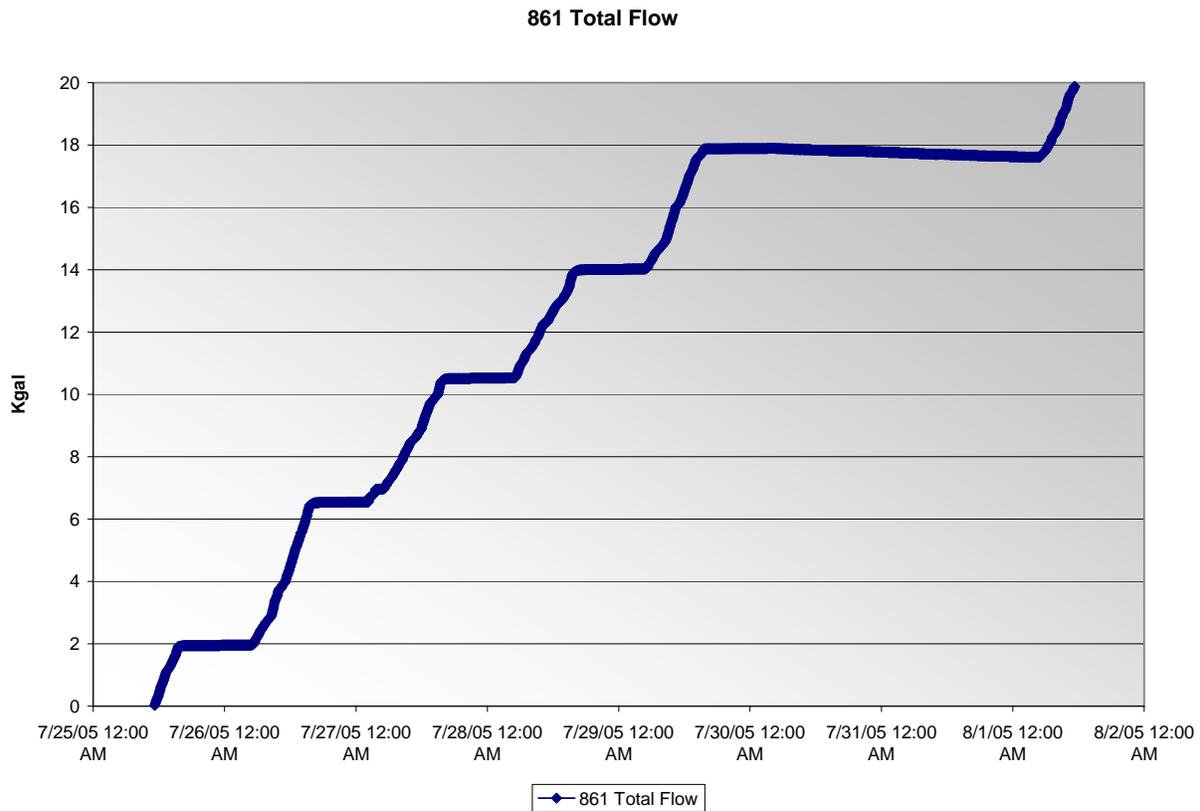


Figure 3. Building 861 Water Consumption Over One Week

During non-operational hours (1700 to 0500), the temporary meter provided fluctuating readings with a net water usage of 6.65 gallons per night. This additional water usage is being attributed to foot patrols that may use the restroom while patrolling the building as part of their route. Additionally, some equipment such as ice machines may draw on the water supply continually. An anomaly was recorded in these off-hours between 0220 and 0345 on Friday, July 29th showing a consumption of an additional 82 gallons. That is equivalent to over 50 toilet flushes or almost three minutes of the automatic dishwasher in active use. The exact source of this anomaly remains unknown.

Opportunity #1



It is recommended that a permanent water meter be installed at Building 861 to permit ongoing collection of water use data. Additionally, periodic leak tests utilizing the meter are recommended.

WATER PRESSURE

The water pressure available to a facility is directly proportional to its elevation relative the source, the distance from the source, and the location of pumping stations in the vicinity. Within a facility, the water pressure can vary according to load usage, if there are multiple floors, and if water is first pumped to the top of a building and then released to gravity for use below. The higher the water pressure available to a building and the fixtures therein, the faster the water will flow out. Some fixtures do attempt to regulate water flow, but are unable to totally mitigate unregulated high water pressure.

The building designers or maintainers have already considered water pressure in the case of Building 960. It is primarily a multistory office and laboratory building with the Tech Area IV Café built as a first-floor addition external to the original superstructure. There is a pressure reducing valve installed at Building 960. A pressure reducing valve brings down the water pressure within the pipes to a predetermined level that is good for two reasons: first, it reduces the pounds per square inch (psi) of water pressure, thereby increasing the life of piping and equipment by reducing the wear, and secondly, conserves water by not forcing more water through a fixture than can be moderated by the fixture itself. Per the Sandia water conservation officer, a water pressure of 60-70psi is considered a good level for equipment longevity and conservation purposes. The valve at Building 960 is set to 65psi. At last measurement though, Building 861, a one-story building, was at 92psi and was not believed to have a pressure reducing valve.

Opportunity #2



It is recommended that a pressure reducing valve set to 65psi be installed in Building 861.

AUTOMATIC DISHWASHER

The automatic dishwasher in Building 861 is the major source of water usage. Building 960 does not have the structural capacity or the volume of customers to warrant having an automatic dishwasher. Building 861 does have reusable service ware and a separate room to support an automatic dishwasher.

At the time of this assessment, Building 861 had a Hobart brand conveyor-style automatic dishwasher, model CRS66AW. Although specific information about this particular model was unavailable from the manufacturer, the user's manual did indirectly reference water consumption volumes. The manual indicates that this model has a drainage capacity of at least 31 gallons per minute. This could be interpreted as the peak water output for this unit.

The dishwasher has three modes: off, on-manual, and on-automatic. When turned to the manual setting, the machine runs continuously, whether dishes are being washed or not. When turned to the automatic setting, the machine detects when one of the 2' x 2' plastic dish racks is pushed into the entrance and immediately begins the conveyor and pre-wash cycle. The dishwasher will continue to run until the last dish rack inserted has cleared the exit of the machine and the conveyor has been unoccupied for three minutes.

Two positive aspects regarding the dishwasher are its internal water recycling and its chemical usage. The water used during the pre-wash cycle is overflow water captured from the wash cycle of the previous dish rack. Rather than using fresh water and perhaps additional washing agents, the once-used water already mixed with soap from the wash cycle is reused once before being sent down the drain. With respect to the automatically dispensed soaps and chemicals, the dispensing mechanisms are checked and optimized on a monthly basis by a trained outside Ecolab employee.

During the primary facility tour, two employees were working in the dishwasher room. One was rinsing the dirty dishes as they were placed on the racks to be sent through the dishwasher, and the second employee was clearing the trays from the machine and taking the dishes to be put away or sent back out to the service area for reuse. The dishwasher was observed to be in the manual mode.

Opportunity #3



First, proceduralize and train the employees to turn the machine on in the automatic mode.

Second, to fully take advantage of the water-saving features of the dishwasher, it is recommended to decrease the automatic shutoff time from three minutes to one minute. This does not adversely impact the operator's ability to load the next rack for placement before the machine shuts down, because the first tray placed in the machine must run through its full wash cycle before the one-minute countdown begins.

Opportunity #4



Thanks to the water conservation group in Facilities, Building 861 has been given a low-flow, high-pressure nozzle free of charge to replace the current nozzle used to rinse the dirty dishes prior to washing. This nozzle should be installed.

Opportunity #5



In order to process the food waste being rinsed down the drain prior to the dishes being washed, the garbage disposal was left on continually as well as a flow of fresh water for rinsing. To eliminate this fresh water use, the soiled water from the dishwasher could be piped directly to the garbage disposal. This would provide grinding of any large chunks of debris that made it past the rinsing and into the dishwasher in addition to maintaining the needed level of flushing of the disposal without an extra input of water.

For consideration:

- Verify that such graywater use is permitted for food handling facilities
- Ensure that the peak drainage of 31gal/min is provided for
- Ensure piping from dishwasher would not become obstructed with debris
- Leave current water source in place should garbage disposal be needed while dishwasher is not yet functioning (generating the graywater)
- Train staff to turn off fresh water while graywater flow is present

HOT WATER HEATERS

Again due to the facility's size, Building 960 does not have its own hot water heater. The Café is provided hot water via the building boiler that was in place prior to construction of the Building 960 addition that contains the Café.

However, Building 861 does have two relatively new 175-gallon hot water heaters. These were installed approximately one to two years ago. The two water heaters are set to optimal temperatures. The first services the dishwasher and is set to 180F, per the dishwasher user's manual. The second services all other hot water fixtures throughout the building and is set to 150F.

TOILETS AND URINALS

The design for the Café addition to Building 960 did not include any bathrooms in construction. The east entry to the customer area is outside the primary lobby of Building 960 where a men's and a women's restroom are available. While perhaps outside the scope of this assessment, it was discovered during a site water audit in the past year carried out by Facilities that Building 960's toilets and urinals are wasteful. The toilets use 3.5 gallons per flush (gpf) and the urinals use 2gpf. The toilets in Building 861 are water-conservative 1.6gpf and the urinals use 1gpf. It should be noted that technology is continuing to progress and that urinals using only half a gallon of water are now readily available.

Opportunity #6



It is recommended that the owners of Building 960 be encouraged to modernize the toilets and urinals available to Café customers in the lobby, if not throughout the building.

Opportunity #7



It is recommended that the owners of Building 861 be encouraged to replace current urinals with more efficient half gallon per flush models as possible or necessary.

FIXTURES

All the faucets in Buildings 861 and 960 have aerators, which moderate the flow rate and provide straight water flow. Additionally, all of the bathroom faucets in Building 861 have motion sensors which prevent accidental unmonitored flows and disenable users from leaving the faucet on during extended hygiene activities. Neither building's bathrooms have the most efficient faucets. All of Buildings' 861 and 960 bathroom faucets use 2.2 gallons per minute (gpm).

Opportunity #8



It is recommended that the owners of both Buildings 861 and 960 be encouraged to replace current fixtures with similar models that use only 0.8gpm as possible or necessary.

LANDSCAPING

The campus areas immediately surrounding both Buildings 861 and 960 are largely either paved or rocked, with a few trees in proximity. At Building 861, the rocked area located to the east contains the trees and will receive additional plantings when a shade structure from the now closed Coronado Club is relocated and installed. There is a drip irrigation system installed at Building 861 which is combined with Building 860 and the north portion of the adjacent walking mall within the limited area. At the end of June, an improved controller for the system was installed and tested for functionality and efficiency by Facilities.

4.2. ENERGY

Building 861 has an annual energy consumption on the order of 387,000kWh of electricity and 1,750,300cu/ft of natural gas. The Café addition in Building 960 is not separately metered from the rest of the building and due to constant process changes therein, no impact from opening is discernable. Additionally, both buildings have battery powered back-up inverters and are designed to varying extents to make use of available sunlight.

ELECTRICITY AND NATURAL GAS

Permanent meters are useful in establishing baselines and evaluating impacts from process changes. Both natural gas and electricity are independently metered for Buildings 861 and 960. See Table 1 which illustrates an historic consumption comparison of electricity and natural gas (NG) both at this time in prior fiscal years and as a total for the fiscal years for Building 861.

	This Time Prior Years	Total Annual Usage
Fiscal Year	kWh Elec. & cu/ft NG	kWh Elec. & cu/ft NG
FY02	347,000 / No Data	426,000 / No Data
FY03	321,000 / 1,344,300	402,000 / 1,563,300
FY04	335,000 / 1,534,700	416,000 / 1,756,400
FY05	306,000 / 1,528,600	NOT YET AVAILABLE

According to the energy use patterns over the past four years, Building 861 will probably have the lowest and best measured kWh consumption in FY05. As would be expected, the electricity consumption increases during the summer to operate the refrigerated air conditioners and peaks during the same months that the temperatures peak. Throughout FY05, the building has consistently used less electricity. This trend may be based upon equipment having been replaced or removed. Since the Café opened in January 2005, Building 960's overall electrical consumption has actually decreased. Over the past three years, electricity usage in Building 960 has fluctuated. From examination of the energy usage trends of the original portion of Building 960, it is clear that significant consumption changes take place periodically.

Natural gas consumption in Building 861 has been consistent for two years. However, a deviation in consumption during FY03 coincided with an unusually warm January that was approximately 8°F warmer than the normal, a 30-year average, and therefore less natural gas was needed for space heating purposes.

See Attachment 1 for electricity and natural gas consumption data and for annual local temperature charts.

BATTERY BACK-UP

Across the Sandia National Laboratories, Facilities has worked to standardize the installation of back-up inverters in each building. Currently, there are two sizes used: 1.5 kVA with a four battery array and 4 kVA with a ten battery array. The size of inverter or inverters installed depends upon the assessed emergency electrical load required in the facility. If the standard alternating current was to be cut off, the inverters are designed to power emergency floodlights as well as emergency exits signs. The required load is proportional to the size of the building. The single-story Building 861 has a small emergency load and requires only a single 1.5 kVA inverter. The multistory Building 960 with the cafeteria addition has a larger load and is connected to two inverters, both a 1.5 kVA and a 4 kVA, to support the emergency load.

Minimizing the number of batteries in the inverter has been recently evaluated by Facilities. For example, if a building requires an emergency load of more than 1.5 kVA, but less than 3 kVA, then two 1.5 kVA units would provide the needed power and require two less batteries than the 4 kVA inverter. However, per National Electric Code (NEC), each inverter requires 42" of clearance in front of its access panel. The installation of two inverters would double the required clearance area in order to save the use of two batteries. It was decided this was not a worthwhile trade-off.

The old model LEC-100 and LEC-200 batteries that require water as well as the old inverters themselves are now considered obsolete. New inverters composed of maintenance free, high-efficiency gel-cells are in the process of being installed in all buildings. Small quantities of the old batteries are being maintained for use in inverters that have not been replaced yet, but the bulk of old batteries had to be disposed. Despite attempts to give them away for reuse, no one wanted them due to their age, maintenance requirements and spill-containment issues.

LIGHTING

Solar energy is used in both cafeterias. In the larger Building 861, skylights were installed in the southern dining area. There are also four groups of tall windows on the southern end of the building that bring in daylight. In the Building 960 addition, floor-to-ceiling windows were installed along southern and southwestern walls of the dining area. Due to their size and orientation, these windows provide ambient heat as well as the primary source of lighting. Additionally, Building 960 has two variations of modern, ceiling-mounted mini-halogen spotlighting. One type is above the service areas, and the second type is above the dining area. There are also track lights and large, generally unused floodlights. Only in the Building 960 kitchen and storage areas are there the standard 48" fluorescent light fixtures. Fluorescents are the primary source of light throughout Building 861. In addition, Building 861 contains a long chain of track lighting that follows the customer food service line.

