Halfway Measures Make Good Incineration Impossible

An old boiler and a growing combustible-waste disposal problem seemed to be made for one another. Here's how (1) the temptation to take the easy way out boomeranged, and then (2) the steps we took to return to sound fundamentals finally produced a topnotch, workable incinerator

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► OUR PLANT kept turning up heavy loads of paper, resin, hair, wood scraps, shavings or what have you, in the daily course of doing business. Like many other plants we got rid of this rubbish somehow—usually the easiest way out. Finally we recognized the problem of waste-matter disposal was getting no better fast, and steps had to be taken to bring it under control.

We had an old low-setting boiler, crowding 50 years of age, quite a little distance from the main plant buildings. It looked like a natural for our problem. We pulled it out of service and added a dutch oven. That, we felt, would do the trick. With this arrangement we planned to burn all our refuse and salvage some low-pressure steam.

Right from the start the scheme backfired. We found any steam generated would be costly because licensed operators *had to be assigned to the unit*: firing was intermittent and heavy. What was even tougher to handle was our stack-discharge problems. *Flames were* shooting out the 75-ft stack! Ash and spark emissions were a sight to behold, and enough to throw the fear of the hereafter into our neighbors. Refractory replacement and stack repair were terrific. Finally, the drums, tubes and headers fell in and severely damaged the walls. We just had to do something.

Incinerator Selection. Best starting-off point was a check on the incinerator equipment available. There seemed to be no accepted standards, but the Incinerator Institute of America and the Air Pollution Control Assn came closest to agreement.

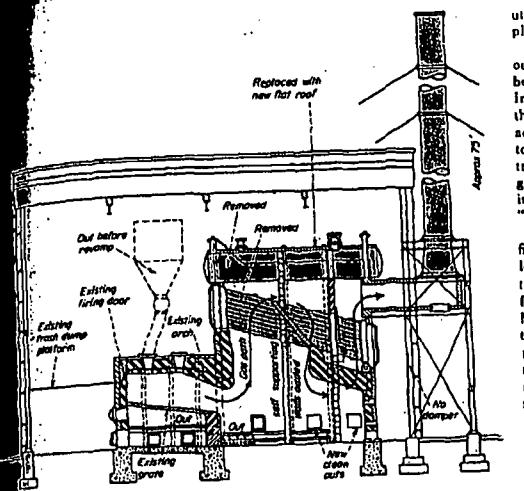
Basis for satisfactory incinerator solution and operation, we found, is the proper analysis of the waste and refuse you've got to burn. There are six major classes of waste fuel, ranging from mixtures of garbage with rubbish to by-product wastes. Our mixture—paper, resin, wood scraps, shavings—came closest to what experts describe as Type 3 waste fuel, or rubbish, consisting of dry, combustible waste with a moisture *content not exceeding 25% by weight.* The term rubbish means paper, rags, scraps, cartons, floor sweepings. The 25% moisture represents normal moisture content in dry-waste materials. Type 3 fuel is based on not more than 6500 Btu as fired per lb, having 10% ash and 25% maximum moisture.

Next, we observed that the large-scale industrial incinerator, designed for the fuel we had and the load we expected, looks somewhat like a brick-set boiler from the front. It has hinged and guillotine-type charging doors, on the end or on either side of the firebox depending on where the incinerator is put and the room around it. Clean-out doors go below the grate level as well as at the bottom of the various chambers.

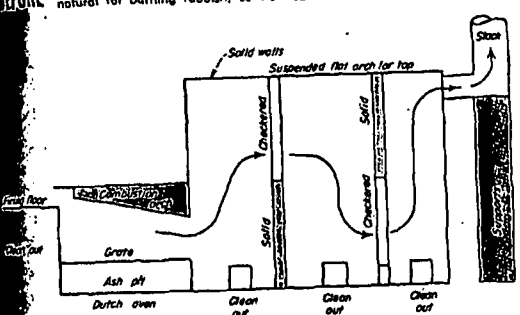
It is quite normal to find the incinerator divided into primary and secondary or smoke-burning chambers. Some designs add a third or flyash settling chamber, see "after" sketch.

