Issues for comment:

11. The emission effects of higher ethanol blends.

C: Health and Safety Implications

Storage and stability

There is a range of safety issues directly relating to the storage and stability of ethanol blends. However, there is a range of vehicle operability issues that may also have broader safety implications. As a result, this section covers issues that relate to storage and stability of ethanol blends as well as the potential impacts of such blends on general vehicle operability.

Storage and handling

In the US, there are specific storage and handling procedures for ethanol blends at distribution and service stations, these include requirements for: tanks and tank linings, piping and fittings, and pumps and dispensers.[70] The Australian Institute of Petroleum is currently developing a code of practice for the storage of ethanol blends.

Although some materials used to fabricate storage systems may have evolved over time to accommodate the storage of ethanol and ethanol blends, a recent US study has revealed that some single-walled fibreglass reinforced plastic tanks as well as some gaskets, sealants, adhesives and other component materials, may not be compatible with ethanol.[71]

Issues for comment:

12. The potential impact of higher ethanol blends on materials construction in the petrol distribution and storage system.

Phase separation in storage tanks

Ethanol blends are particularly sensitive to poor handling and storage practices because of the possibility of phase separation. Phase separation can occur when too much water is introduced into a storage tank. Water has a higher density than petrol, so if water separates, it will form a layer below the petrol. As ethanol has an affinity for water, ethanol blends are more likely to suspend moisture and carry it into the fuel system than non-oxygenated fuels. The higher the ethanol content of a fuel, the greater the amount of water that can be absorbed by the fuel without phase separation occurring. However, if too much water is introduced into an ethanol blend, the water and most of the ethanol (around 60% - 70%) will separate from the petrol and the remaining ethanol. The amount

[70] American Petroleum Institute, 1985, Storing and Handling Ethanol and Gasoline-Ethanol Blends at Distribution Terminals and Service Stations.
[71] NESCAUM, 2001, Health, Environmental and Economic Impacts of Adding Ethanol to Gasoline in the Northeast States.

of water that can be absorbed by ethanol blended petrol without phase separation, varies from 0.3 to 0.5%, depending on temperature, aromatics and ethanol content.[72]

Because ethanol is hygroscopic and can absorb water from the atmosphere (and any vessel containing water that it enters), it is prudent to ensure that water contamination does not occur in the distribution and storage of ethanol blends.[73]

In terms of storage and stability, the NERDDC E15 trial suggested that phase separation stability tests would require a six-month trial on an open vessel to allow the ingress of moisture to assimilate the conditions consistent with ambient air entering underground storage tanks.[74]

Phase separation in the vehicle's tank

Water in petrol can have dramatically different effects on an engine, depending on whether it is in solution or a separate phase. A small amount of water solution in a homogeneous ethanol/petrol blend has no adverse effect.[75] If phase separation occurs and ethanol rich water is drawn into the engine then the engine will stall. Phase separation can occur in a vehicle's tank as a result of first fuelling with an ethanol blend then going out of the ethanol blend system. This situation arises if, for example, a quarter of a tank of ethanol blend is supplemented by three-quarters of a tank of petrol at refill, causing the concentration of ethanol in the blend to fall. It is therefore possible that in this situation, the presence of water normally contained within the ethanol blend may be sufficient to precipitate phase separation.[76]

Issues for comment:

13. The contribution of ethanol content to phase separation in:
a.) the storage and distribution network; and
b.) vehicle tanks.

BTEX plume

Spills of ethanol blends may result in more persistent BTEX (benzene, toluene, ethylbenzene and xylene) plumes in groundwater. There are three properties of ethanol blends of potential concern: a co-solvency effect that makes other petroleum constituents more soluble in groundwater; depletion of oxygen and other nutrients in groundwater due to rapid biodegradation of ethanol that inhibits the degradation of other more toxic components in petrol; and a surface tension effect that takes place when ethanol, in contact with a layer of gasoline on top of the water table, causes greater lateral spreading of the petrol.[77] Studies suggest that ethanol blends can cause the toxic BTEX compounds of petrol to travel up to 2.5 times farther than in the absence of ethanol.[78]

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[72] National Science and Technology Council, Committee on Environment and Natural Resources, 1997, Interagency Assessment of Oxygenated Fuels.
[73] Watson, H., 2001, Technical Assessment of "A Report on Direct Determination of the Effect of the Addition of Ethanol on the Physical Properties of Gasoline".
[74] Hassall and Associates, 1994, Extended Field Trials of Ethanol Blends in Vehicles.
[75] D. Munro, pers. comm.
[76] National Science and Technology Council, Committee on Environment and Natural Resources, 1997, Interagency Assessment of Oxygenated Fuels.
[77] NESCAUM, 2001, Health, Environmental, and Economic Impact of adding Ethanol to Gasoline in the Northeast States, July.
[78] NESCAUM, 2001, Health, Environmental, and Economic Impact of adding Ethanol to Gasoline.