1 Executive Summary

The purpose of this proposal is to clearly explain the scope of the redesign project on the EMD Serono Research Center – existing lab building and provide justification based on the existing condition of the facility. The existing mechanical system of this building is evaluated. Alternative systems are selected based on the objectives of this building design: provide environmental comfort, healthy indoor air quality and be energy responsive.

The EMD Serono Research Center – existing lab building consists of 17% vivarium space, 35% office space, and 48% laboratory space with a gross area of 56,700 square foot. Both the laboratory and vivarium areas are critical spaces that generate hazardous contaminants. As a result, 100% outdoor air system was selected as the mechanical system for those spaces to ensure contaminated air does not recirculate and transfer inside the building. The existing system has a chiller plant and a boiler plant. Chilled water is generated by a water cooled chiller and an air cooled chiller to provide summer cooling. Steam is generated by two gas fired boilers and it is used for summer reheat, winter heating and humidification.

In an effort to optimize the mechanical system, three analyses will be performed involving the possibility of reduce building load by putting solar shading, the implementation of Heat Recovery System, and the application of Dedicated Outdoor Air System(DOAS) with Chilled Beam. For all of the analyses the effect of the systems on building space coordination as well as first cost and lifecycle cost will be investigated. Comparison of the alternatives will be done based on the system's impact on energy consumption, thermal comfort, indoor air quality, space requirement, and cost.

Since all the supply air for the laboratory and vivarium spaces is 100% outdoor air, large amount of energy is consumed to condition the outdoor air. The mechanical redesign proposal will replace the 100% OA AHU units with units containing a heat recovery system. Different heat recovery systems will be investigated: enthalpy wheel, plate heat exchanger, heat pipe, and runaround loop. Comparisons based on the total effectiveness, energy saving, potential cross contamination issue, and maintenance can be made to decide which system is best suited for this building. The other alternative is to utilize the DOAS system to supply only ventilation air to the space and use chilled beams as the parallel system to meet to rest of the sensible load inside the space. Both passive and active chilled beam systems will be investigated.

In addition to investigate the heat recover systems and the DOAS system with chilled beam, two breadth areas will also be developed. The first breadth will look into the solar shading device and the building envelope to determine the optimal building construction

to reduce building load. The other breadth area will be the electrical analysis. Electrical analysis will be done to determine the power distribution requirements for the facility as compared to the existing design with respect to energy consumption and additional cost.

To analysis these topics, several tools are needed. Trane TRACE, a building energy modeling software will be used along with Engineering Equation Solver (EES) and Microsoft Excel to calculate the necessary information needed for system redesign. Autodesk Revit and Adobe Photoshop will also be used to render the solar shading and building envelope material in the architectural breadth.

Lifecycle cost analysis will be performed for all proposed redesigns. The life cycle cost analysis will be used to determine the economic feasibility of the redesigns.