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Recent EPA Tests Show that MSW Landfill Gas Quality Improving

ABSTRACT: The quality of municipal solid waste landfill gas continues to improve, where almost 60 percent of the trace organic contaminates in raw landfill gas are now 10 to 1,000 times lower in concentration than previously reported.

When municipal solid waste (MSW) is disposed of in a landfill, naturally occurring microorganisms (bacteria) begin to degrade the organic portion of the waste. The rate of waste degradation is controlled by the amount of water in the waste or added, and temperature of the waste. Initially, degradation occurs under aerobic (i.e., with oxygen) conditions because of the air entrained in the waste. The byproducts of aerobic degradation are water (H_2O) and carbon dioxide (CO_2).

Once the aerobic bacteria consume all of the available oxygen in the waste, methanogenic bacteria start to degrade the waste under anaerobic (i.e., without oxygen) conditions. The anaerobic bacteria degrade the organic portion of the waste into methane (CH_4), and CO_2 in about equal proportions. The degradation process also generates very small quantities of non-methane organic compounds (NMOCs). Additionally, NMOCs may be released directly into the gas from products contained in the waste (e.g., cleaning products). The NMOCs in the generated gas amount to less than one percent of the total gas created by waste degradation

In June 2001, the U.S. Environmental Protection Agency (EPA) and Environmental Research and Education Foundation (EREF) entered into a cooperative research and development agreement (CRADA) to obtain up to date data from modern, state-of-the-art MSW landfills on the quality of landfill gas pre- and post-combustion. Based on preliminary data, modern MSW landfills generate lower concentrations of NMOCs then older sites. Table 1 provides the concentrations of commonly found NMOCs at older MSW landfills and modern MSW landfills. Older landfill emissions are based on the EPA AP-42 emission

factors for MSW landfills from test programs conducted in the late 1980s *(http://www.epa.gov/ttn/chief/ap42/ch02/index.html)*.

Of the 42 organic compounds regulated by federal Clean Air Act rules, 59 percent of the NMOCs are one to three orders of magnitude lower (i.e., where an order of magnitude is a ten fold decrease) in concentration in modern MSW landfills than in older MSW landfills. In fact, 3 of 24 NMOCs measured at modern MSW landfills were not detected, but present at high concentrations in older MSW landfills. In fact, acrylonitrile was not detected in all samples, despite older data showing that MSW landfills were the largest source of the compound.

The CRADA also collected data on post–combustion emissions of landfill gases from various combustion devices including flares, internal combustion engines, and boilers. However, these data are still under review by EPA.

The final report including all pre- and post combustion landfill gas data is expected by the Fall of 2006. Once the data are finalized, EPA plans to start updating the AP-42 emission factors that are used by the regulated community for compliance with Clean Air Act rules.

For further information on the project, contact Dr. Edward Repa, EREF's Vice President of Environmental Programs, at 703-299-5139 extension 11 or *erepa@erefdn.org*.

Table 1. Concentration of NMOCs in MSW Landfill Gas (ppmv)

Compound	Old MSWLFs	Modern MSWLFs
1,1,1-Trichloroethane	0.48	0.009
1,1,2,2-Tetrachloroethane	1.11	0.008
1,1-Dichloroethane	2.35	0.359
1,1-Dichloroethene	0.2	0.022
1,2-Dichloroethane	0.41	0.021
1,2-Dichloropropane	0.18	0.0015
2-Propanol	50.1	2.095
Acetone	7.01	6.617
Acrylonitrile	6.33	Not Detected
Benzene	1.91	0.789
Bromodichloromethane	3.13	0.0033
Butane	5.03	11.5
Carbon disulfide	0.58	0.0995
Carbon tetrachloride	0.004	0.011
Carbonyl sulfide	0.49	Not Detected
Chlorobenzene	0.25	0.320
Chlorodifloromethane	1.3	Not Detected
Chloroethane	1.25	8.424
Chloroform	0.03	0.365
Chloromethane	1.21	0.395
Dichlorobenzene	0.21	0.589
Dichlorodifluoromethane	15.7	0.856
Dichloromethane	14.3	1.905
Ethanol	27.2	0.197
Ethylbenzene	4.61	4.346
Ethylene dibromide	8	0.007
Ethyl mercaptan	2.28	ND
Fluorotrichloromethane	0.76	0.294
Hexane	6.57	9.067
Hydrogen sulfide	35.5	41.0
Mercury	0.292	0.0598
Methyl ethyl ketone	7.09	3.587
Methyl isobutyl ketone	1.87	0.489
Pentane	3.29	8.601
Perchloroethylene	3.73	0.733
Propane	11.1	21.3
t-1,2-Dichloroethene	2.84	0.027
Toluene	39.3	15.43
Trichloroethylene	2.82	0.266
Vinyl Chloride	7.34	0.618
Xylenes	12.1	10.24