There are benefits to both lighting schemes. In Building 861, the fluorescent lamps are the most efficient fixtures available to fit the need. The dining area has great depth away from the daylighting windows. The fluorescent bulbs have the greatest light output in lumens, the longest life at 20,000 hours, and accomplish both of these while using the least amount of watts. A 48" florescent lamp produces a very efficient 79 lumens per watt. Compare that to a common

incandescent bulb that would only produce 15 lumens per watt and cease functioning after only 1000 hours of service. The long chain of track lighting are manually turned on at approximately 0530 each morning and turned off at 1530 after the facility is closed to customers. All of Building 861's lights are turned off by the cafeteria staff during the daily building shutdown, thereby not wasting any energy to light an unoccupied building.

The Café in Building 960 has a much smaller footprint and is designed to emulate the atmosphere of a trendy college coffee bar. With the presence of the daylighting, less artificial light is needed. The mini-halogen used in the dining area are approximately 12 feet above the floor, and approximately 8 feet above the food service areas. Their elevation away from food and customers is important as mini-halogen burn at incredibly high temperatures. This also impacts the HVAC system, positively in the winter and negatively in the summer, by creating more ambient heat. Mini-halogen's benefits are the clean white light they produce and extended life-spans over incandescent bulbs. Efficiency wise, only a fraction more lumens per watt are received over incandescent bulbs, but their life-span is extended greatly. In the working areas, 48" fluorescent fixtures are installed.

The areas in front of the windows in Building 861 have an abundance of natural lighting. As a result, Facilities has been requested to remove two bulbs per non-emergency fixture in these areas for a trial period of two weeks. By removing two 48" bulbs per fixture, 64 watts per hour per fixture or approximately 700kWh total per year would be saved. If no customer complaints ensue, at the end of two weeks, the last of the three bulbs will be removed from each of the fixtures for an additional test period. This would increase annual savings to approximately 1050kWh.



USING CONVERTED SOLAR ENERGY

Beyond natural lighting, solar energy can be converted into mechanically usable power for many applications such as water preheating and plug-load support. The SNL Solar Power group was contacted to consider Building 861 for potential solar power projects. Water preheating may be the first cost-effective application to be tested. As fuel prices continue to increase, the projected payback period will conversely shorten and more alternate-power options become feasible.

To make water pre-heating a reality for Building 861, an unglazed collector system attached to a 1000 gallon tank that would feed both natural gas powered water heaters is recommended. The collectors would total 400-800 square feet and be applied to the building's flat roof in a flat manner to save the expense and complexity of tilting the panels to follow the sun. The solar radiation would heat the water in the feeder tank between 20°F and 60°F above the groundwater temperature. The temperature increase is a direct function of the available solar radiation. Seasonally, during the winter there would be less energy available due to the angle and position of the sun. Summer would provide the peak energy availability.

The cost of this solar heating system installed is between \$10,000-15,000. It would save 1,200-1,500 therms of natural gas (116,000-145,000 cu/ft; 6-7% of total) annually and reduce greenhouse gas emissions by 7-9 tons. If no financial discounts or assistance is available, the payback period based on cost savings would be 6-9 years. If this opportunity is well received,

the Solar Power group is capable of refining these conservative numbers through several usage measurements.

Opportunity #9



It is recommended that funding for solar powered water preheating in Building 861 be sought.

EQUIPMENT

Current cafeteria management has been very conscientious about equipment efficiency, as evidenced by the following:

- In the Building 960 addition, the Continental brand refrigerator and stand-alone freezer are both labeled as Energy Star® equipment.
- The Building 861 walk-in refrigerator and walk-in freezer coolers do not use a chlorine-based process. They have automatic door closers to preserve conditioned air; and each has a timer-controlled light switch. The light timer can be set to stay on for up to 30 minutes before it turns off.
- In Building 861, many open-top electric refrigerators are used to display the food products during the business day, but are emptied at night. These refrigerators are turned off when not in use. Only one remains on all the time because it contains materials used for morning food preparation.
- When the Coronado Club closed at the end of FY04, all of the equipment was reviewed and compared to current Building 861 equipment. The ice machines and other more modern pieces were brought over to replace and update current equipment in place.
- Office computer monitors have their energy reduction settings activated.
- All of the exit signs in Buildings 861 and 960 are the energy efficient light-emitting diode (LED) models.

SELF-SERVICE REFRIGERATORS

During the brainstorm session, the installation of on/off timers and occupancy sensors in the beverage refrigerators was proposed. It is a documented energy-saving opportunity to have light panels and compressors not operate when not needed. This turned out to be a non-opportunity. The primary reason this is not possible is that the equipment is not owned by Sandia or the vendor Sodexo. The product display refrigerators are owned by the product manufacturers and are not permitted to be altered. Additionally, the cafeteria staff felt that minimal energy is lost during periods of disuse; some products will age prematurely should the temperature not be kept within a constant range as turnover is not daily; and some dairy products will go bad.

The installation of sliding doors or thick plastic curtain flaps on Sandia-owned, open-face, self-service refrigerators was also discussed. This was decided to be a non-opportunity as well for two reasons. First, the curtains were pointed out as a safety hazard as some products sold are in glass containers. Secondly, both options to alter the equipment were pointed out to be a difficult

and time-consuming process for Facilities, as well as a safety hazard due to changing a pre-manufactured electrical appliance.

Opportunity #10



It is recommended that when open-face self-service refrigerators in Buildings 861 and 960 reach the end of their life-cycle, that closed-face energy-efficient models are selected as replacements. See Attachment 6 for sample replacement options.

WIRELESS COMPUTER NETWORK

Within the past 6 months, Sandia National Laboratories has been deploying wireless networks in various locations. One of these locations is the Building 861 cafeteria. Included in the deployment is a wireless bridge that connects Building 861 to the rest of the network and a network switch that connects to the five wireless access points which serve the customers. No servers or other computers were needed to be located within the building. The wireless network equipment has energy-saving features built into their designs, but are not currently activated.

The wireless network administrators determined though that the activation of the energy-saving features in the network equipment would result in compromising the speed and efficiency of the wireless network. Therefore, this suggestion is a non-opportunity. If the wireless network's energy conservation features were activated during off-hours (weekends and weeknights), the reactivation of the network could be slow and difficult. In essence, the various wireless access points would need to reconnect to the main server and download their entire settings program package. If all the access points came on-line at the same time, this would slow down the server. If the reactivation times were staggered, the server would be spared; however the failure rate for reactivation is relatively high and requires a technician's response. However, it should be noted, idle access points use very little energy in comparison to when a customer is actively using one.

OPTIMIZING FOOD EQUIPMENT

The PPOA team considered evaluating the food service and preparation equipment for optimal energy management. This was a non-opportunity. Because the Sodexo staff operates and is certified under the National Safety Foundation's regulations governing food industry safe practices, it was decided not to risk inadvertently upsetting the careful balance needed for food safety and the cafeteria's ability to maintain certification.

ATMOSPHERE CONTROL

Building 861 has four fairly new Carrier-brand HVAC units that maintain four zones within. There are peculiarities inside such as over heating near the kitchen slicer and uncomfortable extremes in the office. A fifth HVAC unit is dedicated solely to the operation of the stoves' ventilation hoods. The Building 861 kitchen backdoor has an air curtain blower installed, which has a manual on/off switch. Although automation of the air curtain blower was considered, this was determined to be a non-opportunity because the back doors are left open all day for constant deliveries. Turning the curtain off is part of the end of day shutdown process.

A building engineer was requested to evaluate Building 861's northwest HVAC zone that is connected to both the automatic dishwasher room and the externally accessed water heater mechanical room. The drawings gave the appearance that there might be conflict between the rooms' objective temperatures due to the functions therein. However, the drawings were out of date. When the new water heaters were installed, additional external ventilation was also installed, and the return ventilation had been capped in the mechanical room to prevent this sort of conflict and to update the mechanical room to code.

The Café in Building 960 had some atmosphere control issues at the beginning of this assessment. Since that time, a number of corrections have been made.



- The thermostat has been programmed for the first time and will now maintain a consistent temperature range.
- The grill vent fan has been slowed down by 20%. It was blowing so hard that grease was being deposited all over the kitchen equipment, walls, and floors. The work order specifically directed a decrease by 20%, but the chef concurs with the repair person that the fan should be slowed down even more. While reportedly much better, some grease is still blown away and deposited in the immediate area.
- Thanks to improved temperature control, the kitchen's back door is no longer needed to be left open for air exchange. Due to functional requirements by the staff, the door is still left cracked open. Installing a doorbell, perhaps wireless, in addition to changing out the door knob for one capable of being left unlocked for deliveries would mitigate this.

Opportunity #11



It is recommended that the grill vent fan repair company be brought back to Building 960 to lower the fan speed additionally.

Opportunity #12



It is recommended that the Building 960 kitchen back door have its handle replaced with a model that is capable of remaining unlocked and a wireless door bell be installed.

For a historical look at the energy efficiency of Building 861, please see Attachment 2 for the 1999 Energy Simulation Results.

4.3. CHEMICALS

To survey the cafeterias' chemical inventory, all the Material Safety Data Sheets (MSDSs) were reviewed and placed in a spreadsheet for analysis. Attachment 3 contains the chemical inventory review data. Available information reviewed included: the hazard ratings for health, flammability, and reactivity; whether or not it is in aerosol form; whether or not it reacts with water; the pH level; and the flash point. Based on these criteria, 24 out of 35 chemical products were determined to be benign.

Of the remaining 11 chemical products, five had health hazard ratings of 3 (on a scale of 4); five had pH's of less than or equal to 2, or greater than or equal to 13; and finally, one had an unusually low flash point. These criteria were used as screening tools simply to identify potential hazards.

Of these eleven products, eight are no longer kept in inventory leaving only three to evaluate further. First, a waterless hand sanitizer had a low-temperature flash point because of the high percentage of rubbing alcohol it contains. This product is kept in wall dispensers near sinks and is not near any open flames or heat sources. Second, an acidic cleaner-delimer from Ecolab had a very low pH. As a regularly occurring and measured process, two ounces of this product are diluted with water in order to clean out the kitchen steamer once per week. Finally, a high alkaline oven cleaner-degreaser is kept in a well-labeled, individual-sized, manual spray bottles and is only used as needed to clean the ovens. Proper ventilation is maintained through the use of the oven vent hoods with additional fresh air brought in through the back doors being left open for vendor deliveries. Most of the other chemicals used are in direct feed systems that minimize the possibility of exposure.

Opportunity #13



It is recommended to replace current caustic chemicals with environmentally preferable chemicals. However, the contracted chemical supplier to Sodexo does not currently offer a line of more preferable chemicals. In support of the DOE Bio-Buy Early Initiative, it is recommended that Sandia test-purchases and evaluates either biobased or less toxic substitutions for the high alkaline oven cleaner-degreaser and the acidic cleaner-delimer.

5.1. WASTE AND POLLUTION

SOLID WASTE

From June 2nd through July 1st, dumpsters used solely by the cafeterias were observed and waste volumes were recorded in order to evaluate ways to minimize fees related to solid waste generated and disposal. Additionally, the current waste stream was assessed for volume minimization opportunities. Since cafeteria waste contains liquids and food waste, it is not able to be processed by the Sandia National Laboratories Solid Waste Transfer Facility (SWTF). Instead, the cafeterias have contracted with Chugach for waste hauling. Chugach sub-contracts to Arrow Disposal Services to engage in the actual dumpster collection. The cafeterias have two solid waste dumpsters outside of Building 861 and one outside of Building 960. Upon collection of the waste, it is trucked directly to the Rio Rancho sanitary landfill. This point is relevant to the assessment of recycling options at the cafeterias.

For liquid and food waste, the Air Force requires three pick-ups per week resulting in an annual cost of \$3069.59 per dumpster. At Building 861, the pick-up schedule of early morning every Monday, Wednesday and Friday was well defined and followed. At Building 960 though, the pick-up service was newly arranged to have begun this past January, but the schedule was not properly communicated at some level. Arrow Disposal Services was following a schedule of once per week, every Thursday. Initially, the volume of the Building 960 dumpster was visually measured on a daily basis, but once the apparent scheduling problem was detected due to waste overflowing, the rate of measurement was increased to twice a day to discern the actual schedule. See Attachment 4 for pick-up and volume observations. Due to phone calls and e-mails exchanged with Chugach and Arrow Disposal Services, the required and contracted schedule of three times per week was begun Wednesday, June 22, 2005.



During the month of dumpster observations, Building 861 was observed to average 3.56 cubic yards of solid waste per workday the cafeteria was open. Taking into account federal holidays and the week Sandia National Laboratories is closed in December, there are 248 workdays in the year, resulting in 883 cubic yards of solid waste generated per year. Using the same process for Building 960, 0.76 cubic yards of solid waste per workday is generated resulting in 188 cubic yards per year.

Since 1997, the Pollution Prevention staff has continuously estimated the volume of waste generated from the food service facilities within Sandia National Laboratories. Food service has undergone a number of major changes since and consequently, the basis for these estimates has been revised at least twice before. Sandia is no longer responsible for the café inside the now relocated National Atomic Museum and the Coronado Club has been closed. The TA4 Café has since opened. There is a semi-permanent food service trailer on the MESA construction site with a dumpster; however it is not tracked because it is believed that the construction company is responsible for the dumpster and waste therein. Finally, there is a food service outlet located at the Department of Energy (DOE) Sandia Site Office (SSO), however all waste generated there falls under the purview of the DOE. There used to be a total of eight dumpsters being tracked, each believed to be 8 cubic yards in capacity. Now there is one dumpster of 8cu/yds capacity at

Building 960 and two dumpsters of 6.11cu/yds capacity at Building 861. The tracking of waste is typically converted into weight by metric ton. The old formula used for this conversion in the past was:

$$\begin{aligned} & \# \text{ cubic yards} * 800 \text{ pounds per cu/yd} \\ & \div 2.204 \text{ pounds per kilogram} \\ & \div 1000 \text{ kilograms per metric ton} \end{aligned}$$

The author found the assumption of 800 pounds per cubic yard an unrealistically high number and researched what applicable conversion numbers might be published. In the McGraw-Hill Recycling Handbook, the conversion for unbaled, loose sanitary waste is 400 pounds per cubic yard.¹ The author adopted this figure and also refined the pounds per kilogram conversion to the next decimal, 2.2046 to match most references found. The revised formula is:

$$\begin{aligned} & \# \text{ cubic yards} * 400 \text{ pounds per cu/yd} \\ & \div 2.2046 \text{ pounds per kilogram} \\ & \div 1000 \text{ kilograms per metric ton} \end{aligned}$$

Prior tracking was based upon maximum capacity, not the volume generated. In FY97, it was estimated at 2420.16 metric tons (mt) annually. At the beginning of FY02, it was estimated at 1781.24mt annually. By the end of FY02, it was estimated at 414.12mt annually, a significant decrease due to it being the first volume generation-based assessment. This estimate was based on six dumpsters – four at the Coronado Club and two at Building 861. From the 2002 survey data, it appears that the Coronado Club only needed two dumpsters, as two of the four regularly sat empty. The current 2005 survey just completed would be estimating 388.73mt by the old formula, which would be in line with the 2002 survey, the net reduction of one useful dumpster and increased business at Building 861 due to the Coronado Club’s closure. However, by the revised formula, FY05 annual putrescible waste is estimated at 194.31mt. See Table 2 below for historic figures’ conversion to the revised formula.

