Technical News Feature

Productivity Management in Oil, Fat and Chemical Derivative Processing Plants[1]

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In a recent television discussion, a consensus was expressed that to have a successful business, the top priority is taking care of the customer. Without this objective, the company is doomed to failure. Other top priority requirements stated were productivity as a measurement of people, adequate quality control and competitive prices. With respect to quality control, its effectiveness was stated as primarily management's initiative and objective. It must be more important than getting the product out the door. There is much more to quality than plastering factory walls with appropriate posters or having more inspectors at the end of the shipping dock. Quality control means, first of all, having established standards understood by all. It also means better training of supervisors and workers. It may require redesigned equipment and perhaps changes in formulation and processing. It also requires adherence to in-process specifications, so that there is much better probability of a satisfactory final product.

Productivity management is the science of optimizing people effectiveness, thus gaining the best quality product at a price recognized as competitive. It generally is felt that people have a strong need to be recognized for individual achievement. It also is admitted that improved worklife and morale are interrelated and, further, people generally want to produce the best quality product at the lowest cost. People also want to do interesting work.

In the successful management of a food fat plant or a chemical derivative plant, the "hands-on" manager is essential. The manager and staff must motivate and provide the training, guidance and facilities to produce the proper quality products on time with the lowest cost. These factors will be described here. The principals will apply equally to the range of processing plants in our industry, whether large or small, from older plants to the most sophisticated and automated new plants.

It is essential that processing plants have accurate process tank and storage tank calibrations and reliable tank meters. Too often the lack of these is apparent. Proper tank weights are essential for adequate inventory, process control, oil and chemical accounting and cost control. A variety of tank meters are available, from the very simple to highly automated digital print-outs. Management and supervisors must get involved to insure that the tank calibration is correct. Without this accuracy, even the most sophisticated and costly tank meter is not worth much. It is obvious that the daily inventory sheet is an essential record for proper day-to-day operation.

All process operations should be carried out using written and updated process manuals approved by management. Such a manual must be available to the operator carrying out a specific process. Management must insist that this type of information is available and current. The best source for these manuals is the in-house staff engineer; if such help is not available or is inadequate, outside consulting assistance should be sought. Such information is essential for proper processing of products under the most efficient conditions and for proper quality. A considerable amount of the time of foremen, supervisors and production managers should be spent training operators to carry out processes as outlined in these manuals. This type of training can result in significant improvements in plant operations, such as product uniformity, better quality assurance, higher yields and lowest possible cost. The engineer in charge of developing the process bulletins is probably an excellent candidate for a future department or production manager.

The standard process bulletins should include information on general pumping rules to be followed. Adherence to these guidelines can be a means to avoid or minimize spills of tanks or mixes of unlike bulk products, which can be very costly. There should be continual emphasis on all safety aspects of carrying out the process. One suggestion is to use yellow copy paper in the manual to highlight such information.

Proper pumping log sheets and a log sheet of the entire operation are essential and must be part of the process manual. Such information makes it necessary for the operator to look at the gauges and instruments and to follow the sequence closely. Recording charts from the instrument panel board also constitute part of the daily records. Information thus is available to management on such pertinent topics as process conditions, yields and production rates. Such information also is essential for material control, accounting and costs. The log sheet should provide for inclusion of the pertinent laboratory analyses, which the operator should record for more effective guidance of current and future runs. The process manuals should contain information about essential servicing of equipment, without which there cannot be assurance of troublefree operation. Examples are the proper operation of pipeline strainers, cleaning of centrifuges and cooling of shaft seals in high temperature applications.

An important part of productivity management is supervisory monitoring of the process to insure the specified standard procedure is being followed by the operator.

