



Emission Controls - Product Transfer & Storage

This monograph, one in a series of single issue documents that deal with our local environment, has been prepared by the Sarnia-Lambton Environmental Association in co-operation with the School Boards of Lambton Kent

Introduction

Emissions lost to the air are nearly impossible to capture; for this reason, continued improvements to control systems are essential. Photochemical smog, (see monograph A2), is produced when nitrogen oxides react with volatile organic compounds that are present in the atmosphere. Photochemical smog is a common summer-time reminder that emissions to the atmosphere must be controlled. Stringent control systems have been proposed for Canada's densely populated areas, specifically, the Lower Fraser Valley and the Windsor-Quebec corridor.

Facts

Trace Emissions Can Be Detected



Control of Gaseous Emissions

Valves, Pumps, Connections

In a typical oil refinery or chemical plant, 20,000 to 30,000 valves control the flow of substances. Emissions from valves and pumps are reduced through monitoring systems and servicing programs.

Storage Tanks

Vapours are displaced (vented) when products are pumped into tanks and also when the contents of tanks are warmed, eg. sunny days. Methods to control such venting problems include floating roof tanks, vapour balance systems, and vent adsorption systems.

Key Words

- fugitive* - emissions from sources that cannot specifically be identified and quantified, eg. emissions from valves, flanges, pumps, compressors, cooling towers, storage tanks
- adsorption* - a concentration of molecules on the surface of a substance such as carbon; moderate attraction between molecules accounts for adsorption forces.
- contaminant* - any solid, liquid, gas, odour, heat, sound, vibration, radiation or combination thereof resulting directly or indirectly from human activities that may cause an adverse effect.
(Ontario Environmental Protection Act)
- seal* - any device or system that controls leakage.
- vapour* - any substance in the gaseous state, that under ordinary conditions would usually be a liquid or solid, eg. water vapour

Vapour Emissions - Some Control Systems

Floating Roof Tanks Reduce Product Losses

This aerial photo shows part of an oil refinery storage tank farm.

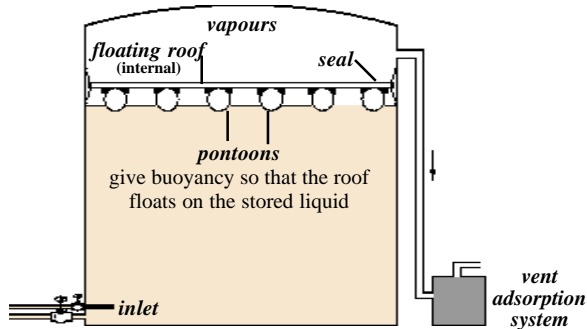
Two types of tanks are apparent -

- (1) **floating roof** - the roof floats on the stored liquid product.
- (2) **fixed roof** - some of these have internal floating roofs.

Vapours are displaced when:

- products are pumped into tanks,
- temperature increases cause expansion of tank contents.

Internal floating Roof Tank



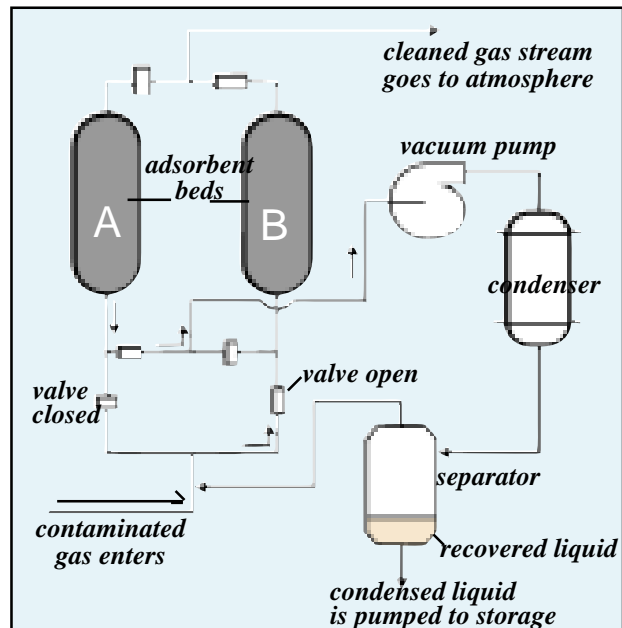
Vent Adsorption System

This adsorption system consists of two adsorbent beds, a vacuum pump, condenser and separator. In operation, a contaminated vapour stream is directed to one of the two adsorbent beds where contaminants are captured. While one bed removes contaminants the second is regenerated. During regeneration, low pressure (produced by a vacuum pump) together with heat built up during the adsorption cycle, removes vapours from the adsorbing material. These vapours are then condensed and returned to storage. Control valves switch the adsorbent beds so that they alternate between contaminant capture and contaminant removal.

- bed A - is being regenerated
- bed B - is removing contaminants from a gas stream



Venting problems are significantly reduced in Lambton County through storage in salt caverns; the temperature, 600 metres below ground level, is quite constant at 20° C.



