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Project Summary

Degreaser System Pollution Prevention Evaluation

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The report gives results of an investigation of the capability of various engineering changes to an existing vapor degreaser to reduce solvent emissions to the atmosphere while remaining within the established U.S. Air Force (USAF) exposure limits for 1,1,1-trichloroethane (TCA). A 1970 vintage vapor degreasing system, serving a USAF metal fabrication shop, had been converted from trichlorethylene to TCA and fitted with a lip vent exhaust system to decrease worker exposure. Solvent consumption by the bath with this configuration was two to three 55-gal. (208-L) drums weekly, all presumed to be emitted to the atmosphere via the lip vent. In sequence various modifications to the degreaser and operating procedures were instituted to define their capability to reduce emissions and comply with exposure limit requirement. They include decreasing and eliminating lip vent suction, a freeboard extension, an ad-on chiller, and a combined freeboard extension and add-on chiller.

Although the lip vent lowered workplace concentrations, it also greatly increased TCA emission rates. Eliminating the lip vent with the simultaneous addition of a combined freeboard extension/add-on chiller provided about equivalent workplace concentrations of TCA but with a decreased discharge rate of TCA. The rate of consumption of TCA was reduced by about 75% with this configuration while maintaining the same degree of worker safety as provided by the lip vent.

This Project Summary was developed by EPA's Air and Energy Engineering Research Laboratory, Research Triangle Park, NC, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).

Objective

The purpose of this project was to investigate the technical and economic feasibility of applying a range of solvent conservation options to a vapor degreaser located at Wright Patterson Air Force Base (WPAFB-4950 TW/AMFSM) while keeping worker breathing zone concentrations at U.S. Air Force (USAF) engineering targets of 25% of Occupational Safety and Health Administration (OSHA) action limits of 43 ppm for an 8-hour time-weighted average (TWA) and a short-term exposure limit (STEL) of 56 ppm for 1,1,1-trichloroethane (TCA). The degreaser uses TCA as a solvent.

Background

The U.S. EPA and USAF are involved in a joint program to identify methods of reducing pollution from USAF depot facilities throughout the U.S. The vapor degreaser being studied was inspected and chosen as a test candidate for reducing emissions of TCA through various pollution prevention options. The degreaser utilizes a lip vent suction system that results in excessive loss of TCA. Since TCA may be phased out of use over the next 10 years, its cost will most certainly rise in the

interim period, increasing the incentive for the implementation of solvent conservation options.

Scope

The scope of the project included baseline degreaser measurements, effects of ventilation patterns on solvent loss/worker exposure, and a series of physical modifications to the degreaser system, such as reducing exhaust fan speed, increasing freeboard area, and installing a freeboard chiller. The physical modifications were designed to systematically reduce solvent consumption at increasing cost levels.

Methodology

Solvent loss and worker exposure measurements were taken during each test. A portable infrared analyzer (Miran 1A) and charcoal tubes were used for the solvent loss/exposure measurements. Various other ancillary parameters such as exhaust duct air flow, atmospheric pressure, degreaser temperature, and solvent level were measured during each test. Both winter and summer operating conditions were tested.

Test Description

Initially, four tests were performed during the winter and spring from February to April 1990. A second series of tests were conducted in late May/early June 1990 to represent summer conditions. Both sets of tests included baseline testing at full fan speed, reduced fan speed, and an increase in freeboard height. The summer tests included the use of a chiller both alone and in conjunction with the freeboard extension, and ventilation patterns were altered to isolate the degreaser room.

Results

Test options controlled worst-case personal exposure to levels (at degreaser midpoint) that achieved, or slightly exceeded, USAF Engineering Target Levels (ETLs): (1) baseline, (2) reduced lip vent suction, (3) fan off with freeboard extension, (4) chiller without fan or freeboard extension, and (5) chiller with freeboard extension. One test option did not reduce worst-case personal exposure to meet the USAF ETLs: fan off with existing freeboard. Two test options achieved acceptable control from a worker comfort standpoint: (1) baseline operation and (2) chiller with freeboard extension. The use of a chiller with freeboard extension resulted in a maximum reduction in solvent consumption of 72%.

Conclusions

Very significant reductions in solvent use are achievable from the USAF degreaser using the chiller-plus-freeboard option, while simultaneously keeping worker exposure below USAF ETLs, and with worker acceptance and support of the physical modifications to the degreaser.

Installing the chiller and freeboard is technically feasible, requiring only a few days of down time. The economic payback for this degreaser is less than 1 year, based on solvent and heat loss savings.

Recommendations

The degreaser should be operated permanently with the chiller and freeboard extension (no fan). Continued isolation of the degreaser room with more permanent materials is also necessary to maintain current levels of worker exposure. Leaks in the degreaser system should be repaired and will likely reduce worker exposure even further. Keeping better records on degreaser operation and solvent use would help identify causes of excessive solvent consumption.

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The complete report, entitled "Degreaser System Pollution Prevention Evaluation," (Order No. ADA 242-110/AS; Cost: $26.00, subject to change) will be available only from:
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5285 Port Royal Road
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