USING SUMMER FACULTY-STUDENT CONSULTANT TEAMS TO SOLVE INDUSTRIAL PROBLEMS

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THE INDUSTRIAL EMPLOYMENT of a summer student between the junior and senior year or between the senior and first-year graduate school often is received by the student with mixed feelings. The experience can be a good one, with a challenging and interesting assignment, good supervision and understanding, and include a sense of community and identity. On the other hand, often summer experiences can leave a student perplexed and frustrated. He or she is not always treated with respect or given very challenging assignments. A stranger in town who feels out of touch with the community. The supervisor does not have adequate time to really provide him with a background to carry out a meaningful assignment in the short period time that is available, and the management does not know exactly how to treat him because he is the result of a public relations program.

During the first three weeks in September 1975, a group of four upcoming seniors, a graduate student, and a faculty consultant spent three weeks at the Yorktown refinery of Amoco Oil Company on four projects related to the wastewater treatments of refinery effluents. These four projects lasted only three weeks but because of good planning, excellent cooperation from the refinery and a good student mix, all the shortcomings often found with summer jobs were overcome. In addition, the technical achievements and maturity of approach were amazingly high. And what was originally thought to be primarily a public relations approach to better recruiting turned out to be quite successful whether measured from a public relations or technical contribution standpoint.

Last fall, while interviewing for Amoco at Virginia Tech, Jerry Arkis discussed with Don Michelsen the use of faculty-student consultant teams as a means for solving industrial problems. Because our unit operation lab occupies most of late July and August between the junior and senior year, the possibilities of using student study group was limited to an eight week period before Unit Operations Laboratory or a three week period following Labor Day prior to the beginning of fall classes at Virginia Tech. Following the exchange the faculty consultant drafted a brief description of consulting faculty-student team possibilities which could be expanded depending upon Amoco's interest. It was suggested that these teams might be used to solve a process development or plant project, complete an energy survey or process control analysis, or study the refinery's waste treatment plant.

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PLANNING PROCEDURE

IN APRIL, AMOCO invited the faculty consultant to visit for further discussion. The faculty member toured the facilities with Gene Echols and exchanged ideas on how students might be effectively used to study a number of waste treatment problems in the refinery. The refinery is committed to an activated sludge process for treating its biological wastes, but has some degree of flexibility in terms of what might be installed be-

tore and after the activated sludge facility. By late afternoon, Echols and Michelsen had defined four possible areas for student investigation.

Subsequently, the faculty consultant completed a proposal describing the four project areas, project definition procedures involving the students, procedures to be followed in carrying out the studies, and a budget. The financial arrangement was made independent of the university. An important goal was to have students identify the projects as their own rather than an assignment delegated by Amoco and/or the faculty consultant. The proposal was shared with the four students selected from six applicants who expressed interest in carrying out this project after Unit Operations Laboratory in the Fall of 1975. Prior to going down to Yorktown in late May, the students and faculty discussed Amoco's treatment procedures, general expectation being placed on the students, and agreed on student project area assignments.

By late May the proposal had been approved by Amoco and the four undergraduate students, plus the faculty consultant visited Yorktown in order to tour the refinery including the waste treatment facilities, and to discuss and exchange ideas on the individual projects. By day's end the students had a good understanding of their project. Prior to revisiting the end of July, each student was responsible for completing a literature search and background study on his project area and for preparing a presentation using flow charts of planned activities for early September. On Monday, July 28, 1975, the four students plus a fifth graduate student (Honcho) and the faculty consultant discussed their approach to the problems with representatives from Amoco Oil in Yorktown including James Grutsch, the Environmental Director for Standard of Indiana. The students' plan of attack differed considerably from the earlier discussions. They recognized increased emphasis on the pretreatment of the waste water following API separator, industrial concern for the aeration and stabilization of the sludges, and decided not to pursue work on the crude desalter but rather to spend that time in the API separator area. Following their flip chart presentation, James Grutsch gave an overview of the operation of the Amoco operation in Texas City. His ideas verified much of what the consulting team had decided Amoco should be doing in Yorktown. After considerable discussion, the four projects were defined. In effect, only one of the students' projects was changed in any significant manner.