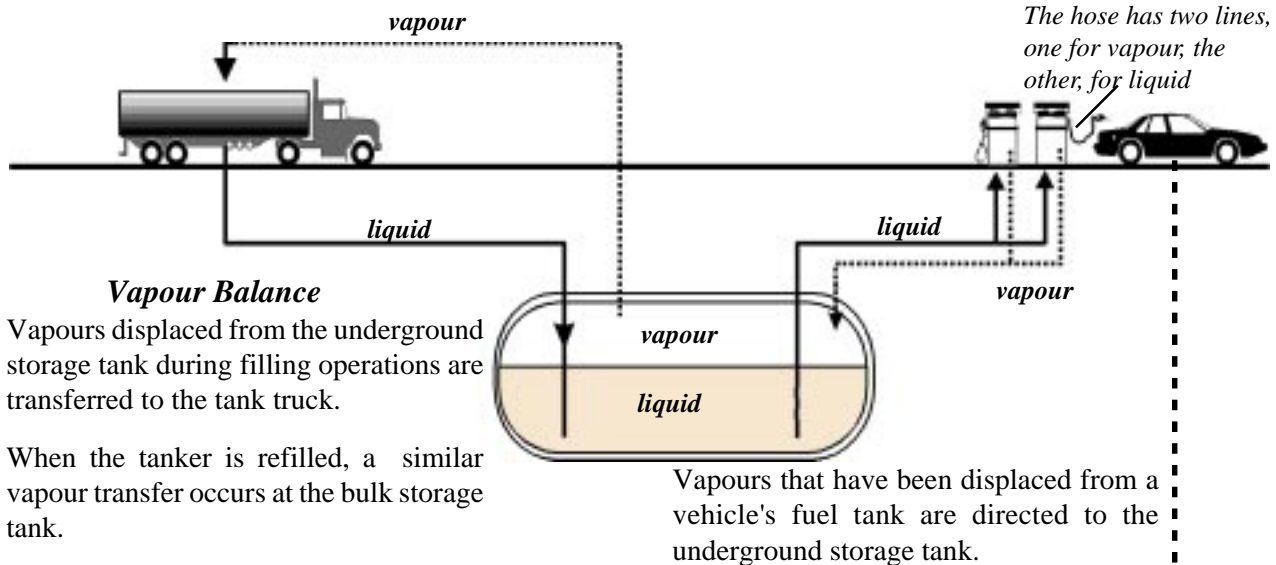
Vent recovery systems collect up to 85% of vapours that would otherwise escape to the atmosphere.

Vapour Emissions - Some Control Systems

Gasoline Vapour Recovery

When gasoline is pumped into storage tanks, gasoline vapours are displaced from the tanks. Use of vapour recovery equipment reduces gasoline vapour emissions during such product transfers by approximately 90%.

CCME, pages 16, 30

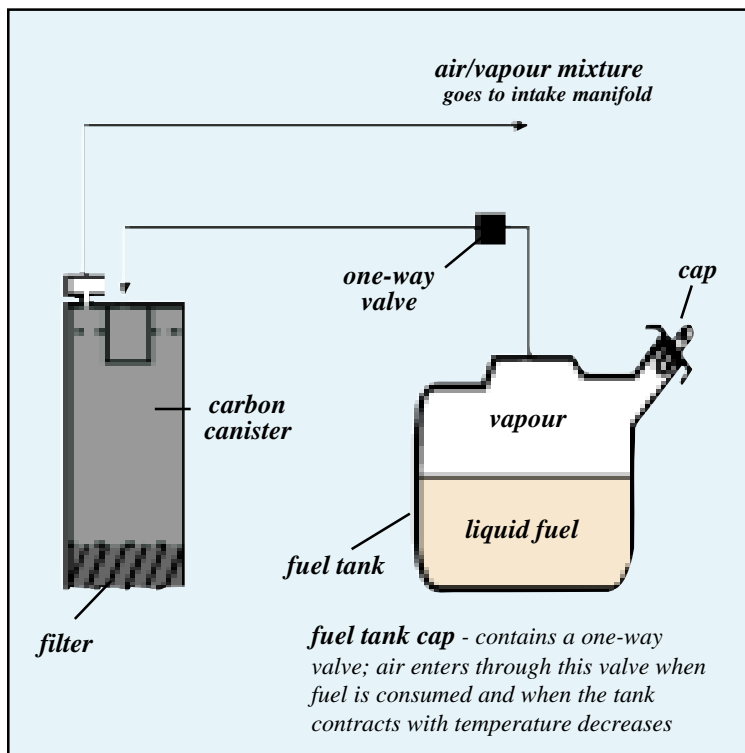


Vapour Balance

Vapours displaced from the underground storage tank during filling operations are transferred to the tank truck.

When the tanker is refilled, a similar vapour transfer occurs at the bulk storage tank.

