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Plant licks solvent emission problem

Control system completely eliminates smoke and odor from oven exhaust gases

Last October, a lady called GAF Corp.'s vinyl floor covering plant (Fullerton, Pa.) to ask when the plant had shut down. She wasn't calling to sympathize; she was—frankly—glad that one of the Lehigh Valley's air pollution problems seemed to have been licked, even if it apparently meant the loss of a local employer. The lady caller was astounded to be told that the plant, far from being closed, was, in fact, running at full production. The reason for astonishment was simple: For 10 years the GAF plant had emitted a white smoke that smelled, according to Lehigh Valley Air Pollution District director R. Emmet Doherty, like 3-in-one oil, and which frequently blanketed the area with a haze that severely reduced visibility. Citizen complaints that the plant quite literally made them sick had not gone unheeded by GAF, but a solution to the problem was not found until 1969, when a new air pollution control system was installed. Fortunately for all concerned, this system has proven a complete success.

Air pollution source

The Whitehall plant of GAF Corp. at Fullerton produces vinyl coated flooring products for a rapidly expanding market that includes offices and mobile homes as well as private homes. The process involves preparing a continuous blank backing sheet with a coating of vinyl polymer, then printing the surface with an attractive pattern and, finally, coating the sheet with a thin, wear-resistant layer of vinyl polymer. The heart of the process, and the reason for the product's popularity is the vinyl layer over the patterned surface. This coating may only be ten thousandths of an inch in thickness (perhaps twenty thousandths in the most expensive products) and is completely transparent, but it is entirely responsible for the long-wearing qualities of the flooring material.

The coating is applied to the continuous sheet by a cylinder which rotates in a bath of fluid containing vinyl monomers dissolved in mineral oil solvent (its exact composition is a proprietary secret). The wet sheeting is transported through a long oven in which the solvent is driven off and the monomers polymerize to yield the clear, wear-resistant coating. The exhaust gases from the ovens were the source of air pollution from the plant.

Development of problems

The plant initially was owned by the Sandura Co. Sandura was bought by the Ruberoid Co. in 1965, and, in 1967, Ruberoid was merged with GAF Corp.

In 1948, Sandura Co. started up the Whitehall plant with one, nine foot wide coating line. Then, in 1957, a second, 12 foot wide line was added in a major expansion move. The added production capacity of the plant, and the need to work more than one shift, brought the pollution problem to the notice of the public and under the eye of the Lehigh Valley Air Pollution District.

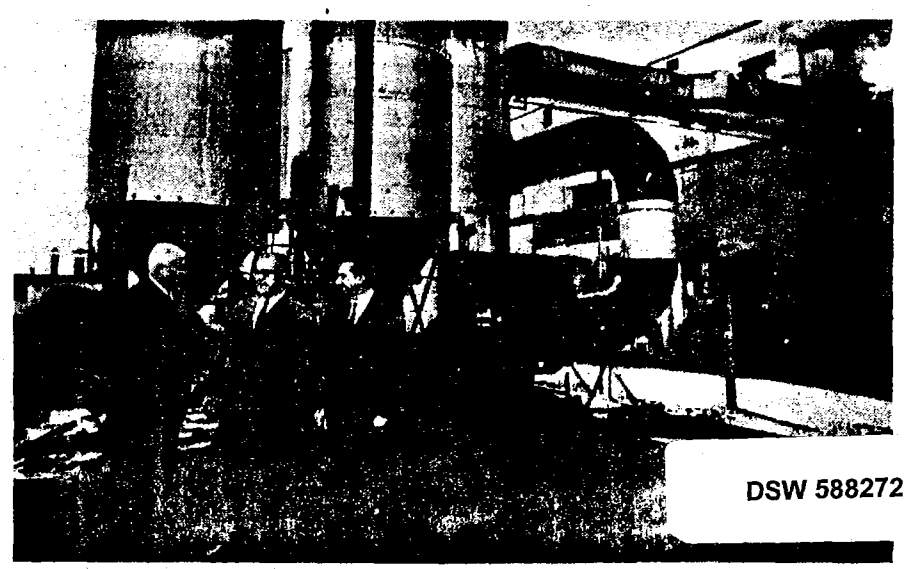
Initially, there were no controls whatsoever on emissions from the ovens. In an attempt to control the problem, plant management installed a catalytic oxidation system which was intended to convert the gases to carbon dioxide and water. Unfortunately, the oxidation unit could not be operated so as to provide complete conversion. The result was that the air pollution nuisance became greater than ever: The smell coming from the plant now was reminiscent of *burnt* 3-in-one oil.

Effective system

After a search in which over a dozen firms were contacted, GAF eventually contracted with Clermont Engineering Co. (Philadelphia, Pa.) for supply of a control system that would eliminate the air pollution problem.

Clermont's approach was to engineer a system that would recover as much as possible of the mineral oil solvent, so that it could be reused as the carrier for the vinyl monomers at the coating stage in the plant. Consequently, combustion processes were not considered.