With a waste fuel such as we have, readily combustible, a grate with 50% air openings is considered just about right. Next, you should have a secondary chamber of baffled brick with refractory lining, where the combustion products leaving the primary chamber have time to burn completely. If the burning is complete enough, you may even lose enough of the heat in the gas in a third chamber so you won't damage the usual chimney.

You see, we felt the old chimney would be a natural for any incinerator. But we had to take some steps to protect it against the high-temperature gas an incinerator puts out. It runs much higher than the usual boiler flue gas. *In fact,* it gets up around 1500 F. So unless the flue, breeching, chimney or incinerator chambers were large enough to let this hot gas dilute and cool to a safe temperature level, we would have



BEFORE Simple, straight-tube, baffled boiler about 50 years old looked like a natural for burning rubbish, so we added a small dutch oven to help



AFTER This streamlined, converted layout, properly baffled and checkered, gives an ideal incinerator with flyash separation, and low stack-gas temperature

abandon the old stack as unsuitable. Once we got *to thinking of* salvaging old boiler plant we decided not to with the chimney. Instead, the layout came in for study with the in mind of making our own incinerator. The following tells the story.

Boiler Conversion. The "before" sketch shows what we started with. The oven, about 15 ft long by 10 ft is as wide as the boiler front. We out drums, headers and tubes, put in full-width, self-supporting, ered baffles to classify the ash and ide a better heat dissipation.

We divided the furnace length into thirds. Then, at about half the furnace height, we cut the solid wall setting at the first third of the furnace. On top of this went the first-pass, self-supporting, checkered baffles. Then at the next or second-third point, we did the reverse. We started with the checkered baffles from the furnace floor, ran them up about half the furnace height, and finished off with a solid wall.

Our last third of the furnace area could be sized, then, to take care of the decreasing volume of gas to meet a maximum gas velocity of 1500 ft per minute. The "after" sketch shows the completed job.

Incinerator Operation. We start up our incinerator by sprinkling oil on a bed of waste paper. Flashback is nil. In fact, our stack is actually too high for the job. But, fortunately, the baffling adds enough resistance to the gas flow to hold down the draft to the proper control point. Operation, so far, has been good and we feel there's no need to put in any dampers at the breeching. See "after" sketch.

We bring in trash to the incinerator firing level and feed it in about 50-cu-ft lots to the incinerator. Operator pushes the waste onto the front of the grate as fast as he can. Combustion is excellent. Maintenance costs have dropped down to an insignificant amount. Stack temperatures are down where they present no special problems. Emission is not noticeable to anyone. In fact, we need no arrester at that level at all. Labor for cleaning out the ashpit is well below the old setup. Our combustion rates are much higher and we need a lot less labor. For our money, we've got a crackerjack incinerator at very little cost.

Incinerator Details. Actually, if you're facing a growing rubbish-disposal problem—and who isn't?—you'll find it smart policy to plan for a large-scale or industrial-type incinerator. Starting from scratch there are some definite advantages you can build into your layout.

First and least obvious is selecting the right place to set up the incinerator. Modern designs are no eyesore and you needn't feel you have to get them out of sight on that score. Your major consideration at this point ought to be convenience. The easier you make it to get refuse into the incinerator, the better it will be. As an example, if you spot it right near the major waste producers, you will have fewer handling problems to lick.

Next in order is feeding method. If your charging method or way of feeding the waste onto the grates is the best for your class of refuse, this operation should be no headache. Dry refuse lends itself to a feed system like the one we use. Garbage or wet material is a different story.

Sizing is the third advantage you want to include in your original selection. Remember, *incineration* is seldom a continuous operation. In some instances the whole day's collection is burned within a few hours. So sizing has to be based on burning rate rather than on a day's total. By the same token, allow time for clean-out and stoking. At lower capacities a damper installation in the breeching to the stack helps regulate overfire drafts for adequate combustion.