

THE RETROFIT OF THE MWC ROTEB IN ROTTERDAM, HOLLAND WITH A MODERN FLUE GAS CLEANING SYSTEM INCLUDING AN ACTIVATED CHAR ADSORPTION UNIT

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Discussion by:

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The author presented an interesting and timely description of pollution control systems for municipal solid waste combustion (MWC) plants. A reading of the paper produced several questions and/or requests for clarification that would increase the utility of the paper.

In Fig. 4, the authors indicate that a parameter " μ " was held at a value of 0.8, yet the parameter was not identified. Also, the vertical scale (e.g., m³ of catalyst per m³/sec of gas treated) on Fig. 4 is missing. Where is the "origin"? For example, at about 260°C, is the volume of normal catalyst about twice the low temperature catalyst, or simply somewhat greater? Further, which of the "heavy metals" is "the worst"? How much (measured how? and where?) is "too much"?

Finally, I am most interested in the costs for the facilities that were the central focus of the paper and, also, for the comparable portions of the plant data summarized in Table IV. If one reduced plants to a common denominator (using the European equivalent of an ENR Index) and reduced the economic data to a "cost per flue gas volume rate processed," the information given would be most useful as input to BACT or other technology cost-benefit evaluations.

AUTHOR'S REPLY

Mr. Walter Niessen's interpretation of Fig. 4 is mostly correct. Figure 4 presents the relative volume of SCR-catalyst required versus reaction temperature at a given NO_x-reduction efficiency = 0.8 (80%).

The vertical scale expresses qualitatively the increase of

required catalyst volume with decreasing temperature. Each increment means an increase in volume by 100%, i.e., in order to achieve a removal efficiency of 80%, a given volume of catalyst operated at 400°C must be doubled when operated at 290°C and tripled when operated at 250°C. Based on that, an operating temperature of around 170°C would not be feasible anymore, since huge volumes of Normal SCR-catalyst would be needed. Therefore, the Low Temperature SCR-catalyst was developed. As shown in Fig. 4, the operation temperature for a given volume of Normal SCR-catalyst can be lowered from, for example, 250°C to 170°C when using Low Temperature SCR-catalyst. Typically, low temperature SCR-catalyst is used in a temperature range of 170–200°C. Normal SCR catalyst is used between 280 and 320°C.

Mr. Niessen's question concerning the heavy metal poisoning of the catalyst cannot be answered clearly. Perhaps the question shouldn't be "How much is too much?" but "What is the expected decrease in catalytic activity for a given flue gas composition?" The heavy metal poisoning is caused by all heavy metals but, depending on the element, at a different speed. Arsenic and cadmium are the worst, but mercury and lead also lead to a loss of activity (Lead poisoning is a problem commonly known from catalytic converters in cars.) Generally spoken, the total concentration of heavy metals should be as low as possible in order to achieve reasonable operating times for catalysts.

Due to its higher activity, the low temperature SCR-catalyst is more susceptible to poisoning than the normal SCR-catalyst. Since this issue is very complex, a significant amount of research has already been carried out and published. Further details and discussion can be provided if there is an expressed interest.

Concerning the cost of the described facility, the investment cost can be estimated to be between \$250/scm and \$400/scm of flue gas treated, depending on the total flue gas volume to be treated and the number of units employed.

Including the operational costs, this converts to approximately \$60–80 per ton of municipal solid waste treated. However, it should be kept in mind that a cost-benefit-evaluation is not considered a valid approach in central Europe.

Discussion by:

Floyd Hasselriis
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The facility described by the authors is certainly an example of the degree to which technical excellence can be applied in retrofitting an existing facility to essentially eliminate environmental impact. The justification for “going this far” appears to be mainly the fact that the facility is in the center of a highly populated area, “nothing is good enough but the best.”

Obviously, adding so many devices is not only costly to provide, install, and debug, but also costly in labor and materials to operate.

If the authors had the opportunity to build this plant from the ground up, (a) Would they select this location? and (b) Would they have to install such a complicated plant? What simplifications could be made if they had a chance to build a new facility, while still achieving almost total emission control?

The fact that water discharges go to the sea simplifies water treatment problems. Since the scrubber water discharges contain almost as much salt as the sea, the salt itself is not a problem, if the metals have been removed. What would the authors suggest if salt water could not be so conveniently discharged?

AUTHOR’S REPLY

Mr. Floyd Hasselriis concludes that the justification for “going this far” appears to be mainly due to the fact that the facility is in the center of a highly populated area, “nothing is good enough but the best.”

This conclusion is incorrect since, for example, the AVR-plant mentioned in the paper is located in a purely industrial area between a refinery and a chemical plant. However, the AVR was retrofitted with a gas cleaning system of exactly the same type.

Even if the plant was to be built from ground up at a remote rural location, it would have to be built in the same way. Based on central European standards, this plant is already simplified, since waste discharge is permitted. To further simplify this plant, the standard U.S. approach of spray dryer/bag-house system extended by an ACR for total emission control and a SCR-DeNO_x for the extremely low NO_x levels required, could be chosen. Yet legislation makes this a more expensive system since:

(a) a separation of fly ash and reaction salts is required; and

(b) the residues from such a system are regulated as hazardous waste to be disposed of underground at costs of currently around \$500/ton.

In other central European countries, where the discharge of waste water is generally prohibited, the first scrubber is being modified to recover the effluent as marketable hydrochloric acid or sodium chloride. The second scrubber is operated on lime milk to convert the SO₂ to marketable gypsum. A system of that type is described in “Recycling of Residuals From Flue Gas Treatment on Municipal and Hazardous Waste Incinerators,” a paper presented at the 86th AWMA meeting in Denver, 1993.