Introduction

Midwest Chemical Safety, LLC (MCS) was retained by Oamic Ingredients LLC (Oamic) to provide expert insight and commentary regarding the toxicity and environmental impact of their proposed product storage facility in Armonk, New York, particularly in the event of a fire or spill emergency. Dr. Elston’s curriculum vitae is attached at the end of this report.

In preparation for this report, MCS reviewed the following documentation:

- Oamic-provided proposed product inventory. This inventory did not include benzoic acid as mentioned in other reports/statements. Twenty-five substances were evaluated.
- Oamic-provided engineering diagrams for the proposed warehouse facility.
- HydroEnvironmental Solutions, Inc. (HES) report on the proposed project, dated 8 December 2017. This report also included Safety Data Sheets provided by Vigon International for the proposed inventory.
- Statement of Oamic Ingredients, LLC on the Environmental Safety of its Stored Products, Dated 30 October 2017. This statement was provided to the Planning Board of North Castle.
- Safety Data Sheets (SDSs) provided by Sigma Aldrich for the proposed inventory. These Safety Data Sheets are publicly available and will not be presented as an appendix to this report.
- Patty’s Toxicology. 5th Ed. (New York: John Wiley and Sons, 2001).
- US Environmental Protection Agency National Primary Drinking Water Standards.
- European Chemical Association (ECHA) profile for Furfuryl alcohol.

The entirety of the proposed inventory are products typical to flavoring and scent manufacturing. All but three compounds fall under the general category of “hydrocarbon derivatives”, mostly alcohols, ketones and aldehydes. 1-acetylpyrazine and methyl anthranilate are nitrogen-containing organic compounds and sulfuroil is a sulfur-containing organic compound. One product is classified as moderately toxic by ingestion (furfuryl alcohol) and comprises less than 0.1% of the proposed inventory.

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Sigma Aldrich is a world’s leading manufacturer and distributor of high-purity chemicals. Their SDSs were selected as the primary reference for screening the effects of the proposed inventory as they represent a source of information independent from any information provided by Oamic or HES. There are few, non-substantive, differences between the Vigon and Sigma Aldrich SDSs.

None of the products in the proposed inventory are specifically regulated by the US EPA’s National Primary Drinking Water Regulations nor are they specifically regulated by the NY Department of Environmental Protection. Likewise, none of the products in the proposed inventory are specifically listed in the US EPA’s Consolidated List of Chemicals Subject to the Emergency Planning and Community Right-To-Know Act (EPCRA), Comprehensive Environmental Response, Compensation and Liability Act (CERCLA and Section 112(r) of the Clean Air Act.) (Note: No listing does not imply that the material is not regulated under one of those Acts.)

**Impact Under Fire Conditions**

For approximately 99.32% (by weight) of the proposed inventory, the combustion products will be no different than the bulk of any hydrocarbon fire: carbon (soot), carbon dioxide, carbon monoxide and unburned product. These would be the same combustion products one would see from a fire involving kerosene or wood. The remaining 0.68% of the proposed inventory will produce nitrogen oxides and sulfur oxides in addition to the carbon and carbon oxides above. Hydrogen sulfide is also a potential combustion product from sulfurol, but it would be a minor contributor as hydrogen sulfide itself is flammable.

The combustion products are common to both industrial and residential fires and do not present a unique toxicological profile to properly trained emergency responders. Likewise, inadvertent mixing of unburned product will not cause an increase in toxicity. Burning products will not “recombine” to form products of higher or unknown toxicity. There are no known synergistic toxicological effects for the combustion products of the material in the inventory nor are there any known synergistic toxicological effects associated with the mixing of unburned product. In terms of toxicity, there is no increase of risk to professional firefighters due to a fire involving the products in the proposed inventory.

There are number of local businesses in the immediate vicinity of the proposed storage location, including a community park, several restaurants and a Montessori school approximately 1600 feet from the proposed location. These businesses will be impacted during a large, uncontained fire, probably resulting in an evacuation. Undoubtedly, there will be a high level of public concern associated with a fire at the facility due to the “chemical” nature of the material, however the main concern will be respiratory irritation.

In the event of a fire involving the warehouse, the risk of exposure to the public will be mitigated by several control measures that should be required by the Authority Having Jurisdiction. Chiefly among those control measures will be a fully-sprinklered warehouse to provide automatic fire suppression. Sprinklers will both suppress the fire, but will also reduce the amount of material that will be released to the atmosphere. Other measures, such as proper storage and handling will also prevent fires at the facility.