Fiscal Year	Old Formula	Revised Formula
FY97	2420.16 mt	1209.75 mt
FY02a	1781.24 mt	890.38 mt
FY02b	414.12 mt	207.00 mt
FY05	388.73 mt	194.31 mt

¹ *McGraw-Hill Recycling Handbook*, Herbert F. Lund, McGraw-Hill, New York, 1993, chapter 24, page 24.

AIR POLLUTION

Carbon Dioxide Released Due to Energy Consumption

There are relatively simple conversion equations which calculate the pounds of carbon dioxide (CO₂) that are released into the atmosphere resulting from the production of electricity used, as well as natural gas consumption. These formulas were derived from statistics compiled by the Lawrence Berkley National Laboratory.² Each kilowatt hour of electricity that is generated, at a coal-fire plant for example, will result in 1.64 pounds of carbon dioxide being released into the atmosphere. Additionally, each cubic foot of natural gas that is burned will result in 0.121 pounds of carbon dioxide being released into the atmosphere. Please see Table 3 for an estimate of the carbon dioxide released as a result of energy usage in Building 861 during past three fiscal years.

Fiscal Year	Electrical Contribution	Natural Gas Contribution	Total Contribution of CO₂
FY03	659,000 lbs	189,000 lbs	848,000 lbs
FY04	682,000 lbs	213,000 lbs	895,000 lbs
FY05	651,000 lbs	212,000 lbs	863,000 lbs

² *Counting Carbons*, Richard Conniff, Discover Magazine, August 2005 edition, page 54.

5.2. RECYCLABLES

CARDBOARD, PLASTIC & ALUMINUM

The Solid Waste Transfer Facility (SWTF) is responsible for many recycling activities at Sandia. One of the materials recycled is corrugated cardboard. The SWTF had a blue cardboard dumpster with capacity for approximately six cubic yards at both Buildings 861 and 960. It conducts pick-ups twice a week. The dock at Building 861 is the primary receiving location for most deliveries bound for any of the four prior mentioned food service locations. The Sodexo chief chef estimated they receive 600 boxes a week that must be broken down and fit in the cardboard dumpster. Despite two pick-ups a week, the cardboard dumpster would fill regularly and any excess cardboard would then be thrown in the putrescible dumpsters and sent to the Rio Rancho sanitary landfill. Bulk ordering was discussed briefly to decrease the amount of cardboard generated, but due to storage space limitations this was a non-opportunity. The SWTF did have an extra eight cubic yard cardboard dumpster in its stock yard and it offered to switch it with the smaller dumpster. Due to a communication error, the SWTF replaced the cardboard dumpster at Building 960 rather than Building 861. This was quickly rectified, but inadvertently provided the solution to another problem.



Due to a lack of vendor employee training and the scheduling error regarding Building 960's putrescible waste dumpster, overflow garbage would be placed in the unlabeled cardboard dumpster, thereby contaminating the recycling stream. Correcting the pick-up schedule for the putrescible waste has reduced the volume of buildup to a minimal level and the possibility for overflow to negligible. Thanks to the cardboard dumpster upgrade delivery error, Building 960's original unlabeled cardboard dumpster was removed from service and Building 960 was given Building 861's original cardboard dumpster that already had "cardboard only" labeling.



The direct delivery of the putrescible waste dumpsters to the Rio Rancho sanitary landfill creates a unique contradiction and recycling problem for the cafeterias. When Building 861 was remodeled approximately five years ago, three recycle bins were drawn into the building plan as part of the process for customers to clear their trays before placing them on the conveyor leading to the dishwasher room. The three bins were built in and labeled: aluminum, plastic, and glass. During the tour, a stand alone regular trash can on wheels, apparently unplanned for, resided in the traffic lane. Elsewhere at Sandia, bags of aluminum and plastic would be placed in any dumpster and the SWTF would pick it up, segregate and recycle it appropriately. Since the SWTF does not pick up cafeteria trash dumpsters due to the liquid and food waste components, Arrow Disposal Services takes it all directly to the landfill with no opportunity to remove the segregated materials for recycling. Although the cafeteria customers regularly segregate their trash according to the bins labels, the waste was being remixed in the putrescible dumpster and landfilled. According to the Sodexo manager, the vendor staff was aware of this and bothered by the deception.

Thanks to the upgraded size of the cardboard dumpster at Building 861, the staff has now been instructed to place the bagged aluminum and plastic with the cardboard to be sent to the SWTF. At Building 960, where previously there was none, an aluminum collection bin has been deployed and the bags can be placed in their cardboard dumpster. The seasonal traveling barbeque and catering service that operates out of Building 861 has also been provided with an aluminum bin. No recycling program currently exists for glass. While the city does segregate glass, it is only for the purpose of crushing prior to being landfilled in order to minimize void space in the landfill. Because of this, it was recommended and accepted by the cafeteria management to remove the “Glass Recycling” sign and convert the built in receptacle to being for regular trash in order to remove the wheeled trash can from the traffic lane. It also eliminates the accumulation of glass which poses safety issues due to weight and possible laceration.



Opportunity #14



It is recommended to update the current recycling guidance signage. It is currently unnoticeable from a distance, unattractive, only in English, and with the implementation of the glass recommendation, the signage is outdated. Mural or poster-sized color pictorial representations would be a great improvement to the immediate area’s ambiance. An SNL/NM architect estimates this will cost \$200-300. If the cafeteria is unable to fund this, Facilities has a building beautification fund that may pay for it.

ALUMINUM CANS VS. PLASTIC BOTTLES

Because there is strong market for recyclable aluminum, the PPOA team considered minimizing the number of plastic beverage bottles available for purchase, by suggesting that the cafeteria only purchase products in aluminum containers when possible. However, this is a non-opportunity due to the current vendor’s contracts that are in place with the beverage companies. The American market is driven more by volume consumption and statistically, the plastic bottles which contain more product are more desirable. Due to the value of aluminum and its associated weight to be transported, the product would cost more per ounce to the end consumer than would plastic contained product. Additionally, the vendor contracts currently in place would need to be altered. Due to market conditions, it is highly improbable that they could be altered to favor aluminum. Continuing with plastic bottles as the primary container of individual beverages and pursuing a renewed plastics recycling program would be more feasible and is the lower of the two hanging fruit.

TIN AND STEEL FOOD CONTAINERS

The PPOA team suggested that tin and steel food containers be segregated by the kitchen staff for recycling. This was considered to be a non-opportunity at this time because the cans would need to be cleaned of all food residues because they would be processed by the SWTF. The Sodexo manager said the staff did not have the ability or time to do so.

GREASE

Similar to Kirtland Air Force Base (KAFB) food service facilities, both Buildings 861 and 960 have special grease tank dumpsters. Two pieces of misinformation surfaced while investigating these special tanks. The first to be corrected is that KAFB and SNL do have separate accounts. Second, pick-up services for the tanks' contents are not free to SNL. Valley Proteins of Bernalillo is scheduled to come every eight weeks and empty the tank at Building 861 for \$250 which is paid annually by the food services vendor Sodexo. Due to the anticipated low volume and unknown necessary disposal frequency, the tank at Building 960 does not have a regular pick-up schedule and is classified as a "call-in only" pick-up location. Each pick-up at Building 960 costs \$50. According to the company, a call for pick-up should be placed when the tank is 75% full. This permits for scheduling within the company's two-week cycle. Valley Proteins does not maintain SNL on a consolidated invoice for the two locations. All the grease collected is used to augment animal feed for local farmers.

FOOD WASTE

Discussed at the time of the prior PPOA was the possibility of collecting food scraps for reuse. From this previous inquiry and discussion with Soilutions, a local composting company, Sandia did not generate sufficient volume from the Coronado Club and the Thunderbird Café to make the process economical. With the closure of the Coronado Club, food waste volume has been further reduced. That coupled with the high-efficiency expertise of the vendor in minimizing waste through food planning and preparation, this opportunity has been eliminated from further consideration.

PALLETS

Wooden pallets are an irregular waste stream that has periodically caused a safety issue for the vendor staff. As the staff places orders, Building 861 will receive a shipment of custodial supplies including paper towels, cleaners and other sanitary products. The delivery would be dropped off on a wooden pallet and left; however, there were no mechanisms in place for the pallet to be retrieved once the material had been offloaded. Since Sandia's Receiving department received the products on the pallet, it would deliver the whole pallet as one package with no interest or need to retrieve the eventually emptied pallet. After a number of pallets had built up, one of the staff would take them to the Kirtland landfill. This is outside the job description of cafeteria vendor's staff and a safety hazard. To immediately rectify this, a temporary process to have Logistics retrieve and reuse the emptied pallets has been developed using their online item move request form. See Attachment 5 for instructions on how to find and use the web form. Should this fail to adequately address pallet disposal, the staff should contact Telecon at 844-4571. They should be able to pick the pallets up and take them to the landfill instead of the vendor staff. Hopefully, a site-wide permanent pallet recycling program will begin some time in FY06 and replace the cumbersome web form.



WHITE PAPER

Though Sandia has an excellent white paper recycling program, the administrative office that manages both cafeterias is unable to participate. There is insufficient space for a blue tote inside and they should not be left outside exposed to the weather. However, some of the white paper is reused internally by the catering service. The paper is quartered and used as order tickets.

REUSABLE OR BIODEGRADABLE SERVICE WARE

Four years ago, the Coronado Club and Building 861 converted to using reusable trays, dishes, silverware and cups to reduce the amount of waste generated and to save the expense of constantly purchasing additional supplies. These savings were offset by the demand for water, energy, chemicals and additional labor to support the process.

There are disposable service ware supplies being used at both of the current locations. The primary purpose of the Building 960 Café is to provide take-out food, and due to space and staffing reasons, it has no reusable ware. In Building 861, to advocate increased use of washable cups, their position next to the soda fountains was rotated with that of the disposable cups to be in the place of greatest convenience for the customer. Now the customer must consciously choose to reach further to pick up a disposable cup. Additionally, customers are encouraged to bring their own reusable coffee mug of any size to get a coffee refill for a flat price. At this time, it is 90¢ per refill.



The increasing availability of biodegradable, biobased service ware is an opportunity that should be explored. This has the potential to be a rather difficult task. Due to contractual restrictions placed upon the food service vendor by its suppliers, Sodexho cannot purchase any “to-go” products from other companies, and its suppliers do not have reasonably priced biodegradable products available at this time. If Sandia were to request that Sodexho purchase the more expensive bio-ware regardless, then the vendor would be forced to pass the cost increases onto the individual customers. Food prices in general are on an upward trend and to-date, Sodexho has chosen not to pass on the increases which directly impact their profit.

Opportunity #15



In order to foster goodwill between Sandia and Sodexho and reduce the non-biodegradable petroleum-based waste generation, it is recommended to Sandia to select a highly visible biobased product, such as cups with lids or utensils. It is proposed that Sandia purchase and provide this product to Sodexho for use in the cafeterias. Consequently, Sandia would enhance its corporate image and participate in DOE’s Bio-Buy Early Initiative. Sodexho would realize a reduction in overhead costs and the cooperation from their customer. The Sodexho site manager has indicated that a gesture of this nature would go a long way to influence Sodexho to continue differing price increases.

6. OPPORTUNITY REVIEW AND RANKING

The fifteen opportunities listed below are categorized according to the respective group that should implement them. They are then ranked according to ease and highest return on investment (ROI) opportunities beginning at the top of each section. The P2 group will assist in the implementation of these opportunities wherever possible.

6.1. DIVISION 3000 TOP OPPORTUNITIES

A. *Opportunity 3: Use Dishwasher in Automatic Mode with Turn-Off at 1 min.*

Training the staff to procedurally select the automatic mode for washing is an important aspect that should be revisited periodically during staff meetings.

Time: 15 minutes

Cost: Free

ROI: Moderate to High Volume of Water Saved

B. *Opportunity 4: Install the High-Pressure, Low-Flow Rinse Nozzle*

Due to the Water Conservation group's generosity, this relatively simple installation requires no additional training or awareness to be effective.

Time: 10 minutes

Cost: Free

ROI: Low to Moderate Volume of Water Saved

C. *Opportunity 14: Update Recycling Signage in Building 861*

Refreshing the look and feel of an area can develop new attention and interest. Updating the receptacle signage, perhaps to even be bilingual, could both increase recycling awareness and enliven the atmosphere if designed well.

Time: 1-3 hours

Cost: \$200-300, unless paid for by Facilities' Building Beautification Fund

ROI: More waste recycled; Intangible positive effect on customers

D. *Opportunity 13: Sandia provide Greener Chemicals for Pilot Testing*

Reviewing the health and safety aspects of cleaners used is a good practice to perform periodically. The fumes and other side effects can impact both workers and customers. Seeking more environmentally preferable products to use also fulfills both Federal and DOE mandates.

Time: Research by Pollution Prevention group; Application by trained staff

Cost: Minimal cost difference over current products; Provided as goodwill by Sandia to Vendor staff for use

ROI: Improved safety; Intangible positive effect on customer pricing; Positive press for Sandia awareness with employees and community

E. Opportunity 15: Sandia provide Greener Service Ware for Pilot Testing

Periodically reviewing the availability of more environmentally preferable service ware over what is currently used is a good practice to remain on the cutting edge of new green technologies. Seeking more environmentally preferable products to use also fulfills both Federal and DOE mandates.

Time: Research by Pollution Prevention group

Cost: Some cost difference over current products; Provided as goodwill by Sandia to Vendor staff for use

ROI: Less petroleum-based waste; Intangible positive effect on customer pricing; Positive press for Sandia awareness with employees and community

F. Opportunity 10: Upgrade both Open-Faced Refrigerators to Efficient Models

The two open-faced, self-service refrigerators are power-inefficient. The conditioned air is lost continually requiring the machine to run constantly. As mechanical alteration of the existing models is not a possibility, replacement should be the next step. Upgrading to models with closed containment of the conditioned air is preferred.

