

EXECUTIVE SUMMARY

Project H76 Overview

In 2002, the Texas Commission on Environmental Quality (TCEQ) established the first set of regulations limiting emissions of highly reactive volatile organic compounds (HRVOC) via both long-term cap (HRVOC emissions cap and trade, or HECT program) and short-term emission limit. Modified in 2004, this program limits emissions from 51 affected facilities in Harris County, Texas, to collectively no more than 3,451.5 tons of HRVOC annually. It also limits emissions of HRVOC from any facility in Harris County to no more than 1,200 pounds in any one hour. Compliance with these limits is demonstrated through use of emission source testing, process knowledge and, in the case of most affected facilities, installation and operation of continuous emission monitor systems (CEMS) on flares and cooling towers.

In May 2006, the Houston Advanced Research Center (HARC) authorized ENVIRON to investigate the effectiveness of HRVOC monitoring as a control measure. Designated Project H76, the work involves a comprehensive quantitative and qualitative review and analysis of HRVOC emissions monitoring data for representative facilities that are located in Harris County and subject to both short- and long-term HRVOC emission limits. Among other anticipated outcomes, the primary goal of Project H76 is to provide insight into the effectiveness of monitoring as an emission control strategy.

Nine facilities representing eight companies participated in this study.

Basell USA – Bayport Plant

Celanese, LTD – Clear Lake Plant

Chevron Phillips Chemical Company, LP – Cedar Bayou Plant

ExxonMobil Chemical – Baytown Chemical and Baytown Olefins Plants

ExxonMobil Corporation – Baytown Refinery

Lyondell Chemicals / Equistar Chemicals, LP – Channelview Chemical Complex

Shell – Deer Park Plant (refinery and chemical plant)

Texas Petrochemicals, LP – Houston Plant

Collectively, these facilities represent 67.5% of the HRVOC allowance allocated to facilities in Harris County and they continuously monitor 41 flares and 50 cooling towers.

Study participants provided both quantitative monitoring data and qualitative HRVOC program implementation information in support of this study. This data and information were evaluated with respect to, among other items: monitoring implementation schedule and difficulties, actual emissions in comparison to HECT program allowance allocations, actual flare and cooling tower emissions in comparison to historical reported values, use of monitors to eliminate/reduce sources of HRVOC emissions, changes in practices resulting from use of HRVOC monitors, HRVOC emission control projects, costs and cost effectiveness, and use of remote sensing technologies.

Key Findings

The key findings of Project H76 investigations are as follows.

- For the nine facilities participating in the study, eight projects have been or are being implemented that, collectively, will reduce HRVOC emissions approximately 396 tons/year. This is equivalent to approximately 17% of the annual allowances allocated to the study participants as a group. As discussed in more detail within the body of this report, several of these projects were undertaken for other reasons, with HRVOC control being a secondary benefit. The largest project (as measured by capital cost) undertaken by the study participant group is designed to control unscheduled, episodic emissions for purposes of complying with the short-term, 1200 pound per hour HRVOC emission limit. Reductions in actual annual emissions that will result from this project have not been estimated.
- Collectively, HRVOC projected annual emissions from study participant facilities are less than HECT program allowance allocations. However, there is significant variability within the study group, with projected actual emissions ranging from 18% to 115% of annual allowance allocations.
- No study participant indicated that they are going to rely upon the purchase of allowances to cover actual emissions in excess of allocations. Instead, they are taking measures necessary to ensure that site and/or company allowance allocations are more than adequate to cover anticipated actual emissions.
- Some study participants have taken steps to use HRVOC monitoring data to improve operating and maintenance practices that may eventually may lead to a reduction in emissions. However, at this time, insufficient data is available to quantify any future emission reductions resulting from improved practices.
- HRVOC monitoring program implementation costs are higher than estimated during HRVOC rule development. For example, the average cost of an installed HRVOC monitor at the participating facilities is approximately \$569,000. This compares to an estimate of \$88,000 to \$90,000 presented in the 2002 HRVOC rule development documents. Actual source testing costs and estimated annual operation and maintenance costs are also higher than estimated during rule development.
- Insufficient data is available at this time to evaluate economic benefits resulting from the recovery and sale or reuse of materials that would have otherwise been emitted or flared.
- Use of remote sensing to identify and reduce and/or eliminate sources of HRVOC and other emissions has already demonstrated specific economic and environmental value.
- Data collected by the Houston Regional Monitoring Corporation indicates a significant reduction in annual average HRVOC concentrations along the Houston Ship Channel between 2003 and 2005. ENVIRON discusses in the Analysis section of this report the potential reasons for this reduction; however, to the best of our knowledge, no investigation into the actual causes has been conducted.
- HRVOC emissions to atmosphere from flares are estimated by assuming a destruction efficiency. Even a modest variation in actual flare performance relative to assumed performance could significantly impact actual versus reported emissions.

In addition to the key findings, ENVIRON identified the following best management practices among study participants.

- Early engagement in the regulatory development and stakeholder process.
- Allocate sufficient resources in a timely fashion. Ideally the regulations should allow for a two year

implementation schedule.

- Leverage existing environmental data management systems or implement systems that have been used successfully in similar applications at other sites.
- Access to a sufficient number of skilled analyzer technicians and/or engineers.
- Active use of HRVOC monitoring data to improve operations and maintenance practices. Ultimately, this should result in improved environmental and economic performance.
- Greater use of remote sensing technologies to find and fix sources of HRVOC and other VOC emissions. One study participant claims that the payback on the purchase of infrared cameras has been less than four months.

Recommendations

ENVIRON offers the following recommends with respect to Project H76 findings.

- Further study once at least two years of monitoring data is available to evaluate trends and develop more detailed cost-effectiveness estimates.
- Investigate the underlying causes for the observed 36% decrease in Houston Ship Channel HRVOC concentrations between 2003 and 2005.
- Continue the investigations initiated by URS Corporation and the University of Houston in 2004 with respect to flare performance. Specifically, through use of remote sensing technologies, investigate in-field destruction efficiency of flares under a variety of operating and meteorological conditions.
- Continued investigation of opportunities for use of remote sensing to identify sources of emissions for use in developing cost-effective, source-specific reduction strategies.