The impact of the release of water used in fire suppression would have a similar, but smaller (due to reduced quantity of pure material and dilution by suppression water), impact as a spill, described below.
Impact Under Spill Conditions

Of the proposed inventory, three liquids and five solids are identified as hazardous to the aquatic environment: Benzaldehyde, benzyl alcohol, hexanoic acid, guaiacol, $\alpha$-terpineol, decanoic acid, vanillin, and heliotropin.

Any appreciably large spill allowed off-site is expected to have some localized, short-term environmental impact, particularly to the Bear Gutter Creek and associated wetlands as identified in the HES report. The impact will be largely mitigated by the physical properties of the products. Low miscibility (or solubility) for the products will limit transport downstream.

Environmental data for eight of the products in the inventory (benzaldehyde, benzyl alcohol, hexanoic acid, guaiacol, $\alpha$-terpineol, furfuryl alcohol, $\gamma$-decalactone, and triethyl citrate) indicate all eight are highly biodegradable and none of those eight have any indication for bioaccumulation. Based on chemical structure, it is anticipated that the remainder of the proposed inventory will likewise be highly biodegradable.

Downstream of the Bear Gutter Creek and the associated wetlands is the Kensico Reservoir, the primary reservoir that serves New York City. The impact of a release from the proposed facility to the Kensico Reservoir will be minimal based on the following analysis:

1. Furfuryl alcohol is the single most toxic-by-ingestion component identified in the proposed inventory. The Derived No Effect Level (a dose) is 2.4 mg/kg body weight per day; or 168 mg/day for a 70 kg (154 lb) person$^2$.
2. Assume that the entire inventory (in excess of 600,000 kg) is furfuryl alcohol (the most toxic-by-ingestion component) is released into the reservoir. The resultant concentration would be approximately 5.5 ppm (or 5 mg/L) of untreated water.
3. An individual would have to ingest approximately 30 liters of untreated water to reach the Derived No Effect Level (dose). For comparison, water itself becomes toxic at doses greater than about 1 liter per hour.
4. Given that the actual inventory amount of furfuryl alcohol will not exceed 100 kg, the impact of a release of the most toxic-by-ingestion component will reach a concentration of approximately 0.9 ppb (parts-per-billion) in the untreated water.

The likelihood of a catastrophic release that will negatively impact the Kensico Reservoir is minimal for the following reasons:

- Supplied engineering diagrams of the proposed facility show that the internal containment is to be made of epoxy-over-concrete, similar to some in-ground swimming pools. The volume of the proposed facility is approximately 200,000 gallons$^3$. The total liquid capacity of the proposed inventory is approximately 50,000 gallons or roughly one-quarter of the internal containment capacity. The HES report indicated that there were no observed floor drains in the facility.

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$^2$ ECHA profile for furfuryl alcohol.

$^3$ Personal correspondence with Mr. Steven Gu, representative of Oamic.
• The proposed facility has a water storage tank for fire suppression, roughly 150,000 gallons. The combined fire suppression water and inventory will still be contained within the building.
• Water transport of most of the products is limited by low miscibility or solubility.

It should be recognized that a release of the entirety of the inventory in a single event is an implausible scenario; the most plausible scenario is the rupture of two of the drums by a fork-lift driver which would release approximately 110 gallons locally. The containment and clean-up of a two-drum release is a common training item for warehouses handling liquid products.

Conclusions and Opinions

The products in Oamic’s inventory are routinely handled safely throughout the food and scent industries. Additionally, any catastrophic release of products in the inventory will have minor, if any, impact on the Kensico reservoir, as detailed above.

In order to handle the inventory safely and responsibly, Oamic should use a two-layer approach to prevent release and community impact:

Engineered Controls: These controls are always present and do not require operator action. Examples include:

• Building design: The proposed facility already will install a containment system which will hold approximately 200,000 gallons of liquid.
• Building design: Installed fire suppression. This will help prevent any fire from becoming catastrophic. If the facility does not currently have a fire suppression system, it is strongly recommended that Oamic install one.
• Additional Pallet Secondary Containment. These portable secondary containments are designed to contain leaking or ruptured drums.

