# Tire dump fire
## February 12, 1990
## HAGERSVILLE (Ontario) - Canada

**Tires**
**Fire**
**Pollution**
**Malevolence**
**Difficulties of intervention**
**Evacuations**

## THE INSTALLATIONS CONCERNED :

The tire dump is situated in a rural zone on a 6,9 ha site. The ground is flat but well drained with fields for crops and grazing all around. The ground is composed of a 1 metre layer of clay on chalky subsoil.

Ten million tires were stored on 5 of the 6 ha of the site (200x300 m) at 300 m from an inlet from lake Erie. The dump, with a total volume of 200 000 m³ was not enclosed. It comprised 5 storage zones of an average height of 4m. (maximum 7 m) separated by alleys between 3 and 5 metres wide. The site had no fixed network of fire-fighting piping. The closest useable water source in case of accident was a small artificial pond 100 m away, close by the access road to the dump

## THE ACCIDENT, THE SEQUENCE OF EVENTS AND THE CONSEQUENCES :

On the 12th of February 1990, a fire, initiated in the North-West angle extended in 8 hours to the entire depot. The wind, and to a lesser degree the violent internal convection currents favoured the extension of the fire.

For the first 7 days, the Canadian authorities recommended a strategy of "Let it burn" on account of the intense heat and the impossibility for the volunteer fire brigades to reach the centre of the blaze. The intervention was thus limited to the construction of access routes, 2 on the West and North of the site and one at the South-West corner, and the hosing of the periphery using recycled fire-fighting water. The construction of the access ways was facilitated by the configuration of the ground (flat) and the frozen soil. The supply of water (286 m³/day) was handled by 9 tanker trucks from sources as far away as 7 km.

Photo DR

Later on, the requisition of heavy equipment allowed for the dismantling of the piles of tires after the passage of the fire to sort out the few unburned tires and to use them as a wind break. The firemen placed on both sides of the equipment, hosed down the cinders as well as the equipment to cool them down. At the same time, the use of foam (mixture of water / 0,3 % foaming agent), more effective than water alone, enabled the flames to be extinguished, at least temporarily. A Canadair was also requisitioned but could only fly during two days on account of the negative temperatures.

Operations were just as difficult on the ground. The firemen had to walk in the mud, always equipped with stand-alone breathing equipment. The carcasses of the burned tires were also a source of danger for the heavy equipment and their drivers who risked being immobilised in the fire zone on account of the metal wires. The fire-fighting operations continued 12 h/day in 2 teams, each working 6 hours shifts. The dangerous nature of the work (smoke, oil, mud, metal carcasses…) made it impossible to continue operations at night. The heavy equipment only operated in daytime and handled, on average 0,5 ha/day the work was finally completed after an intervention lasting 16 days and when the quasi-totality of the dump had been destroyed.

Photo DR

*Alternative strategies* :
Taking into account the circumstances, the 2 alternative strategies initially envisaged to control the fire could not be implemented: the first of these would have consisted of covering the tires with a layer of sand or earth. This solution would have necessitated too large quantities of earth to be found and transported to cover 5 ha; further, once the fire extinguished, it would have been necessary to treat enormous quantities of polluted earth. The second alternative would have consisted of introducing pipes into the heart of the fire to pump out the cinders and the liquid residue. However, in this case where the tires were very densely stacked, it would have been very difficult to insert these pipes into the piles of tires.

**Evaluation of the consequences :**

During the fire, a major part of the pollutants generated by the combustion of the tires was emitted into the atmosphere in the form of smoke. Given the intense heat produced, it is possible that a large part of the oil produced by the combustion of the tires was burned. However, a significant quantity of oil was found in the water used to extinguish the fire or penetrated the soil. Roughly 700 000 l of oil as well as double this amount of contaminated water were collected during the fire. The contaminants, (benzene, toluene…) reached the watercourse and it is to be feared that the water contaminated with oil may have penetrated the clay soil and reached into the fissures of the chalky subsoil.

The incident generated 20 000 m³ of solid waste and non collected extinguishing water, heavy with 12 to 50 m³ of liquid residues (benzene, styrene, toluene) contaminated 4,5 ha of ground. During a period of three months, 25 people were deprived of drinking water on account of the pollution of the ground water.

The importance of the incident led the authorities to evacuate 1 700 people for a period of 17 days from a zone with a radius of 4 km.

The cost of such an environmental catastrophe linked to the pollution generated is estimated at some 25 million Canadian dollars, that of the intervention (fire brigades, transport of sand, requisition of heavy material, collection of oil…) at 500 000 dollars.

EUROPEAN SCALE OF INDUSTRIAL ACCIDENTS

Using the rules for scaling by the 18 parameters of the scale formalised in February 1994 by the Committee of Competent Authorities of the Member States in application of the 'SEVESO' directive and taking into account the available information, the Hagersfield incident is characterised by the following indices:


The parameters comprising these indices are available at the following address : http://www.aria.ecologie.gouv.fr

The combustion of tires produced Seveso classified substances such as benzene, styrene and toluene. The quantities of dangerous substances released being unknown, the index relating to the quantities of materials the default index is 1 (see. parameter Q1**)**. Roughly 1 700 people were evacuated for a period of 17 days. These evacuations lead to an index relating to human and social consequences of 6 (see. parameter H7 : number of persons evacuated x number of hours, or 1 700 x 24 x 17 = 693 600 > 500 000). The blaze involved the contamination of the wells in the region and the pollution of an area of 4,5 ha, leading to an index relating to environmental consequences of 3 (see. parameter Env13 : surface area to be decontaminated, between 2 and 10 ha). Finally, the costs linked to the pollution generated and the actual intervention on the site lead to an index relating to economic consequences of 5 (parameter €18).

