THE ENVIRONMENTAL TECHNOLOGY VERIFICATION PROGRAM

U.S. Environmental Protection

ETV JOINT VERIFICATION STATEMENT

TECHNOLOGY TYPE:	**AEROSOL CAN PUNCTURING AND DRAINING**
APPLICATION:	**TREATMENT OF HAZARDOUS WASTE AEROSOL CANS CONTAINING PAINTS OR NON-HALOGENATED HYDROCARBON LUBRICANTS AND CLEANERS**
TECHNOLOGY NAME:	**AEROSOLV® AEROSOL CAN RECYCLING SYSTEM**
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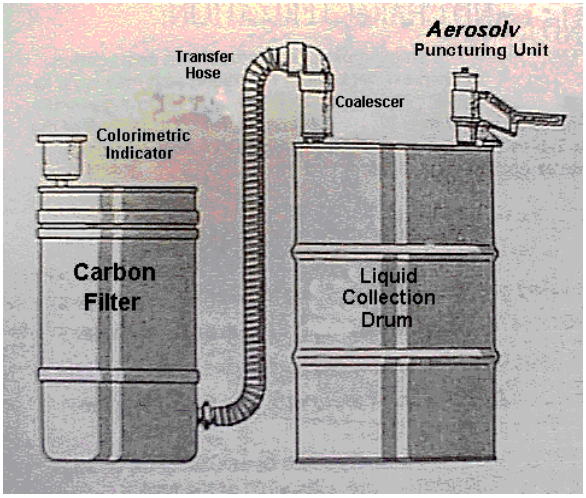
The U.S. Environmental Protection Agency has created the Environmental Technology Verification (ETV) Program to facilitate the deployment of innovative or improved environmental technologies through performance verification and information dissemination. The goal of the ETV Program is to further environmental protection by substantially accelerating the acceptance and use of innovative, improved, and more cost-effective technologies. The ETV Program is intended to assist and inform those individuals in need of credible data for the design, distribution, permitting, and purchase of environmental technologies.

ETV works in partnership with recognized testing organizations to objectively and systematically document the performance of commercial ready environmental technologies. Together, with the full participation of the technology developer, they develop plans, conduct tests, collect and analyze data, and report findings. Verifications are conducted according to an established workplan with protocols for quality assurance. Where existing data are used, the data must have been collected by independent sources using similar quality assurance protocols.

EPA's ETV Program, through the National Risk Management Research Laboratory (NRMRL), has partnered with the California Department of Toxic Substances Control (DTSC) under an ETV Pilot Project to verify pollution prevention, recycling, and waste treatment technologies. This verification statement provides a summary of performance results for the Katec, Inc. **Aerosolv® Aerosol Can Recycling System**.

TECHNOLOGY DESCRIPTION

The Katec, Inc. MODEL 6000 AEROSOLV® AEROSOL CAN RECYCLING SYSTEM (hereinafter referred to as the Aerosolv® System) is a waste aerosol can puncturing and draining technology. The technology punctures and drains waste aerosol cans while collecting their liquid contents in a storage drum and treating gases and vapors with a carbon filter. Treated waste aerosol cans may then be recycled as scrap metal. The collected liquids and used carbon filters are classified as hazardous or non-hazardous waste and managed accordingly. The system evaluated consists of four components: the Aerosolv® Puncturing Unit, a liquid collection drum, a coalescing filter and flexible hose, and a carbon canister with a Colorimetric Indicator. The liquid collection drum, a standard 55-gallon closed-head drum, is supplied by the user. Katec also provides an instruction manual on how to operate and maintain the system.



The *Aerosolv® Puncturing Unit* screws into the 2-inch bung hole of a standard 55-gallon drum (i.e., the liquid collection drum). To operate the Aerosolv® Puncturing Unit, the spray nozzle is first removed from an aerosol can, then the can is placed upside down into the top of the unit. The sliding top plate assembly is swung over the can and then depressed to push the can down against a flat silicone gasket inside the unit. After the aerosol can is secured in place, a spring-loaded handle on the unit is pushed down to pierce the dome of the can with a carbide-tipped puncture pin. Gradually releasing the handle allows the aerosol can contents to discharge through the bottom of the unit into the liquid collection drum. The handle must be released slowly to avoid rapid release of the can contents and the potential for uncontrolled releases of the gases and liquids. As the can is emptied, vapors and gases pass from the collection drum through the coalescing filter into the carbon filter. After the contents of the can have been allowed to drain (approximately 30 seconds to two minutes), the can is removed from the unit for recycling as scrap metal. For viscous materials such as paint, the can should be vigorously shaken before puncturing and more than one puncture hole may be necessary. To make additional drain holes the can is rotated and punctured again before being removed from the unit.

EVALUATION DESCRIPTION

The evaluation of the Model 6000 Aerosolv® System was designed to provide the data necessary to draw conclusions on the technology's performance, reliability and safety, as well as to identify the critical operating parameters and conditions. The evaluation consisted of a field test to provide independent data on the technology's performance and safety. Supporting documents and information submitted by Katec which describe their technology and its intended operation and maintenance were also reviewed. Additionally, the Aerosolv® 6000 Instruction Manual, the field test health and safety plan, and the field test results were reviewed with respect to protection of worker health and safety.