Also important are manuals on formulations and quality control. Usually such manuals are prepared

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under the guidance of the chief chemist. If necessary, outside consultants can be used to get the job started and done, at least initially. Standards must exist for all formulations. There may be alternate formulations depending on the relative price of the specific fat, oil or chemical derivative component. In addition to your own products, specific customer formulations must be covered. Whenever a mixture is made, such information must appear in writing on a batch sheet, blend sheet, pumping record or the log sheet. Other ingredients also must be listed on these records. Quality control specifications must cover all raw materials and supplies, and the program must provide for adherence to these specifications. In part, this may require submission of analyses by the suppliers as well as in-house monitoring. If deficient, this may be cause for rejection of a claim settlement based on the purchase basis.

There must be adequate in-process control and adherence to the standards for each step of the manufacturing processes. By this means, there will be better assurance of final product quality, which is of paramount importance. In most companies, responsibility for correct processing is that of the production manager, whereas adherence to quality standards is the responsibility of the chief chemist; both often report to the plant manager.

Analytical standards and procedures are most important. These procedures must be written down. They may be official procedures such as those issued by the American Oil Chemists' Society or in-house company procedures. Regardless, technicians must be well-trained by the chief chemist.

Service departments, too, should have processing manuals and reporting log sheets as does any production department. Included are such facilities as the steam boiler plant, refrigeration and air conditioning plants, electrical generation and distribution, compressed oil supply, nitrogen supply, hydrogen supply or generation, waste water treatment plant, cooling tower services and similar services. Too often such service departments are neglected in this regard and therefore are not as effective as desired. Generally, these departments are the responsibility of the plant engineer.

As a prerequisite for computer use for all plant records as well as monitoring materials, cost control and other accounting, code numbers must be established by the accounting department for all raw materials, supplies, in-process products and finished products. Codes are necessary for the allocation of all labor charges, with time cards made out by individual operators and other personnel. These codes should appear on all original source information to the extent practical.

Another area of consideration is the maintenance department. There is specific need here also of the industrial engineering and productivity management that other departments require. In fact, here the need is greater because the worker rather than the equipment usually sets the pace, such as in a straight production process. The plant engineer is the key motivator to develop and establish written job and work procedures for all crafts. Special emphasis must be placed on safety in such areas as welding, especially in hazardous locations. Effective management of a preventive maintenance program will pay great dividends. This starts with a controlled store supply room. A work order system is essential, and such orders should be pre-estimated by maintenance supervision; These work orders should end up with complete labor and parts charges for proper allocation by the accounting department. A running record of maintenance on all equipment is desirable. All of this information can be computerized to the extent compatible with the accounting department's capability and services.

The plant engineer has another important role to play in productivity management. He should allocate plant services to the production departments based on a unit of production as well as perhaps on a fixed basis. The most important item is that of steam use. Others include electricity, refrigeration, compressed air, waste water services, cooling tower services, solid waste disposal and similar charges. Building and yard space may require allocation to various departments. All such charges are essential for proper cost accounting and department costs.

Let us consider the further use of log sheets and other original records which have been developed in this productivity management program. This information can be developed and summarized by the supervisor in smaller plants. In a medium or large plant, a clerk may work under the jurisdiction of the plant manager or the production manager. The data summarized should include such information as production quantities, batch cycles, production rates, yields or losses, chemicals and supply usage. By this means, actual yields can be compared with theoretical yields of a chemical derivative reaction process. A distillation or fractionation yield can be compared with past performance. A refining yield can be compared to the neutral oil loss or a factor times the free fatty acid of the crude oil. A deodorizing or physical refining loss can be developed for comparisons with accepted practice. Oil accountability by type can be developed, which is especially desirable when some oils are more expensive than others. Hydrogen purchases or production should be compared with theoretical oil absorption and a loss quantity for the "month to date" determined. This can help pinpoint losses, possible hazards and waste. Expensive chemicals such as glycerine for esterification must be accounted for.

Other important data can be developed by the plant accountant or the central accounting department. These include oil accountability by general type, oil losses and degraded oils. The latter must be monitored so that it will not get out of line. Chemical and supply usage should be compiled to compare with a norm or standard to make sure they are in line, as they can be significant cost factors.

