

VARIABILITY OF METALS AND DIOXINS IN STACK EMISSIONS OVER FIVE YEARS: HOW MUCH IS CONTRIBUTED BY THE WASTE AND HOW MUCH BY THE TECHNOLOGY?

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ABSTRACT

The environmental impact of emissions from planned new and upgraded waste-to-energy facilities have been predicted based on the variable emissions reported for tests of existing facilities having apparently similar technologies. These emissions reflect seasonal and other variations in the waste as well as in the operating and performance characteristics of different furnace and air pollution control technologies. Conservative estimates of health risk and environmental impact, based on this data and manufacturers' and operators' guarantees, necessarily including safety factors so that when compliance tests are performed, the owner can reasonably anticipate that the facility will meet emission limits. Since many state-of-the-art waste-to-energy (WTE) plants have now been tested at least annually for several years, a large database has been developed which can be used to characterize the variability of stack emissions. This paper looks at data from facilities burning municipal solid waste (MSW), having refractory furnaces with dry-lime sorbent injection (DL) and baghouses, wall furnaces with spray dryer absorbers (SDA) and baghouses, and shredded MSW-fired water-wall furnaces with SDA and electrostatic precipitator (ESP) emission controls. The range of emission factors for particulate matter, heavy metals and dioxins from these individual facility over a three to five year period and test data from another 20 WTE facilities with SDA/baghouse combinations is found in EPA's AP-42 and follow lognormal distributions. The percentage of metals in the particulate matter (PM) varies with PM concentration and air pollution control technology. Methods are presented for estimating probable annual averages and the maximum emissions level likely to be measured in future tests. The testing limit which is not expected to be exceeded by 95% of future tests exceeded three times the average using this data set. These findings are significant from the standpoint of the Maximum Available Control Technology (MACT) regulations in the Clean Air Act (CAA) since they point out that simple arithmetic averaging produces emissions limitations that do not consider real world variability.

INTRODUCTION

In order to obtain State and local permits for WTE facilities, environmental impact statements had to be prepared and permit limits set based on the projected emissions from the facility. These projections are based on test data from facilities having similar or similar-performing technology. The EPA and literature emissions database were used to obtain emissions estimates for the pollutants such as particulate matter and the regulated heavy metals, cadmium, lead and mercury, as well as dioxins.

The primary purpose of making emissions estimates was to set permit limits which protect the public and to use as a conservative basis for the environmental impact statements and health risk assessments. Another purpose was to set limits which vendors and operators of the facility could reasonably expect to meet each time a stack test is performed. It was often

understood that when the facility was first operated and tested, if one or more of the original permit levels was exceeded, the permit level could be adjusted after efforts were made to reduce emissions as much as possible. This might occasionally happen because the MSW in a given locality, or at a given time, was very different than the waste burned by the facilities included in the database. Permit limits are usually set at a level significantly higher than normal performance, providing a reasonable factor of safety for the guarantees which developers and vendors of combustion and emission control equipment have to make, but not at a level which would trigger non-compliance and prevent building the facility. The mean plus two standard deviations is a generally used rule of thumb for emission limits used in permits and upper limit health risk estimates.

The EPA's Emissions Guidelines (EG) and New Source Performance Standards (NSPS) published on December 19, 1995 require that all new waste-to-energy (WTE) facilities burning municipal solid waste (MSW) obtain permits to construct and permits to operate containing numerical limits on emissions. The Clean Air Act (CAA) requires that a Maximum Available Control Technology (MACT) floor be established for new units taking into account the cost of achieving such emissions and non-air-quality health and environment impacts. EGs for existing units may not be less stringent than the average emission limitations achieved by the best-performing 12% of units in a category (MACT Floor).

While the USEPA was in the process of developing the guidelines and new plant emission standards, new facilities continued to be built and permitted by the States using Best Available Control Technology (BACT). These plants have environmental impacts far below the levels of concern established by authorities from the standpoint of health and the environment. These facilities are now the basis for the MACT floor.

While the EPA pondered over how to implement the CAA, permits for some new facilities were delayed, and owners and operators of existing facilities were frozen into a waiting strategy. Without actual regulatory, there is a large risk in embarking on retrofit activities, or even in making plant improvements, since the effort could all be wasted.

The EPA's Administrator signed the EG and NSPS limits on October 31, 1995 and published them in the December 19, 1995 Federal Register. They are summarized in Table 1. The EPA Administrator has established capacity categories for small (38.6 ton/day to 248 ton/day) and large (greater than 248 ton/day) plants. The emissions limits are shown in Table 1. Even though these emissions limitations have been published, there remains concern that the whole procedure contains flaws which may haunt us in the future. In accordance with this approach, as additional new facilities are built exhibiting lower emission levels, these levels might in the future be "ratcheted down" under the auspices of Prevention of Significant Deterioration. Permits for existing facilities could also be revised downward over time as they come up for periodic renewal, and