CASE HISTORY:
AGGLOMERATION OF COAL FINES
AT A FOSSIL FUEL POWER STATION

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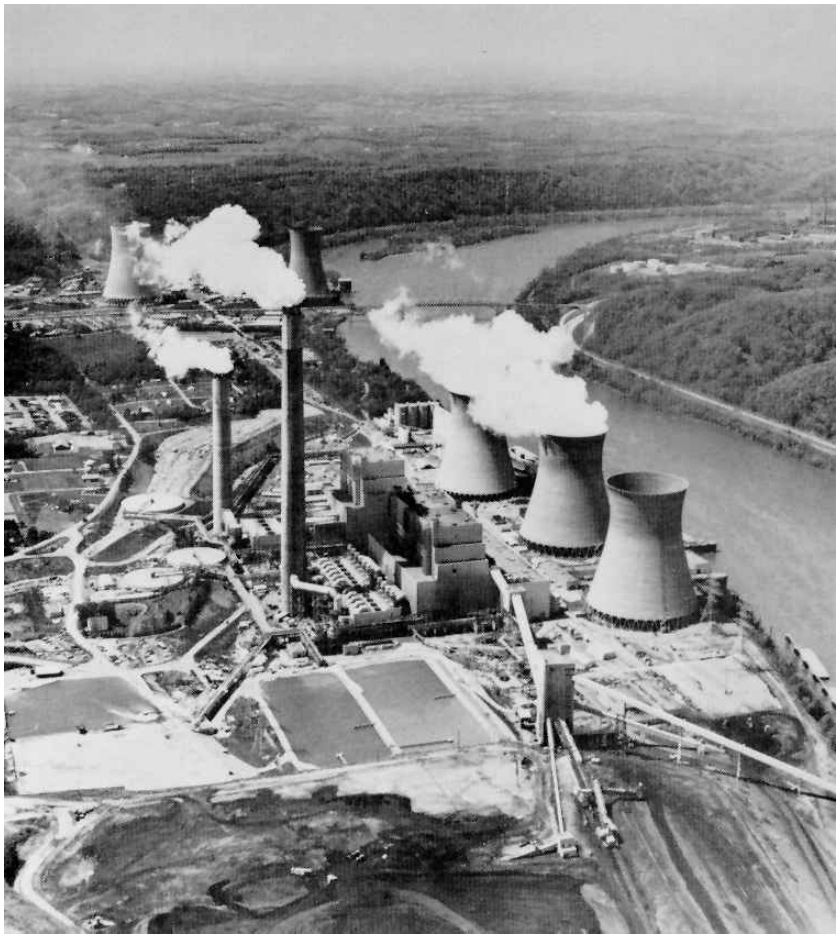


This is a case history of an agglomeration system installed in a fossil fuel power station to convert coal fines into nondusty agglomerates for the purpose of improving environmental conditions. The installation is at the Bruce Mansfield Station of Pennsylvania Power Company in Shippingport, Pennsylvania.

The Bruce Mansfield Plant is a 2,360,000-kilowatt, coal-fired power-generating station located on the Ohio River. The facility was built by Pennsylvania Power Company, which owns the plant in common with four other companies -- Cleveland Electric Illuminating Company, Duquesne Light Company, Ohio Edison Company and Toledo Edison Company.

The Bruce Mansfield Plant, designed by Gilbert/Commonwealth and constructed by Townsend & Bottum, is a recognized showplace for environmental technology. Its air and quality control systems permit the plant's generating units to convert 24,000 tons of coal into 56 million kilowatt-hours of electricity daily in a clean and acceptable way.

In 1981, Pennsylvania Power Company installed a dust-collection system on its primary crushing system to collect dust fines generated at the crushers and conveyor transfer points.

The dust-collection system removes the coal fines from the building and delivers the dust-laden air to the baghouse, which is located on the ground level. Once the fines were collected, the next objective was to reintroduce the fines to the coal-handling system without creating additional air entrainment of the dust.

