Staley refinery in Des Moines, Iowa

Staley's automated oil refinery

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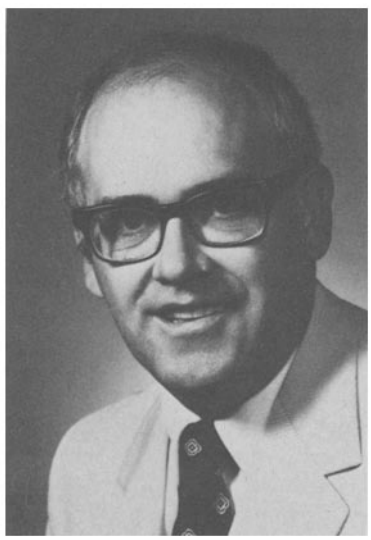

Norm Smallwood . . . plant superintendent

A.E. Staley's new multi-million dollar vegetable oil refinery in Des Moines, Iowa, combines state-of-the-art processing equipment with the latest computer technology in what may be the United States' most automated refinery.

"A person used to a conventional plant would be very frustrated here," says Plant Superintendent Norm Smallwood. "The only access to the system is via the computer. There are no local start-stop buttons, no manual valves (except for a few isolation valves."

The compact refinery is on a 10-acre tract adjacent to Staley's Des Moines soybean processing plant which supplies soybean oil direct to the refinery via a pipeline. The refinery has about 45,000 square feet, plus its hydrogenation plant and tank farms. Cottonseed oil and palm oil are stored in the tank farm for blending shortening oils to customer specifications. The refinery's compactness is a major factor in what Smallwood describes only as "unique proprietary energy saving" technology. The refinery capacity is about one million pounds of oil each day, or about 360 million pounds a year. Construction was completed the latter part of 1981. At early spring, when start-up had reached the hydrogenation process, Smallwood was estimating the plant would be in full production by June.

The showplace of the refinery is the control room. A Foxboro 1A computer with Microspec and Videospec are the heart of the control system. Microspec consists of the computer with microprocessor. This portion monitors conditions throughout the refinery and keeps operations running smoothly. Videospec is the window to the system. Foxboro conducted a course on its equipment for Staley employees, but the software for the refinery was developed by Staley. About a fourth of the program was adapted from Staley's corn wet milling plant in Lafayette, Indiana, and the rest is unique to the Des Moines refinery. Smallwood describes Staley as an industry leader in computer programming for the fats and oils industry. While Staley officials don't want to be specific, the full software program for Des Moines represents about six years of effort by the company's software specialists.

Videospec's window to the system consists of two sets of consoles, each set having three display screens and one printer. The two sets sit side-by-side in the second floor control room, each set monitoring half the refinery operation. If one set should fail, the other set can monitor the full system. At each video display terminal an operator can review data on any part of the system. One split screen display provides simultaneous readings on eight operations. At the touch of a button, a technician can get a full-screen version for any of the eight operations and then further enlarge that image to pinpoint a particular portion of that operation. Pulsating red visual signals indicate problems. At the first indication of trouble, a printer begins providing hard copy on operating data for that process. That will make it easier to reconstruct conditions at the time of such incidents, Smallwood says. The computer can detect the start of any power failure and,

with aid of a flywheel backup, transfer all critical operating data to core memory, Smallwood says.

Providing access to the system only through the computer indicates Staley's confidence in the new control method. "If we were to build in the redundancy of local operator controls, they might tend to become a crutch," Smallwood says.

Shipment of finished oils is recorded by the computer. The loading area for railroad tank cars and tank trucks is below a window in the computer center. The computer prepares necessary paperwork on loadings and shipments.

If persons familiar with a traditional refinery would feel out of place at the Staley refinery, where did the employees come from? And what type employees did Staley seek?

The recruiting was done in the Des Moines area. Average educational level for the operation staff is 15.5 years, Smallwood says, with the backgrounds ranging from a high school dropout to persons with graduate degrees in such fields as food science and computer science. About one-third of the staff is female. Five persons in the 50-member staff have previous vegetable oil refinery experience, including Smallwood who before joining Staley had more than two decades with Procter & Gamble, Hunt Wesson and Lou Ana Foods.

