AN INDUSTRIAL/ACADEMIC PARTNERSHIP BETWEEN SALISBURY STATE UNIVERSITY AND INDUSTRY ON THE DELMARVA PENINSULA

Thomas W. Jones, Professor, Elichia A. Venso, Assistant Professor, John L. Tyvoll, Associate Professor, David Jenkins, Visiting Assistant Professor, Barbara Wainwright, Assistant Professor. Salisbury State University, 1101 Camden Avenue, Salisbury, Maryland 21801. USA

Excellence in science and mathematics in today's students is absolutely essential to maintaining industrial leadership in tomorrow's technology-based products and services. Therefore companies in the Delmarva Region and the greater Baltimore and Washington areas (Industrial), in a joint cooperative effort, have established a voluntary Industrial and Academic Partnership with the Richard A. Henson School of Science and Technology of Salisbury State University (Academic) to promote quality science and mathematics education while simultaneously aiding industry in meeting the demands for environmental protection.

Previously, the National Science Foundation (NSF) created during the 1980s new types of industrial and academic partnerships in response to a perceived need to foster and to support cross-disciplinary research. Among these were Engineering Research Centers (ERC), designed to bring the academic sector into a systems-based partnership with industry and which emphasized both integrated science research and education.

The State of Maryland established the Maryland Industrial Partnerships (MIPS) in 1984 as its ERC. Specifically, MIPS is charged with the promotion of cooperative ventures between University of Maryland faculty researchers and local industry. MIPS serves both as an information conduit, making connections between UMS faculty and potential industrial partners through communication of industrial research needs and also as a project facilitator, providing funding necessary to jump start projects of mutual interest to both university researchers and their industrial counterparts. As a result, such programs make technical expertise and existing university research facilities available to Maryland industries on an as-needed basis.

This paper will present a case study of a project, ultimately funded by MIPS, that was undertaken to achieve three of the goals of the Industrial and Academic Partnership, including (1) coordination of industrial research and consulting activities with local universities, (2) facilitation of grants and internships beneficial to the University and the external community, and (3) improved communications between the University and business, industry, and government.

The case study covers the development of a project involving faculty at Salisbury State University (SSU) and the regional electric power company, Delmarva Power (Delmarva). Delmarva received a new National Pollution Elimination Discharge System (NPDES) permit from the Maryland Department of the Environment (MDE) for a peaking plant on Maryland's Nanticoke River effective March 1, 1996. On March 1, 1999, a copper limit of 59 ppb will go into effect for the cooling tower effluent (Outfall 004) unless an increase in the limit can be negotiated with MDE. Copper levels obtained by traditional monitoring at the plant currently range from 110 to 345 ppb. If the permit level is not reduced, the plant would operate out of compliance with its permit, and extremely expensive replacement of copper alloy piping in the cooling tower with titanium would be required. These levels are based on total recoverable metals, which are not necessarily representative of the toxicity of copper concentrations to river biota. Dissolved copper is thought to more nearly represent toxicity of metals in a watershed. Therefore, regulatory agencies sometimes allow use of a chemical translator (a value based upon the dissolved to total recoverable metal concentrations) to adjust NPDES permit effluent limits.

An interdisciplinary team of SSU faculty researchers, including an environmental scientist, two chemists and a statistician, were trained in "Clean Sampling" protocols in early 1997 by a consultant employed by Delmarva. Sampling protocols utilized newly developed methodology that eliminates influences by various chemical and physical interferences that can establish exact copper concentrations in the water. "Clean Monitoring" uses extensive quality assurance and quality control throughout sampling and analysis to obtain accurate, valid data by identifying and eliminating interferences. It employs all procedures needed to accurately measure trace metal concentrations when metals levels are < 100 ppb to determine concentrations that represent true values that are free of error due to sample contamination that occurs in traditional sample collection and analysis. This new protocol has been used by other utilities and has met with regulatory agency approval. Their use of "Clean Monitoring" has resulted in measured levels that are an order of magnitude lower than those detected by traditional methods.