First attempts involved blending the coal fines with the crushed coal on the conveyors that feed the coal bunkers. This created a dust problem at the bunker as well as problems in blending the coal on the conveyor.

To arrive at a solution to the fine dust handling problem, three methods were considered and evaluated. The first method was to pneumatically convey the fines from the baghouse to the bunker prior to feeding to the boiler. This method only transferred the coal dust problem from the crusher house to the bunker area, where additional dust collection would have been required.

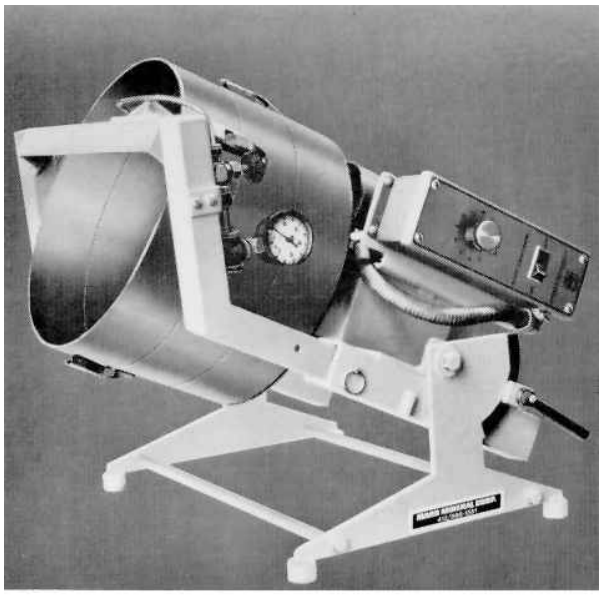
The second method considered was a dust-wetting system involving a ribbon-type conveyor and the spraying of a chemical additive on the fines to wet the dust for introduction into the coal-handling system. The chemical additive would have been similar to the type used to wet coal in the stacker/reclaimer system.

The third method was a pelletizing operation that would convert the fines into manageable-size agglomerates that could be easily introduced into the crusher house system and handled in the exact same manner as the crushed coal.

An economic evaluation of the three systems under consideration found the pneumatic system to be the highest in cost. The pelletizing system was second highest and the dust-wetting/ribbon conveying system was the least expensive. It is conceivable, however, that the pelletizing system would have been the lowest in cost had the chemical additive costs been considered as a factor in the pricing of the dust-wetting system.

To determine the feasibility of using pelletizing equipment to produce an acceptable product, several tests were conducted to obtain predicted performance data on several types of pelletizers.

It was the purpose of the tests at Mars Mineral Company’s (MMC) laboratory to develop methods of agglomerating and conditioning the dust and to render it dustless for reintroduction into the system without overwetting the dust, which would cause sticking and poor flow.



DP14 Agglo-Miser

Typical Ampel
Paddle Arrangements

MMC's first tests were conducted on a Laboratory DP-14 Agglo-Miser, which is a 14-inch-diameter, multiple-depth pelletizer. The tests were performed using the 3-inch, 6-inch and 9-inch pan depths to simulate disc, deep-disc and deep-drum pelletizers. The coal fines pelletized well with water as the only binder to form 3/8-inch-diameter to 1/2- inch-diameter pellets. Samples were collected and sent to Pennsylvania Power for evaluation.

A second test was performed on the MMC Ampel Horizontal Pelletizer/Conditioner, which is used primarily in applications that do not require uniformity in the agglomerated product. The test was conducted on a Model A-025, which has a trough area of 6 inches wide by 30 inches long. The Ampel is a single-shaft device with radially extending mixing paddles that mix the water binder and feed material, producing irregular-sized agglomerates.

For demonstration purposes, the A-025 Ampel unit was hand fed to the inlet and the binder was added through a spray system. The coal fines were conditioned at various moisture contents to observe the effects on the finished product. The product ranged from damp dust to seed pellets to large agglomerates, which is the natural progression in forming pellets by the agitation method. The results of this test were encouraging enough to warrant additional testing to set the parameters of moisture content and acceptable product.

