## 1.1 Executive Summary

The fallowing report is based upon the design of the University of Delaware's new Interdisciplinary Science and Engineering building (ISEB). An in depth analysis of the building's mechanical system reveled that the owners and designers of ISEB left little room for improvement. One area that all laboratory buildings designers look to in order to save energy is the ventilation system. Although the current ventilation system implements some of the most current energy efficient design approaches, such as energy recovery wheels and variable flow fume hoods, this report proposes two alternatives methods of handling the laboratory ventilation air.

Although ISEB contains over 17 laboratory spaces, only the 8 instructional laboratory spaces and their accompanying prep rooms were analyzed for this report. This was done for two reasons; first, these instructional labs have lower hood densities than the research laboratories and therefore offer more advantages for the proposed alternative systems. Second, the air handling units serving these instructional labs also serve non-lab spaces, which also presents energy saving opportunities.

The first alternative method proposed in this report involves separating the lab and non-lab spaces to their own air handling systems, implementing a demand based air change rate system in the lab spaces, and implementing passive chilled beams to meet any sensible load that is not met by the (now lowered) ventilation air change rates. An energy simulation of this proposed alternative showed an annual reduction in the building chilled water consumption by 18,111 ton-hrs (2%), a reduction in steam consumption by 405 MBTU (15%), and a reduction in electrical consumption by 55,479 kW-hrs (1%).

The second alternative method proposed for this report takes advantage of the fact that AHU's 3 and 4, which serve the instructional labs, also serve non-lab spaces. In this approach, room air from the non-lab spaces (offices, classrooms, and corridors) is transferred to the laboratories to reduce the amount of outdoor air brought in to

the space to meet the minimum air change rate or fume hood requirements, whichever is greater. This method reduced the annual building chilled water use by 24,898 ton-hrs (2%), and steam use by 256 MBTU (5%).

When comparing the two alternative approaches it was concluded that moving the lab and non-lab spaces to their own air handling units along with implementing a demand based lab air change rate system would provide the most energy savings while maintaining good occupant safety. Analysis revealed that the use of the passive chilled beam system in redesign approach 1 actually increased chilled water and steam consumption while accounting for 52% of this approach's capitol cost. Although energy savings were also seen from alternative method 2, the amount of control needed to maintain proper space pressure relationships and prevent contaminant spread to the rest of the building would require a trained building operating staff and may not be feasible.