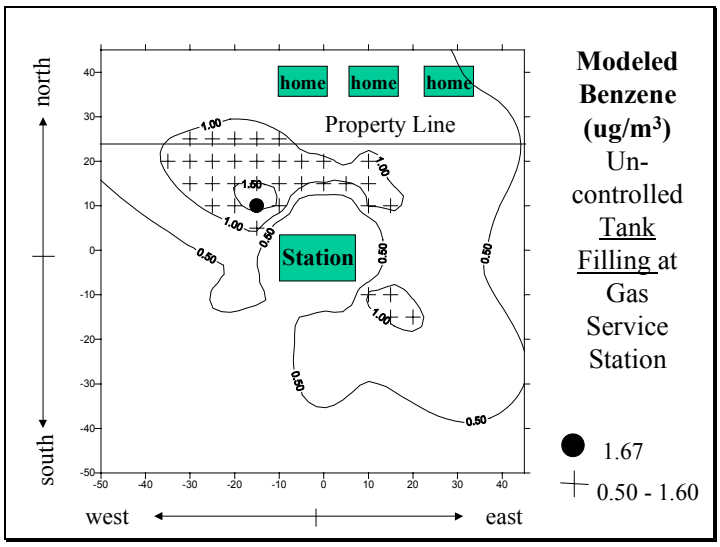
Stage One Vapor Control in Minnesota

Minnesota's concerns about air pollution.

In response to Legislative concerns about air quality in Minnesota, the Minnesota Pollution Control Agency (MPCA) produced a report this year about the state's air quality, future trends and approaches to address pollutants of concern. Among the pollutants of greatest concern to the MPCA are benzene and pollutants that form ground level ozone, or smog. The MPCA proposed a mixture of regulatory and voluntary approaches to drive measured benzene concentrations to below health risk benchmarks. Additional approaches were proposed to ensure that Minnesota continues to meet federal air quality standards, especially for ozone, into the future. Concern about ozone has increased since the release of the report because the Twin Cities had several air alert days this summer. On four occasions ozone concentrations were at levels deemed unhealthy for sensitive populations, which includes children, people with lung diseases, the elderly and athletes.

As part of its strategy to reduce benzene emissions and ozone-forming pollutants, the MPCA is pursuing a voluntary program with gasoline service stations. There are about 4000 gas stations in Minnesota and they dispensed approximately 2.5 billion gallons of gasoline in 2000. Emissions from these gas stations consist primarily of volatile organic compounds (VOCs), which are ozone-forming pollutants. In addition, some VOCs are also classified hazardous air pollutants (HAPs) under the Clean Air Act Amendments of 1990, including benzene.

The greatest impact of many HAPs, like benzene, is local. In other words, the pollutant concentration is greatest within very short distances (feet to miles) of the source rather than hundreds of miles from the source. Computer modeling is used to estimate the concentration of pollutants emitted from a source. The figure below illustrates the results of a modeling exercise for a hypothetical gas station. This figure illustrates that the greatest concentration of benzene emitted from a gas station is predicted to be in the immediate vicinity of the tank's vent pipe with high concentrations at the property line.



In the case of the hypothetical gasoline service station, the greatest impact from VOC emissions may be tens to hundreds of miles away due to the ozone formation that results from the reaction of VOCs in sunlight. There are relatively few other cities of the Twin Cities' size that have always met the ozone standard. With increasing urban development and vehicle miles traveled, however, the MPCA is concerned about future ozone attainment. To help ensure future compliance with federal ozone standards, the MPCA is looking to reduce ozone-forming pollutants with proven and cost-effective means that are not required in Minnesota at this time and thus are often not employed.

Gasoline and sources of emissions.

The sources of emissions from gas stations can be divided into three main categories, stage-one, stage-two, and spillage emissions. Stage-one emissions are those that occur while refilling the underground storage tanks at the gas station. Stage-two emissions are those that occur while refilling a vehicle. Spillage emissions are those that occur as a result of spilling liquid gasoline. Stage-two (and to a certain extent spillage) emissions are being addressed through federal vehicle standards which require the use of on-board vapor recovery equipment. Stage-one emissions account for about 1/3 of the emissions from gas stations. Gasoline station stage-one emissions contribute about 0.82% of total benzene emissions and about 3% of total VOC emissions in Minnesota.

Stage-one vapor recovery reduces VOC emissions from refilling the tanks by 95 or more percent. In addition to being effective in reducing VOC emissions that affect ozone concentrations in a region, the stage-one vapor recovery equipment effectively reduces emissions of HAPs such as benzene. These emission reductions affect the concentration of these pollutants in the area and, perhaps more importantly, in the immediate vicinity of the gasoline service station. The concern is for long-term residents near these facilities. The *MPCA Staff Paper on Air Toxics* reported average monitored benzene concentrations in Minnesota ranging from 0.649 to 3.185 $\mu g/m^3$. Modeled benzene emissions from filling gasoline storage tanks increase those concentrations by as much as 1.521 $\mu g/m^3$ at the property line. This would produce an estimated benzene concentration as high as 4.706 $\mu g/m^3$ at the property line. The health benchmark for benzene is 1.3 to 4.5 $\mu g/m^3$. With the installation of stage-one vapor recovery equipment and the turnover of the vehicle fleet in Minnesota (to vehicles with on-board vapor recovery), the modeled increased ambient benzene concentration from gasoline service stations would decrease to 0.216 $\mu g/m^3$ above background concentrations.

Cost of Stage One Vapor Control in the Twin Cities.

The cost to install a stage-one vapor recovery system can be as little as $1050 for a station with three storage tanks with adequate access to as high as $15,000 if an extraordinary amount of work is necessary (e.g. a lot of concrete has to be removed and later re-poured). A typical cost of retrofitting a gas station including some concrete work is approximately $10,000. Using control cost methodologies developed by the US Environmental Protection Agency, if a retrofit cost is $15,000 and amortized over twenty years at 10% APR, the annualized cost is $1762.50. If the retrofit cost is $1050 and amortized over the same period at the same rate, the annualized cost is $123.38.

Using the above stated throughput and cost estimates, the amortized cost to reduce VOC emissions ranges from $18.98/ton of VOC to $705/ton of VOC. Recent analyses conducted by

the businesses in Minnesota, including refineries, considered $3,000 to $4,000/ton to be a reasonable cost. Another yardstick by which to measure the cost of installing stage-one vapor recovery is the increased price per gallon if the cost was passed through to the consumer. The estimated price increases, based on the above-stated cost and throughput assumptions, range from $0.0028/gal. (0.28 cents/gal) to $0.000082/gal. (0.0082 cents/gal.).

Conclusion: the benefits of a proactive voluntary effort.

Stage-one vapor control at gas stations is a proven and cost-effective control measure to reduce emissions of ozone-forming pollutants and particularly benzene. It reduces measurable amounts of pollutants at the property line of each station and would improve air quality in the Twin Cities metropolitan area as well. The MPCA is committed to a voluntary approach to meet the goal of having 85% of gasoline sold in urban areas coming from stations with stage one controls by June 2003. The MPCA will be reporting its progress in achieving this goal, and the other goals outlined in this year's air quality report, during the next legislative session. We look forward to the opportunity to share our successes at that time.

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