Recent food safety and security headlines are creating fresh opportunities in markets for lubricants with incidental food contact (also known as food-grade lubricants). The use of food-grade lubricants minimizes the threat to food safety by eliminating the risk of mistakenly using conventional lubricants where food-grade lubricant is required. Increased use of higher performing food-grade lubricants ensures efficient and reliable operation of food-processing equipment, minimizing downtime, and increasing productivity. The growth of food-grade lubricants will also be supported by increased application in other industries, such as cosmetics, pharmaceuticals, tobacco, and animal feedstuffs.

Safe and Secure

Food recalls can destroy a brand. Recent headlines include recalled chicken products due to potential pesticide contamination and recalled ground beef due to possible contamination with hydraulic fluid. Other incidents involving variously contaminated spinach, dog food, and peanut butter justify concerns of chemical or biological food contamination. Concerns have increased for food security and the risks of bioterrorism; this should increase the frequency of plant inspections and audits, and the desire to control and minimize risks. Proper integration of food-grade lubricants into a plant’s process can help reduce the risk of contaminations and recalls.

Afton Chemical’s Key Driver Seminar during the Commercial Marketing Forum at the 2007 STLE Annual Meeting in Philadelphia, featured guest speaker Sarah Krol, Business Unit Manager, Nonfood Compounds Registration Program at NSF International. (Based in Ann Arbor, Michigan, NSF is an independent, not-for-profit organization committed to providing public health protection.) Krol shared insights from a 2004 FoodNet Surveillance Report of the Centers for Disease Control and Prevention (CDC): “Annually in the US, 76 million illnesses, 325,000 hospitalizations and over 5,000 deaths are caused by food-borne pathogens.” Clearly, food safety is not to be taken lightly.

Krol also reported that the U.S. uses a risk-based approach to food safety. Based on strong, flexible, science-based federal and state laws, a federal regulatory organizational network coordinates with complementary food safety missions. They include the Department of Health & Human Services, Food & Drug Administration, Department of Agriculture, Food Safety and Inspection Service, Animal and Plant Health Inspection Service, and Environmental Protection Agency.
NSF manages its voluntary Nonfood Compounds Registration Program in support of this risk-based approach. This program began in 1999 to replace the one previously administered by the U.S. Department of Agriculture, and is for compounds used in and around food establishments (nonfood compounds), including lubricants. After putting candidate lubricant formulations through a comprehensive formulation review against CFR Title 21, 9, and 40, NSF toxicologists determine product acceptability and assure product manufacturers, inspection officials, and end users that formulations and labels meet appropriate food safety regulations. Products complying with these requirements are identified in the online NSF White Book™ Listing (www.nsf.org/usda/psnclistings.asp) of proprietary substances and nonfood compounds.

The NSF Nonfood Compounds Program Lubricant includes three category codes:

**H-1 – General – incidental food contact.** These are permitted for use where there is a possibility of incidental food contact.

**H-2 – General – no food contact.** These are for use where there is no possibility of the lubricant or lubricated part contacting edible products. Most substances generally used would be acceptable.

**H-3 – Soluble Oils.** These products are used to prevent rust on hooks, trolleys, and similar equipment.

Each of these categories has a related category for ingredients (HX-1, HX-2, and HX-3).

The use of Hazard Analysis and Critical Control Point (HACCP) inspection methodology focuses on identifying and preventing hazards such as lubricant contamination; this is an effective and valuable tool for processing and manufacturing plants. Food regulators throughout the world have adopted HACCP principles into their facility inspection requirements. HACCP leaves the food processor responsible to fully understand the potential physiological risk that a lubricant may pose to the consumer if ingested. The use of food-grade lubricants is one important way for processors to comply with HACCP programs.

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**Figure 1. Foam Control**

Foaming lubricants can pose serious problems to the end user, including cavitation, insufficient lubrication, and mechanical failure. Foaming becomes a housekeeping problem if left unattended and overflowing from a reservoir. Figure 1 shows the difference in foam control of three white-oil based AWHOs, one based on Afton Chemical’s HiTEC® 1850FG Food Grade Additive and two commercially available products.