The operating staff members are all considered "technicians" and there are no persons with the title "supervisor" whose primary job is to oversee what others do. Each crew of technicians has a "coordinator," which Smallwood likens to a playing captain on sports teams. Each technician is rotated through the refinery's various operations. A technician working today in the computer control room may find the next assignment is with quality control or engineering or some other aspects of the plant.

"When we're in full operation, this crew will know more about oil processing than any other crew in the country," Smallwood says with pride.

The refinery equipment and engineering reflect the same care and thoroughness that went into computer process control and personnel selection. The contractor on the plant was J.A. Jones of Des Moines; Sullivan Systems provided design services.

There are two crude oil scale tanks in the refinery for temporary storage of crude oil from the adjacent extraction plant, or crude may be piped directly into the refinery system. Crude oil filtration is accomplished in a system chosen in part for its adaption to automatic cleaning. The degumming and caustic refining centrifuges are just outside the control center. Bleaching equipment is adjacent.

Sullivan Systems deodorization and hydrogenation systems are used. The separate hydrogen plant has two 80,000-lb capacity units. Smallwood says the plant has storage capacity for a full day's charge of hydrogen.

The tank farm provides storage space for refined oils and finished products, which include salad oils, frying oils, margarine oils, shortenings, coatings and stabilizers, intermediate oils, lecithin, acidulated soapstocks and distillates.

Cooling towers are used to reduce air pollution. A separate building houses treatment facilities for wastewater, with recovered oil and fatty acid recycled back into the processing system and purified effluent discharged into the sanitary sewer.

A thorough description of the plant was published in the March 1982 issue of *Food Engineering*; author was Charles E. Morris Jr., whose father is a former AOCS president.

The site includes a small stormwater discharge holding pond that, Smallwood notes with a hint of bemusement or puzzlement in his voice, employees have lately begun to refer to as "Lake Smallwood."

Everything about the Des Moines refinery has an atmosphere of newness to it—from the compact engineering to the relatively young staff to the computer control center. There's an air of pride at being part of an operation that Staley describes as the most modern of its type in the nation.

Start-up, like any shake-down cruise, was a time to discover if the system would operate as planned, where the glitches were, what modifications or additions were needed. The cold winter (with a -95 F wind chill) showed the need for minor modifications in the tank farm, and some wastewater holding and treatment areas required minor changes. Overall, however, Smallwood obviously is pleased with the new plant. In fact, he says there's only one thing he would change if he had it to do over and, he said as he wiped his feet after an early spring tour, that would be to wait until after start-up to install office carpeting.

That's about the only operation in the refinery not controlled by a computer. □

Staley's other facilities

The Des Moines refinery is Staley's second oil refinery. The first is at Staley's home base in Decatur, Illinois, where initial refinery operations began in 1937. Staley began producing hydrogenated oils at the Decatur facility in 1978.

Staley has five domestic soybean processing plants—Decatur and Champaign, Illinois; Fostoria, Ohio; Frankfort, Indiana, and Des Moines, Iowa. It also has purchased a 100-acre site in Memphis, Tennessee, with plans to build a soybean processing mill at an unspecified future time.

Staley has corn refining plants in Decatur, Illinois; Lafayette, Indiana, and Morrisville, Pennsylvania. Another corn refining facility is being built in Loudon, Tennessee. Staley is a principal in construction of a new sunflower processing facility in Velva, North Dakota.

The oil refinery in Des Moines was built in response to market demand for refined oils west of the Mississippi River, a Staley spokesman said.

billion bushels, so it is apparent that while many futures contracts change hands at the CBT, there is little shifting of actual soybeans. The CBT estimates less than 2% of the beans contracted for are actually delivered. CBT 1981 futures contracts totaled 304 million tons of soybean meal and about 183 billions pounds of soybean oil.

Futures trading permits a process known as "hedging." Hedging is a risk-management tool that involves the sale—or purchase—of a futures contract to offset a previous or expected transaction involving a particular commodity. For a commodity producer or handler, hedging is a marketing tool. Farmers use hedging to establish the price of a crop before, during or after harvest. Consumers of the commodity use hedging as a purchasing tool to establish the price to be paid for products to be processed or resold at a later date. Thus, U.S. food processors hedge against possible increases in the price of raw materials they must purchase, and soybean exporters use hedging to establish a price for the beans they have committed to sell. The futures exchange provides the place, facilities and regulations for thousands of buyers and sellers—or their broker representatives—to determine prices, hedge, and otherwise transact their business.