The accounting department is responsible to provide computer services and issue monthly or four-week department costs based on continual data inflow from all departments. Comparisons with the past can be made on a month-to-month as well as an accumulative basis. They can develop product costs for comparison with standard costs in the same manner. Computer

technology is a vital means of implementing productivity management with respect to expediting the program, fewer people involved and reduced costs, once the basic system has been established and is functioning smoothly.

As much of all summarized information as possible should be available not only to managers and supervisors, but also to foremen and all production and service personnel. By this means, chances of improvement will be better and everybody may become a more effective team player through being better informed.

Production planning has a key role in productivity management, which is primarily the production manager's responsibility. Planning may require the use of a coordinator under the production manager. This is a very important function and, if properly executed, will pay dividends. The position requires liaison with the order and sales departments and the production manager's personnel. A complete knowledge of all operations is necessary. There also must be sufficient liaison with the commodity buyer and the purchasing manager.

The matters of safety and compliance with pertinent regulatory agencies are very necessary parts of productivity management. In a small plant, the plant engineer and production manager may have responsibility for them. In a medium or large plant, they may call for a staff engineer. Safety must be emphasized throughout the organization in all process manuals, worker training and monitoring. Management has the responsibility to provide a safe working environment as well as worker training. Aside from the humanitarian aspects, injured workers may mean lost time with attendant inefficiencies and added costs. There must be compliance with all regulations on locker rooms, toilet facilities, liquid and solid waste disposal, and air and noise pollution.

There should be specific job descriptions for everybody in the factory. These should be in language understood by all, and available to the specific workers. This information is essential for effective productivity management. It should be kept updated and can be referred to at the time of salary or wage adjustments.

In summary, productivity management is motivating people in a created desirable environment to do more complete and efficient jobs, all for increased profits. It can have a vital role in plants to the extent that there is management receptive to its implementation. Significant dividends are a better work place, more efficient operation and greater assurance of quality products at lower costs.

Productivity Management in Vegetable Oil Refineries[1]

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If managed properly, computer-based process control has significant potential for productivity improvement in vegetable oil refineries. It has been technically feasible to utilize computer process control since the early 1970s. Because of apprehension of computer system reliability, the estimated cost of retrofitting and the high risk involved with a new technology, no one made a major commitment until 1981. With experience and confidence gained from successful applications in wet corn milling, the A.E. Staley Manufacturing Co. made a full commitment to computer-based process control in the design and construction of its Des Moines soybean oil refinery. Subsequently, others in the industry have made applications beyond the scope of programmable logic controllers.

The intent of this paper is to examine the computer-based process control experience logged to date in vegetable oil processing, to point out both benefits and shortcomings, to outline the strategy utilized to achieve successful application and finally to offer some experienced counsel to those contemplating a commitment to computer control. The perspective offered is that of a former plant manager responsible and accountable for the hard-measure results of a computer-process-controlled operation.

[1]Presented at the AOCS meeting in Philadelphia, PA, May 1985.

BENEFITS

There are many potential benefits of computer-based process control. While the magnitude of possible improvement will vary by plant, the specific advantages of computer control are the following:

Endpoint control. This is enhanced for batch processing operations such as hydrogenation. With precise programmed reaction conditions (temperature, pressure, catalyst addition and hydrogen gas input) for hydrogenation, the physical characteristics for each basestock produced are more uniform. The results of improved basestock uniformity are more predictable product blending/mixing results, fewer correction requirements for blends or mixes and a possible reduction in basestock inventory. With conventional control, a larger basestock inventory often is maintained in an effort to dampen the variation between batches of the same basestock.

Material usage. More precise, responsive control results in minimum use of materials such as caustic soda, sulfuric acid, bleaching earth, filter aid, catalyst, hydrogen gas, nitrogen gas and other processing reagents and aids. The hydrogen gas plant operating rate can be programmed according to hydrogen demand, and hydrogen venting can be consistently avoided.

Operating mistakes. Once the process control