Time: Pollution Prevention group to research models with required capacity

Cost: *Samples in Attachment 6*

True Brand, 9cu/ft, Countertop, Slide-door is \$1,200 each

True Brand, 49cu/ft, Freestanding, Swing-door is \$2,000 each

ROI: Immediate reduction in electricity consumption; Reduction in HVAC competition during seasonal heating periods; Potential extension of food shelf life

G. Opportunity 9: Seek Funding for Solar-Powered Water Preheating in Building 861

Finding alternative fuel sources for ongoing processes is an excellent way to reduce resource dependence and the resulting pollution. Seeking alternative fuel sources also fulfills both Federal and DOE mandates. Solar preheating of water has the potential to reduce the consumption of natural gas in Building 861 by 6-7%.

Time: Pollution Prevention group to seek alternative funding; Solar Power group to refine estimates

Cost: \$10,000-15,000

ROI: Immediate reduction in natural gas consumption by 1,200-1,500 therms per year; Payback from cost savings in 6-9 years; Decrease net greenhouse gas emissions by 7-9 tons annually

6.2. FACILITIES TOP OPPORTUNITIES

A. *Opportunity 6: Upgrade to Efficient Toilets and Urinals in Building 960*

According to a recent water audit, there are ten 2 gallon per flush (gpf) urinals and sixteen 3.5gpf toilets in Building 960. Upgrading to water-efficient 0.5gpf and 1.6gpf models respectively would prevent the needless waste of at least 1000 gallons per day (gpd) according to the audit's conservative usage figures.

Time: 52 plumber labor hours, by estimating 2 hours per fixture

Cost: \$150-200 per toilet; \$150 per urinal; \$3,900-4,700 total

ROI: Conservatively, at least 1000 gallons of water per day

B. *Opportunity 2: Install a Pressure Reducing Valve at Building 861 set to 65psi*

A recent assessment recorded Building 861 with an unregulated water pressure of 92psi. The Water Conservation group recommends a building's water pressure be set to approximately 65psi. It is estimated that water savings will be 2% of the total volume used for every 5psi decreased. Based on Building 861's 4,000gpd, a 25psi reduction would equate to a 10% volume reduction, saving 400gpd.

Time: Less than a day

Cost: \$200-800 (dependant on pipe fitting size and whether one or two needed)

ROI: Approximately 400 gallons of water per day; Reduced wear on pipes and equipment

D. *Opportunity 11: Implement Additional Grill Vent Fan Maintenance in Building 960*

The ventilation situation in the TA4 Café, kitchen and specifically above the grill has improved with the speed reduction of the vent fan by 20%. Allowing the technician to again reduce the speed will further improve the indoor air quality balance.

Time: 45 minutes

Cost: Technician labor

ROI: Minimize grease contamination; Balance needed air flow with other HVAC systems and requirements to minimize competition

E. *Opportunity 12: Upgrade Backdoor to Building 960 Kitchen*

The ability to maintain an indoor air quality balance is impaired by the backdoor to the kitchen being left open to permit deliveries and ventilation. Now that the thermostat has been programmed and the grill vent has been corrected, the backdoor is the final piece to completing the circuit. Replacing the door's handle with a handle that can be left unlocked in addition to installing a simple doorbell will accomplish what is needed.

Time: 1-2 hours

Cost: Technician labor; Wireless doorbell \$20; Door handle \$40

ROI: Minimize conditioned air loss from the system to decrease mechanical effort and energy usage

F. Opportunity 7: Upgrade Building 861 Urinals to 0.5 gal/flush

Building 861 currently has three urinals that use 1.0 gal/flush. These urinals are in a high traffic location with the potential for hundreds of uses each day, increasing the feasibility. Additionally, it may be possible to simply replace the flush valve to upgrade efficiency.

Time: 3 hours

Cost: Plumber labor; \$200 parts

ROI: Approximately 200 gallons per day with an estimated 400 uses.

G. Opportunity 8: Upgrade all Faucets to Efficient 0.8 gal/min

Both Buildings 861 and 960 have 2.2gal/min sink faucets in the bathrooms. This could be reduced by 60% by updating to current water-efficient models. Including motion detectors in the faucets would provide additional water savings but increase the cost.

Time: 1 hour each

Cost: Technician labor; \$50 each (with hands-free sensor, \$200 each)

ROI: Immediate decrease of 60% in faucet water consumption

H. Opportunity 1: Install a Permanent Water Meter at Building 861

For the purpose of having the data readily available, installing a meter to monitor water use is important. Over time, a standard use pattern can be established. Knowing this pattern and periodically doing leak tests using the meter would be wise.

Time: 4 hours

Cost: \$5,000-12,000 installed (range dependant on type needed: single or dual)

ROI: Ability to recognize leaks; Awareness of usage volumes

I. Opportunity 5: Investigate Dishwasher Graywater Use in Garbage Disposal

Rerouting the used water from the automatic dishwasher in Building 861 to the garbage disposal would serve two purposes. First, it would minimize the fresh water used simply to flush out the disposal, and second, it would enable the grinding of any food wastes from the dishwasher and prevent possible drain blockages.

Time: Facilities to research feasibility and legality issues outlined in section 4.1

Cost: Dependant upon plumbing alteration requirements

ROI: If used consistently by the staff, then fresh water use could be eliminated from this process except for during the start-up phase when the dishwasher is not yet running to provide the graywater.

7. CONCLUSION

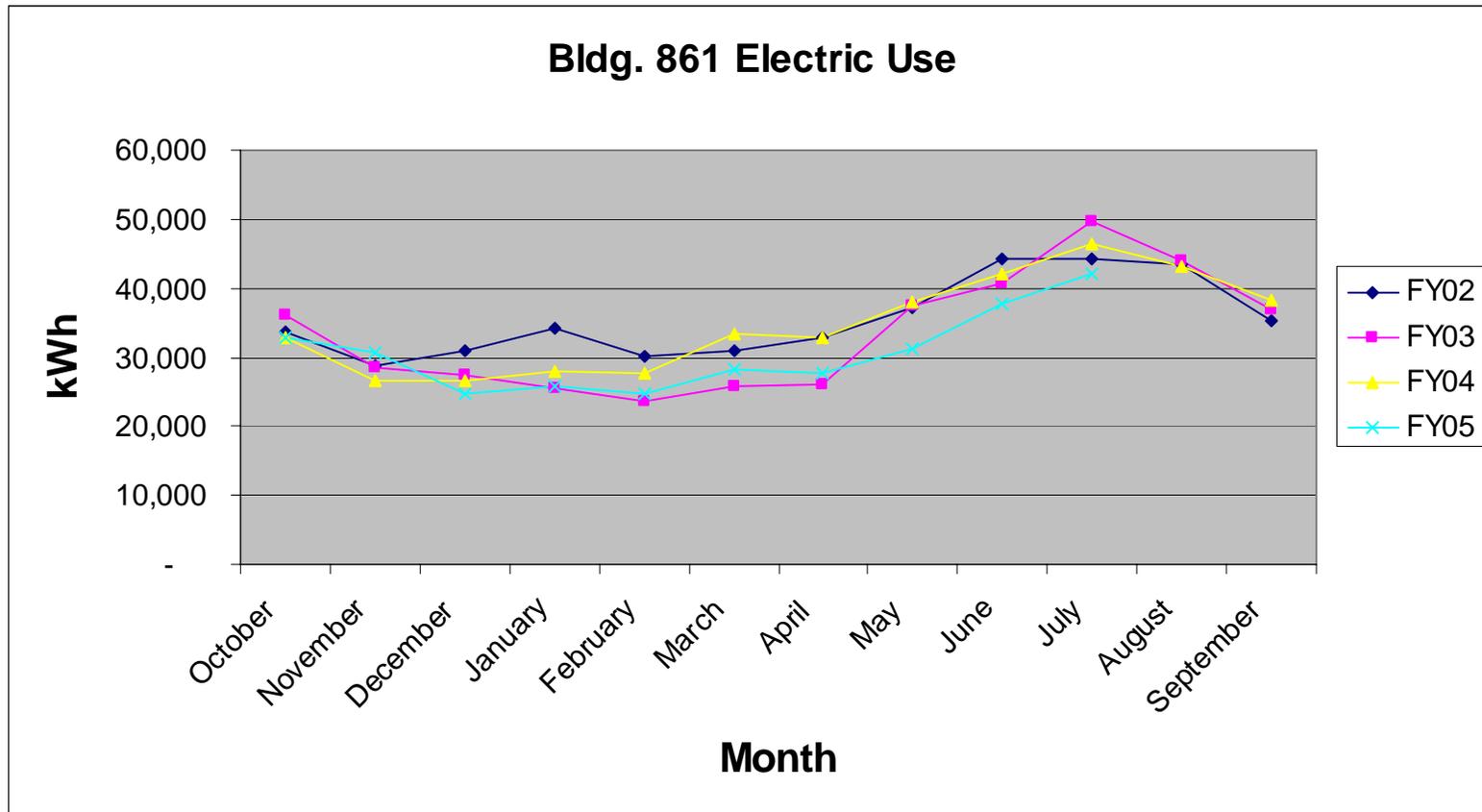
The Cafeterias in Division 3000 are environmentally proactive and supportive in their attitude and approach to the new Environmental Management System and the performance of this PPOA. They have already recognized a number of positive process and waste reduction changes. Should the opportunities in this assessment be combined with ongoing improvements in environmental management and stewardship, they will recognize additional reductions in waste, improvements in worker and customer safety, and operational efficiency.

ATTACHMENT 1

Buildings 861 and 960 Electricity and Natural Gas Consumption with Annual Local Temperature Charts

Building 861 Electric Use (kWh)

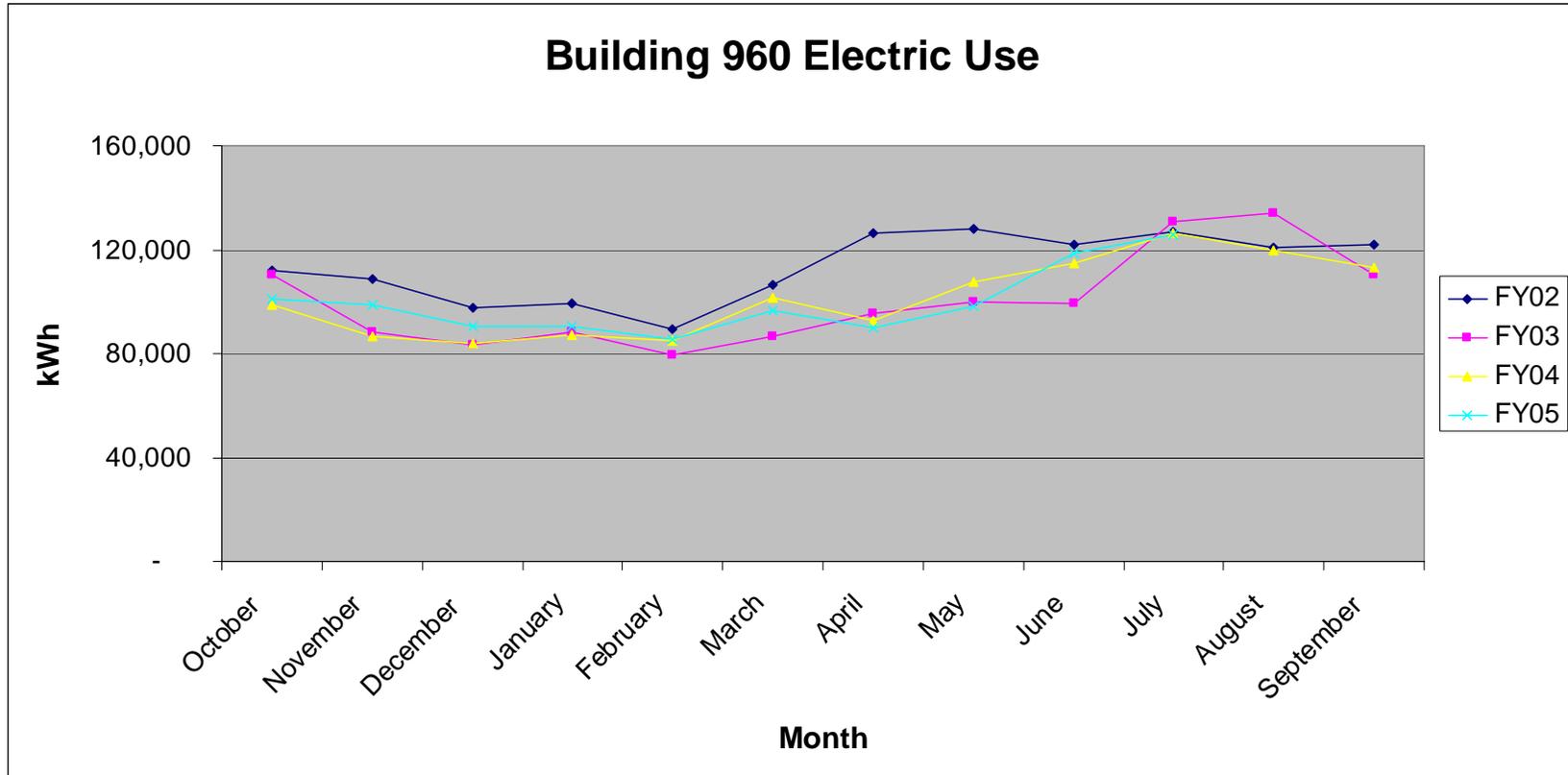
	October	November	December	January	February	March	April	May	June	July	August	September
FY02	33,617	28,725	31,056	34,179	30,187	31,008	32,904	37,089	44,372	44,296	43,491	35,302
FY03	36,029	28,583	27,422	25,393	23,506	25,666	26,185	37,592	40,638	49,746	43,941	37,038
FY04	32,926	26,571	26,631	27,891	27,813	33,321	32,919	37,937	42,168	46,425	43,227	38,202
FY05	32,832	30,628	24,705	25,726	24,754	28,108	27,655	31,282	37,793	42,213		



Building 960 Electric Use (kWh)