DTSC prepared the Technology Evaluation Field Test Plan which identified specific field test objectives, data quality objectives, testing procedures, and roles and responsibilities for performing the field test. Development of the field test plan was coordinated with Katec, Inc. and the U.S. Navy Public Works Center, San Diego (Navy), as well as with the ETV Program.

DTSC assumed the primary oversight role and was responsible for independent, third party verification of the field test. The Navy provided the necessary resources for conducting the field test. The Navy conducted the field tests during the period from August 3 through November 29, 1998 at the U.S. Navy Public Works Center facility in San Diego, California. The Navy is a Katec customer and agreed to provide facilities, staff, and waste aerosol cans from their hazardous waste storage facility for conducting the field test. Following the completion of the field test, the Navy submitted their report providing the field test data collected and a summary of field test results.

The performance of the Aerosolv® System was evaluated for three categories of aerosol can products: paints; hydrocarbon cleaners and lubricants; and chlorinated solvent cleaners. The selection of specific products to be used for the field tests was based on the availability of a sufficient quantity of the waste aerosol cans at the Navy storage facility, and the desire to test the performance and safety of the technology on products with a range of physical and chemical properties. Additionally, the selection of specific products within each product category was based on the need to gather data on emissions, carbon capacity, and the effectiveness of the Colorimetric Indicator. Eco Sure brand high solids enamel and primer paints, and So Sure brand standard lacquer and enamel paint products were selected to represent the paint products category. These paints contained propane, butane, isobutane and dimethyl ether propellants; aliphatic and aromatic hydrocarbons; and ketones and other oxygenated solvents. Some of the paints contained dichloromethane. Brakleen, manufactured by CRC Chemicals, was selected to represent the chlorinated solvent cleaner category and contained primarily carbon dioxide propellant, tetrachloroethene, and trichloroethene, along with some hydrocarbon solvents. Corrosion Preventative Compound (CPC) manufactured by LHB Industries was selected to represent the hydrocarbon cleaners and lubricants category. The CPC contained propane, butane, isobutane, and Freon propellants; aliphatic and aromatic hydrocarbons; and Freon, aliphatic, and olefinic chlorinated solvents.

A series of seven (7) test runs were conducted to evaluate the Katec Aerosolv® System for treating the three types of aerosol can products. During the seven test runs a total of 2270 waste aerosol cans were punctured and drained using the Aerosolv® System. This included 1690 paint aerosol cans, 350 CPC aerosol cans and 230 Brakleen aerosol cans. For each of the three product types, field test measurements were made to assess removal effectiveness, system capture efficiency, effectiveness of the carbon filter and Colorimetric Indicator, and protection of worker heath and safety. Field test measurements made during each test run consisted of:

- Weighing each aerosol can before and after treatment to determine the amount removed.
- Determining the tare weight of a representative number of cans of each product type.
- Weighing the Aerosolv® System before and after each test run to determine the amount captured.
- Continuously monitoring total hydrocarbon emissions immediately downwind of the Aerosolv® Puncturing Unit and at the carbon exhaust using a Total Vapor Analyzer with a Flame Ionization Detector (FID) calibrated to methane.
- Collecting personal monitoring and area samples to evaluate worker exposure during operation of the Aerosolv® System for each of the three product types. Samples were collected and analyzed using OSHA Methods 07 and 48 for the target constituents expected to be in the products tested.
- GC/MS analysis by EPA Method 8260 of liquid collection drum samples for each product type to confirm the composition of the products being tested.
- Monitoring wind speed with a Met-One wind speed indicator and Campbell Scientific data logger .

Details of the evaluation, including data summaries and discussion of results may be found in the report entitled "Environmental Technology Verification Report, Aerosolv® Aerosol Can Recycling System ."

VERIFICATION OF PERFORMANCE

Performance results of Katec, Inc.'s Model 6000 Aerosolv® Aerosol Can Recycling System are as follows:

- *Removal To 3% Capacity:* The Aerosolv® System effectively removed the residual contents for waste aerosol cans less than 25% full. In six of the seven test runs conducted for the field test, the Aerosolv® System removed the residual contents in aerosol cans runs to below 3% of their original net contents (upper 95% confidence limit of the mean), the federal definition of an empty container. For the one paint test run which did not meet this objective, Test Run #1, the Aerosolv® System removed the residual contents to 3.41% (upper 95% confidence limit). As expected due to higher solids content in paint products, the Aerosolv® System was less effective in removing residuals from paint products than for the other two product types tested. Additionally, the two paint test runs involving fuller cans showed higher percent residuals remaining.

- *Capture Efficiency:* The Aerosolv® System captured 83.2%, 96.8% and 94.9% (lower 90% confidence limits of the means) of the liquid and gaseous contents removed from the respective paint, CPC and Brakleen products tested. The amounts not captured were lost to the atmosphere due to fugitive emissions around the puncturing device or emissions from the carbon filter.

