

MTBE & the Environment

Air quality benefits

Direct effects

Using MTBE in unleaded gasoline has resulted in a remarkable reduction of specific pollutants limited by law, such as carbon monoxide (CO) and unburned hydrocarbons (HCs), as well as other serious pollutants such as particulate matter (PM) and ground-level ozone (O₃).

Indirect effects

Using MTBE in unleaded gasoline has also resulted in the reduction of sulphur, olefins, aromatics and benzene levels, regardless of whether the fuel is used in current or older technology vehicles.

A summary of the emission reductions are tabulated below :

Carbon monoxide	CO emission is reduced on average by at least the same percentage as MTBE content in gasoline
Unburned hydrocarbons	For each 1 or 2% of MTBE, there is a 1% reduction in total HC emissions.
Particulate matter	It is estimated that each 1% of MTBE results in a 2 to 3% PM emission reduction.
Ozone	MTBE generates about half the ozone compared with iso/alkylates and one-tenth that of aromatics.
Benzene	It is estimated that, for each 1% of MTBE, there is an equivalent percentage reduction in benzene emissions, both evaporative and exhaust.
Olefins	MTBE displays low vapour pressure and low volatility compared to olefins. Converting olefins to MTBE in the refinery removes some of the most reactive and volatile components from the gasoline pool.
Lead	MTBE is an ideal substitute for lead, a toxic compound that has been phased out in most parts of the world.

As an example of the potential air quality benefits of MTBE, the following significant reductions of pollutants have been achieved through the use of reformulated gasoline containing 10-15% MTBE, compared to conventional gasoline:

- 20-25 % less carbon monoxide
- 10-15% less unburned hydrocarbons
- About 30% less particulate matter
- 20-30% less benzene
- 5% less nitrogen oxides
- 15% less evaporative emissions
- Reduction of ground-level ozone

In the United States, federal air quality improvement programmes that require the use of oxygenated fuels have resulted in reductions of up to 95% in the number of days exceeding air quality standards.

The US EPA has reported the following on the resultant use of MTBE:

- A benzene reduction of approximately 40% and
- An overall air toxics reduction of approximately 30% (versus the 15% minimum requirement) following the introduction of Phase 1 reformulated gasoline in 1995.

- EPA has attributed two-thirds of the observed “over compliance” to the use of oxygenates in RFG. California’s Air Resources Board reports similar findings for the state’s cleaner burning gasoline.
- It concluded that the annual reductions in cancer incidence due to toxic air emissions are in the order of 40%-50%.
- Clearly, this outcome is enhanced by the unique and far more stringent gasoline formulation used exclusively in that state.
- However, 95% of the state’s cleaner burning gasoline contained MTBE in 1998; emission estimates using the CARB predictive model indicate that approximately 25-33% of the observed overall reduction in toxics is ascribable to the use of MTBE.

The introduction of “reformulated gasoline” in the USA, and of “cleaner burning gasoline” in California has resulted in significant reductions of toxic pollutants.

In fact, according to the California Air Resources Board (CARB), cleaner burning gasoline with MTBE has:

- Reduced smog-forming emissions by more than 1300 tons per day.
- Eliminated toxic emissions equivalent to removing 3.5 million cars from Californian roads.
- Reduced human cancer risk related to gasoline exposure by an estimated 40%.

In Finland, the widespread use of oxygenated fuel containing 9-13% MTBE has reduced CO emissions by 10-20% and hydrocarbons by 5-10%.

Environmental Successes of Cleaner Burning Gasoline

The 1990 Clean Air Act amendments resulted in many changes to US gasoline. These gasoline improvements have achieved major reductions of air pollution in the US. For example, cleaner burning gasoline made with MTBE has achieved emissions reductions as follows:

In California, since 1990, cancer risk from toxic air pollutants is 40% lower, ozone violations have been reduced by as much as 70%, and except for Los Angeles, all other areas of California have achieved the carbon monoxide standard.

Since 1994, in the Northeast, US cancer risk is 12% lower, ambient benzene levels are 38% lower, ozone precursors are 20% lower (in RFG areas), carbon monoxide levels are 10% lower, and ambient lead levels are 78% lower, since the phase-out of leaded gasoline.