COMPARISON OF AIR EMISSIONS FROM WASTE MANAGEMENT FACILITIES

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Discussion by

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A. There is a dearth of references in this piece. For example, who says that methane is 20-30 times as potent a greenhouse gas as carbon dioxide? The most recent material I have seen reduced this factor to 10-20. It doesn't really affect the outcome of the analysis, but it does address the question of credibility.

B. Why are the emissions estimates compared on a peak-year rather than life-cycle basis? I suspect that when the global environment and atmospheric life-times in excess of a few days are considered that life-cycle emissions estimates are preferable?

AUTHORS' REPLY

A. All statements of fact about landfill air-pollutant emissions had been meticulously referenced (some 78 references) previously in the February 1995, paper by D. Minott, cited in the reference list at the end of the present paper. The authors should have referred readers to the 1995 paper in this regard, or repeated the detailed referencing here.

B. Sources of air pollutant emissions are regulated under the Clean Air Act, based generally on their maximum, annual emission rates. Unlike most traditional air pollutant sources, the annual emissions of landfill gas vary markedly, depending on the pace of MSW decomposition over the years. The peak-year emission rate projected over the landfill's lifetime is what is compared to regulatory emissions thresholds to determine whether Title V permitting, PSD permitting, New Source Review, etc. applies. This explains the paper's comparison of peak-year emissions for landfill versus WTE. A comparison of emissions on a life-cycle basis would be more informative in terms of general environmental impacts.

Discussion by

By Audience

B. Would doing the analysis of emissions on a life cycle basis be more meaningful?
C. Is Fresh Kills Landfill representative since it is not built to Subtitle D requirements?
D. Did you recognize that landfill gas concentrations are usually reported in ppm_{dv} instead of on a ppm_{w} basis as was done in the Tellus Institute work?
E. How do your findings compare to Tellus'?
F. Do you have any comments on air emissions from landfill reclamation?
G. Did your landfill particulate emission estimate include fugitive dust? What did it include?
H. Were PCDD/F emissions particulate or gaseous from the landfill? What references did you use?

AUTHORS' REPLY

B. See AUTHORS' REPLY to Mr. Rigo's question B.

C. The gas production rate at a landfill depends on many variables. Whether or not emission from the Fresh Kills Landfill are

representative of other landfills is simply unknown. The Fresh Kills has no Subtitle D liner beneath it. The landfill is said to rest in ground water. Should this result in the landfilled MSW's being kept very moist, the MSW at Fresh Kills may decompose more rapidly than at a lined landfill. If so, one could speculate that the gas production rate and emissions duration at Fresh Kills might be greater and shorter, respectively, than would be expected with a lined landfill.

D. Yes. Concentrations reported here are expressed in units of ppmdv, as hexane.

E. The authors have not, to date, reviewed the Tellus Institute work in detail.

F. The authors have no data on such emissions. One of the authors (Minott) observed an intense odor (from anaerobic decomposition) for days at a Massachusetts landfill being dug up to retrofit a liner system. It would be reasonable to anticipate that substantial, short-term emissions of landfill gas (methane, other pollutants, odorants) might occur during the mining operation. The issue merits study, from the standpoint of worker exposure as well as public nuisance/health.

G. The emission rate for fugitive dust was determined for landfilling operations by applying emission factors for road-building activities, given in the US EPA compilation of emission factors ("AP-42").

H. There is relatively little data available on dioxin emissions from flares and diesel engines, and the literature reviewed did not explicitly document whether dioxin emissions reported included the sum of gaseous and particulate forms (which would be the norm). The literature sources reviewed included:

- Eduljee, G.H., Dyke, P., and Cains, P.W., "PCCD/PCDF Releases from Various Waste Management Strategies, *Warmer Bulletin*, August 1995.

- Lahl, Uwe, et al, "PCDD/PCDF balance of Different Municipal Waste Management Methods," Chemosphere, Vol. 23. Nos. 8-10, pp. 1481-1489, & 1841.

- Mueller, U., Hoer, B., Zeschmar-Lahl, B., Wilkens, M., and Jager, J., "PCDD/PCDF Balance of Different Municipal Waste Management Methods. II Waste Disposal and Disposal Gas Incineration." presented at Dioxin 90, Bayreuth, Germany, August 1990.

Jones, Kay H., "Diesel Truck Emissions, An Unrecognized Source of PCDD/PCDC Exposure in the United States," Journal of Risk Analysis, Vol. 13, No. 3, June 1993.

The following charts reflect updated regulations issued after the paper was printed in the proceedings and correction of typographical errors, and should replace the charts presented in the paper.

TABLE 4
MWC REGULATED AIR EMISSIONS 1500 T/D MWC (OPERATING CAPACITY)

POLLUTANT	BASED ON EPA NSPS (12/95)[4]		BASED ON TYPICAL OPERATIONS	
	Emission Rate[1]	T/Y[2]	Emission Rate[1]	T/Y[2]
Particulates	0.01 grs/dscf	60	0.005 grs/dscf	30
SO_2	30 ppmv	195	15 ppmv	98
HCl	25 ppmv	93	10 ppmv	47
Cd	0.02 mg/dscm	0.18	0.005 mg/dscm	0.045
Pb	0.20 mg/dscm	1.80	0.05 mg/dscm	0.45
Hg	0.08 mg/dscm	0.72	0.04 mg/dscm	0.36
NO_x	150 ppmv	799	100 ppmv	467
CO	100 ppmv	285	25 ppmv	71
Dioxins (mass)	13 ng/dscm	4.5×10^{-7}	5 ng/dscm	1.8×10^{-7}
Dioxins (I-TEQs)[3]	≈0.2 ng/dscm	6.92×10^{-9}	≈0.08 ng/dscm	2.88×10^{-9}

1. All emission data corrected to 7% O2
2. Based on annual average emissions for 1500 T/D for 365 days
3. Dioxin not regulated by TEQs and are presented for reference only
4. Based on new, large size, mass burn technology.

TABLE 5
COMPARISON OF EMISSIONS FROM COMBUSTION OF MSW TO REPLACE 45 MW

ELECTRICAL OUTPUT AT STEAM GENERATING FACILITIES FIRING COAL OR OIL

REGULATIONS BY FUEL				CONTROLLED EMISSIONS (LB/HR)						
FUEL TYPE	HHV (BTU/LB)	% S	% Cl	PM	NO_x	CO	HC	SO_2	HCl	Total Emissions
CLEAN AIR ACT - EXISTING SOURCES										
Coal - Phase I	12,000	3.0	0.12	14	236	38	19	1181	4	1492
Coal - Phase II	12,000	3.0	0.12	14	236	38	19	567	4	878
NSPS SUBPART DA - NEW SOURCES										
Pulverized Coal	12,000	3.0	0.12	14	284	38	19	284	4	643
No. 6 Residual Oil	19,000	1.0	trace	14	135	14	3	90	trace	256
No. 2 Distillate Oil	19,000	0.2	trace	6	128	17	3	90	trace	244
NSPS SUBPART EA - NEW SOURCES 10/95										
MSW, Mass Burn	5,000	0.2	0.5	12	154	62	4	43	20	295

TABLE 6
COMPARISON OF AIR EMISSIONS
WITH EQUIVALENT ELECTRICAL GENERATION CAPACITY
FUEL OIL Vs. COAL Vs. MWC
Tons per Year

Pollutant	Fuel Oil	Coal	MWC
Particulates	48	223	34
SO_2	249	859	66
CO	100	73	43
NO_x	1345	1224	568
HC	15	9	16
PCDD/PCDF (E -07)	-	2.83	2.31