

Single Serpentine Helps CH²M Hill Design Compact Primary Treatment Center



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**Surcharge Reductions And
Increased Potato Waste Recovery
Insures Quick Payback On
Center's Cost**

The "fatted calf" is a far cry from a Michigan company which produces frozen french fried potatoes.

But, cattle, the company and the Michigan environment are reaping continuing benefits from action taken five years ago when the firm cleaned up its plant effluent dramatically and — in the process — salvaged a valuable product for resale as livestock feed.

Mid-America Potato Company, headquartered near Grand Rapids, Michigan, specializes in processing quality frozen potato products sold on a regional basis to the institutional-commercial market — hospitals, restaurants, schools, etc. Its Grand Rapids



facility includes an 85,000 square foot manufacturing plant, a 3,000 square foot office complex and a 130-employee work force.

On first appearance, the Mid-America plant seems to operate at a leisurely pace. However, with the fall harvest of the nation's potato crop, an instant transformation occurs in September when the first shipment of potatoes arrive at the plant. A feverish pitch of activity then ensues which continues unabated through the following June. Basically, Mid-America has a 200-day production year which commences in September. From that point, it operates 24-hours-a-day (except Saturdays and Sundays) until the potato crop is fully processed — normally the following June. The plant is down 12 weeks of the year for most maintenance and repair work and the year-end holiday season.

Until the late 1970s, Mid-America relied on a primary screening system for its wastewater treatment. It removed particulate (potato waste) matter over .060" in size from the process water. This potato waste was shunted to a 50,000 gallon holding tank then picked up by cattle feeders for use as livestock feed. The particulate matter under .060" remaining in the water, went into the city sewage system.

This created two basic problems which the plant had been forced to live with:

- 1). During its 200-day operating season, the large amounts of small particulate waste greatly increased the bio-chemical oxygen demand (BOD) and suspended solids levels which were unacceptable to Mid-America;
- 2). Company management realized that the smaller particulate matter entering the city's sewage system was mixed with domestic waste — making it unfit for use as feed or most other beneficial uses. They knew that recovery of additional potato waste could give them a larger profit center in the form of livestock feed. Its sale, in turn, could help pay

POTATO WASTE FROM floor stations at Mid-America is fed onto the Serpentix system by a screw conveyor and sludge is received from centrifuges (top). Don Howland, assistant plant superintendent, inspects the helical, climbing turn made by the Serpentix after it leaves the floor level tunnel (center). Completing the first helical turn, the continuous path conveyor climbs between the holding tank and tunnel structure (bottom).

for the design, equipping and installation of a new primary system for treating the plant effluent.

As Mid-America was moving to correct its problems voluntarily, the Environmental Protection Agency (EPA) started bringing pressure along a broad front to "encourage" industrial facilities nationwide to clean up plant effluent wastes. In keeping with EPA recommendations, a tough, new surcharge ordinance was adopted in Wyoming, Michigan — a Grand Rapids suburb where the Mid-America Potato plant is located. But, Mid-America had done its homework well and was in full compliance when it went into effect.

Well before passage of the surcharge ordinance, Mid-America started planning a primary treatment system to replace its old primary screening center. Working closely with the consulting engineering firm of CH²M Hill, an industrial primary treatment center was designed, approved and installed. It is currently recognized as a model in the potato processing industry.

Working within the confines of the Mid-America plant, the compact treatment center designed by CH²M Hill included a clarifier, two centrifuges, a silt-handling system and a second 50,000 gallon holding tank which would be required to handle the increased recovery of usable potato waste.

An acute problem faced by CH²M Hill engineers and Mid-America in equipping the center was one of space. If they were to make the new center work without enlarging the plant they knew they could not use conventional conveying methods to transport the waste potato sludge to the holding tanks. There was a scant 40 feet from the pickup point under the centrifuges to the required point for discharge between the two holding tanks. Within that distance, an elevation gain of 31 feet would be necessary.

The only possible option — without expanding the plant — would have been a conveying combination consisting of: a flat belt conveyor under the centrifuges to end discharge the potato waste onto another flat belt for transfer to and discharge into a bucket elevator. The bucket elevator would have then had to transport the potato waste vertically more than 31 feet and end load onto a reversing screw conveyor which would then carry the material to the holding tanks.

The basic problems were: the need for four conveyors, three transfer points and a possible serious bottleneck with the bucket elevator. The wet potato waste could not be cleaned sufficiently from the elevator buckets to ensure the smooth, continuous trouble-free operations which Mid-America's 24-hour-a-day operation would demand. These problems, coupled with the added energy consumption, maintenance requirements and

space problems which the option would create ruled out that avenue.

