

Announcement
Non-Hazardous FCC Additives
for SOx Reduction with Improved Performance

G. W. Aru, LLC is founded on the principles of integrity, innovation and value. Nothing is more important to our integrity than fully understanding and assessing any health and safety issues that may be associated with our products and ensuring our employees and customers are fully aware of such issues so that safe and proper handling procedures can be implemented. We also believe it is critically important for the environment and everyone's health and safety to innovate and develop non- or less-hazardous alternatives with the potential to provide even greater value to our customers whenever possible.

I am, therefore, extremely pleased to announce that after a one-year development and analytical testing program in conjunction with Argonne National Labs and Virginia Commonwealth University we are now able to offer non-hazardous FCC SOx reduction additives (Ultra SOxBuster®) in both spinel (USB-M30™) and hydrotalcite (USB-M60™) variants. Our additives are also proving to be better performing in operational use than the top-selling competitor's hydrotalcite-based additive that has an SDS listing the following hazards (our Ultra SOxBuster® additives do not have these hazards):

- Eye Irritant - Category 2A;
- Germ Cell Mutagenicity - Category 2;
- Toxic to Reproduction (Fertility and unborn child) - Category 2; and
- Specific Target Organ Toxicity Repeat Exposure (respiratory tract) – Category 1.

I am incredibly proud of the work that we have done to make this possible. Our team, led by Dr. Natalie Herring, has spent considerable time and effort to execute this project. This was not an easy task for a small company with limited resources, but we believed it extremely important given the health and safety issues involved. Our work in this area continues and we will publish the results jointly with Argonne National Labs in an upcoming scientific journal.

I am very grateful to the support of our refinery customers that have tested and used our Ultra SOxBuster® additives and provided various samples for our testing and analysis program. These included density-separated e-cat samples so that the effects of exposure to FCC conditions on SOx additives could be determined in order to understand the potential hazards of the spent SOx additives in e-cat and fines. It is also important to recognize and compliment the work done by W. R. Grace to understand the health and safety issues of their spinel-based Super DESOx® FCC additive much of which is fully documented in their REACH registration.

The significant analysis and extensive biological testing documented in the REACH registration for the substance CAS No. 170621-28-0 aluminum magnesium vanadium oxide provided the foundation for our work. By employing the advanced analytical techniques afforded at Argonne National Labs and Virginia Commonwealth University, we were able to determine which vanadium compounds form under various production conditions. This enabled development of both spinel and hydrotalcite-based SOx additives with vanadium in the form of this reference substance. Furthermore, the improved vanadium dispersion in the aluminum-magnesium structure of this substance is proven in operational use to result in better performing SOx additives as compared with the top-selling competitor's hydrotalcite-based additive who states in their SDS that multiple hazardous vanadium compounds form in their product.

FCC emissions regulations are being continuously reviewed and tightened by regulatory agencies such as the US EPA and South Coast Air Quality Management District (SCAQMD) in the US as well as various regulators around the world such as the European IPPC Bureau. Better-performing and non-hazardous FCC SOx reduction additives such as our Ultra SOxBuster® USB-M30™ and USB-M60™ additives provide a safe and more cost-effective alternative to capital projects (e.g., wet gas scrubbers) to meet these SOx emissions regulations. Further, by employing one of our non-hazardous additives, refiners can proactively prevent hazardous exposure to their employees and their communities from accidental spills or inadvertent air emissions during loading and injection of these SOx additives into the FCC. Why risk the liability of using a hazardous additive when a proven, non-hazardous and more cost-effective alternative is readily available?

Our Ultra SOxBuster® additives are manufactured by our partners in China and the USA which uniquely enables us to manage costs from a global supply chain - tariffs versus security of supply concerns with Chinese rare earth oxide export issues. We will be pleased to share with you the details of our work and provide you a safer and more cost-effective alternative for your FCC SOx emissions control requirements. Please contact Guido Aru at Guido.Aru@GWAru.com or any of our sales team listed on the reverse for additional information about our SOx additives.

About G. W. Aru, LLC: G. W. Aru, LLC is founded on the principles of Integrity, Innovation and Value. We specialize in sales, marketing and technical support services for catalysts, sorbents, chemicals and related technologies and services for the petroleum refining and petrochemical industry. We provide a channel-to-market for our manufacturing partners and we work with them to develop new and innovative products to meet your needs, thus offering you new value-creation opportunities. Our objective is to offer you the best-value solutions through our ability to access a robust portfolio of products and services which our highly experienced team can tailor to meet your unique requirements. Please see www.GWAru.com for more information.

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