- Gasoline Vapour Recovery**
- * is used in some densely populated areas
 - * vapour recovery controls, including larger on-board canisters, are being considered for use in Canada



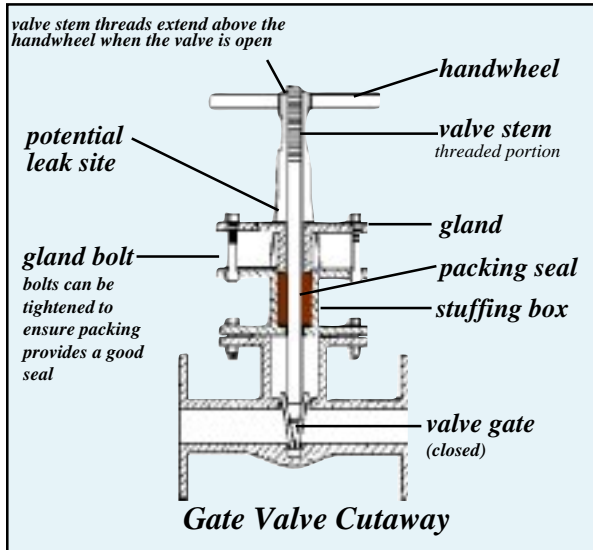
Evaporative Emissions Control

Installation of carbon canisters, for control of evaporative emissions, from vehicles operated in Canada was instituted in 1968.

When temperatures rise causing expansion of fuel in the tank, vapours are displaced from the tank through connecting lines to a carbon-filled canister where carbon adsorbs the vapours. When the engine is fully warmed up, the car's electronic control module initiates a vacuum on the canister causing air to enter through a filter at its base. The air/vapour mixture is drawn into the vehicle's combustion chambers where the vapour is burned.

CCME, page 31

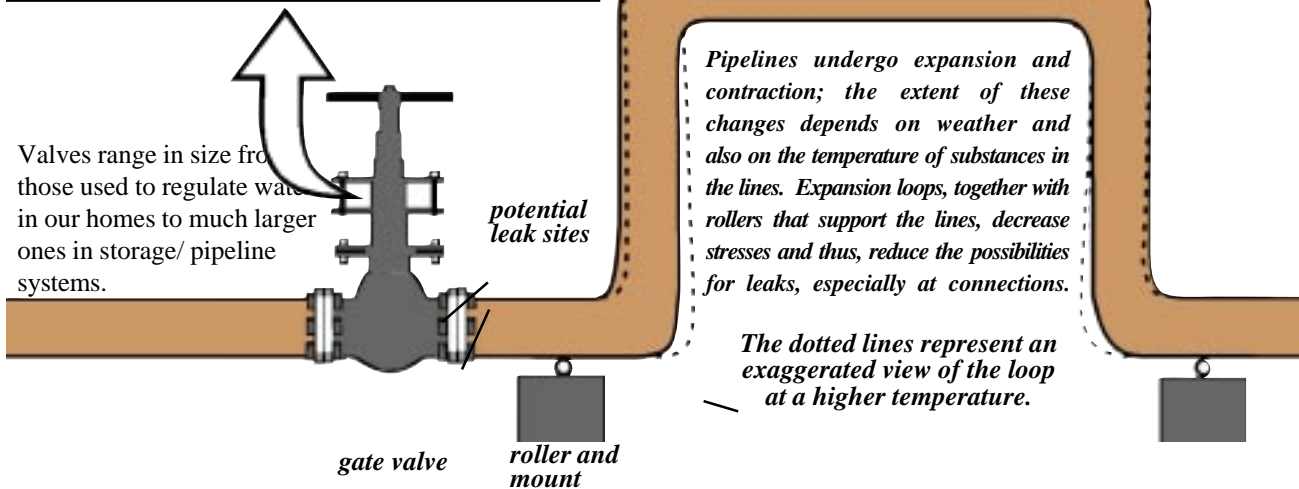
Effective Emissions Controls Include:



* Continuing Technological Improvements

* Regular Maintenance Checks / Servicing

Seals minimize emissions between the stem and body of the valve. As the wheel of the valve is rotated, the stem (threaded) raises or lowers the gate thus regulating flow rates. Frequent operation of the valve necessitates regular servicing of the seal. The seal is created and maintained by the valve packing located in the stuffing box and gland of this gate valve



Conclusion

Some sources of emissions together with control systems have been introduced in this monograph. The resources listed below will assist readers who wish to pursue the topic.

Resources

- Air & Waste Management Assc., 1992, Air Pollution Engineering Manual
- Canadian Council of Ministers of the Environment (CCME), 1991, Environmental Code of Practice For Vapour Recovery in Gasoline Distribution
- Environment Canada, 1992, Implementation of Stage II Vapour Recovery in the High Ozone Regions of Canada
- Environment Canada, 1993, Programs/Strategies to Minimize and Prevent Benzene Releases from Industrial, Commercial and Transportation Sources

Information Compiled by:

Tom Hamilton, teacher, retired

* materials from this monograph may be reprinted

* references are available in our Resource Centre

* additional copies of this monograph are available from the Sarnia-Lambton Environmental Association or on-line at www.sarniaenvironment.com

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Sarnia Lambton Environmental Assoc.

Suite 111, 265 N. Front Street
Sarnia, Ontario
N7T 7X1

(519) 332-2010

email: admin@sarniaenvironment.com