- *Carbon Filter Effectiveness:* The carbon filter was effective in capturing emissions from the Aerosolv® System during the puncturing and draining aerosol cans. The capacity of the carbon filter, however, was limited. Plots of the breakthrough curves indicate that the emissions increase rapidly as the emission levels approach the carbon filter changeout criterion of 100,000 ppm total hydrocarbon emissions. The field test results show that the Aerosolv® System can process at least 187 waste aerosol paint cans (lower 90% confidence limit) with an average fullness of 17% before the filter reaches the changeout criterion. The field test results also indicate that the mass adsorbed on the carbon filter before changeout was about 60% greater for the CPC products tested than for the paint products. This is probably due to the propellant in the CPC product tested being one that is known to strongly adsorb onto carbon, while other propellants do not adsorb as strongly. A filter was not saturated during the Brakleen aerosol product test runs and a relatively low mass of tetrachloroethene was adsorbed onto the carbon filter.

- *Carbon Filter Monitoring:* The Colorimetric Indicator did not work as claimed and did not effectively monitor the carbon filter for breakthrough. Based on the field testing experience, the best approach to determine when to replace the carbon filter is to continually monitor the carbon filter exhaust with a TVA-FID monitor (or equivalent). The next best approach would be to weigh the carbon filter before and during use to determine when it has reached capacity.

- *Katec Aerosolv® Puncturing Unit:* Based on observations during the field test, certain mechanical components of the Aerosolv® Puncturing Unit lack reliability. The lock knob failed on one Aerosolv® Puncturing Unit after less than 350 cans and failed on another after approximately 1000 cans. In each case, the failure rendered the unit inoperable. On another unit, the puncture pin was observed to protrude into the barrel of the unit when in the retracted position, preventing proper operation.

- *Katec Aerosolv® System Compatibility with Aerosol Can Products:* Based on observations made during the field test, the Aerosolv® System is not compatible with compounds present in chlorinated solvent products or with hydrocarbon cleaners and lubricants which contain chlorinated propellants. The hydrocarbon cleaner/lubricant used during the field test contained Freon propellants as well as Freon-113 solvent, while the Brakleen product contained tetrachloroethene. For these product types the gasket in the unit swelled such that a can would not seal properly before puncturing. It is unknown whether acetone or other ketones also present in the hydrocarbon lubricant/cleaner might have also been incompatible with the gasket material. Because of the risk of uncontrolled emissions during the puncturing operation, the Aerosolv® System should not be used for products containing halogenated compounds or other constituents which are not compatible with the seal and gasket materials.

- *Liquid Collection Drum:* The technology's performance and safety when the liquid collection drum had a minimum of headspace was not fully evaluated during the field test. The 55-gallon liquid collection drums used during the field test were never filled to more than 29% of their capacity, well below the 70% maximum capacity specified in the Model 6000 Instruction Manual. Reduced headspace would mean higher pressures in the liquid collection drum during puncturing operations and consequently a higher potential for emissions and releases around the puncturing unit's gasket and seals.

- *Worker Health and Safety*: Based on field test results, it could not be determined that potential exposures will not occur in the absence of appropriate engineering and administrative controls, or personal protective equipment. Therefore, each specific operation should be evaluated to determine the appropriate controls and personal protective equipment required to address potential worker health and safety concerns.

Results of the verification show that the Katec, Inc. Model 6000 Aerosolv® Aerosol Can Recycling System is capable of treating hazardous waste aerosol cans which are less than 25% full such that they are non-hazardous and may be recycled as scrap metal. The Aerosolv® System did not function properly for use with aerosol can products containing halogenated hydrocarbons because of the incompatibility of these solvents or propellants with the seal materials used in the Aerosolv® Puncturing Unit. End-users should follow procedures for operating and maintaining the technology described in Katec, Inc.'s Aerosolv® 6000 Instruction Manual.

End-users should contact their appropriate local, state, or federal regulatory authority regarding required permits for hazardous waste treatment and air emissions, and regarding the management of the collected liquid residuals, spent carbon filters, and treated aerosol cans.

Originally Signed by
E Timothy Oppelt
December 21, 1999

E. Timothy Oppelt Date
Director
National Risk Management Laboratory
Office of Research and Development
United States Environmental
Protection Agency

Originally Signed by
James Allen
December 24, 1999

James T. Allen, Ph.D., Chief Date
Office of Pollution Prevention
and Technology Development
Department of Toxic Substances Control
California Environmental Protection Agency

Availability of Verification Statement and Report

Copies of the public Verification Statement and Verification Report are available from the following:

1. **U.S. EPA**

   Web site: http://www.epa.gov/etv/library.htm *(electronic copy)*

2. **Department of Toxic Substances Control**
   Office of Pollution Prevention and
   Technology Development
   P.O. Box 806
   Sacramento, California 95812-0806

   Web site: http://www.dtsc.ca.gov/sppt/opptd/etv/txppetvp.htm
   or http://www.epa.gov/etv *(click on partners)*

(Note: Appendices are not included in the Verification Report and are available from DTSC upon request.)