

**SECOND, UPDATED SAFETY EVALUATION:
EMISSIONS FROM THE GAS-FLARE AND ENGINE
AT THE ALPHA RIDGE LANDFILL**

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This safety evaluation updates and expands upon assessments that we presented in December, 2011 (Green, 2011; Green & Zemba, 2011), and March, 2012 (Green & Zemba, 2012), with regard to impacts from emissions from the combustion of gas at the Alpha Ridge Landfill, in Marriottsville, Maryland.

By way of brief review: In the autumn of 2011, we were asked to evaluate whether burning gas from the Alpha Ridge Landfill in a proposed GE Jenbacher internal combustion engine would be safe. Based on gas composition data from the Landfill, and emissions test-data from gas combustion systems at other landfills, we determined that impacts to ambient air, and hence to public health, would be inconsequential (Green, 2011; Green & Zemba, 2011). Thus, the proposed combustion would be safe.

In response to community concerns, Howard County committed to testing the Alpha Ridge Landfill flare and, once installed on site, the proposed Jenbacher engine; and we committed to re-running our analyses based on these test data.

Test-data for the flare became available in March, 2012. We re-evaluated impacts to ambient air based on these data and found, as expected, that impacts remained inconsequential (Green & Zemba, 2012).

Test-data from the now-operational Jenbacher engine have just become available (Avogadro, in preparation), and, as summarized below, these data also indicate safety.

As shown below (Table 1), ten *potentially* hazardous substances were detected in trace concentrations in the engine exhaust — and all but one (acetone) were found at levels lower than we had assumed in our March, 2012 health evaluation update. Importantly, acetone is a relatively benign chemical (it is produced naturally in our bodies), and the modeled maximum impact from acetone (and all other emitted chemicals) is still well within safe limits (as indicated in Table 2).



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Table 1 Chemical emission rates based on tests of the Jenbacher engine at the Alpha Ridge Landfill, compared with levels assumed in our March, 2012 Safety Evaluation

Chemicals detected in Jenbacher engine exhaust testing at Alpha Ridge	Average emission rate measured in engine exhaust — micrograms per second (µg/s)	Emission rate assumed in March 2012 Safety Evaluation (µg/s)	Ratio of measured to assumed rate
Acetone	205	75.1	2.7
Benzene	6.01	319	0.019
Carbon Disulfide	5.33	61.9	0.086
Chloromethane	3.99	23.5	0.17
Freon 12 (Dichlorodifluoromethane)	3.78	14.1	0.27
Hexane	20.2	28.1	0.72
Methylene chloride (Dichloromethane)	11.4	54.4	0.21
Propene	8.27	11.3	0.73
2,3,7,8-Tetrachlorodibenzo(<i>p</i>)dioxin toxic equivalents (2,3,7,8-TCDD TEQs; “dioxins and furans”)	0.000000616	0.0000703	0.0088
Toluene	10.8	103	0.10

Table 2 Modeled ambient air impacts due to emissions from the Jenbacher engine and flare at the Alpha Ridge Landfill. The *italicized* values reflect recent engine test results and are updated relative to our March, 2012 Safety Evaluation.

Emitted chemical	Maximum residential impact — micrograms per cubic meter of ambient air (µg/m ³)	Harmless concentration (µg/m ³)*	Is impact harmless?
Acetone	<i>0.001</i>	30,900	Yes
Benzene	<i>0.0004</i>	3	Yes
Carbon disulfide	<i>0.00009</i>	700	Yes
Chlorobenzene	0.00003	50	Yes

Table 2 Modeled ambient air impacts due to emissions from the Jenbacher engine and flare at the Alpha Ridge Landfill. The *italicized* values reflect recent engine test results and are updated relative to our March, 2012 Safety Evaluation.