The next test was again performed on the Model A-025 Ampel Conditioner, this time using a controlled feed rate accomplished by a Vibra Screw volumetric feeder equipped with a 3-cubic-foot-capacity vibrating hopper. The feed was introduced to the Ampel and the water binder was applied at varying ratios to determine all agglomerating conditions, from dust to wet pellets.

It was observed that the low moisture content (8.0% by weight) produced a damp product, one that was not dusty but also not agglomerated. As the moisture content was increased, the material then agglomerated into a granular product. The moisture content of the granular product

was 18.4% by weight. When the moisture content was increased to 22% by weight, moist pellets were formed. The following chart illustrates the test results:

PENNSYLVANIA POWER COAL DUST
TEST RT 822210
A-025 AMPEL CONDITIONER

Sample	Rate of Feed lb/hr	Moisture* Content	Condition
A	288	2.5%	Dry Dust
B	480	8.0%	Damp Dust
C	480	10.0%	Damp Dust
D	240	18.4%	Granular
E	288	22.0%	Pellets, Moist
F	(Not Taken)	24.4%	Pellets, Lumps to Moist

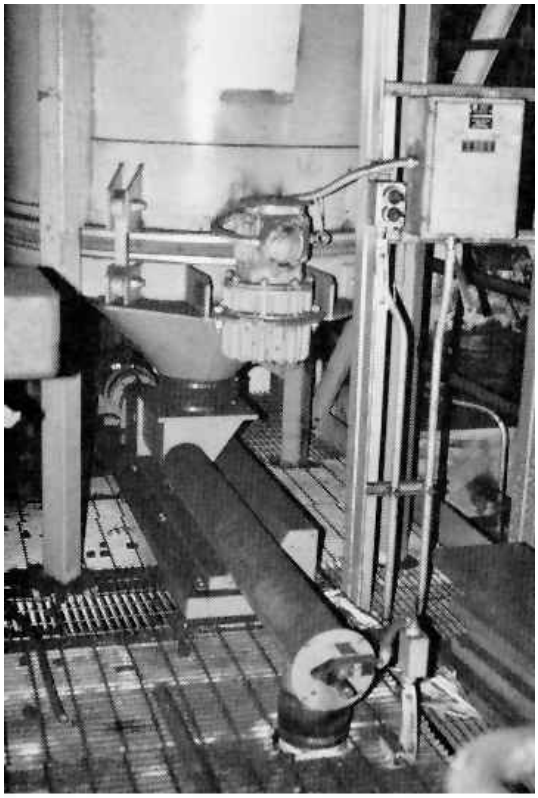
*Percent by weight, wet basis

The next step in the evaluation was to determine what actual condition was acceptable to Penn Power. The only criterion was that the agglomerated coal must not become air entrained during subsequent handling. The agglomerated coal would be delivered to either of two locations, one being the stockpile, which meant handling by belt conveyor to the stacker/reclaimer, and the other being the bunker, which is serviced by a 200-ton surge bin and belt conveyors.