Futures trading plays a crucial role in the nation's economy and is experiencing rapid growth. "This country's futures industry—with the Chicago Board of Trade at its center—has experienced dramatic growth in the last decade," says an editorial comment issued by CBT. "In 1971, 8.5 million futures contracts were traded on the CBT floor. For 1981, that figure exploded to 49.1 million, capping twelve consecutive years of record growth." Each contract represents a specified amount of a designated commodity. In the soybean complex, a soybean contract consists of 5,000 bushels; a soybean oil contract of 60,000 pounds; and a soybean meal contract of 100 tons. There were a total of about 16.5 million soybean complex contracts traded in 1981, about a third of the total number of contracts at the CBT.

Soybean trade started on the exchange in 1936; oil, in 1950; and meal, in 1951. In 1974, the soybean complex accounted for nearly half the dollar volume on the CBT. Soybeans in 1981 accounted for 52% of all grain and oilseed contracts traded on the Chicago Board of Trade. Last year, soybeans ranked third in total contracts traded at all 11 U.S. futures exchanges. Soybean oil ranked eighth; meal, ninth.

The growth of the futures industry is reflected not only by quantity and dollar volumes traded, but also by changes in the physical environment in which it operates. The first meeting of the Chicago Board of Trade was convened above a Chicago flour store in 1848. Seventeen years later, the board moved to its first permanent home in the Chicago Chamber of Commerce Building. When the 1871 Chicago Fire destroyed its facility, the board met in a wigwam on a street corner until trade could resume in the restored building. The CBT moved into its own building in 1885, and has remained there since. A 19,000 square-foot trading floor opened in 1930 and was the predecessor of today's floor.

The floor's size is complemented by its technology. The floor's 838 telecommunications booths are served by over 4,000 miles of cable. The facility is equipped with trading pits that can be altered to allow for growth and flexibility in day-to-day operations. To support voice projection in the pits and to reduce sound levels elsewhere, engineers designed a discriminating acoustical system. A specially designed lighting system provides light levels twice that of the old trading floor. Price display boards have been expanded to include actively traded spreads and smaller boards for other contract markets.

The Board of Trade has run into problems in its expansion. When the new floor opened, according to the *Wall Street Journal*, the acoustics were so bad that traders standing not 10 feet apart couldn't hear each other. The acoustical design supported voice projection too well. Traders resorted to plugging their ears with cotton and industrial earplugs to dull the noise. To alleviate this acoustic problem, the board has added sound-absorbing materials on the walls and on the perimeter of the ceiling. Further analysis is planned when the 23-story addition is completed, probably sometime this summer.

Soy oil futures trading resumes in London

The London soybean futures market was scheduled to reopen on April 19, 1982, according to the March *Newsletter* of the Federation of Oils, Seeds, and Fats Associations (FOSFA).

News of the reopening accompanied the announcement of a new EEC contract in U.S. dollars, which FOSFA says will give the vegetable-oil trade protection against price movements and enable crushers and processors to price their supplies or requirements over a 13-month period.

The contract unit is 25 tons, with trading months in February, April, June, August, October and December. According to the *Newsletter*, the contract specification is the same quality as is generally traded in the physical market, with an initial delivery point in Rotterdam.

New Cargill refinery opens

Cargill's new $12.3 million soybean oil refinery in Wichita is now in production with a capacity of 700,000 pounds of refined edible oil each day.

The refinery will use crude soybean oil produced in Cargill's adjacent soybean crushing facility, which can process about 14 million bushels of soybeans annually. It is Cargill's sixth domestic vegetable oil refinery and its second capable of producing hydrogenated oils.

The finished salad oils and hydrogenated oils will be sold

to processors in southwestern and western states for use in margarine, bakery products and shortening. Storage capacity is about 8.4 million pounds, Cargill says. The refinery also will be able to process sunflower and cottonseed oils.

