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Project Summary

Solvent Emission Reduction Study at Newark AFB, Ohio

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The objective of this effort was to collect baseline Freon emissions data, and subsequently recommend potential emission control alternatives to minimize Freon emissions that result from routine maintenance and repair operations conducted at Newark AFB, Ohio.

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).

Introduction

Newark AFB, Ohio, uses a number of solvents to clean and maintain electronic guidance devices. The solvent most often used in this application is 1,1,2-trichloro-1,2,2-trifluoroethane, commonly known by the DuPont Company trademark Freon 113™ (hereafter referred to as Freon). Newark AFB purchases large quantities of Freon (nearly 600,000 lb annually), and in previous years, lost nearly all of it (555,000 lb) as unrecovered Freon vapor.* Freon is one of a general class of chemicals known as chlorofluorocarbons (CFCs). Scientific evidence strongly suggests that CFC emissions are responsible for the depletion of the protective ozone layer surrounding Earth's atmosphere. For this reason, the U.S. Air Force must reduce and eventually eliminate CFC emissions from Air Force facilities.

Several steps have been taken to reduce the quantity of Freon emitted from the more than 100 emission point sources at Newark AFB. For example, solvent vapors emitted from more than half of the point sources at the facility are recovered with limited success by the use of two carbon adsorption (CA) systems. The performance of the recovery system in the past has been marginal at best, primarily due to an inadequate regeneration schedule.

In addition to the CA systems, continuously operated distillation equipment is used to purify recovered liquid Freon for reuse. However, military specifications require that most processes use only ultrapure solvent, so only Freon that is not significantly contaminated may be recycled. The remainder is sold to an offsite waste handling facility.

Scope

To develop methods of reducing Freon emissions from the cleaning and maintenance activities at Newark AFB, baseline emissions testing at key sites was performed. The data collected were evaluated to identify primary emission sources, and ventilation system inefficiencies. The results of this evaluation were used to de-

* This quantity was derived in an earlier solvent inventory study performed to identify significant Freon emission sources at Newark AFB. This study took into consideration the quantity of Freon purchased in the 1-year period studied, the change in the quantity of Freon stored onsite, and the quantity shipped offsite as a hazardous waste and sold to a solvent reclamation facility. The quantity of Freon lost due to evaporation (555,000 lb [252,272 kg]) was only slightly less than the quantity purchased (596,000 lb [270,909 kg]).

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velop several Freon emission reduction strategies.

Approach

This project was conducted in two steps. Step 1 involved a source identification study and a Freon emissions survey. Such engineering parameters as temperature, pressure, flow rates, and Freon concentrations were measured. This information was required to accurately determine the Freon emissions profile of Newark AFB, as well as to facilitate the identification of various emission reduction strategies. Step 2 consisted of reducing the data collected in Step 1 and developing and evaluating a number of Freon emission control strategies.

Test Description

Three principal measurements were performed during this test series: (1) measurement of air flow rates through exhaust ducts, (2) measurement of the linear flow rate at the front faces and access ports of process booths connected to the CA systems, and (3) measurement to determine Freon concentration variations in the duct over an extended period of time. At two test sites (CA 3 and 4), a fourth measurement was performed to determine the 1,1,1-trichloroethane (TCA) concentration variations. TCA is occasionally used in the process booths connected to the CA systems.

Results

The emission test results obtained were in good agreement with results obtained from the Freon emission inventory study performed a month prior to testing. Thus, the confidence level in the data collected is high. Several Freon emission reduction strategies were identified based on these results which, if implemented, will result in a Freon emission reduction of more than 60%.

Conclusions

From the data collected in this test effort and the engineering evaluation results, the following conclusions can be drawn:

- The quantity of Freon emitted from the Peacekeeper, Refurbishing, and Clean Room 12 areas total more than 54,432 kg (120,000 lb) per year; thus emissions from these areas should be targeted for major reduction.
- Emission sources not vented from process areas should be placed in hoods vented to a solvent vapor recovery system.
- Current CA system regeneration schedules are inadequate.
- Test results are in general agreement with those obtained from the Newark solvent chemical inventory survey performed prior to testing.
- Implementing the recommendations made in this report should result in an emissions reduction of more than 113,400 kg (250,000 lb) annually.

Recommendations

Recommendations made are of two types: those that can be adopted almost immediately and those that will take some time to implement. These short- and medium-term recommendations are presented separately. The medium-term recommendations are:

- Significant emissions from the Peacekeeper area should be eliminated by connecting the source exhaust ducts from the Peacekeeper area to the CA 3/4 network.
- Under current operations, CA 4 is significantly underutilized compared to CA 3, which is operating at near maximum capacity. Newark AFB should either connect the Peacekeeper area exhaust ducts to CA 4, or offload most of the CA 3 sources to CA 4, and connect the Peacekeeper exhaust ducts to CA 3.
- Some flow balancing will be required after the sources are integrated to ensure that sufficient ventilation air passes through each source.
- A separate solvent vapor recovery system should be installed to control emissions from the Refurbishing and Clean Room 12 areas.
- The emission sources that are currently uncontrolled (i.e., degreasers and ultrasonic cleaners), should be vented to a vapor recovery system. However, the cumulative contribution from these sources could have a significant impact on the recovery system operation. Thus, after they are vented, the Freon emissions from these sources should be quantified to assess their potential impact on vapor recovery system operations.
- A means of determining Freon evaporation rates in the significant emission source areas (i.e., Peacekeeper, Refurbishing/Clean Room 12, Clean Room 3) should be installed. In this way, the impacts of changes in operating areas on CA bed performance can be determined.

The short-term recommendations are:

- Feedback control loops should be installed at the exits of both CA systems to eliminate the emission of Freon vapor into the environment due to CA bed breakthrough.
- CA 3 and 4 should be converted from split-flow to single-bed operation.
- Until feedback control loops are installed in the CA bed effluents, new regeneration schedules for CA 3 and 4 should be adopted.
- Freon emissions from CA 4 due to the intermittent duty cycle of the point sources vented in CA 4 should be significantly decreased. The most cost-effective means of controlling these emissions is to turn off the 10-hp (7.5 kW) exhaust fan upstream of the bed during process downtime (i.e., weekends, and second and third shifts). This will reduce the possibility of solvent migration through the bed and subsequent breakthrough.

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The complete report, entitled "Solvent Emission Reduction Study at Newark AFB, Ohio," (Order No. ADA 242-091/AS; Cost: $26.00, subject to change) will be available only from:

National Technical Information Service
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