Metcalf & Eddy Academic Design Competition
2004-2005

Introduction

The formulation of appropriate environmental engineering solutions requires not only the involvement of environmental engineers, but also engineers from other disciplines (civil, chemical, mechanical, electrical) as well as scientists (biologist, chemists, ecologists, geologists, etc.), economists, sociologists, political scientists, and computer scientists. It is therefore essential that environmental engineering students should possess a fundamental knowledge of these broad areas. In addition, it is also essential that the students are provided hands on experiences as part of their environmental engineering curriculum so that they can fully appreciate the challenges and rewards of a fulfilling environmental engineering career.

Objectives

- The Metcalf & Eddy Environmental Engineering Design Competition is primarily aimed at exposing students to designing environmental unit processes based on multi-disciplinary environmental engineering principles as a means of supplementing material that they are exposed to via classroom teaching.
- By imparting to the students a glimpse of exciting environmental engineering applications, the competition aims to greatly enhance their overall environmental engineering educational experience.
- The competition also targets development of highly valuable teamwork and project management skills in the students that they will utilize when they go forth into their future career pursuits.

Design Topics

The topics for selection in this year’s design competition are as follows:

1. Development of a biological treatment process for cost effectively achieving low nitrogen effluents from domestic wastewater treatment anaerobic sludge digestion centrate.
2. Development of a continuously applied comprehensive froth control system focusing on surface wasting of mixed liquor and surface chlorination.
3. Development of a Gould Type II final clarifier design for solids separation from step-feed BNR mode.
4. Development of a dual-phase digestion design for sCOD recovery, enhanced solids destruction and methane gas production.
5. Development of CSO management strategies using the specific example of a step-feed BNR configuration.
6. Design of a hybrid (suspended and attached growth) reactor for enhanced biological nitrogen removal in a step-feed configuration.
7. Development of a biosolids treatment/management strategy to handle primary and waste sludge for concurrent froth control and COD generation.
9. Development of strategies for concentrate volume minimization; product recovery, zero level discharge and beneficial and non-traditional use of concentrate from desalination applications.
Design Approach

The overall design approach is expected to broadly involve the following steps:

- Analysis of developed unit operations/processes applicable to design question
- Selection of process most applicable for NYC WPCPs
- Operational challenges for full-scale operation – questions such as reactor start-up, stable operation etc.
- Appropriate configuration for e.g., attached or suspended growth mode, completely mixed, plug-flow, pre- and post-denitrification (hand calculations, modeling or documented evaluations)
- Design calculations and simulations (using generic or specific software packages) to determine sizing and performance and other evaluation criteria (outlined below)
- Quantitative sensitivity analysis indicating the response of the chosen process design to variation in inputs and parameters (such as kinetic parameters, temperatures, flow rates)

Design Competition Deliverables

Design Reports

Project teams are expected to furnish a final design report detailing the design calculations and analyses performed. It is highly recommended that a poster submission should accompany the text report summarizing the design highlights.

Final Presentation

Design competition finalists are expected to make a professionally geared fifteen minute oral presentation during the finals of the competition held at the corporate headquarters of Metcalf & Eddy. The presentation should summarize the system design procedure, its results and highlight any additional innovative features.

Design Competition Evaluation Criteria

Design Project evaluations will be performed by design experts from Metcalf & Eddy. Specifically, the following criteria that revolve around thoroughness and completeness of design will be given the maximum weight.

System Performance and Stability

- How well is the system capable of meeting effluent discharge criteria stated above under steady state conditions?
- How well is the system capable of meeting the effluent discharge criteria stated above under the impact of several transients such as pH, temperature, inhibition and influent flow and load variability?
- Confidence in chosen input parameters, and response to variability in input parameters.

Operation Simplicity

- How well can the designed systems be operated, controlled and monitored by typical wastewater treatment plant operators?

System Versatility

- How does the system handle the target as well as other relevant contaminants of interest?
- How does the designed system fit in as an add on to an existing conventional activated sludge system?
- How does the system function independently, can it handle main plant flows and loads partially or wholly?

Capital and Operating Costs

- Based on engineering judgment, how can capital and operating costs be minimized for centrate treatment while at the same time enhancing system performance and stability?
- Cost estimates based on equipment vendor databases
Design Competition Schedule

Depending upon the course structure in the respective institutions, either of the following tracks can be followed by the participants.

**Track I – Academic year schedule**

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<thead>
<tr>
<th>DATE</th>
<th>TASK</th>
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<tbody>
<tr>
<td>September 15, 2004</td>
<td>M&amp;E issues design problem</td>
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<tr>
<td>October 1, 2004</td>
<td>Kick off presentation</td>
</tr>
<tr>
<td>April 15, 2005</td>
<td>Final Design Report and Poster to M&amp;E</td>
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<tr>
<td>May 14, 2005</td>
<td>Oral Presentation at M&amp;E</td>
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**Track II – Semester schedule**

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<tr>
<th>DATE</th>
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<tr>
<td>January 15, 2005</td>
<td>M&amp;E issues design problem</td>
</tr>
<tr>
<td>January 31, 2005</td>
<td>Kick off presentation</td>
</tr>
<tr>
<td>April 15, 2005</td>
<td>Final Design Report and Poster to M&amp;E</td>
</tr>
<tr>
<td>May 14, 2005</td>
<td>Oral Presentation at M&amp;E</td>
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**Overall Scoring**

Overall scoring for the project is divided into four components with the following scoring weights.

- Justification for selected technology: 20%
- Final design report: 50%
- Final design poster: 30%
- Final design report and poster submissions will be evaluated based on the above criteria. The top three teams will be invited for a final presentation at the corporate headquarters of Metcalf & Eddy.

**Eligibility**

- Participating academic institutions should have an instituted design course or a dedicated senior-level Water Quality Engineering course to enable integration with the Metcalf & Eddy Environmental Engineering Design Competition.
- Student teams working on this project shall include primarily undergraduate students and each team shall be actively guided a graduate faculty advisor throughout the course of the project.

**Awards**

- Design competition winners will be announced at the end of the academic year in May 2005.
- The winning team will receive an award of $2,500. The ‘MVP’ of the winning team will be recognized with a contribution of $1,500 made to a general scholarship fund in his/her name.
- Additionally, the winning team will receive copies of the Metcalf & Eddy Design Com- memorative Plaque bearing the name of the University, team members and the selected design and copies of the Metcalf & Eddy textbook on Wastewater Engineering.
- The overall award winning project design may be selected for pilot-scale implementation by Metcalf & Eddy. During this effort, Metcalf & Eddy will provide travel reimbursement.

For more information, please contact James Anderson, P.E. at Jim.Anderson@m-e.com or Kartik Chandran, Ph. D. at Kartik.Chandran@m-e.com. Information can also be obtained at www.m-e.com.

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Metcalf & Eddy, Inc. provides planning, design, construction and operations services for water, wastewater and hazardous waste management facilities and programs. As an AECOM company, M&E is part of a diversified professional technical services organization with over 17,000 employees worldwide. AECOM is a global leader in the transportation, environmental and facilities markets with projects in more than 60 countries. Named to Forbes magazine’s list of the Top 500 Private Companies, AECOM Technology Corp. is a $1.8 billion corporation.

Further information on the firm is available through its website at www.m-e.com.
Application Form

Metcalf & Eddy Academic Design Competition
Academic Year 2004-2005

Name of University: ____________________________________________________________

Location: __________________________________________________________________

University Faculty Liaison: _____________________________________________________

Phone: ___________________________ Fax: ___________________________

Email: ______________________________________________________________________

Topic: _____________________________________________________________________

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