SSU personnel will develop a chemical translator plan and conduct 12 consecutive monthly sampling events that consist of collecting samples from the mixing zone for analysis of total copper, dissolved copper, total dissolved solids (TSS), hardness, and pH. Sampling is projected to begin during the summer of 1997. We will examine subsequent data, develop recommendations, and will, in collaboration with Delmarva personnel, use the data to calculate a chemical translator. If MDE accepts the results of the project, the chemical translator can be multiplied against the current level based on total recoverable copper to obtain a permit limit that more accurately reflects the toxicity of the effluent from Outfall 004. Our responsibilities also include preparation of periodic status and final reports for submittal to MDE and MIPS, in collaboration with Delmarva personnel.

Education and training of students are usually the prime benefit to the University in partnerships with industry, either directly by student participation or indirectly through faculty involvement. However, a national shift toward consultant-like interactions with industry by universities demands a new look at expectations of both parties. Therefore, this case study also addresses the issues found in developing academic and industrial partnerships in proposals such as this one, including negotiations, benefits and constraints for both parties, differences in expectations, and reward structure differences that dictate responses of both partners to a proposal.

Valuable lessons about relationships between academic and industrial partners were learned firsthand as a result of our collaboration with Delmarva Power. Our initial negotiations were concerned with how much the project would cost Delmarva and, conversely, how much the University would get for its contribution to the project. Our corporate experience with academic grants suggested faculty stipends as a standard *quid pro quo.* The typical reward structure for university faculties promotes funded projects or publication of peer-reviewed papers for professional development over unremunerated experience in field applications. Therefore, since time is such a precious commodity in academia, as in industry, the time required for a project such as this would have been more profitably spent in preparation of a paper than in participation for intellectual stimulation alone. Delmarva initially felt that the professional association and training in a new state-of-the-art methodology were in and of themselves sufficient remuneration. While the difference in outlook initially threatened and delayed further negotiations, both parties were able to achieve a compromise position, which translated into a joint strategy to obtain third party financial support through the MIPS program.

As previously indicated, this approach proved beneficial to both parties. The project, as funded by MIPS, both provided for faculty support and relieved Delmarva of a portion of its financial commitment to the project. Ironically, as the technical phase of the project unfolded, concern over funding was soon overshadowed by our joint interests as scientists and engineers in working in the most efficient, cooperative way to handle the actual sampling and data management aspects of the project. It was this focus on the technical details that effected a profound change in how we dealt with each other and produced a mutual trust born of our working together.

Even so, however, there was a natural tension between university and industry interests: the university participants argued for a project design which would provide the maximum amount of data and be a complete study from a scientific perspective. Delmarva, arguing from an economic perspective, wanted to generate the minimum data necessary to argue its position in the NPDES permitting process, meaning sufficient only to support relaxed outfall standards which would allow continued plant operation without a costly cooling tower retrofit. In the end, the Delmarva approach won out, primarily on grounds of cost-effectiveness.

Other lessons learned in this lengthy process included the need to allow for realistic time lines when projects involve academic and industrial partners, the need for flexibility and a willingness to compromise at all stages of the negotiation and planning processes, and the importance of university administrative support for the faculty involved in the project.

Throughout the process, the university administration allowed the principal investigators to handle most of the negotiations and the freedom to design a final contract, subject to university approval. While this was a significant advantage, lack of much previous experience with these kinds of contracts meant that appropriate administrative structures had to be formulated as the negotiations proceeded. Another advantage which we had was geographic proximity of the university to the sampling site. This not only allowed for easy access for sampling purposes, but also for flexibility and responsiveness to sampling on demand and for meetings with counterpart Delmarva personnel.

Negotiations and preparation for this project required nearly eighteen months from inception to the actual sampling and data collection phase. Results for initial samples taken at the outfall showed minimal reduction of copper concentrations relative to the "conventional" sampling and analysis previously undertaken in recent years. Thus, a revised proposal was submitted to MIPS, specifying a change in approach: we would now sample the river (rather than the outfall) to monitor copper in the outfall mixing zone and use the results to develop a chemical translator for dissolved to total recoverable copper.