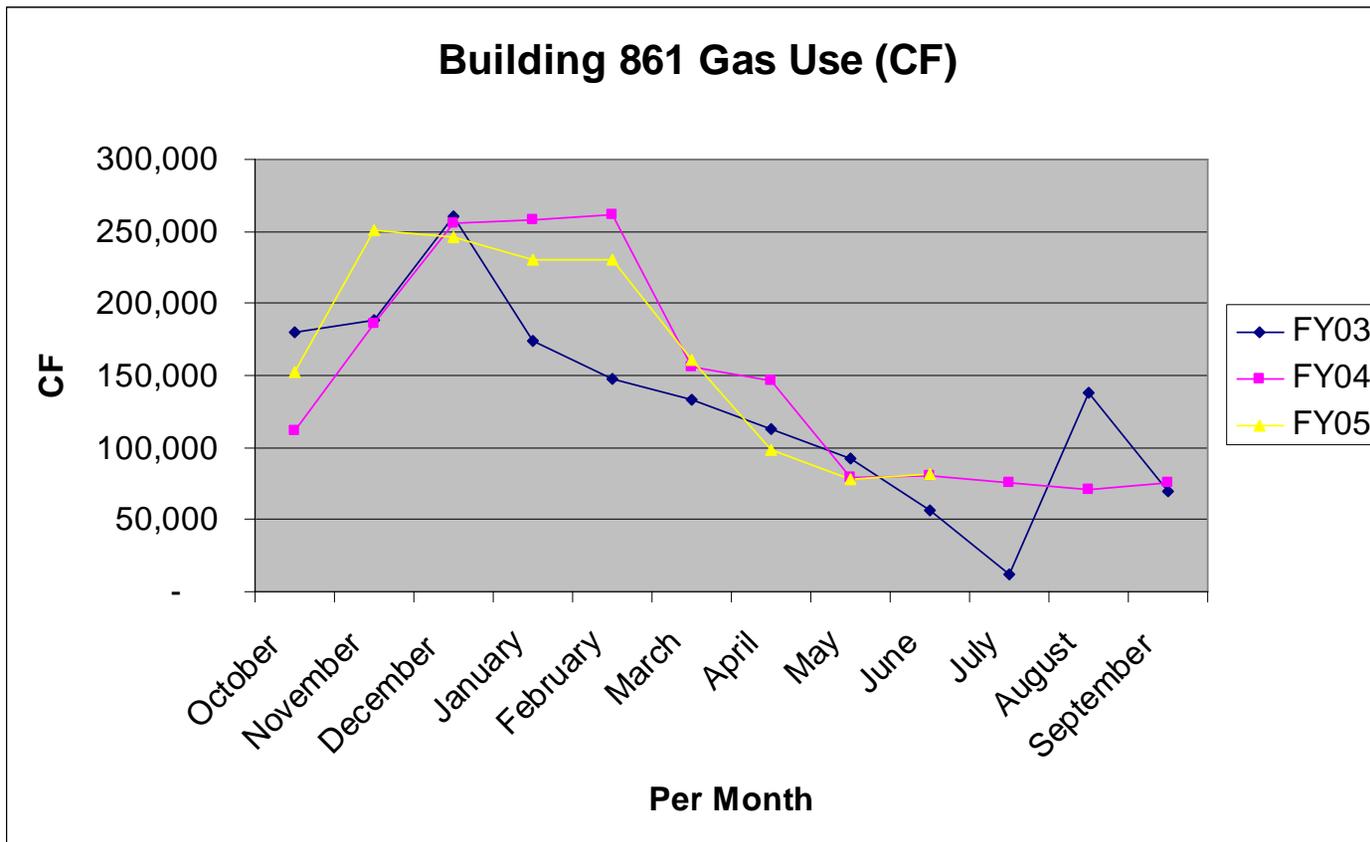
	October	November	December	January	February	March	April	May	June	July	August	September
FY02	112,211	108,756	97,779	99,173	89,567	106,244	126,494	127,973	121,968	126,874	120,587	121,715
FY03	110,246	88,426	83,310	88,245	79,529	86,473	95,533	99,653	99,545	130,975	133,976	110,423
FY04	98,735	86,681	83,652	87,003	84,761	101,596	92,949	107,360	114,775	126,596	119,487	112,935
FY05	101,088	98,830	90,647	90,316	85,449	96,546	90,159	98,168	118,837	125,838		

*Color indicates Café addition open for business.



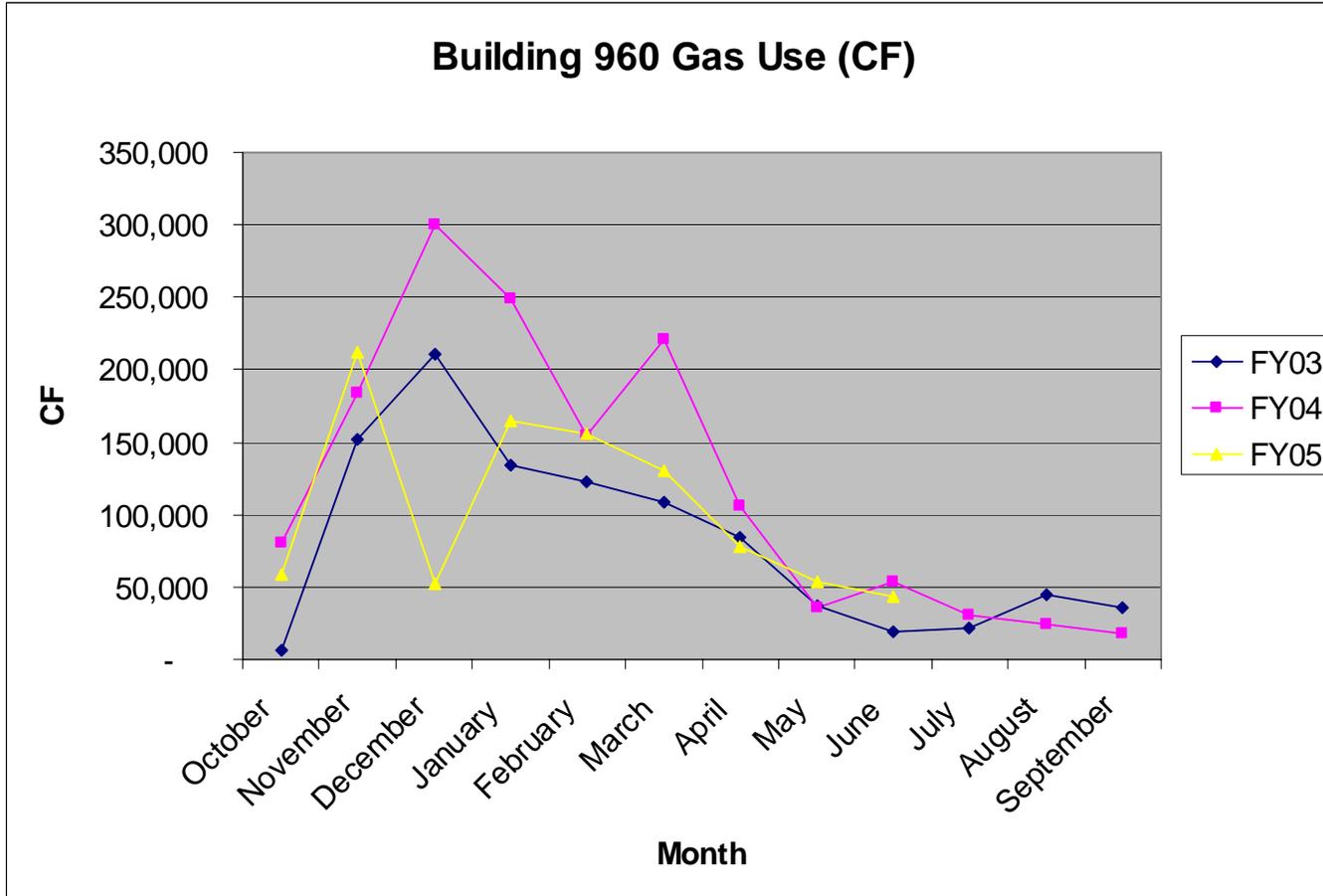
Building 861 Gas Use (CF)

	October	November	December	January	February	March	April	May	June	July	August	September
FY03	179,500	188,200	260,100	174,500	147,000	133,600	112,800	92,300	56,300	12,300	138,100	69,200
FY04	111,800	185,600	255,700	258,200	261,800	155,900	145,900	79,700	80,100	75,800	70,900	75,000
FY05	152,500	250,300	246,300	230,700	230,100	160,900	97,900	78,100	81,800			

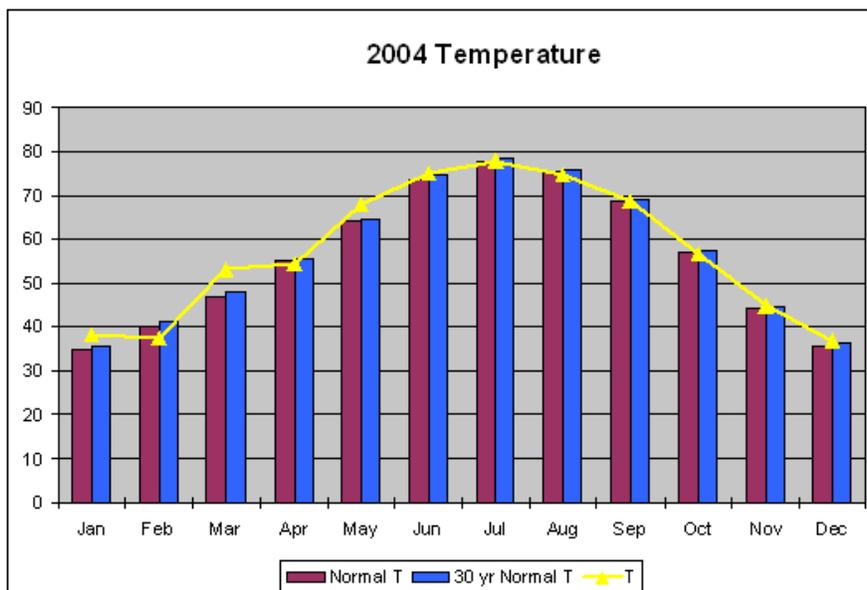
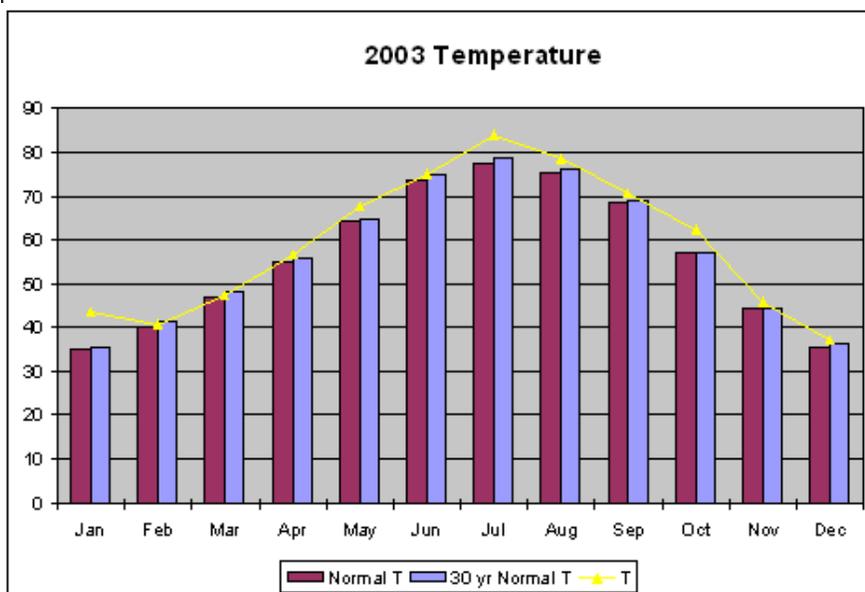
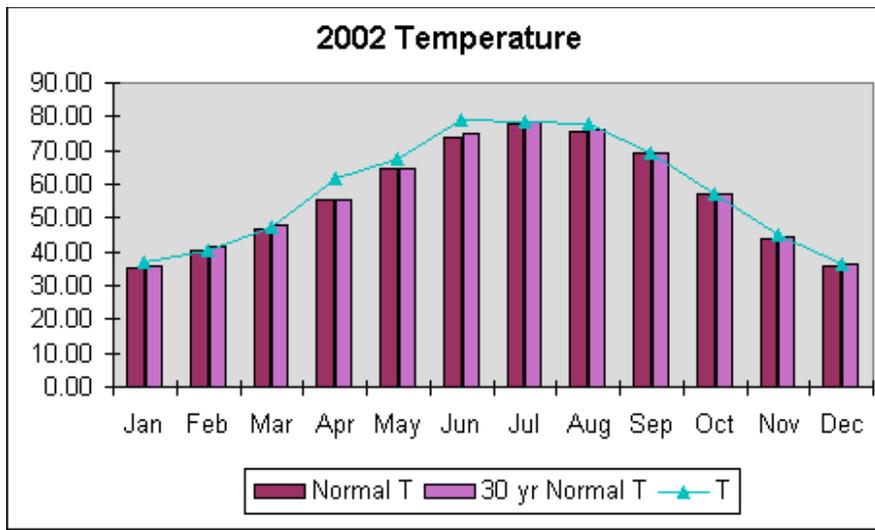


Building 960 Gas Use (CF)

	October	November	December	January	February	March	April	May	June	July	August	September
FY03	5,800	152,200	210,800	134,400	122,700	108,300	84,500	36,700	18,900	21,200	45,000	36,200
FY04	80,900	183,600	300,600	248,600	154,400	220,800	105,700	36,000	53,600	30,800	24,500	17,800
FY05	58,800	211,500	52,100	165,000	156,000	129,900	78,000	54,000	43,100			



Albuquerque, NM Annual Temperature Curve (NOAA)



ATTACHMENT 2

1999 Energy Simulation Results Building 861, Cafeteria Renovation

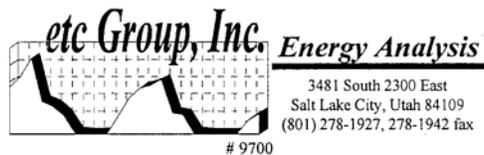
Energy Simulation Results

Sandia National Laboratories

Building 861, Cafeteria Renovation

DRAFT

September 1999



1	Background.....	2
2	Baseline	3
	2.1.1 Envelope	3
	2.1.2 Lighting	3
	2.1.3 HVAC.....	3
	2.1.4 Kitchen.....	3
	2.1.5 Hot Water.....	3
	2.1.6 Schedule.....	3
	2.1.7 Modeling Matters.....	4
	2.1.8 Modeling Issues and Concerns	4
	2.1.9 Simulation Results	4
3	Design Scenarios	6
	3.1.1 Scenario 1 - New Roof.....	6
	3.1.2 Scenario 2 - Lighting Improvements	6
	3.1.3 Scenario 3 - High Efficiency Packaged Air-Conditioning Units	6
	3.1.4 Simulation Results	6
	3.2 Additional Energy Efficiency Measures to Consider for Renovated Facility	7
	3.2.1 Load Management/Kitchen Equipment Selection	7
	3.2.2 Ventilation Systems	9
	3.2.3 Refrigeration Systems.....	9
	3.2.4 Heat Recovery	10
	3.2.5 Controls	10
	3.2.6 Solar Water Heating.....	10
4	Appendix	11
	4.1 Baseline	11
	4.2 Scenario 1 - New Roof.....	11
	4.3 Scenario 2 - Lighting Improvements	11
	4.4 Scenario 3 - High Efficiency Packaged Air-Conditioning Units	11

DRAFT
Bldg 861 Cafeteria Energy Simulation Report
Sandia National Laboratories, Albuquerque, New Mexico

etc Group, Inc. ☎ 3481 South 2300 East, Salt Lake City, Utah 84109 ☎ (801) 278-1927, FAX (801) 278-1942

1 BACKGROUND

The renovation of Building 861, to address issues associated with capacity and worker health and safety, presents a unique opportunity to capture significant energy efficiency and sustainable (green) design opportunities at the same time.