Emitted chemical	Maximum residential impact — micrograms per cubic meter of ambient air ($\mu\text{g}/\text{m}^3$)	Harmless concentration ($\mu\text{g}/\text{m}^3$)*	Is impact harmless?
Chloroethane	0.00002	10,000	Yes
Chloromethane	<i>0.00004</i>	13	Yes
Cumene (Isopropylbenzene)	0.000004	400	Yes
Cyclohexane	0.00003	6,000	Yes
Decane	0.002	3,500	Yes
1,2-Dichlorobenzene	0.0001	200	Yes
1,3-Dichlorobenzene	0.00009	70	Yes
1,4-Dichlorobenzene	0.00007	2	Yes
1,1-Dichloroethane	0.00002	15	Yes
cis-1,2-Dichloroethene	0.00002	7	Yes
trans-1,2-Dichloroethene	0.00002	60	Yes
1,2-Dichloropropane	0.00005	2	Yes
1,4-Dioxane	0.0002	3	Yes
Ethylbenzene	0.0002	9	Yes
Ethylene dibromide (1,2-Dibromoethane)	0.00004	0.04	Yes
Freon 12 (Dichlorodifluoromethane)	<i>0.00003</i>	100	Yes
Freon 113 (1,1,2-Trichloro-1,2,2-Trifluoroethane)	0.00003	30,000	Yes
Hexane	<i>0.0001</i>	700	Yes
Hydrogen sulfide	0.001	2	Yes
Isopropyl alcohol (2-Propanol)	0.0002	7,000	Yes
Methylcyclohexane	0.0002	3,000	Yes
Methylcyclopentane	0.00008	1,400	Yes
Methylene chloride (Dichloromethane)	<i>0.0001</i>	600	Yes

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Emitted chemical	Maximum residential impact — micrograms per cubic meter of ambient air ($\mu\text{g}/\text{m}^3$)	Harmless concentration ($\mu\text{g}/\text{m}^3$)*	Is impact harmless?
Methyl ethyl ketone (2-Butanone)	0.0003	5,000	Yes
Methyl isobutyl ketone (4-Methyl-2-pentanone)	0.0004	3,000	Yes
Methyl tert-butyl ether (MTBE)	0.00002	90	Yes
Nonane	0.001	200	Yes
Pentane	0.00003	1,000	Yes
Propene	<i>0.00005</i>	3,000	Yes
n-Propylbenzene	0.000001	1,000	Yes
2,3,7,8-Tetrachlorodibenzo(<i>p</i>)dioxin toxic equivalents (2,3,7,8-TCDD TEQs; “dioxins and furans”)	<i>0.0000000008</i>	0.0000006	Yes
1,1,2,2-Tetrachloroethane	0.0001	0.4	Yes
Tetrachloroethylene	0.00004	40	Yes
Tetrahydrofuran	0.00004	2,000	Yes
Toluene	<i>0.0002</i>	5,000	Yes
1,1,1-Trichloroethane	0.00005	5,000	Yes
1,2,4-Trimethylbenzene	0.0002	7	Yes
Trichloroethylene	0.00005	2	Yes
1,3,5-Trimethylbenzene	0.0001	6	Yes
Vinyl chloride	0.00001	5	Yes
Xylenes (mixed isomers)	0.002	100	Yes
* Harmless concentrations are derived, by health scientists at U.S. EPA and elsewhere, from dose-response data from epidemiologic studies and/or studies in laboratory animals, and incorporate ample margins of safety, such that they pose no significant risk to health.			

Overall, then, this updated evaluation agrees with our earlier assessments in demonstrating no significant impacts to ambient air or to public health from combustion of gas at the Alpha Ridge Landfill.

References

- Avogadro (in preparation). Emissions Test Report for Evaluation of the Jenbacher Engine Outlet; Alpha Ridge Landfill; Marriottsville, Maryland, Test Dates: November 5-6, 2012 and November 9, 2012. Project 12-9179, Avogadro Environmental Corporation, Easton, PA.
- Green, L.C. *Safety evaluation: Alpha Ridge Landfill emissions from flare and proposed engine.* December 16, 2011.
- Green, L.C. and Zemba, S.G. *Information on polychlorinated dibenzo-p-dioxins and polychlorinated dibenzo-furans — also known as “dioxins”.* December 16, 2011.
- Green, L.C., and Zemba, S.G. *Updated safety evaluation: Alpha Ridge Landfill emissions from the flare and proposed engine.* March 29, 2012.