

INDUSTRIAL HYGIENE REPORT

Control of Diethyl Ether

In the Workplace

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Introduction: Diethyl ether (“ether”) is a colorless, very volatile, highly flammable organic solvent. It has been used as an anesthetic agent and it is also used as a fuel additive for diesel and gasoline engines. Its boiling point is 34.6°C (94 °F) and it has a characteristic, sweetish odor. Ether is much less toxic than the common hydrocarbons (e.g., gasoline) and chlorinated hydrocarbons such as methylene chloride and carbon tetrachloride. OSHA has established an exposure limit of 400 ppm (8-hr. TWA). Ether should be handled with care to avoid skin contact and inhalation of vapors.

Purpose: The purpose of this experiment was to demonstrate the effectiveness of the Sentry Air Systems Model 300 *Winged Sentry™* with Lid (WSL) in collecting and removing diethyl ether vapors produced by the evaporation of a measured amount of liquid ether. The Model 300 WSL was equipped with an activated charcoal filter. There are two WSL models available (Model SS-200 WSL and Model SS-300 WSL); the latter was used in this project.

Discussion: Solvent vapors are best captured near their source and the Model 300 WSL is very efficient in capturing and removing ether vapor before it mixes and disperses into the surrounding workplace air. Diethyl ether vapors that escape into the room air can be a health concern for personnel since they can cause eye and respiratory tract irritation and at high levels, light-headedness and anesthesia. For purposes of this experiment a measured amount of liquid diethyl ether was distributed drop-wise from a burette onto several cotton balls placed in a shallow pan. The cotton provided a large surface area to facilitate the evaporation of the ether. When the Model 300 WSL was turned on, a stream of air was drawn across the cotton balls and into the Sentry fume extractor.

Experimental: On July 27, 2011, an activated carbon filter, which is generally employed for organics removal, was installed in the Model 300 WSL. The air flow rate with this filter was set for approximately 250 cfm (cubic feet per minute). 25.0 ml of diethyl ether was dispensed from a 50-ml burette and evaporated into the air stream over a 30-minute period. Air samples were collected during the experiment using SKC 226-001 sorbent tubes and battery-powered sampling pumps. The pumps were set to pull about 100 cc/min. and were pre- and post-calibrated. All personnel involved in the sampling project were provided with half-face, air-purifying respirators equipped with an organic vapor cartridge while ether was being handled. The operator also wore eye protection. Samples were

taken at the inlet and outlet of the Model 300 WSL. A personal sample was collected on the operator and an additional sample was taken of the room air in the vicinity of the operation. All samples, including a blank, were sent to an AIHA-certified laboratory and analyzed using gas chromatography and flame ionization detection (OSHA Method 7).

Results: The sampling results are presented in the following table:

Sample #	Sample Description	Avg. Flow Rate, cc/min	Sampling time, min.	Sample vol., liters.	Diethyl ether found, mg (ppm)	% Removal
RFA-001	<i>Winged Sentry™</i> Inlet	99.80	30	2.994	1.5 (170)	-----
RFA-002	<i>Winged Sentry™</i> Outlet	97.36	30	2.921	0.004 (0.5)	>99.7
RFA-003	Personal sample (Operator)	95.35	30	2.860	0.015 (1.7)	-----
RFA-004	Area sample	101.4	30	3.043	0.017 (1.8)	-----
RFA-005	Blank	-----	-----	-----	<0.003	-----

Results and Conclusions:

1. The Sentry Air Systems SS-300-WSL unit did an excellent job of removing diethyl ether from the air in the experiment described herein. The calculated efficiency of removal was >99.7%.

Results and Conclusions, continued:

2. The personal sample taken on the operator during the experiment was found to be 1.7 ppm of diethyl ether, compared with the OSHA exposure limit of 400 ppm. Assuming no further exposure to ether during the day, the 8-hr. TWA would have been approximately 0.1 ppm.
3. An area sample was collected approximately six feet from the operation during the experiment with diethyl ether. The odor of ether was noticeable in the ambient air. The area sample showed a concentration of 1.8 ppm of diethyl ether in the ambient air. The circulation of ambient air through the Sentry Air Systems extractor was effective in maintaining a low level of ether in the room air. Sentry Air Systems recommends the use of the Model 300-WSL equipped with an activated carbon filter for the control of diethyl ether vapors in laboratories and other workplaces.
4. Care must be exercised not to exceed the capacity of the activated charcoal canister or to exceed the lower explosive limit of ether. The LEL of diethyl ether in air is reported¹ to be 1.9% (19,000 ppm).

If you have any questions or comments regarding this report, please contact me at 713-983-7910 or by e-mail at BobCIH@aol.com.

Respectfully submitted,

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¹http://www.engineeringtoolbox.com/explosive-concentration-limits-d_423.html

NOTE: An MSDS (Material Safety Data Sheet) for diethyl ether as used in this project can be found at: <http://fscimage.fishersci.com/msds/90868.htm>