The building is a cafeteria/dining room operated for Sandia National Laboratories by contractor, Marriott. The operations are subsidized by the government contractor (Lockheed Martin) as an employee benefit. The cafeteria contractor does not pay the energy bills for the facility. The facility was built in the 1960's and has been remodeled since, including a major addition to the dining area on the south end of the building.

The current operations have outgrown the existing space. Worker and patron health and safety concerns are at a critical state. Problems include: inadequate temperature controls in the food preparation and storage areas and the walk in coolers, inadequate ventilation and temperature controls (cooling capacity and load related) in both working and dining areas, inadequate equipment ventilation, outdated ventilation hood grease traps, inadequate working space, and non-compliant floor coverings.

The building is being redesigned to address these problems. We have developed a building model which simulates the building energy performance. The model is intended to help the design team evaluate the potential of various energy efficiency measures for the renovated facility. This report summarizes the modeling effort and results.

DRAFT
Bldg 861 Cafeteria Energy Simulation Report
Sandia National Laboratories, Albuquerque, New Mexico

ete Group, Inc. 36 3481 South 2300 East, Salt Lake City, Utah 84109 36 (801) 278-1927, FAX (801) 278-1942

Cafeteria 9/29/99 10:23 AM

2 of 2

2 BASELINE

The first step in the modeling effort was to develop a simulation of the baseline building design. This baseline model was used to estimate benchmark energy performance for the renovated building – a starting point for estimating the effect of proposed energy efficiency measures. Any simulation effort includes estimates and assumptions about the systems and operations being simulated. Building energy use simulation is no exception. The following is a description of the baseline model with key assumptions and estimates used.

The building is a 13,000 sq. ft. one-story, rectangular brick structure, with a north/south long axis. The kitchen occupies the north third of the building. The center third contains a service area on the east side with open dining areas in the center and a small office area and restrooms on the west side. The south third is also open dining. The new building entry (an “airlock” vestibule) is in the center of the south wall. The baseline building simulation incorporated the following assumptions.

2.1.1 Envelope

Existing wall construction and glazing.

Roof R 12.8 (13.3 originally, “degraded” by increasing insulation conductivity by 15 %).

Default roof color (for built-up, gravel roof) and wall color (solar heat gain).

2.1.2 Lighting

Lighting power density based on fixture count provided for renovated facility. Existing skylights in dining room to remain. Skylights in kitchen area removed.

Full output ballasts and manual switching.

Some lights left on nights and weekends.

2.1.3 HVAC

New rooftop air cooled packaged DX units, Trane YCD series.

Setback thermostat controls.

2.1.4 Kitchen

New and refurbished equipment – low & standard efficiency.

New energy/water efficient dishwasher.

New fans with manual controls – on when kitchen is occupied.

New makeup air unit.

2.1.5 Hot Water

Existing 175 gallon water heaters with 180F set point.

2.1.6 Schedule

Operating 5 days /week, 51 weeks/year. Closed last week in year and major holidays.

Kitchen occupied 5 am to 6 pm; 20 people.

Dining room occupied 6 am to 6 pm, peak occupancy noon to 1 pm, 600 total “people-hours” per day.

DRAFT
Bldg 861 Cafeteria Energy Simulation Report
Sandia National Laboratories, Albuquerque, New Mexico

ete Group, Inc. 36 3481 South 2300 East, Salt Lake City, Utah 84109 36 (801) 278-1927, FAX (801) 278-1942

Cafeteria 9/29/99 10:23 AM

3 of 3

2.1.7 Modeling Matters

6 Zones/Spaces, NE Kitchen, NW Kitchen, Middle Dining, South Dining, Dishwasher, and Make up air space (to balance fans/makeup air unit).

1 thermostat/space.

Process loads estimated from equipment schedule and load factors from PG & E (Pacific Gas & Electric) test kitchen and ASHRAE (American Society of Heating, Refrigeration, Air-Conditioning Engineers, Inc.). Fraction of process load to space based (for heating/cooling) on ASHRAE.

Kitchen equipment assigned to NE and NW kitchen zones.

Service area equipment assigned to Middle Dining zone.

2.1.8 Modeling Issues and Concerns

Walk-in coolers and freezer were not included. We have no information on equipment size or performance.

Assumptions on process equipment (designated miscellaneous equipment in simulation output) are key. The process load (kitchen and service area equipment) dominate the simulation (the baseline estimate is 59% of the total annual electrical energy and 53% of the total annual natural gas). Assumptions used for equipment size, performance and operating schedules have a profound impact on the simulation results. The assumptions directly impact the estimated process energy consumption and indirectly impact the heating, ventilating and cooling loads and energy consumption. The available information was limited. As better information becomes available, the process equipment assumptions should be reviewed.

The Appendix contains a summary of the kitchen and serving area equipment, including size, load factor contribution to the space loads, and the load schedule used in the simulation.

2.1.9 Simulation Results.

The model input files (inp and pdp) and output files (sim) have been forwarded, as have key reports from the sim file. The Appendix includes copies of the Building Utility Performance (BPU) and Building Energy Performance (BEP) reports as well as Energy End Use Summary, by month (PS-E) and System Loads summary, for each system (SS-A) reports from the simulation output (sim) file.

Table 1 below summarizes the baseline energy end use estimates – annual kWh and MBTU.

Table 1 Baseline Energy End Use Estimates

End Use	kWh/year	MBTU/year
Lights	31,243	
Cooling	47,260	
Fans	40,865	
Process Equipment	168,546	1,455
Aux (pumps, standby)	806	34
Heating		465
Hot Water		805
Total	288,720	2,759

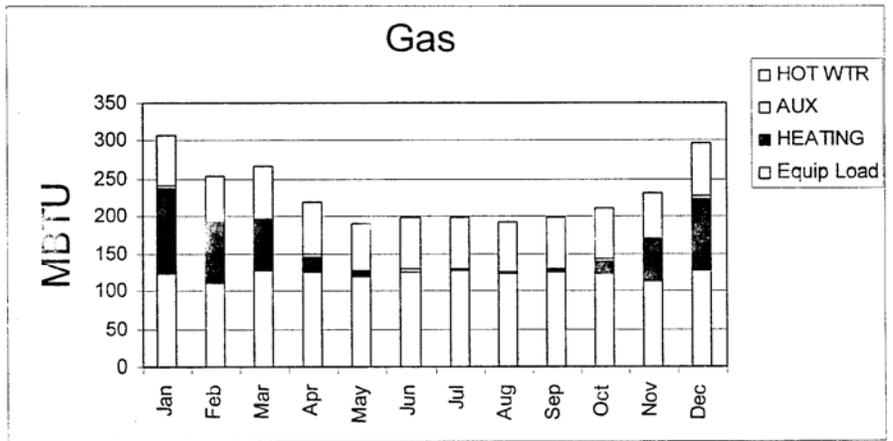
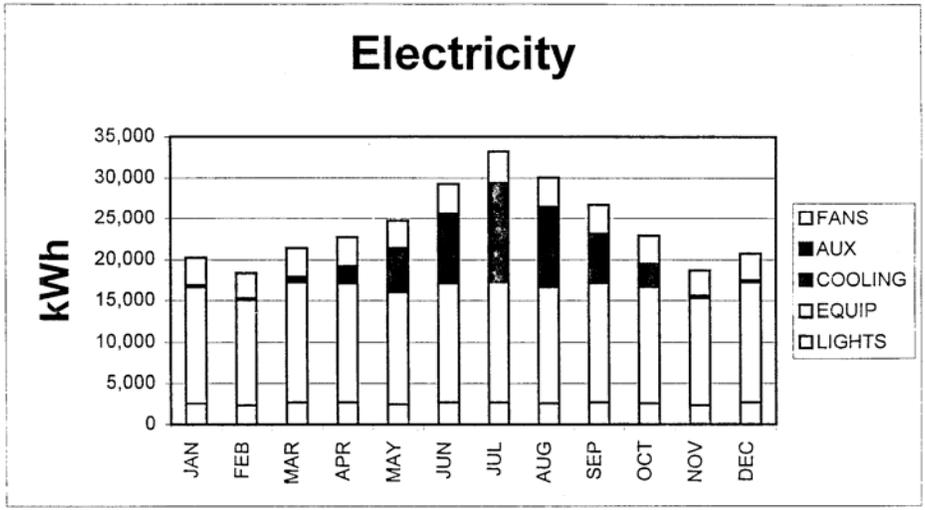
DRAFT
Bldg 861 Cafeteria Energy Simulation Report
Sandia National Laboratories, Albuquerque, New Mexico

etc Group, Inc. 36 3481 South 2300 East, Salt Lake City, Utah 84109 36 (801) 278-1927, FAX (801) 278-1942

Cafeteria 9/29/99 10:23 AM

4 of 4

Figure 1 Baseline Monthly Energy Consumption



DRAFT
 Bldg 861 Cafeteria Energy Simulation Report
 Sandia National Laboratories, Albuquerque, New Mexico

ete Group, Inc. 36 3481 South 2300 East, Salt Lake City, Utah 84109 36 (801) 278-1927, FAX (801) 278-1942

3 DESIGN SCENARIOS

Three design improvements were simulated to evaluate the potential effect on building energy use. The three scenarios described below were evaluated in sequence and interactively. The roof composition was changed, then the lighting improvements included (with the new roof) and then the packaged unit efficiency improved – with both the new roof and improved lighting.

3.1.1 Scenario 1 - New Roof

The building is over 30 years old and the roof is in near term replacement. The most cost effective time to replace the roof is during the renovation. The new roof will be well insulated (R30) and have a white, solar reflective surface.

The effect of the new roof was simulated changing the baseline model roof thermal resistance to R30 and reduced exterior absorbtivity (0.5).

3.1.2 Scenario 2 - Lighting Improvements

Lighting system improvements included day lighting from additional skylights in the dining area – a total of six 2'x4' skylights and 2 light pipes in the dishwashing area. Improved controls include automatic dimming controls for day lighting in the dining and dishwash areas and occupancy controls to turn the lights off when spaces are unoccupied.

3.1.3 Scenario 3 - High Efficiency Packaged Air-Conditioning Units

The third scenario is to install the most energy efficient packaged rooftop units available, while keeping the roof and lighting improvements.

3.1.4 Simulation Results

The model input files and output files for each scenario have been forwarded, as have key reports from the sim file. The appendix includes copies of the Building Utility Performance (BPU) and Building Energy Performance (BEP) reports as well as Energy End Use Summary, by month (PS-E) and System Loads summary, for each system (SS-A) reports from the simulation output file.

Tables 2 and 3 below summarize energy end use estimates – annual kWh and Mbtu for each scenario. The savings shown are incremental - the savings for the lighting measure is in addition to the savings for the roof measure. etc.

Table 2 Electrical Energy End Use Estimates

Electricity (Kwh/year)				
	Baseline	Roof	Lighting	EER
Lighting	31,243	31,243	16,144	16,144
Equipment	168,546	168,546	168,546	168,546
Cooling	47,260	44,579	42,148	36,724
Aux	806	864	824	824
Fans	40,865	40,697	40,406	40,406
Total	288,720	285,929	268,068	262,644
Savings		2,791	17,861	5,424

DRAFT
Bldg 861 Cafeteria Energy Simulation Report
Sandia National Laboratories, Albuquerque, New Mexico

etc Group, Inc. 36 3481 South 2300 East, Salt Lake City, Utah 84109 36 (801) 278-1927, FAX (801) 278-1942

Cafeteria 9/29/99 10:23 AM

6 of 6

Table 3 Gas Energy End Use Estimates

Natural Gas (MBtu/year)				
	Baseline	Roof	Lighting	EER
Equipment	1,455	1,455	1,455	1,455
Heating	465	409	429	429
Aux	34	34	34	34
Hot Water	805	805	805	805
Total	2,759	2,703	2,723	2,723
Savings		56	(20)	-

3.2 Additional Energy Efficiency Measures to Consider for Renovated Facility

The planned renovation provides a unique opportunity to capture energy efficiency opportunities while addressing worker and patron safety and health concerns and improving the comfort level of the building. Careful design and thoughtful equipment selection can have a synergistic effect; integrated choices have the possibility of reducing both capital and operating costs. For example, purchasing steam-jacketed kettles, instead of more gas-fired ranges, will reduce space cooling and ventilation loads. The smaller loads mean smaller, less expensive cooling equipment and smaller kitchen hoods. The savings can be “reinvested” in high efficiency equipment or better controls, resulting in even greater operating cost savings.

3.2.1 Load Management/Kitchen Equipment Selection

Managing the internal building loads has a profound impact on HVAC system design and cost – both equipment and operating cost. Thoughtful design will result in synergistic effects, improving comfort, productivity and performance, while reducing initial and operating costs and impacts on the environment.

The kitchen ventilation system is a prime example of how one design/process decision affects the rest of the building and impacts the overall equipment and operating cost. The size of the kitchen hood/ventilation system is dictated by the size and type of equipment installed. A four-jet gas range adds much more heat to the space and requires a much higher exhaust volume than does a gas-fired steam jacketed kettle.

The cost of a kitchen exhaust system is a function of size as shown in Figure 2 below.

