

**UPDATED SAFETY EVALUATION:  
ALPHA RIDGE LANDFILL EMISSIONS FROM THE FLARE AND PROPOSED ENGINE**

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**Introduction**

This safety evaluation updates and expands upon assessments that we presented this past December (Green, 2011; Green & Zemba, 2011) with regard to impacts from Alpha Ridge Landfill emissions from the existing gas-flare and the proposed gas-fired internal combustion engine. Our prior assessments were based on a combination of data from testing of Alpha Ridge Landfill gas in 2010 (Analytical Solution, 2010) and test data from other landfills. The updated evaluation presented here relies on comprehensive data from testing at Alpha Ridge — which included testing of both “raw” (that is, uncombusted) landfill gas (as it entered the existing flare) and combusted gas, as measured in the exhaust stack of the flare (Analytical Solution, 2010; Avogadro, 2012).

As you will read, our updated evaluation agrees with our original assessments in demonstrating no significant impacts to ambient air or to public health from Alpha Ridge Landfill emissions. Our methods and results are summarized below; technical details are presented in an Appendix.

Our approach was straightforward. First, we examined the test-data to determine the types and amounts of chemicals emitted from gas-combustion at Alpha Ridge.

Second, using a dispersion model developed by scientists at U.S. EPA and elsewhere, we calculated impacts of these emissions throughout the neighborhoods surrounding the landfill. Our calculations erred on the side of safety in that we relied on least favorable meteorological conditions — such as when stagnant air would reduce dispersion — and we honed in on the residential location where impacts were predicted to be highest.

Third, we compared these maximum impacts from combusted gas to concentrations expected to be harmless, based on data from epidemiological studies and/or tests in laboratory animals. In each case, as shown in the following table, the predicted impacts were found to be harmless, by substantial margins of safety.

Finally, with regard to polychlorinated dibenzo-*p*-dioxins and polychlorinated dibenzofurans — also known as “dioxins” — we compared our estimated maximum residential dose from combusted gas — which is 0.0001 picograms per kilogram of body weight per day — with U.S. EPA’s recently published reference (that is, safe) dose — which is 0.7 picograms per kilogram per day. Because the former is much smaller than the latter, it is harmless.

Accordingly, combustion of gas from the Alpha Ridge Landfill would not be expected to harm people’s health.

| <b>Emitted chemical</b>                           | <b>Maximum residential impact — micrograms per cubic meter of ambient air (<math>\mu\text{g}/\text{m}^3</math>)</b> | <b>Harmless concentration (<math>\mu\text{g}/\text{m}^3</math>)*</b> | <b>Is impact harmless?</b> |
|---|---|--|----------------------------|
| Acetone   | 0.0005  | 30,900   | Yes                        |
| Benzene   | 0.002   | 3  | Yes                        |
| Carbon disulfide                                  | 0.0004  | 700  | Yes                        |
| Chlorobenzene                                     | 0.00003   | 50   | Yes                        |
| Chloroethane                                      | 0.00002   | 10,000   | Yes                        |
| Chloromethane                                     | 0.0001  | 13   | Yes                        |
| Cumene (Isopropylbenzene)                         | 0.000004  | 400  | Yes                        |
| Cyclohexane                                       | 0.00003   | 6,000  | Yes                        |
| Decane  | 0.002   | 3,500  | Yes                        |
| 1,2-Dichlorobenzene                               | 0.00010   | 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)                | 0.00009   | 100  | Yes                        |
| Freon 113 (1,1,2-Trichloro-1,2,2-Trifluoroethane) | 0.00003   | 30,000   | Yes                        |
| Hexane  | 0.0002  | 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)              | 0.0003  | 600  | Yes                        |
| 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                        |

| 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? |
|--|---|--|---------------------|
| Propene  | 0.00007   | 3,000  | Yes                 |
| n-Propylbenzene  | 0.000001  | 1,000  | Yes                 |
| 2,3,7,8-Tetrachlorodibenzo(p)dioxin toxic equivalents (2,3,7,8-TCDD TEQs; “dioxins”) | 0.0000000004  | 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  | 0.0006  | 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.

## References

Analytical Solution (2010). Analytical Report for Sample Log#K1102a.doc, November 27, 2010, Analytical Solution, Inc., Willowbrook, IL.

Avogadro (2012). Emissions Test Report; Landfill Flare Outlet Alpha Ridge Landfill; Marriottsville, Maryland, Test Dates: January 17 & 19, 2012. Project 11-8210, Avogadro Environmental Corporation, Easton, PA.

Green, L.C. *Safety evaluation: Alpha Ridge Landfill emissions from flare and proposed engine*. December 16, 2011.

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