Administrative Controls: These are “work-rules” put in place and enforced by management to prevent personnel injury and environmental insult. Examples include:

• Developing a Spill Prevention, Control and Countermeasure plan and periodically train on that plan.
• Working with the local Authority Having Jurisdiction (or “Fire Marshal”) to ensure required fire codes are being met.
• Developing a safety program that is in complete compliance with the Occupational Safety and Health Administration. This will include but not be limited to Hazard Communication, electrical and materials handling safety and a full Powered Industrial Truck program.
• It is strongly recommended that the facility have a response team trained to at least an “Operations Level” according to the OSHA Hazardous Waste and Emergency Response Standard. Better would be a complete 40-hour training as recommended by the HES report.
• Oamic must identify and maintain proper EPCRA (Emergency Planning and Community Right to Know) reporting and should voluntarily work with the Local Emergency Planning Committee to keep them apprised of their inventory.
• Develop and maintain a strong preventative maintenance program with respect to engineered controls, powered industrial trucks and spill clean-up.
Dr. Elston reserves the right to revise this opinion should any new information become available. For questions regarding this opinion, Dr. Elston may be contacted at the phone number or email listed on the first page.

Harry J. Elston

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Curriculum Vitae

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Education

Ph.D. Columbia Pacific University, College of Arts and Sciences, San Rafael, CA. 1996.

Doctoral Dissertation: Molecular Dynamics in p-Difluorobenzene-Ar van der Waals Molecules. Rotational Effects of Dissociation, Heavy Molecule Spectroscopy and Dissociation Dynamics.

M.S. Indiana University, Bloomington, IN. Physical Chemistry, 1992.


Professional Certification

Diplomate, American Board of Industrial Hygiene. (Comprehensive Practice). Certificate number 8258, 2002-Present.

Certified Chemical Hygiene Officer, National Registry of Certified Chemists, (Number 2421), 1997-2010. (Certification voluntarily relinquished due to financial considerations)

Professional Societies

American Chemical Society, 1990-Present
Division of Physical Chemistry, 1990-1995
Division of Chemical Health and Safety, 1995-Present

American Industrial Hygiene Association, 2003-Present.
Professional Experience

Midwest Chemical Safety, LLC, Dawson, IL. Principal. 1996-Present. (Midwest Chemical Safety specializes in chemical safety consulting, formulating chemical hygiene plans and facility safety plans, emergency preparedness, chemical safety training, emergency management, crime scene safety (clandestine laboratories) and occupational/industrial hygiene and environmental consulting services.)


Professional Involvement

Editor in Chief, Journal of Chemical Health & Safety, 1999-Present
Certification Examination Committee, National Registry of Certified Chemists, 2000. (Chemical Hygiene Officer Examination)
American Industrial Hygiene Association Publication Committee, Committee Member. 2002-Present
Chair, American Chemical Society, Division of Chemical Health and Safety, 2017.
American Chemical Society Committee on Chemical Safety:
  • Associate Member, 2003-2006
  • Consultant, 2006-2010
  • Member, 2010-Present
  • ACS Representative to ANSI Z9.5 Laboratory Ventilation Subcommittee, 2011-Present

Springfield-Decatur Local Section – American Chemical Society
  • Local Section Chair, 2015
  • Councilor, 2015-Present

Awards and Honors

Fellow, American Chemical Society. 2015

Howard Fawcett Chemical Health and Safety Award, Division of Chemical Health and Safety, American Chemical Society, 2003.
Fellow, Division of Chemical Health and Safety of the American Chemical Society, 2003.

Adjunct Teaching Experience

Adjunct Professor of Mathematics and Chemistry. Richland Community College, Decatur, IL. 1993-1997

Community Involvement


Springfield Area Christian Home Educators, Springfield, IL. Member. 2000-2010.


Publications


**National Methods Developed**


**Dissertation**

Molecular Dynamics in *p*-Difluorobenzene-Ar van der Waals Molecules. Rotational Effects of Dissociation, Heavy Molecule Spectroscopy and Dissociation Dynamics. Ph.D. Dissertation. Columbia Pacific University, San Rafael, CA. 1996. (Available at University Microfilms, Ann Arbor, MI)

**Presentations**


2. *p-Difluorobenzene-d4 S1 Vibrational Spectroscopy.* American Chemical Society Regional Meeting, Indianapolis, IN, 1991.


19. *Ask Dr. Safety.* A regularly occurring panel discussion at ACS National Meetings. Various dates.