Cargill's first domestic refinery producing hydrogenated oils was completed in 1978 in Gainesville, Georgia. Other Cargill refineries are at Fayetteville, North Carolina; Hartsville, South Carolina; Des Moines, Iowa; and Chicago.

Cargill's 15 soybean processing plants are located in Arkansas, Iowa, Illinois, Minnesota, Kansas, Virginia, North Carolina, South Carolina, Tennessee, Ohio and Georgia.

The firm announced in April that it would close on April 16 a large part of its flaxseed plant in Minneapolis and crush flax at the sunflower seed processing plant in Riverside, North Dakota. The Minneapolis facility will still be used as an oil refinery and to store grain and vegetable oil.

Occupational injuries decline

Occupational injuries in the chemicals and allied products industry and in the food and kindred products industry decreased in 1980, according to the Bureau of Labor Statistics report cited in the February 1982 issue of *OSHA News*.

The BLS report reveals that total cases of occupational injuries (including deaths) in the chemicals and allied products industry was 6.4 per 100 full-time workers in 1980, down from 7.2 in 1979. In the food and kindred products industry, the incidence of injury was higher—18.1/100—but still lower than the 19.2/100 level of 1979.

BLS estimates that one injury occurred for every 12 workers in the private economy in 1980. In comparison, the chemical industry's rate is approximately 1 in 16; the food industry, 1 in 6.

Spanish contaminated oil problems linger

Food Chemical News (March 15, 1982) reports that Spanish health officials are becoming increasingly concerned over the continuing deaths of persons, especially children, made ill by ingestion of contaminated salad oil last summer. Although there have been no new cases of poisoning reported, persons who became ill during the incident last year were reported suffering relapses. Deaths attributable to the incident now number more than 250, *Food Chemical News* said.

Central Soya upgrades plant

Central Soya Co. Inc. has completed a $9 million first-phase modernization of its Decatur, Indiana, soybean processing plant, but there is no official word on what the second phase will be or when it will be announced.

The first-phase work, completed in November 1980, increased capacity to 2,500 tons a day, about 20% above previous capacity. The Decatur facility was originally built in 1934 and was Central Soya's original soy processing plant. The firm now operates eight domestic soy processing plants and one in the Netherlands with a total annual capacity of 110 million bushels.

Two die after explosion

Two employees at the Delta Cotton Oil and Fertilizer Co. in Jackson, Mississippi, have died as the result of a March 26 explosion at the cottonseed processing facility. Five other persons were injured.

There were two explosions at the plant on March 25 that resulted in injuries. The fatal explosion occurred March 26. Consultant C. Louis Kingsbaker of Atlanta, hired by Delta, said the fatal explosion may have resulted when a worker opened a hatch on the extractor unit, permitting oxygen to reach a fire that may have been smoldering inside the extractor after the March 25 explosion and fire. Hexane was used as a solvent at the plant.

Kingsbaker said the company is repaired with new safety devices including steam lines to put out fires, improved hexane fume detectors, and devices to halt operations if the extractor malfunctions.

H.L.S. announces 1982 contracts

H.L.S. Ltd. Industrial Engineering Company has announced four contracts for new fats and oils plants for 1982. Two of the contracts are for South America, two for South Africa.

The South American plants are a 100 metric tons per day castor seed oil factory to include extraction, meal treatment and refinery for Aceites Vegetales in Guatemala and a 75 metric ton per day crude oil, degumming, bleaching, deodorizing and winterization unit for Venezolana de Grasas in Acarigua, Venezuela.

The South African plants are a 400 tons per day extraction unit for corn, sunflower and soybean with a 100 tons per day flash desolventizer for Nola Industries (Pty) Ltd. in Randfonetin, South Africa, and a 150 metric tons per day oil refinery for Epic Oil Mills Ltd. in Johannesburg, South Africa.

New Guadalajara plant

Completion of a 1,600 metric tons per day soybean processing plant is forecast for mid-1983 by Industrias GOSA, a sister company of Aceites, Grasas y Derivados, S.A., near Guadalajara, Mexico.

French Oil Mill Machinery Co. is providing preparation and extraction equipment, including a stationary basket extractor and a French combination meal dryer and cooler. Guadalajara is one of the centers of oilseed processing in Mexico.