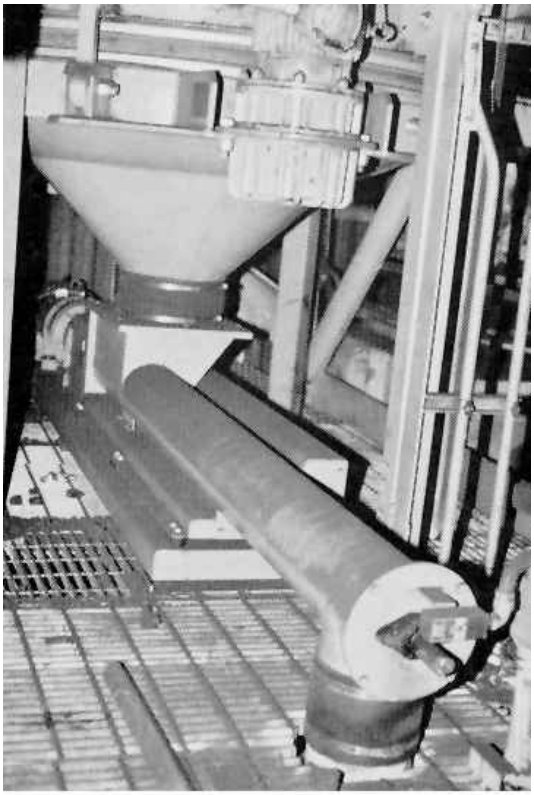
A simple test was performed on the agglomerated coal fines to confirm the dedusting efficiency. A sample of low-moisture-content material was dropped from heights of 6 feet and 12 feet while making a visual inspection of any airborne dust. None was evident. The same test was done on the material containing 18.4% moisture, yielding the same result: no dust. It was also observed that material containing less than 8% moisture caused additional dusting on impact. The material containing 22% moisture, although not producing dust, was considered too wet and sticky and would probably cause material-handling problems in chutes and on belt conveyors. Based upon this information, a range of acceptable moisture content in the finished product was set at 8% minimum, 18% maximum.

Two types of pelletizers were considered by Pennsylvania Power. The Deep Drum and the Ampel both produced an agglomerated product to equal standards. The Ampel was eventually favored for its simplicity of design and for its compact feature, capable of fitting within existing space limitations.

The system that was supplied to Pennsylvania Power consisted of the following major components:



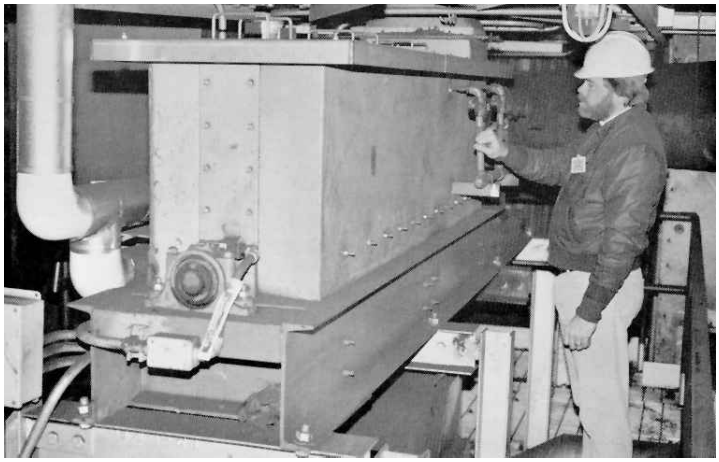
A



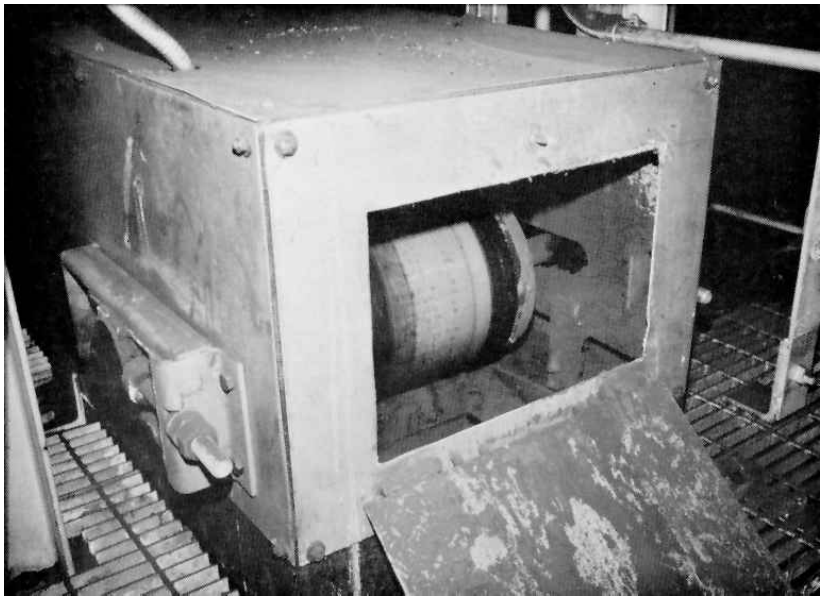
B

A. 100-cu-ft-capacity surge hopper, equipped with a bin activator; emergency high, high-and-low-level indicators; and an emergency blowout panel

