



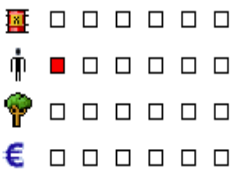
## Transport of waste in tank trucks



### ② Accident involving a tank truck transporting waste

ARIA 33767 - 31/07/2007 - 78 - LIMAY

22 – Treatment and elimination of hazardous waste



In an industrial waste treatment centre, the cover of a manhole on the back face of a tank truck ruptured due to overpressure resulting from the decomposition of the waste contained in the truck. The tank degassed abruptly. The truck moved 15m forward and the cover was projected onto the siding of a hydraulic plant. The tank truck and the waste dispersed in the surrounding area were sprayed with water for 30 min to bring their temperatures down. The operating staff was evacuated from the accident zone and the administrative staff required to stay indoors. The water used to cool the tank and the waste was collected. An employee of the site sustained partial burns on his foot.

The waste responsible for the accident was a mixture of 30% hydrogen peroxide and 5% resin acids. The accident resulted from a transfer error that occurred on 29 May 2007 in a paper mill where the waste was produced. The waste was received in the treatment centre on the day before the accident for incineration. The operator faced problems in extracting the waste from the tank and observed a rise in the external temperature and internal pressure in the tank. The tank was sprayed with water from 8.30 am. Water curtains were used around 12.30 pm and finally fire nozzles at around 1.30 pm. The abrupt degassing occurred around 2.30 pm.

The analysis of the accident shows several failures: shortcomings in the waste acceptance process, transformation of the waste between the time of transmission of sample by the customer and reception of waste in the centre, no checks on temperature for manholes and vents on reception of the tank truck, etc.

# Transport of waste in tank trucks

The Limay accident shows the risks involved in collecting, sorting, mixing and transporting liquid wastes.

Besides their nature, unlike pure products waste can be “sensitive” as their physico-chemical properties are not clearly identified. The risks involved result from the dangerous, sometimes sudden and violent, chemical or biological reactions that occur accompanied by abrupt increase in temperature (ARIA [4460](#), [4859](#), 10621, [15096](#), etc.) enhanced by the possible insulation of the container (ARIA [4460](#), etc.), masse polymerisation, production of significant volumes of gaseous reactants mainly through hydrolysis (ARIA [12062](#), etc.), gas emissions from the tank truck manhole or valve (ARIA [4859](#), 10621), even explosion of the tank (ARIA [1159](#), [4460](#)), etc.

The 11 accidents from the Aria database enclosed in the annex thus bear out the crucial role played by organisational and human factors in the corresponding accidents.

Before sorting and mixing residual effluents or liquid waste in a fixed storage tank, and even more so in a tank truck (agitation during transport, absence of cooling device, etc.), it is crucial to ensure that the physico-chemical properties of the collected waste are perfectly compatible with those of the material constituting the tank truck (ARIA [4460](#), [12164](#), [20095](#), 34465, etc.). The transformation of the waste must be constantly monitored throughout the treatment chain: error in identifying and mixing incompatible products (ARIA [15096](#)), unforeseen presence of a toxic gas (ARIA [4637](#), [32574](#), etc.), unsupervised transformation in the properties defined at the time of identification of waste (ARIA 33767, etc.), inappropriate “treatment” infrastructure or transfer process (ARIA [12062](#), [32540](#), etc.), etc.

While transferring substances, the open vents of fixed or mobile tanks (ARIA [4460](#)) must be connected if required to an adapted residual gas collection and treatment device since all persons not directly involved in the operations are prohibited from entering the transfer zone between the tanks (ARIA [32574](#), [4637](#), etc.).

Lastly, special care must be taken in the upkeep of the transport vehicle: hydraulic tests not performed, engine oil leakage (ARIA [34236](#)), tank truck not properly cleaned between two transport operations (ARIA [20095](#), [29942](#), etc) are all causes of accidents.

The most serious accidents involving transport of waste by tank trucks and that have resulted in deaths attribute the cause to toxic gases including fermentation effluents. Technicians carrying out the transfer operations are the first victims, followed by persons attempting to rescue them without adequate protection and ignorant of the exact causes and circumstances of the accident (ARIA [4673](#), 31000, [32574](#), etc.).

Smoke from fires (ARIA 15844, 19078, 20063, etc.) as well as fallouts from the projection of dangerous substances in the air (ARIA [1159](#), [4460](#), [7833](#), [15096](#), [34236](#), etc.) can help assess the nature and impact of toxic, polluting or hazardous substances at various concentrations on the surroundings, as well as the extent of the polluted areas before implementing safety perimeters, reducing water and food, cleanup operations, etc.

Besides the hazardous nature of the transported material, non-compliance with basic waste management procedures and more generally inappropriate safety provisions result in the majority of such accidents. To bring down the number while reducing the consequences, several recommendations may be put forward pertaining to:





- ✓ Properties of the substance in question (pH, temperature, colour, viscosity, odour, etc.), controls and tests ensuring chemical compatibility between substances, ensuring absence of phases and any immediate and sudden chemical reaction or transformation in the properties of the substance in time in the mixture;
- ✓ Defining and laying down responsibilities and adapting them to all operations to be performed by subcontractors until the treatment site;
- ✓ Training technicians to manage encountered risks especially the ones related to unloading or transfer operations of substances (possible presence of toxic or inflammable residual gases, etc.);
- ✓ Defining measures to be taken in the event of an accident or incident, implementation of detection, surveillance and corresponding mitigating devices and measures;
- ✓ Documentation of all procedures right from receipt of hazardous waste to its elimination with reference to critical safety parameters and properties.