The four projects selected for study were as follows: 1) a study of the performance and capabilities of the API separator, as well as the feasibility of using a coalescer following the API separator, 2) a pilot dissolved air-flotation system following the API separator to remove dispersed oil and suspended solids, 3) evaluation of final filter using newly installed equipment including a dual polymer flocculation system, and 4) a plant study of sludge settling in their backflush pond, including the use of polymer addition, turbulence in the backwash pond; and a laboratory study on air stabilization of backflush solids.

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The students were very busy during the next five weeks completing the rather intensive Unit Operations Laboratory at Virginia Tech; therefore, when they arrived on Labor Day to start work on the second of September, the first day was spent discussing each project assignment. The first week was spent laying out test work, fabricating equipment, and becoming familiar with standard laboratory tests. Because of good understanding with management, laboratory, shop and plant personnel an atmosphere of good cooperation and encouragement was achieved—essential if any progress was to be made in three weeks. Equipment modifications were quickly made. A favorable union situation gave the students considerable freedom to design and fabricate much of their own equipment.

Projects were reviewed after the second week with Amoco management. By that time the students had completed their Introduction, Background and Theory, and Procedure sections which included plans, equipment, chemical analyses, data reduction, and presentation of expected results section. Monday, September 21, 1975, the students, Honcho, and faculty member gave a final oral report of the results of the study using flip charts.

Each student had completed a rough draft of his report and the results were presented to five representatives from the Amoco refinery. The

three hour session included an individual presentation by each of the students involving their projects, a report of the short-term recommendations by the group leader, and a discussion of long-term recommendations to meet the BPT goals by 1977 by the faculty consultant. The long-term recommendations on the use of a DAF and equalization pond system are in conflict with present plans for Yorktown. A final report was completed by November 10, 1975, which included a write-up by each of the students and an overall Summary, Introduction and Recommendations section.

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PARTICIPANTS' RESPONSIBILITIES

ALTHOUGH THE STUDENTS could call on support from faculty consultant, Honcho, and Gene Echols from Amoco, the students were given most of the responsibility for carrying out their individual projects. This was reinforced by the oral presentation given the end of July which laid the groundwork for the students to start immediately after Labor Day. A significant amount of flexibility was provided while on site. The faculty consultant was in the plant four days although he did spend a number of Sundays reviewing projects with individual students. The Honcho was necessary to provide technical assistance, interact on numerous questions, provide liaison with Amoco and to encourage students when bogged down. He acted as an intermediary and yet as much as possible direct interaction of the students with refinery representatives was encouraged. The students did much of their own work and were free to go into the shops and work directly with Amoco personnel. The team lived together in two adjoining kitchenettes with the Honcho and faculty consultant. The group ate together during the week but tended to scatter during the weekends. Because of the close proximity, the two conducted studies around the API separator working together closely, and the two operating the filter and backwash worked together. A two man team effort developed.

The faculty consultant's responsibility centered primarily on setting up the projects, making sure the teams got off to a good start, setting some guidelines and directions for the overall projects, and reviewing the results and recommendations closely.

The waste treatment area is a good area in which to work because of short induction period. That is, a high level of technical know-how is not required before an understanding of the problem is appreciated. The students picked up a grasp of the subject rather quickly. However, prior to hands-on experience, the students had difficulty relating literature to plant operations. Books on industrial waste treatment are abundant and provide background, but until the student is directly involved appreciation of the literature is difficult. As a result, background and theory and the significance of the literature were initially glossed over. During the three week work period, the level of appreciation increased and the results and comparison to the literature represented a real contribution.

The biggest analytical stumbling block came in the analysis of the oil and grease using freon extraction. The standard procedure for conducting these tests is time-consuming and subject to error. The students spent two or three evenings at the end of the project completing these analyses, yet this was crucial to the study in Yorktown because of an oil carry-over problem from the API separator into the biological basins. As the refinery moves toward the installation of an activated sludge process, a more elaborate oil and suspended solid removal procedure will be necessary in order to insure good oxidation.

The level of technical throughness with which the students approach their individual problems was truly remarkable and the magnitude of the results are really quite impressive. It has provided the basis for a number of conclusions and recommendations which suggest a review of current and future plans for waste treatment.

CONCLUSION

THROUGH PROPER organization and planning a short-term three week consulting team project can be conducted with significant technical and public relations payoff with students contributing in a very responsible fashion. A combination of introductory visits and a presentation by the students resulted in a strong committment to their project area. Once motivated the students moved ahead quickly wih their project. In addition, a strong sense of comradarie developed from living in those two adjacent kitchenettes and working together in two man teams. □