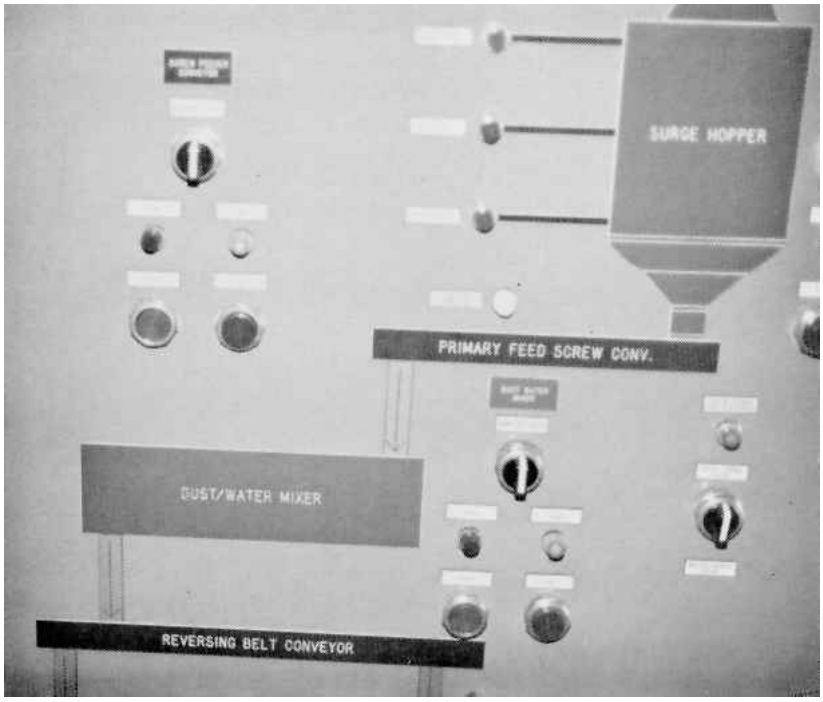
B. Vibrating volumetric feeder, 6-inch-diameter with a 2-hp DC variable-speed motor



C. MMC Ampel Model A-175, stainless steel construction, with a 10-hp variable-speed drive, rubber trough bottom and special composition mixing paddles

