Extended Pooling Problem with the Summer Time (EPA) Complex Emissions Constraints

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Overview

Environmental Protection Agency (EPA) *Title 40 Code of Federal Regulations Part 80.45: Complex Emissions Model* [40CFR80.45, 2007] codifies a mathematical model of gasoline emissions for reformulated gasoline (RFG). The RFG program, which impacts roughly 75 million people, was developed to reduce smog and airborne toxic pollutants (*e.g.*, benzene, a human carcinogen) in accordance with the Clean Air Act. The Complex Emissions Model calculates volatile organic, nitrous oxide (NO_X), and airborne toxic emissions using functions of eleven fuel qualities. The three emissions models form the basis for other legislation, such as 40CFR80.41 [2008], to set emissions standards. Final products exiting an oil refinery must comply with these standards, or upper bounds, on volatile organic, NO_X and airborne toxic emissions.

The *pooling problem* minimizes cost by optimally selecting flow rates on a predetermined network structure of feed stocks, pooling tanks, and final products. A common refining application of the pooling problem addresses the temporary storage of intermediate feed stocks exiting processing units. The temporary storage tanks or *pools*, which are subsequently mixed into final products, are monitored to ensure that the concentration of regulated qualities does not exceed environmental limits in the final products [Misener and Floudas, 2009]. The *extended pooling problem* appends the EPA Complex Emissions Model and associated constraints to a standard pooling problem [Misener et al., 2010]. The goal is to comply with reformulated gasoline standards while maximizing profitability.

References

40CFR80.41. Code of Federal Regulations: Standards and requirements for compliance, 2008. http://www.gpoaccess.gov/cfr/retrieve.html.

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