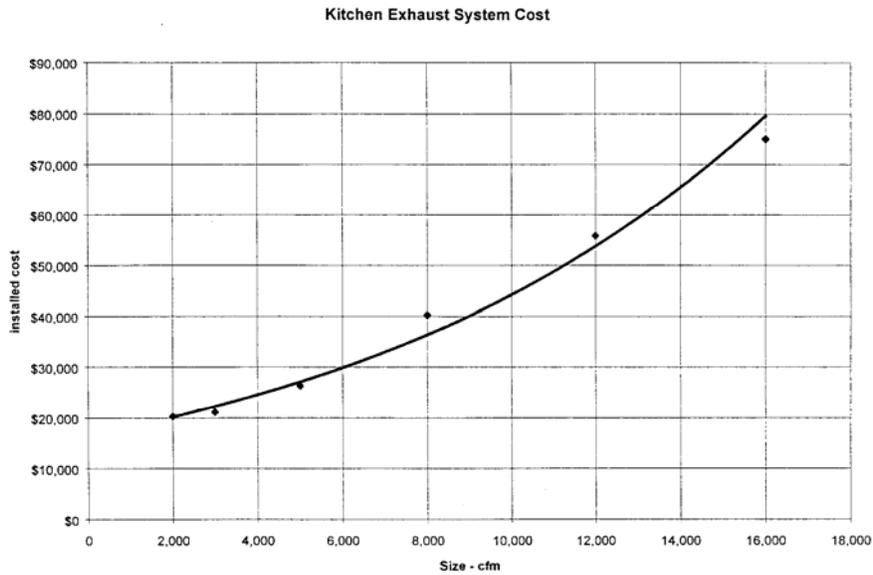
DRAFT
Bldg 861 Cafeteria Energy Simulation Report
Sandia National Laboratories, Albuquerque, New Mexico

ete Group, Inc. 36 3481 South 2300 East, Salt Lake City, Utah 84109 36 (801) 278-1927, FAX (801) 278-1942

Cafeteria 9/29/99 10:23 AM

7 of 7

Figure 2 Kitchen Exhaust System Cost



Installing one kettle in place of one four-jet range top will reduce the sensible cooling load to the space by 95 % (both total and peak load). The air-conditioning unit cost is a direct function of size. Figure 3 below shows the cost of rooftop DX air-conditioning units (air cooled, gas heat) as a function of size. We estimate the total building load at 75 ton. Heating one stockpot on a four-jet range contributes 1.5 tons to the sensible cooling load.

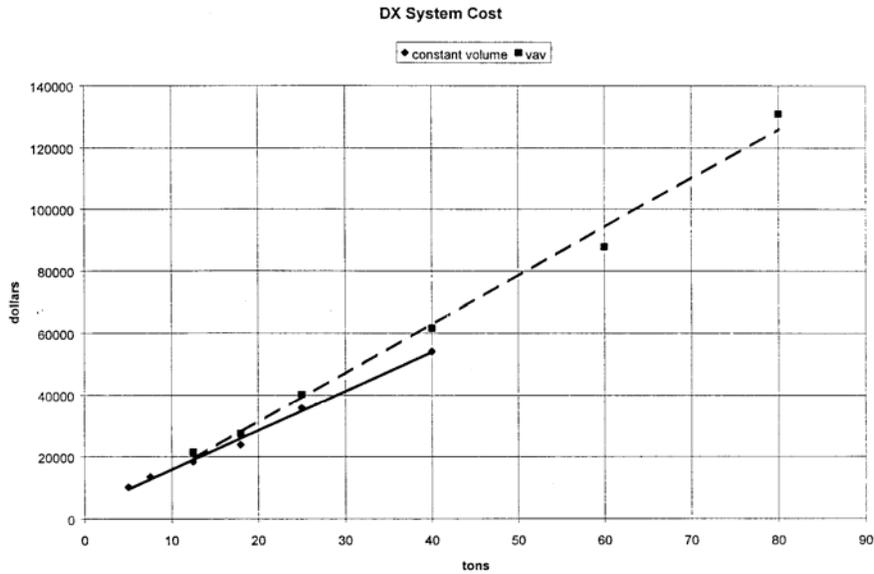
DRAFT
Bldg 861 Cafeteria Energy Simulation Report
Sandia National Laboratories, Albuquerque, New Mexico

etc Group, Inc. 36 3481 South 2300 East, Salt Lake City, Utah 84109 36 (801) 278-1927, FAX (801) 278-1942

Cafeteria 9/29/99 10:23 AM

8 of 8

Figure 3 Unit Air-Conditioning System Cost



High efficiency lighting systems (0.5 to 1 watt/sq.ft.) will reduce cooling system loads. Using day lighting controls can also reduce peak cooling loads, since the peak cooling load and peak daylight coincide. At 13,000 square feet, a 0.1 watt/sq.ft. reduction in lighting load results in about 0.3-ton reduction in cooling load.

High efficiency glazing can reduce both heating and cooling loads.

Locating refrigeration condensers outside conditioned spaces and/or using heat recovery systems (see below) can reduce cooling loads. Minimize the use of indoor refrigerators. They are less efficient than the best split-system boxes and contribute to air-conditioning loads.

Careful design and placement, and proper ventilation of ranges, ovens, fryers and other heat generating equipment can also reduce peak and operating loads.

3.2.2 Ventilation Systems

Consider installing an advanced ventilation control system on the kitchen exhausts. Small variable speed motors, controls and sensors are becoming very affordable. Kitchen exhaust systems with automatic controls that sense temperature, particulate, and water and adjust the fan speed in response, are now available.

3.2.3 Refrigeration Systems

The existing walk-in coolers are inadequate and will be replaced. The new systems should be carefully sized and well insulated. Consider variable speed evaporator fans, oversized condenser(s), two-stage systems and very high efficiency compressors.

DRAFT
Bldg 861 Cafeteria Energy Simulation Report
Sandia National Laboratories, Albuquerque, New Mexico

ete Group, Inc. ☎ 3481 South 2300 East, Salt Lake City, Utah 84109 ☎ (801) 278-1927, FAX (801) 278-1942

The possibility of water or evaporative cooling should be investigated, as should the use of waste heat recovery systems (see below).

The above discussion on air-conditioning system's relative performance also applies to the refrigeration systems except that the refrigeration systems operate 8760 hr/year so relative efficiencies have even greater impacts on energy consumption and cost. The new systems will probably require on the order of 5 tons of cooling. (The existing systems total 5.5 tons. They are inadequate but the boxes are also under insulated.) System efficiencies range from EER of 4 to better than 10 depending on operating temperatures (evaporator and condenser) refrigerant and compressor. At 5 tons and 0.82 kw/ton (25F evap, 70F condensing) the system would use about 36,000 kwh/year. while at a 140F condensing temperature it would use about 110,000 kwh/year. *(Again, the calculations are to make a point. They do not include load profiles and part load performance impacts.)*

3.2.4 Heat Recovery

Consider waste heat recovery for the refrigeration systems. Piping the hot refrigerant exiting the evaporator coils through a heat exchanger – typically in a hot water storage tank or water heater – can both heat the water and improve condenser compressor performance. Systems designed for restaurant use, walk-in coolers and water heaters, are available.

3.2.5 Controls

Consider installing direct digital control cards with the new HVAC units to allow the existing facility wide control system to operate the building. This will have some impact on the system first cost but the potential payback in operating and maintenance savings, as well as energy savings, is high.

VAV box "cards" with extra points for lighting controls are now available. Consider retrofitting the lighting systems to allow the ddc system to turn the lights off when the building is unoccupied.

3.2.6 Solar Water Heating

The kitchen has a high, high temperature (190F) hot water load. The hot water load peaks at the same time that the solar radiation peaks, which is midday. Albuquerque has a high solar potential and Sandia National Laboratories leads the world in the design and application of solar thermal technologies. The situation seems very promising. The opportunity to use solar water heating should be evaluated.

DRAFT

**Bldg 861 Cafeteria Energy Simulation Report
Sandia National Laboratories, Albuquerque, New Mexico**

etc Group, Inc. ☎ 3481 South 2300 East, Salt Lake City, Utah 84109 ☎ (801) 278-1927, FAX (801) 278-1942

Cafeteria 9/29/99 10:23 AM

10 of 10

ATTACHMENT 3

Chemical Inventory Review

#	Chemical Name	Hazard Rating			Aerosol		Water React.		pH Level	Flash Point	Comments	Not in Inv.	Direct Feed
		Health	Flam.	React.	Yes	No	Yes	No					
1	Ecolab High Alkaline Oven Cleaner/Degreaser						x	13.5		RCRA Corrosive			
2	Ecolab Keystone Low Temp Liquid Detergent	3	0	0		x	x	13.0		RCRA Corrosive, Health Hazard 3	x		
3	Ecolab Oasis 115 XP Ammoniated Floor Cleaner Concentrate	3	0	0		x	x	13.0		RCRA Corrosive, Health Hazard 3	x		
4	Airstrip Professional Floor Stripper	3	0	0		x	x			Health Hazard 3	x		
5a	Ecolab Aqueous Acidic Cleaner/Delimer						x	1.5		RCRA Corrosive	x		
5b	Ecolab Aqueous Acidic Cleaner/Delimer Solution						x	2.2		RCRA Corrosive (solution of)			
6a	Ecolab EcoTemp Ultra Sodium Hypochlorite Sanitizer	3	0	1		x	x	10.5		Health Hazard 3	x		
6b	Ecolab Keystone Sodium Hypochlorite Sanitizer	3	0	?		x	x	10.5		Health Hazard 3	x		
7a	Ecolab Idophor Detergent Disinfectant						x	2.0		RCRA Corrosive	x		
7b	Ecolab Idophor Detergent Disinfectant Solution						x	4.0		RCRA Corrosive (solution of)	x		

Allstar Dazzle Floor Cleaner	1	0	0		x		x				x	
Allstar New Look Thermal Spray Buff	1	1	0		x		x			Contains zinc-complexed polymer	x	
Allstar Outstanding Floor Coating	1	0	0		x		x			Contains zinc-complexed polymer	x	
Ansul Foray Dry Chemical Extinguishing Agent							x					x
Ansulex Liquid Fire Suppressant							x		None			x
Carbon Dioxide, Gas	1	0	0				x					x
Ecolab Antibacterial Clean & Smooth					x			6.5				
Ecolab Aqueous Anionic Cleaner Concentrate (All Purpose)					x		x	7.5			x	
Ecolab Aqueous Anionic Cleaner Solution (All Purpose)					x		x	7.5			x	
Ecolab Digiclean Anti-Bac Foam	0	0	0		x			8.6				x
Ecolab Digisan E Foam Hand Sanitizer	1	1	0					7.0	107°F/42°C			x
Ecolab EcoShine Liquid Stainless Steel Polish	1	0	0		x		x	7.5				x
Ecolab Encompass MultiPurpose Alkaline Cleaner Concentrate	1	0	0		x		x	10.6				x
Ecolab Keystone Rinse Additive	1	0	0		x		x	6.2			x	
Ecolab Keystone Silverware Presoak	2	0	0		x		x	12.4				x
Ecolab Liquid Lotion Hand Cleaner					x		x	6.5			x	
Ecolab Medallion Liquid Solvent Metal Polish	1	2	0		x		x		170°F		x	
Ecolab Oasis 136 Multisurface Cleaner Concentrate	1	2	0		x		x	11.5	130°F			x
Ecolab Oasis 144 Quat Sanitizer Concentrate					x		x	7.5				x
Ecolab Oasis 255 SFLiquid Glass Cleaner Concentrate	2	2	0		x		x	11.2	135°F			x
Ecolab Rinse Dry Automatic Warewashing Rinse Aid					x		x	5.5				x
Ecolab Silver Power Solid Enzyme Silverware Pre-soak					x		x	11.0				x
Ecolab Solid Hand Dish Detergent					x		x	8.2			x	
Ecolab Solid Metal Pro High Alkaline Solid Detergent					x		x	11.0				x
Sysco Coffee Equipment Cleaner	2	0	0		x		x	11.3				

ATTACHMENT 4

Dumpster Volume Assessment Data 2005 and 2002

2005 Dumpster Volume Assessment Data

Location	Collection Schedule	Date of Visit	Time of Visit	Dumpster # 1 = East # 2 = West	Capacity (cu.yd.)	% Filled	Actual Capacity Utilized (cu.yd.)		
Thunderbird Café Bldg 861	M W F Early Confirmed	R 6/2/05	1630	1	6.11	40	2.444		
				2	6.11	80	4.888		
		Friday morning = empty							
		F 6/3/05	1620	1	6.11	10	0.611		
				2	6.11	25	1.5275		
		Monday morning = empty							
		T 6/7/05	1735	1	6.11	15	0.9165		
				2	6.11	70	4.277		
		Wednesday morning = empty							
		R 6/9/05	1650	1	6.11	60	3.666		
				2	6.11	85	5.1935		
		F 6/10/05	Missed (Averaging F's)	1	6.11	6.5	0.39715		
				2	6.11	34.5	2.10795		
		T 6/14/05	1655	1	6.11	50	3.055		
				2	6.11	80	4.888		
		R 6/16/05	1630	1	6.11	75	4.5825		
				2	6.11	70	4.277		
		F 6/17/05	1630	1	6.11	5	0.3055		
				2	6.11	30	1.833		
		T 6/21/05	1630	1	6.11	40	2.444		
				2	6.11	90	5.499		
		R 6/23/05	1540	1	6.11	50	3.055		
				2	6.11	80	4.888		
		F 6/24/05	1635	1	6.11	10	0.611		
				2	6.11	50	3.055		
		T 6/28/05	1625	1	6.11	50	3.055		
				2	6.11	70	4.277		
		R 6/30/05	1620	1	6.11	60	3.666		
				2	6.11	70	4.277		
		F 7/1/05	1630	1	6.11	1	0.0611		
2	6.11			33	2.0163				

Location	Collection Schedule	Date of Visit	Time of Visit	Dumpster # (Only One)	Capacity (cu.yd.)	% Filled	Actual Capacity Utilized (cu.yd.)		
Bldg 960 Café	MWF day	R 6/2/05	1620		8	80	Not Collected by Next Visit		
		F 6/3/05	1610		8	90	Not Collected by Next Visit		
		M 6/6/05	0750		8	90	7.2		
		Monday day = emptied							
		T 6/7/05	1730		8	33	Not Collected by Next Visit		
		W 6/8/05	0710		8	33	Not Collected by Next Visit		
		R 6/9/05	1645		8	40	Not Collected by Next Visit		
		M 6/13/05	0815		8	45	Not Collected by Next Visit		
		T 6/14/05	0735		8	55	Not Collected by Next Visit		
		W 6/15/05	0700		8	60	Not Collected by Next Visit		
		R 6/16/05	1610		8	75	6		
		Friday day = emptied							
		F 6/17/05	1625		8	15	Not Collected by Next Visit		
		M 6/20/05	1615		8	25	Not Collected by Next Visit		
		T 6/21/05	1620		8	40	3.2		
		Wednesday day = emptied							
		R 6/23/05	1530		8	20	1.6		
		Friday day = emptied							
		M 6/27/05	0705		8	10	0.8		
		Monday day = emptied							
		W 6/29/05	0725		8	25	2		
		F 7/1/05	0730		8	15	1.2		

