FACTS Database with hazardous materials used for industrial safety maintained by the Department of Industrial Safety of TNO Coded Accident Abstract		Accident Nr. 10257
Identification		
Type	*Value*	*Text*
Class	* * * *	-
Abstr	Extended abstract english	-
Abstr	Extended abstract french	-
Address	i	
Adate	1988	
Time		0755
Activ	Transshipment	From road to store
Loctn	Storage/Depot	-
Surr	Other	Sea
Surr	Nearby-objects/Places	Road
Encir	Winddirection	To sea
Dtype	Wholesale	Trade of chemical products
Cause		
Type	*Value*	*Text*
Cause	Unknown-cause	Wrong connection?
Description		
Type	*Value*	*Text*
Occur	Clean	-
Eqinv	Tank	Storage tank
Load	Empty-unclean	?
Occur	Unload	-
Occur	Operators error	?
Occur	Mount/Connect	Connected the wrong tank?
Eqinv	Tankvehicle (road tanker)	-
Chem	Nitric acid	-
State	Liquid	-
Eqinv	Tank	Wrong storage tank?
Chem	Formic acid	-
State	Liquid	-
Text		Or
Chem	Ammonia	-
State	Liquid	-
Occur	Run-away-reaction	Exothermic
Occur	Explosion	-
Eqinv	Tank	Storage
Occur	Release	-
Eqinv	Vapour-cloud	Toxic, orange
Rchem	Nitric oxide (no)	-
State	Gas	-
Occur	Pollution/Contamination	-
Envdm	Air/Atmosphere	-
Envdm	Ground	Polluted with
Chem	Acid n.o.s.	-
State	Liquid	-
Occur	Fire fighting/Emergency response	Prevent spreading of acid
Occur	Dilute	Acid with water
Dtime		5/h
Occur	Safety-measures	Observed cloud by helicopter
Occur	Traffic-interruption	Road
Eqdm	Tank	Some

Eqdm	Building	In plant
Eqdm	Window	-
Dist		300/m
Fatals	Worker	1
Injurs	Worker	7-11
Wndng	Toxic-inhalation	-
Scene		
Type	*Value*	*Text*
Scene		Explosion during unloading of nitric acid from
Scene		Road tanker to storage tank caused toxic cloud
Scene		And at least 8 casualties

EXTENDED ABSTRACT ENGLISH

At about 0755 hours, a strong explosion inside a tank occurred during the unloading of nitric acid from a road tanker, followed by the release of a cloud with a yellow/red colour. This produced a rapid exothermic reaction that led to the explosion. The cloud had a strong smell and caused irritation of the eyes and skin. The main pollutants were nitrogen oxides. It seems that, by mistake, the operator connected the road tanker to the wrong tank, i.e. he emptied the nitric acid into a tank containing formic acid. The mixing of the two acids produced a rapid exothermic reaction that led to the explosion. Another possibility is that he connected the right tank, but that tank was filled with ammonia residues. The man attending the operation was killed by the explosion. Few minutes later the fire brigade intervened (using personal breathing apparatuses and protective clothing), diluted the liquid acid on the ground with water and created a containment to prevent the acid spreading over on the ground. Nebulized water was also used to dilute the nitrogen oxides vapours. In the meantime the evolution of the cloud (directed towards the sea) was continuously observed from a helicopter. Personnel on the helicopter relieved that the cloud was rapidly dispersing in about 100/meters from the source of release. At about 1200 hours the concentration of the cloud, diluted by the action of wind, was no more dangerous.
The explosion seriously damaged some tanks.

The exploded tank was cut along the inferior weld; some parts have been found at about 50/meters away while the top flange in which the relief valves were installed was found at about 100/meters away. Two other empty tanks, nearby to the exploded one, were found at 25 meters from the point where the accident occurred. The road tanker struck a wall. Some buildings inside the establishment suffered extensive damages. Some walls and roofs inside the establishment were put down. Broken windows were found up to 300/meters away. Road traffic around the establishment was prohibited for some hours. The water to the water treatment plant, connected with the chemical factory, reached a low pH (about 3.5) and returned to pH=7 after the intervention of fire brigade in diluting the liquid acid on the ground with water.

On the basis of some stoichiometric calculations it has been estimated that, following the explosion, a cloud of about 12000 Nm3 was released. The cloud was composed by oxygen, nitrogen, water and nitrogen oxides.

No data are available about the amounts of nitric acid and formic acid involved in the explosion. Also, no data are available about the amount of nitrogen oxides released into the environment as a consequence of the reaction between nitric acid and formic acid. On the basis of some stoichiometric calculations it had been estimated that, following the explosion, a cloud of about 12E+3/m3 was released. The cloud was composed by oxygen, nitrogen, water and nitrogen oxides.

Consequences
1 person killed, 7-10 persons injured, material damage both inside (destruction of

tanks, damage to buildings) and outside (windows broken within 300/m) of the establishment, closure of roads to traffic.

Causes
Immediate:
operator error (operation-related), unexpected chemical reaction.
Underlying: managerial/organizational omissions (insufficient operating procedures) and/or appropriate (operation) procedures not followed.
Under these hypotheses the tank explosion could be explained because the reaction between the formic acid (a reducing substance) and the nitric acid (a strong oxidizing substance) is very rapid and highly exothermic and leads to the formation of water, carbon dioxide and nitrogen oxides. The operator's error in the unloading operation was caused by an inadequate training/instruction together with an insufficient operating procedures.

EXTENDED ABSTRACT FRENCH

Une citerne routi??re d'acide nitrique explose lors de son d??potage dans un r??servoir contenant encore de l'ammoniac. L'incendie qui en r??sulte est ??teint en 5 h. Un mort est ?? d??plorer ainsi que 11 intoxiqu??s qui sont hospitalis??s. Les employ??s des usines voisines sont ??vacu??s. Des vitres sont d??truites et un nuage orange de vapeurs nitr??es se disperse sur une zone habit??e en provoquant de vives r??actions de la population.