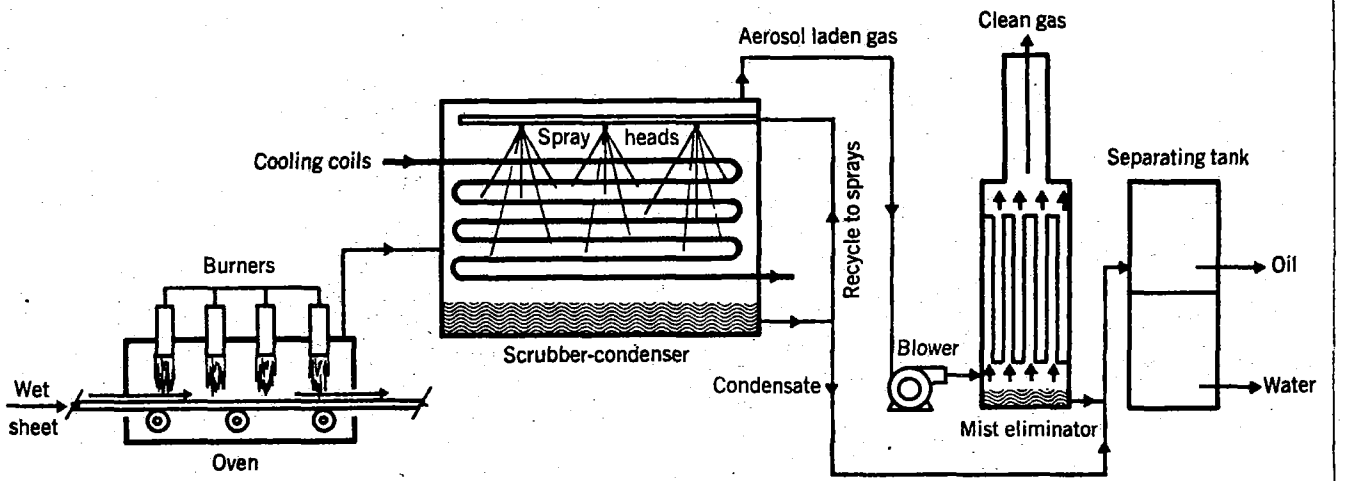
In the Clermont design at the Whitehall plant, exhaust gases from the ovens first are sent to a scrubber-condenser unit in which many of the less volatile components in the gases condense out on the surface of water coils. Some of the condensate recovered



Job complete. *Construction firm and* GAF *plant officials pose in front of new unit*

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Control of coating solvent emissions is two-stage process



from the scrubber-condenser is recycled to spray heads; the spray is used to prevent condensate from coating the coils and thus causing reduced heat transfer rates. The rest of the condensate is piped to tanks where the oil and water fractions are separated.

The gases leaving the scrubber contain a fine oil droplet mist; most of the drops are less than one micron in size. Final removal of the mist is accomplished in a pair of towers containing Brink mist eliminator elements (Monsanto Enviro-Chem Systems, Inc., Chicago, Ill.). These fiber filters are widely used to trap particles less than three microns in size at high collection efficiencies.

The liquid draining from the mist eliminators, together with condensate from the scrubber, is pumped over to a pair of settling tanks where the heavier water fraction separates out from the lighter oil fraction. The water is drained away periodically, and the oil is available for reuse. In practice, GAF has sent this oil back to its supplier of coating liquid for reprocessing before it is reused.

Efficiencies

Clermont claims that 80% of the contaminants in the oven exhaust gases are removed in the scrubber-condenser. At the stack outlets above the mist eliminators, 90-95% of the volatilized organics have been removed (and recovered), according to Clermont. (The Brink mist eliminator elements are claimed to remove 99+% of the mists and other condensate reaching them. The residual low boiling organics escape as vapors.) GAF agrees with these figures, but quotes no precise poundages, for competitive reasons. The 90-95% removal figures are not arrived at by measurement, but by subjective evaluation of the state of the exhaust plume rising from the stack. The plume is remarkably light, even on a cold, dry day when the presence of water in the gases always tends to produce a white plume.

GAF claims that maintenance of the control system is both easy and inexpensive; there are few moving parts to service. The fans which draw the gases through the scrubber and force them through the mist eliminators do, of course, require servicing. Their operation is the prime operating expense: Together, the two blowers move 33,000 c.f.m. of gases while requiring 175 h.p.

Economics

The goal—at least ideally—of every pollution control system is to pay for itself. Systems in which a raw material or byproduct is recovered for reuse obviously have a much better chance of meeting this goal than those in which wastes are burned or otherwise converted to valueless products. In the case of the GAF vinyl sheeting plant, there seems to be some reason for optimism. Although Don Dorfman, president of Clermont Engineering, insists to J. Paul Lasley, manager of the Whitehall plant, that the system eventually will save more than it cost ($363,000), Lasley understandably is reluctant to make unequivocal statements on the subject. After all, the plant manager says, the control system has been in operation only a few months (since October 1969), and it is too early yet to say anything with assurance. Nevertheless, Lasley is certainly delighted that a problem which has plagued him for years appears to have gone forever.

Even though effort was continually expended, it took 10 years to arrive at a satisfactory solution to the Whitehall plant air pollution problem. The fact that so much time was needed brings up an important point that seldom is appreciated fully: Eliminating air pollution is rarely just a simple matter of purchasing a piece of control equipment off the shelf and installing it on line.

Especially interesting in this connection is the Pennsylvania plant's poor experience with its catalytic oxidation system. Such systems have regularly been employed with success to solve difficult air pollution problems (see, for example, the description of catalytic oxidation of monomer emissions at a wax plant in ES&T, November 1969, page 1159). Yet, recurrent problems with incomplete conversion forced abandonment of catalytic oxidation at the Whitehall plant.

One is compelled to recognize that even pollution problems which are similar in nature may not be amenable to solution in the same ways. This is a sobering thought, for it means that experience in controlling one type of air pollution may be practically worthless in controlling another. Little wonder, then, that air pollution control can not be achieved overnight, even by firms such as GAF that have shown themselves to be in earnest in tackling their emissions problems.

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