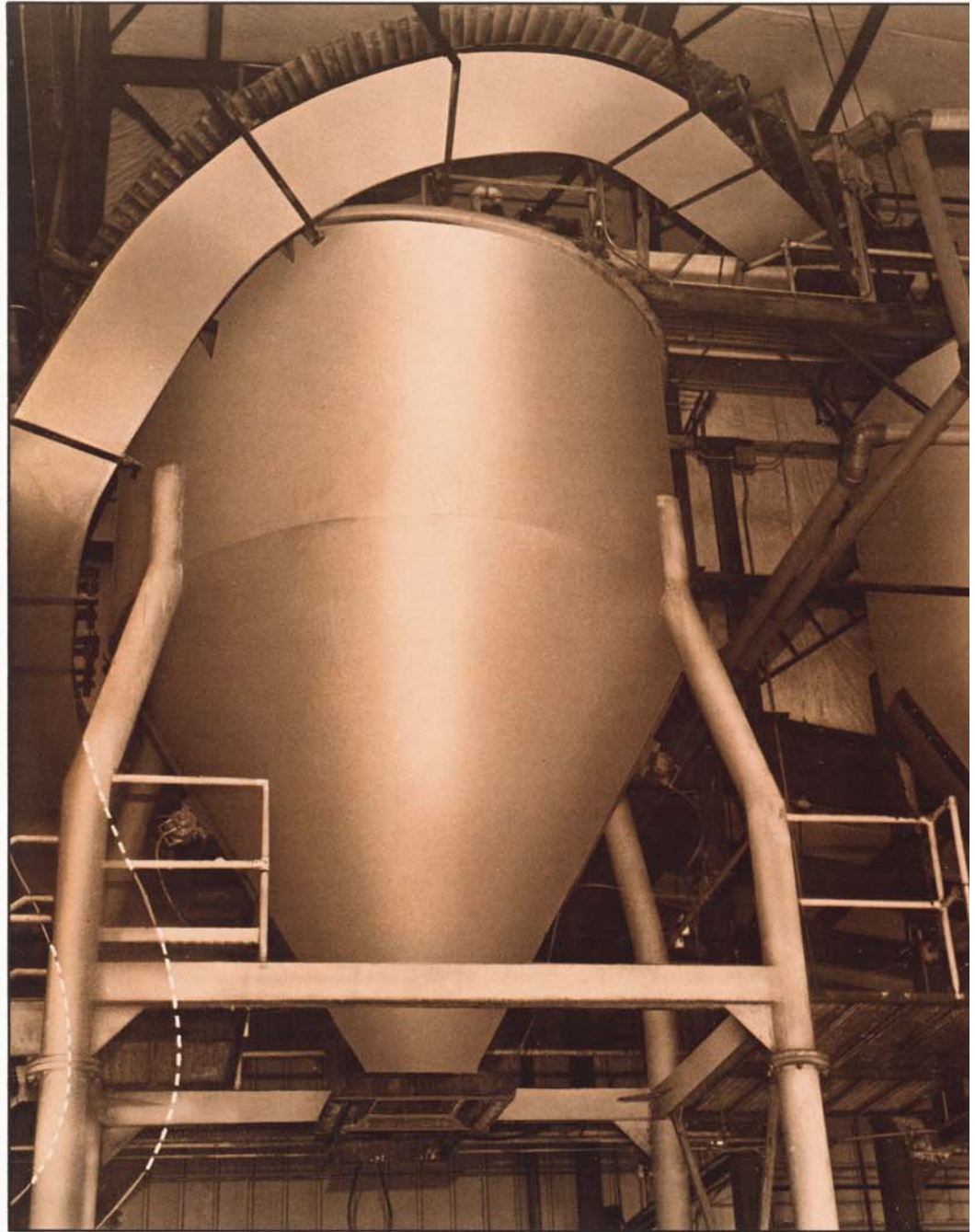
The problems of space, multiple conveyors, excess energy, maintenance requirements and costs were solved decisively by CH²M Hill. A continuous path Serpentix conveyor, capable of operating in all three dimensions, was specified.

Manufactured by Serpentix Conveyor Corporation, Westminster, Colo., the Model I Serpentix covers a 95'8 $\frac{3}{4}$ " continuous path from pickup to discharge. Operated by a single 5-horsepower motor, the system utilizes a 20-inch wide belt traveling at 30 feet per minute to convey 4.7 tons per hour of potato waste.

The Serpentix system completed equipment requirements for Mid-America's primary treatment center. It was installed in five working days by a four-man company maintenance crew. When completed, it formed a giant, climbing "S" curve, preceded by a 28'6" horizontal loading run which passes under the centrifuges for product pickup. After pickup, the Serpentix system completes a vertical curve at the end of the horizontal run, helixes up to the right at a 30-degree incline around a 210-degree arc. While still climbing at 30 degrees, the system straightens and enters a second helix then climbs up and to the left around a 160-degree arc. At its terminal, the convolutions in the Serpentix belt flatten and the potato waste is scraped cleanly from the belt onto a 10-foot troughed belt conveyor 36 feet above floor level. A reversing belt carries the potato waste into either of the 50,000 gallon holding tanks.

Its new primary treatment center provides Mid-America future growth potential. A maximum of 500,000 pounds of potato waste could be run per day — 200,000 to 225,000 pounds per centrifuge. However, due to present plant loads only one of the two centrifuges, located 16 feet apart, runs at a time on an alternating basis. Each centrifuge discharges onto the Serpentix belt every 12 minutes in batches. The 600 pound batch loads — comprising a 35% solids cake — dumps within a one minute period.

Since becoming operational, the treatment center has been removing 30% of the BOD and 75% of the suspended solids from the plant's effluent — a 50% overall gain. The surcharge in Wyoming, Mich., is 3.4-cents per pound on BOD and 11-cents per pound on suspended solids. The cost savings now being realized annually by Mid-America on the surcharge reduction made possible by the new treatment center ensures an early payback on its cost of approximately \$900,000. Another important feature of the primary treatment facility is the conservation factor involved and the added profit resulting to Mid-America. The large amount of potato waste particulates which were previously "flushed down the drain" into



THE SECOND HELICAL turn is completed by the Serpentix system for end loading the potato waste onto a reversing conveyor 31 feet above floor level. The need for multiple conveyors was eliminated by using the three-dimensional continuous path Serpentix system.

the city's sewer system is now removed from the process water by Mid-America's primary treatment center. Since it is not exposed to domestic waste, it remains a commodity which is sold by Mid-America as cattle feed.

A single, large cattle feeder now contracts with Mid-America for all of its potato waste —

a hefty 16 million pounds per year. When the plant is in full operation, eight truck loads of potato waste are removed weekly over a 40-week period. The cattle feeder mixes the potato waste with hay, corn and cattle supplements to help produce another product for America — beef.