Executive Summary

The Amini Medical Center is the newest addition to the City of Hope Campus located in the suburbs of Los Angeles, CA. The community's main functions include cancer research, treatment and education. As a part of this community, the Amini Center is responsible for blood collection, analysis, processing, transfusion, and storage.

To accommodate the campus' needs, central heating and cooling plants with spare capacity for expansion were designed. The Amini Center's design utilizes the central steam and chilled water plants to run rooftop air-handling units (AHUs) and space fan coil units (FCUs) throughout the 3-story building.

Because little information could be obtained about the campus' central plants, the mechanical redesign starts with sizing chillers and pumps for the building's primary chilled water loop; making the Amini Center's cooling plant independent from the campus. The chiller and pump sizes mentioned here then become the baseline system for which my design is compared.
(With this design change, an analysis of the roofing structure was performed to evaluate the changes needed by adding the chiller equipment loads to the roof.)

The existing primary loop of the building now contains a single air-cooled chiller with constant volume pumps. The system supplies water at 42 ^{o}F for use by the AHUs and FCUs.

The objective of my redesign was to reduce the annual operating costs with a system that doesn't have extreme first cost numbers. To try and accomplish my objective, ice storage systems were researched because they can bring down the annual operating costs of a building by shifting the on-peak load with high energy costs to off-peak hours where energy is cheaper.

Through the several ice storage technologies, I chose to design an internal melt ice-on-coil system. This closed system runs 25% ethylene glycol at 23 ^{o}F through coils in a water storage tank during non-peak hours to create ice. To discharge this stored capacity, the glycol solution, at a higher temperature, is pumped through the storage container where it rejects heat to the ice.

When designing ice storage systems it is very important to know the building load profile and the control strategy for chiller operation. Three control strategies were researched and designed for this report, full storage, load leveling partial storage, and demand limiting partial storage.

In the end, the full storage strategy produced the largest equipment with the highest first cost and close to highest return. The demand limiting scenario was in middle on equipment size and cost while having the least annual savings. The load leveling system seemed to fit this building the best with a first cost just $59,000 over the existing system but savings of $137,000 the first year of operation. Please note, the annual savings recorded included a special program rate offered by the Amini Center's utility company for providing a load shifting technology.

To help reduce the power consumed by the Amini Center, a lighting analysis and redesign was performed in an attempt to reduce the lighting power densities while maintaining the work plain light levels prescribed by the *Illuminating Engineering Society of North America* (IESNA).