**Figure 2. Rust Protection**

Food-processing establishments make use of generous amounts of water for washing, maintenance, cleanliness, and hygiene in work areas. Therefore, it is essential for food-grade lubricants to demonstrate effective rust protection. The extensive use of water also demands excellent demulsibility of an AWHO. Relative rust protection of three AWHOs is shown in Figure 2, one based on Afton Chemical’s HiTEC® 1850FG Additive and two commercially available products.

**Figure 3. Pump Durability**

A key performance indicator of AWHO is its ability to control wear in industry standard tests using actual hydraulic vane pumps like the Eaton 35VQ25 pump test. In Figure 3, the performance of a white-oil based AWHO using Afton Chemical’s HiTEC® 1850FG Additive is measured based on the total cam ring and vane weight loss of three cartridges used in the test.

**Figure 4. Sludge Control**

Elevated temperatures, oxygen, and water can lead to oxidation and sludge deposits from inadequately formulated lubricants. These deposits can further accelerate oxidation of the fluid and build up on critical parts such as spool valves and filters, causing poor performance, higher operating pressures, and premature equipment failure. Sludge formation of three white-oil based AWHOs is shown in Figure 4, one based on Afton Chemical’s HiTEC® 1850FG Additive and two other commercially available products.
Growing Global Market

The market opportunity is not limited to the United States. The leaders of Canada, Mexico and the U.S. included Food Safety in their recent Montebello 2007 Summit Joint Statement. In Asia, there is a market increase for food-grade lubricants due to their growing population, high demand for processed food and a rise in exports from the region to the US. Other regions of the world also have specific registration or inspection programs for nonfood compounds such as lubricants. In many cases, the NSF system serves as a basis for further regional review. The Canadian Food Inspection Agency (CFIA), working to improve the overall health of Canadians, makes food safety a top priority. CFIA helps implement HACCP systems in federally registered food establishments. Dr. Kenji Yano, President of Yano Consulting, a guest speaker at Afton’s Key Driver Seminar, commented on the Australian Quarantine Inspection Service (AQIS) which requires the use of AQIS-approved chemicals in registered export red meat establishments. Generally, the U.S. criteria pertaining to incidental contact lubricants are accepted.

In Europe, the EHEDG provides guidance on the hygienic engineering aspects of manufacturing safe and wholesome food. It maintains a handbook of hygiene control in the food industry guidelines, addressing the production and use of food-grade lubricants.

Another recently introduced standard, ISO 21469:2006, impacts the use of food-grade lubricants and goes beyond formula review. It specifies hygiene requirements for the formulation, manufacture, use, and handling of lubricants which, during manufacture and processing, can come into incidental contact with products and packaging. NSF recently announced plans to introduce a certification program for the industry.

When developing lubricants with incidental food contact for today’s modern equipment, it is important to not only consider the food safety and HACCP aspects of lubrication, but also the equipment’s appetite for higher performing lubricants that can maximize productivity and reduce operating costs. A properly balanced food-grade lubricant will have that equipment coming back, asking for seconds.

Balancing Performance and Safety

Performance and safety should be balanced in food-grade lubricants to reduce risks and operating costs, and maintain productivity targets. This balance can be achieved as higher performing products penetrate the market. Compromise shouldn’t be necessary; the environment and equipment operating conditions for food-grade lubricants call for nothing less. Industry Anti-Wear Hydraulic Oil (AWHO) standards such as DIN 51524-2 and those of pump OEMs Eaton and Denison are attainable with today’s technology. A few important performance areas to highlight for AWHO include foam control, sludge control, rust and corrosion protection, and pump durability. Afton Chemical has recently introduced HiTEC® 1850FG Food Grade Additive for use in the blending of NSF H-1 registered lubricants that maintain this balance. HiTEC® 1850FG Food Grade Additive is NSF HX-1 registered, Kosher and Halal certified, and maintains performance found in conventional AWHOs.

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Afton Chemical would like to personally thank Ms. Sarah Krol, Business Unit Manager of NSF International and Dr. Kenji Yano, President of Yano Consulting for their contributions to this article.

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