2002 Dumpster Volume Assessment Data

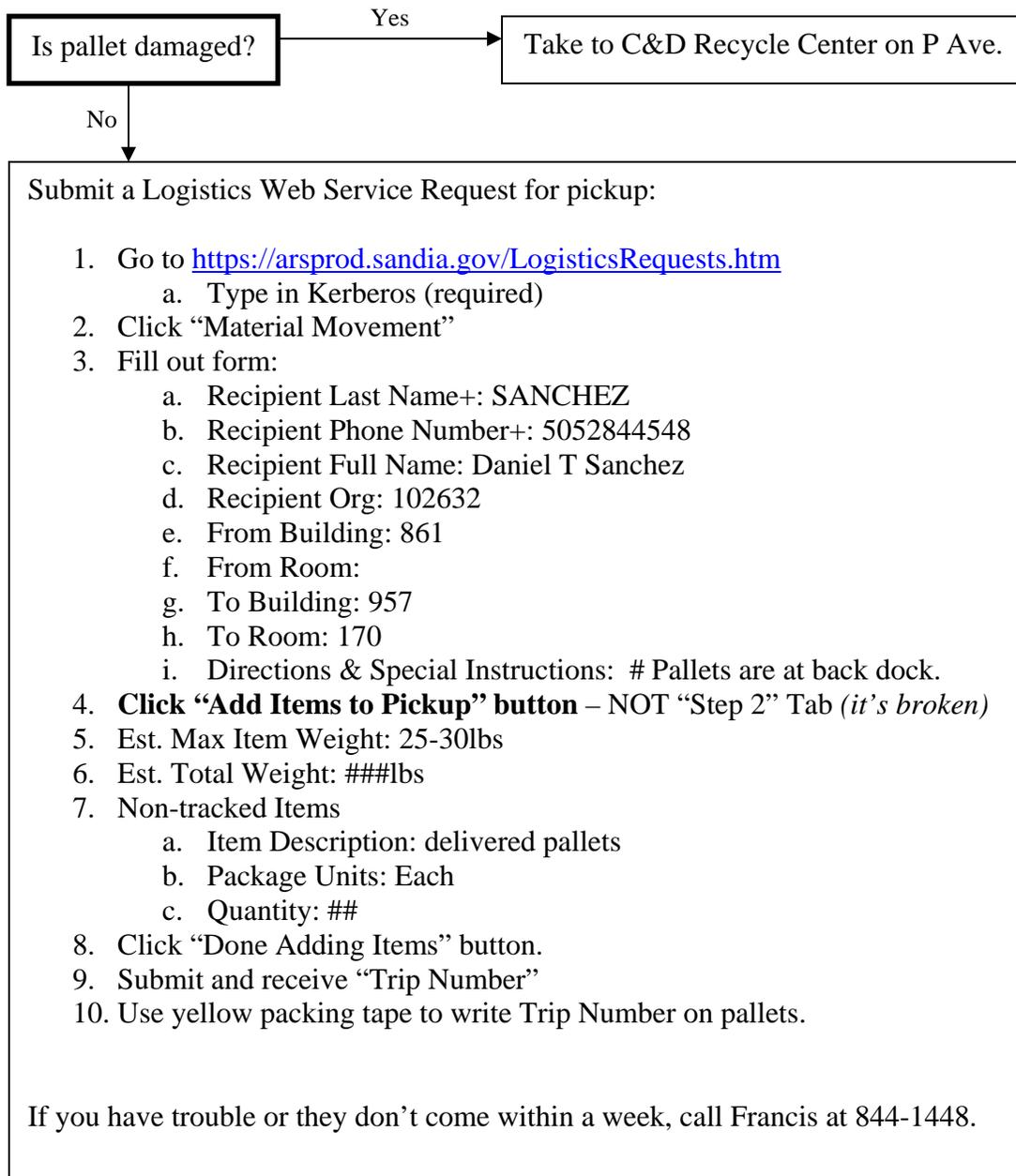
Raw Data							Results	
Location	Collection Schedule	Date of Visit	Time of Visit	Dumpster #	Capacity (cu.yd.)	% Filled	Actual Capacity Utilized (cu.yd.)	Reliable Data
Sandia Cafeteria	MWF 8-10am	6/24/2002 Monday	9:50 AM	1	8	0	0	0
				2	8	50	4	4
Sandia Cafeteria	MWF 8-10am	6/26/2002 Wednesday	10:30 AM	1	8	0	0	
				2	8	0	0	
Coronado Club	Wed. 8-10am	6/26/2002 Wednesday	10:30 AM	1	8	pallet	--	
				2	8	25	2	2
				3	8	33	2.64	2.64
				4	8	33	2.64	2.64
Sandia Cafeteria	MWF 8-10am	6/27/2002 Thursday	4:30 PM	1	8	0	0	0
				2	8	80	6.4	6.4
Sandia Cafeteria	MWF 8-10am	7/1/2002 Monday	9:30 AM	1	8	0	0	
				2	8	0	0	
Sandia Cafeteria	MWF 8-10am	7/10/2002 Wednesday	8:20 AM	1	8	40	3.2	
				2	8	0	0	
Coronado Club	Wed. 8-10am	7/10/2002 Wednesday	8:30 AM	1	8	0	0	
				2	8	0	0	
				3	8	0	0	
				4	8	0	0	
Sandia Cafeteria	MWF 8-10am	7/11/2002 Thursday	5:00 PM	1	8	30	2.4	2.4
				2	8	60	4.8	4.8
Sandia Cafeteria	MWF 8-10am	7/15/2002 Monday	8:10 AM	1	8	30	2.4	2.4
				2	8	80	6.4	6.4
Sandia Cafeteria	MWF 8-10am	7/19/2002 Friday	7:00 AM	1	8	0	0	
				2	8	0	0	
Sandia Cafeteria	MWF 8-10am	7/24/2002 Wednesday	7:50 AM	1	8	0	0	
				2	8	0	0	
Coronado Club	Wed. 8-10am	7/24/2002 Wednesday	8:00 AM	1	8	0	0	
				2	8	0	0	
				3	8	25	2	
				4	8	0	0	
Sandia Cafeteria	MWF 8-10am	7/25/2002 Thursday	4:45 PM	1	8	0	0	0
				2	8	60	4.8	4.8
Sandia Cafeteria	MWF 8-10am	7/29/2002 Monday	?	1	8	0	0	
				2	8	0	0	
Sandia Cafeteria	MWF 8-10am	7/31/2002 Wednesday	7:30 AM	1	8	0	0	
				2	8	0	0	

Coronado Club	Wed. 8-10am	7/31/2002 Wednesday	7:30 AM	1	8	0	0	
				2	8	10	0.8	
				3	8	0	0	
				4	8	30	2.4	
Sandia Cafeteria	MWF 8-10am	8/1/2002 Thursday	4:00 PM	1	8	0	0	0
				2	8	60	4.8	4.8
Sandia Cafeteria	MWF 8-10am	8/4/2002 Sunday	5:00 PM	1	8	0	0	0
				2	8	45	3.6	3.6
Coronado Club	Wed. 8-10am	8/6/2002 Tuesday	5:00 PM	1	8	0	0	0
				2	8	40	3.2	3.2
				3	8	0	0	0
				4	8	30	2.4	2.4
Sandia Cafeteria	MWF 8-10am	8/8/2002 Thursday	5:00 PM	1	8	25	2	2
				2	8	55	4.4	4.4
Sandia Cafeteria	MWF 8-10am	8/10/2002 Saturday	4:40 PM	1	8	0	0	0
				2	8	40	3.2	3.2
Sandia Cafeteria	MWF 8-10am	8/20/2002 Tuesday	5:10 PM	1	8	0	0	0
				2	8	50	4	4
Coronado Club	Wed. 8-10am	8/20/2002 Tuesday	5:15 PM	1	8	0	0	0
				2	8	75	6	6
				3	8	0	0	0
				4	8	0	0	0
Sandia Cafeteria	MWF 8-10am	8/27/2002 Tuesday	5:00 PM	1	8	0	0	0
				2	8	55	4.4	4.4
Coronado Club	Wed. 8-10am	8/27/2002 Tuesday	5:05 PM	1	8	30	2.4	2.4
				2	8	30	2.4	2.4
				3	8	0	0	0
				4	8	0	0	0
Sandia Cafeteria	MWF 8-10am	9/3/2002 Tuesday	4:55 PM	1	8	0	0	0
				2	8	55	4.4	4.4
Coronado Club	Wed. 8-10am	9/3/2002 Tuesday	5:00 PM	1	8	gone	0	
				2	8	gone	0	
				3	8	gone	0	
				4	8	gone	0	
Sandia Cafeteria	MWF 8-10am	9/10/2002 Tuesday	5:20 PM	1	8	20	1.6	1.6
				2	8	80	6.4	6.4
Coronado Club	Wed. 8-10am	9/10/2002 Tuesday	5:25 PM	1	8	0	0	
				2	8	0	0	
				3	8	50	4	
				4	8	95	7.6	

ATTACHMENT 5

Pallet Removal Procedure

Pallet Removal Procedure



If neither of these work, contact Telecon Plus at 844-4571 and a crew will come remove any pallets.

ATTACHMENT 6

Replacement Options for Open-Faced, Self-Service Refrigerators

COUNTERTOP OPTION

True GDM-9 Countertop Merchandiser \$1,200



Product Features:

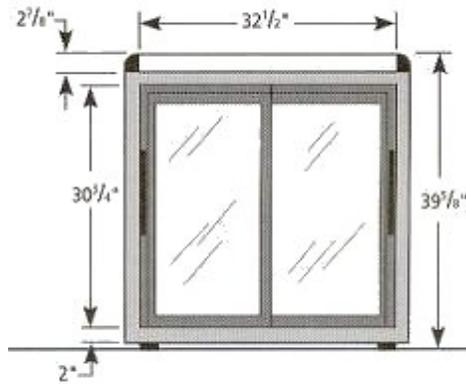
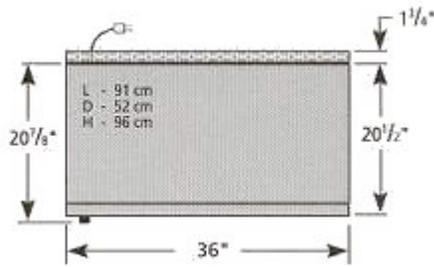
- **Walnut Laminated Vinyl Exterior . . .**
White and black vinyl also available.
- **White Anodized Aluminum Interior and Stainless Steel Bottom . . .**
- **Oversized and Balanced . . .**
Oversized and balanced environmentally friendly, refrigeration system - holds 32°F-38°F
- **Positive Seal, Self-Closing Swing Doors . . .**
Positive seal, self-closing swing doors counter-balanced weight system self-closing doors for GDM-9 slide door
- **Adjustable Vinyl Coated Wire Shelves. . .**
- **Epoxy Coated Evaporator . . .**
- **Fluorescent Interior Lighting . . .**
- **Environmentally Friendly 134A Refrigerant (CFC FREE) . . .**
- **1 Year Parts & Labor Warranty (USA) . . .**

● **5 Year Compressor Warranty . . .**

Product Specifications:

- **Net Capacity . . .9 cu. ft.**
- **Motor . . .1/5 HP**
- **Voltage . . .115 volts, 1 phase, 6.0 amps.**
- **Weight . . .240 lbs.**

Overall Size . . .
36 L x 22-1/4 D x 39-5/8" H



GDM-9

FREESTANDING OPTION

True GDM-49 Glass Door Merchandiser \$2,000



Product Features:

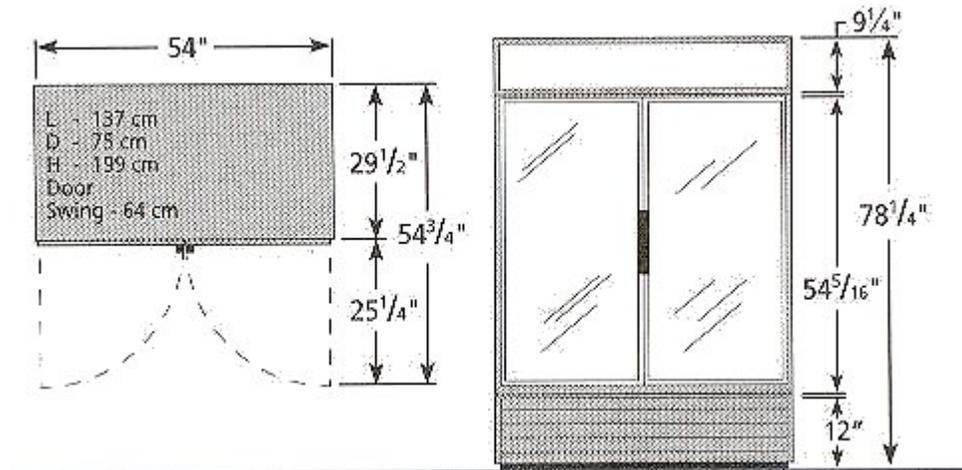
- **Walnut Laminated Vinyl Exterior . . .**
White and black vinyl also available.
- **White Anodized Aluminum Interior and Stainless Steel Bottom . . .**
- **Oversized and Balanced . . .**
Oversized and balanced environmentally friendly, refrigeration system - holds 32°F-38°F
- **Bottom Mount Compressor . . .**
- **Slide Out Compressor . . .**
Slide out Compressor Can be serviced Easily and Accessed by a Single Repairman.
- **Positive Seal Torsion Spring, Self-Closing Doors . . .**
- **Adjustable Vinyl Coated Wire Shelves. . .**
- **Epoxy Coated Evaporator . . .**

- **Fluorescent Interior Lighting . . .**
- **Environmentally Friendly 134A Refrigerant . . .**
- **1 Year Parts & Labor Warranty (USA) . . .**
- **5 Year Compressor Warranty . . .**

Product Specifications:

- **Net Capacity . . .49 cu. ft.**
- **Motor . . .1/2 HP**
- **Voltage . . .115 volts, 1 phase, 10.0 amps.**
- **Weight . . .472 lbs.**

Overall Size . . .
54" L x 29-1/2" D x 78-1/4" H



DISTRIBUTION

1 Carolyn Holloway
U.S. Department of Energy
National Nuclear Security Administration
Sandia Site Office
PO Box 5400
Albuquerque, NM 87185-5400

1 Charlie Henn
U.S. Department of Energy
Albuquerque Operations Office
Pennsylvania & H Street
Kirtland Air Force Base
Albuquerque, NM 87116

1	MS	1042	Hue-Su A. Hwang, 10331
1		1050	Jack Mizner, 10331
1		0186	Ina Frazier, 03000
1		1021	Linda Stefoin, 03330
1		1021	John Davis
1		0945	Patrick T. Ortiz, 10864
1		1192	David Saxton, 10864
1		0777	Samuel McCord, 10331
1		9018	Central Technical Files, 8945-1
2		0899	Technical Library, 9616