Risk Assessment for Fluorinated Fuel Tanks and Fuel Storage Containers

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Executive Summary

On behalf of Inhance Technologies, LLC (the Company), ToxStrategies, Inc., has performed exposure modeling and risk assessments for long-chain perfluoroalkyl carboxylate substances (LCPFACs) that are produced unintentionally during fluorination of small combustion engine fuel tanks and portable fuel storage containers. The fluorination process, which is conducted at low, medium, and high levels according to the customer's needs, imparts a critical barrier to the fuel tanks and fuel storage containers to protect against fuel evaporative emissions. The LCPFACs offer no functionality to the fluorinated fuel tanks and fuel storage containers, and no poly- and perfluoroalkyl substances (PFAS) are ever utilized in any of the Company's production processes. The U.S. Environmental Protection Agency (EPA) has established a significant new use rule (SNUR) to require companies who manufacture or process certain LCPFACs to submit a significant new use notification (SNUN) for the LCPFACs. This exposure modeling and risk assessment report supports consolidated SNUNs for the relevant LCPFACs formed in fluorinated fuel tanks and fuel storage containers.

LCPFACs from fluorinated fuel tanks and fuel storage containers may migrate into the fuel contained in the tanks and fuel containers. Fuel with LCPFACs will be combusted in a small engine. Although no literature was found about the combustion of LCPFACs in small engines, temperatures in such engines can exceed those known to sufficiently destroy PFAS.

When fuel tanks and fuel storage containers reach the end of their useful service life, they may be disposed of in a landfill. Although it is theoretically possible for residual LCPFACs to migrate to landfill leachate, this report demonstrates that a substantial portion of the available LCPFACs are likely consumed during the fuel combustion process over the useful life of the equipment.

During the fluorination process, excess fluorine and hydrofluoric acid (HF) is captured by alumina in scrubbers in accordance with air permits. The alumina media may also contain small amounts of LCPFACs. Spent alumina is sent to a cement company for use as an additive in Portland cement clinker. Clinker pyroprocessing temperatures are well in excess of those known to mineralize LCPFACs.

This report includes conceptual exposure models of SNUN LCPFACs that may reach humans and environmental receptors, as well as the associated concentration estimates and risk assessments. Estimates were based on measured LCPFAC migration into fuel from fluorinated fuel tanks and fuel storage containers, as well as industrial hygiene studies to estimate Company worker exposure to LCPFACs. Risk assessments (screening-level comparison ratios [SLCRs]) were derived by dividing the modeled exposures (concentration or dose) by human health-based protection levels (HBPLs) or predicted no-effect concentrations (PNECs). HBPLs included reference doses for occupational exposures, and EPA or state regional screening levels for residential soil (direct contact with soil), soil to protect groundwater (consumption of groundwater with leachate from soil), and drinking water (consumption of surface water). PNECs included those for aquatic species (exposure to surface water) and terrestrial species (exposure to soil). In each worst-case scenario, the SLCRs were well below one, indicating no likely risk of overexposure to the SNUN LCPFACs.

Exposure to workers is most likely from incidental ingestion associated with hand-to-mouth (HTM) transfer of LCPFACs from gloves. Dermal absorption is an unlikely exposure pathway,

and Company workers wear new gloves while handling fluorinated fuel tanks and fuel storage containers. In addition, LCPFACs have low volatility, and Company processes do not generate fluorinated particles or dust, making LCPFAC inhalation among Company workers unlikely. LCPFAC transfer to gloves was measured for workers who handle fuel tanks and fuel storage containers across the range of fluorination levels. The amounts of LCPFACs on gloves were then estimated for HTM transfer using conservative estimates. The resulting amounts of LCPFACs that could be incidentally ingested are well below the reference doses (RfDs) for each LCPFAC, with SLCRs ranging from $8.3x10^{-5}$ to 0.025 for packers and up to 0.69 for assemblers.

Following fluorination, certain fuel tanks undergo assembly operations. After assembly, the fluorinated fuel tanks are submerged in water for pressure testing during which some LCPFACs may leach into the water. When the water is released to the wastewater treatment plant (WWTP) in accordance with the Company's discharge permit, the LCPFACs will likewise be sent to the WWTP. Using conservative assumptions, such as no LCPFAC removal in the WWTP and the lowest recorded flow rate in the effluent receiving water body, the resulting maximum SLCRs are $8.3x10^{-5}$ for aquatic species.

A worst-case scenario for environmental exposures to LCFPACs from fluorinated fuel tanks and fuel storage containers would involve a catastrophic fuel tank and fuel storage container failure resulting in a release of the entire fuel contents. For land-based small combustion engines, such as lawn mowers, string trimmers, and power sports equipment, such a worst-case scenario was modeled for release to soil, a small lake, and a farm pond. Although these fuel tanks and fuel storage containers are fluorinated at all levels, these models considered fluorination at both the high and medium levels, which are representative of higher-end concentrations. In each case, the worst-case concentrations in soil were well below HBPLs for residential soil (maximum SLCR of $7.9x10^{-4}$), soil to protect groundwater (maximum SLCR of 0.16) and drinking water (maximum SLCR of $1.3x10^{-5}$). Modeled soil concentrations were also well below PNECs for terrestrial species (maximum SLCR of $3.0x10^{-4}$), and surface-water concentrations were well below PNECs for aquatic species (maximum SLCR of $3.6x10^{-5}$).

A catastrophic failure of a marine fuel tank, which is only fluorinated to a high level, considered a release to a small lake that is capable of supporting recreational boating and aquatic life, and that is large enough to serve as a drinking-water source. Surface-water concentrations were also well below HBPLs for drinking water (maximum SLCR of $6.4x10^{-5}$) and were also below aquatic PNECs (maximum SLCR of $2.8x10^{-9}$).

The third primary conceptual exposure model included catastrophic failure of a five-gallon portable fuel storage container (medium fluorination level) in which the entire fuel contents would be released to soil, a small lake, or a farm pond. Similar to the other exposure scenarios, the model results indicated concentrations well below HBPLs for soil (maximum SLCR of $3.5x10^{-4}$), soil to groundwater (maximum SLCR of 0.16), and drinking water (maximum SLCR of $3.5x10^{-5}$). Soil and surface-water concentrations were also well below PNECs for terrestrial species (maximum SLCR of $1.7x10^{-10}$) and aquatic species (maximum SLCR of $1.1x10^{-5}$), respectively.

In conclusion, worst-case exposure assumptions and conservative modeling parameters have demonstrated that LCPFACs in fluorinated fuel tanks and fuel storage containers would not pose an unreasonable risk to Company workers. Additionally, worst-case modeling for environmental releases also indicated that LCPFAC concentrations do not pose an unreasonable risk to humans, aquatic species, or terrestrial animals based on the assumptions of this assessment.