## ORIGIN, CAUSES AND CIRCUMSTANCES OF THE ACCIDENT:

The police despatched to the site rapidly suspected a criminal origin for this incident. The fire had been deliberately lit in the North-West corner of the site. On July 3rd, 1991, an adolescent was found guilty of having deliberately caused the fire at the tire dump and was sentenced to 16 months in prison. His 3 accomplices benefited from lighter prison sentences.

The meteorological conditions largely contributed to the rapid spread of the incident, additionally the absence of a source of water complicated the intervention of the emergency services; thus in 8 hours the entire depot was on fire while it was not only impossible to extinguish it but even to approach it

Photos DR

## SUBSEQUENT ACTION TAKEN:

Elaboration of directives for storage of tires:
Following this fire, the Ministry of the Environment and Energy of Ontario set up a working group to examine the quantities and the management of used tires, this being the responsibility of the Canadian Council of Ministers of the Environment (CCME). This group produced a document entitled "Proposed Guideline for the Outside Storage of Used Tires" from which the directives have also resulted in changes effected to the "Ontario Fire Marshals Act". Faced by a serious threat of fire, the fire service is now authorised to take preventive measures and to do whatever is necessary if it judges that a fire in a tire depot risks provoking grave human or environmental consequences, even if the risks of such a disaster are minimal.

The establishment of a procedure for the authorisation of tire depots:
In July 1991, the directives of the CCME impose an authorisation procedure for installations where large quantities or tires are stored (more than 1 000).

A legal loophole allowed the company in Hagersfield not to conform to environmental orders (obligation to separate the stacks of tires in hundreds of smaller stacks with fire breaks, the construction of chain fencing and a large reservoir of water). In fact the appeals procedure blocked the execution of all these orders. This loophole has since been closed, the Environmental Appeal Commission now having the power to take an immediate position concerning an order being appealed before the court of the province.

This fire, followed by another which took place a few months later at Saint-Amable from 16$^{th}$ to 19$^{th}$ May 1990, obliged the various Canadian provinces, all having similar depots, to develop recycling industries. A tax on new tires was decided. This tax varies from one province to another (4 dollars in Alberta, 3 in Manitoba…). With the new recycling methods in place, this new tax permitted the reduction of the deposits to the point where, in Alberta, all the tire depots were supposed to have disappeared as from 1998.

## THE LESSONS LEARNED:

Fires in tire depots, which are characterised by very abundant, black and polluting smoke, are often spectacular.

Two phases of combustion are generally observed. The first which corresponds to the combustion in freely circulating air of the tires at the periphery, is accompanied by "high" flames rising several metres above the stack, abundant smoke (nearly 1 000 m high at Hagersville) and a major radiation of heat (defoliation of trees at up to 100 m). The second phase corresponds to internal combustion following the creation of a relatively compact "crust" of cinders and steel wire from the tire carcasses. The heat radiated is then reduced, which makes intervention possible.

The quantity of liquid residues generated by the combustion or the pyrolysis of the rubber materials can be estimated at an average of approximately 5 l per tire. Despite the part consumed in the fire, one can estimate that several thousands of m³ of extinction water, heavy with these residues are poured onto the ground. Their toxicity requires that such a depot be set up on a water-proofed site.

From experience, a weak concentration of emulsifier (0,3 %) assists in the cooling of the fire-fighting material and the tires which are subjected to thermal radiation, in improving the damping and the adherence of the hosed water.

The use of water bombers during two days did not appear conclusive. Once snuffed out, the flames recovered the same vigour a few minutes later.

The Canadian authorities have introduced, for depots of more than 1 000 tires and as from the 17$^{th}$ July 1991, an authorisation procedure including a public enquiry. Among the technical conditions imposed are:

- Minimum distances of 150 m from watercourses, water catchment areas or zones of ecological interest, and 35 m from roads, railways or electrical cables of more than 750 V.

- Two access points, with roadways capable of carrying up to 20 t vehicles.

- The storage in stacks of less than 900 m² (height limited to 4 m, slope limited to 5 %) separated by passages of at least 15 m width.

- The enclosure of the entire site.

- A drainage system and a "sufficient" retention capacity for fire-fighting water (capacity not specified).

- Portable extinguishers on the site and in each service vehicle as well as a reserve of sand or earth of at least 300 m³.

- The constitution of a financial guarantee of 2 CAN$ per tire, reaching a maximum of 100 000 CAN$.

Furthermore, these used tire depots pose other problems than the fire risk. Tires buried in these dumps take up a lot of space and tend to rise gradually to the surface. Often mixed with household waste, they provide an attractive habitat for rats and other undesirable animals. Further, as they retain water, they favour the reproduction of mosquitoes with the risk of transmission of viruses such as the West Nile virus: this often fatal virus has spread very rapidly in North America and efforts to eradicate it include the elimination of used tire depots.

Thus, as much as for the fire risk as for the health and environmental risks, these tire depots must apply a very strict series of specifications. Their elimination being planned in the future, this requires the development of industries to recycle tires into new products with an added value (combustion in cement works and other industries, thermal insulation under roads or material for roadside embankments, retaining walls, base layer in systems for the recovery of leaching, synthetic coating for sports fields…).