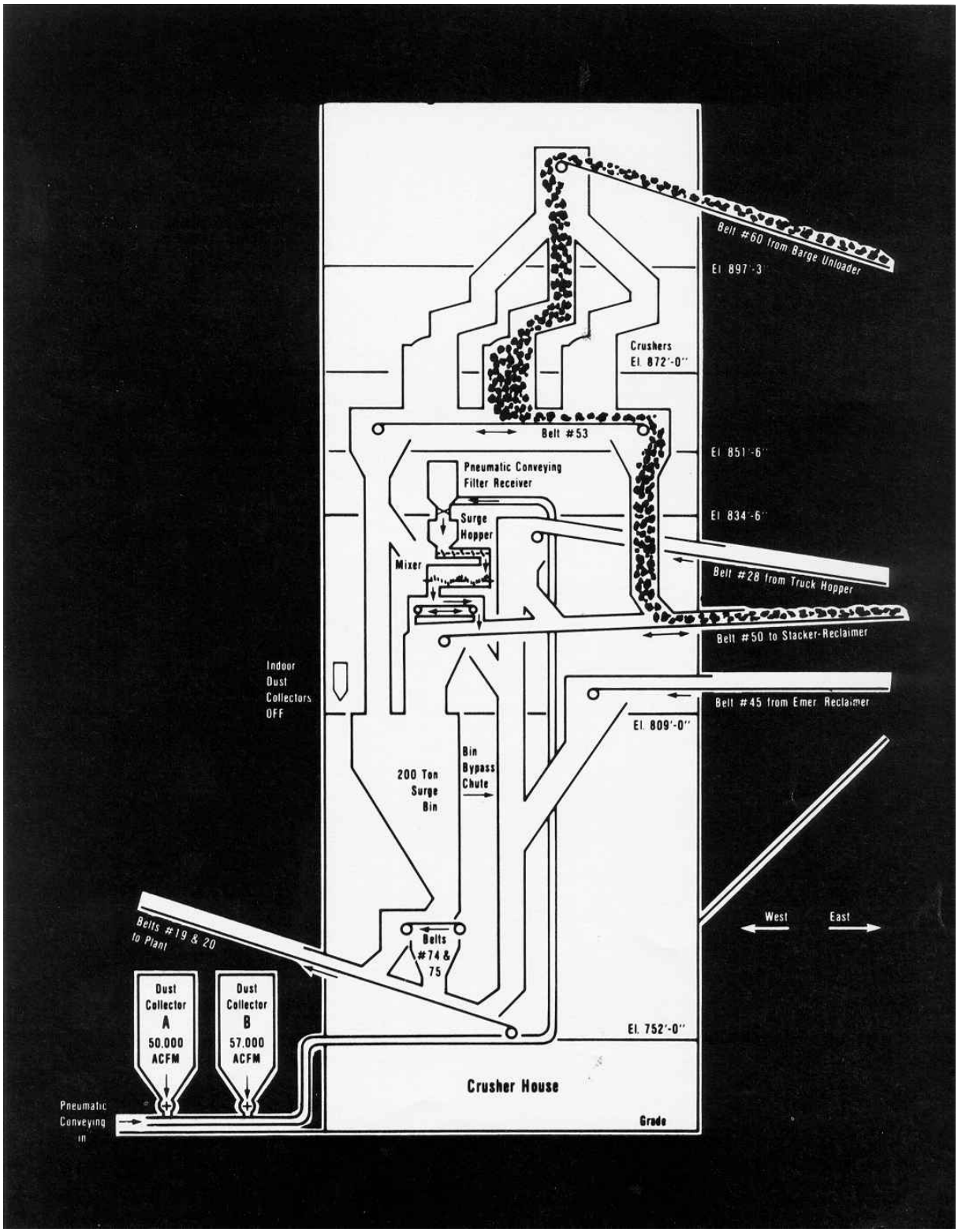


D. Reversing belt conveyor, 1 inches wide by 14 feet long with a 1-hp drive



E. Complete control system including a free-standing factory-wired, remote NEMA 12 panel with instrumentation, indicating lights, graphic display and all components required to operate the agglomeration system

F. Design engineering for this system and all necessary details for installation.



The system was designed to process 10,000 pounds per hour of coal dust weighing 40 pounds per cubic foot.

The coal processed at the Pennsylvania Power facility is from Pennsylvania, Ohio, West Virginia and Kentucky. A typical analysis shows that the average sulfur content is 4.3%, with 12.5% ash at a Btu-per-pound rating of 11,900.

The dust that is collected in the baghouse is pneumatically conveyed to a filter receiver located high within the crusher house. The dust is then gravity-fed to the 100-cubic-foot-capacity surge bin located on the floor below.

At the Bruce Mansfield Plant crusher house operation of Pennsylvania Power, agglomeration has thus far proven to be an ideal solution to a unique problem.

In several industries in which agglomeration is used to recover and recycle valuable fines, pelletizing systems eventually pay for themselves. At Pennsylvania Power, the Ampel system also is cost-effective, although the recycling aspect of coal recovery is small. In terms of maintenance costs due to decreased housekeeping, however, the agglomeration system is saving the utility money.

Of greater importance to Pennsylvania Power is the safety factor achieved through use of its baghouse and agglomeration system. A safer working environment has been achieved for operating personnel at the plant by eliminating airborne dust. The possibility of explosions, always a concern in situations involving coal dust, has been substantially reduced through the use of agglomeration.

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