## Additional references (detailed sheets):





- ARIA [4637\\_grasse\\_1993](#) / Emission of H<sub>2</sub>S in the end of transfer of liquid waste from a tank truck
- ARIA [22170\\_persan\\_2002](#) / Emission of HCl while emptying a tank unused for several years.
- ARIA [31000\\_rhadereistedt\\_2005](#) / Emission of H<sub>2</sub>S while unloading slaughter waste from a truck.
- ARIA [32574\\_stuttgart\\_2005](#) / Release of H<sub>2</sub>S from the vent of a tank truck in a waste treatment plant.





The accidents whose references are not underlined may be consulted at:





[www.aria.developpement-durable.gouv.fr](http://www.aria.developpement-durable.gouv.fr)





       **ARIA 1159 - 01/04/1989 - 38 - SALAISE-SUR-SANNE**  
 38.22 – *Treatment and elimination of dangerous waste*  
       While emptying a tank truck at an industrial waste treatment site, an explosive reaction occurred after several  
       kinds of chemical waste were mixed. Material damage was significantly high and five people sustained slight  
       injuries.

       **ARIA 4460 - 27/04/1993 - 84 - SORGUES**  
 20.51 – *Manufacture of explosives*  
       On 19 March, a tank glazed with 85% H<sub>2</sub>SO<sub>4</sub> ruptured leading to a workshop to close down for five days.  
       Given the waste acid storage autonomy period of four days for production, 3 tank trucks hired in February  
       and not dispatched following a leak in the waste acid tank were reused and three additional tank trucks were  
 hired. Tank truck 2 was half filled with waste acid from the production of dinozebe on 26/02, and completed  
 on 23/03 with waste acid from the production of DNTCBB (dinitro 2-6 tertibutyl 4 chlorobenzene), a crop  
 protection intermediate. On 27/04, nitrous vapours were emitted from the manhole of tank truck 2. The internal contingency plan was  
 triggered. The insulated tank truck was cooled with water hose nozzles. A water curtain was used to disperse the nitrous vapour cloud  
 that was 30 m high and 180 m long. The tank truck exploded since the situation was aggravated by its insulation and closed vents. An  
 acid aerosol was projected over 135 m, metal debris of 3 kg reached 195 m and 15 m<sup>3</sup> of matter was spilt on the ground. Two  
 technicians affected by the accident at the boundary of the site were treated onsite. Despite the projections, three lifeguards located at  
 25 m remained intact. Ground pollution in the town of OUVÈZE was limited and the spill was neutralised with calcium carbonate. After  
 an enquiry was conducted, it was shown that at room temperature and under adiabatic conditions, dinozebe starts to decompose after  
 15 days of contact with waste acids from the production of DNCTBB along with the formation of nitrous vapours. There was a slow  
 decomposition reaction between the contents of the tank truck and the trace dinozebe during the month of storage accompanied by an  
 increase in pressure of the airtight and insulated tank truck. The accident resulted from inadequate cleaning between the two uses and  
 the mixing of incompatible materials that triggered the sudden reaction. Measures were taken for other tank trucks containing the same  
 acids: opening of manholes, cooling devices for tank trucks, etc. The use of temporary mobile storage containers without retention tanks  
 was not allowed. Furthermore no risk assessment studies were carried out on the storage and treatment of waste acids. Material  
 damage was evaluated at 0.36 MF.

       **ARIA 4637 - 07/07/1993 - 06 - GRASSE**  
 20.14 – *Manufacture of other basic organic chemicals*  
       At the end of transfer operation involving concentrated liquid waste, a tank truck driver collapsed after closing  
       the vacuum pump circuit. A voluntary fire-fighter took ill and had to turn back. The driver died soon after.  
       Hydrogen sulphide (H<sub>2</sub>S) was undoubtedly released at the end of the transfer. The inspection authorities of  
 classified facilities noted that certain specific procedures had not been followed.





       **ARIA 4859 - 29/06/1993 - 52 - BOLOGNE**  
 49.41 – *Road transport of freight*  
       Gas emissions were released from the manhole of a tank truck transporting acid waste (mixture of chromic and  
       sulphuric acid). The resulting exothermal chemical reaction was brought under control by cooling the tank truck.  
       The vehicle then continued with its journey to the treatment plant.

       **ARIA 7833 - 22/11/1995 - 70 - VAIVRE-ET-MONTOILLE**  
 38.11 – *Collection of non hazardous waste*  
       While transferring smoke residue from the incineration of household waste to a silo in a transfer area of a  
       special industrial waste stabilisation/solidification platform, a tank truck accidentally released four tonnes of ash  
       containing lead, zinc and chromium. The steam-laden emission was spilt on the ground around the platform.  
 Tests were carried out and samples taken. None of the homes were effected.

       **ARIA 12062 - 02/12/1997 - 33 - BASSENS**  
 38.22 – *Treatment and elimination of hazardous waste*  
       In a waste treatment centre, 10 m<sup>3</sup> of acid chloride delivered in a vacuum stainless steel tank was transferred to  
       a 22 m<sup>3</sup> tank truck. The operation was carried out to dilute the acid before incineration and no other container  
       was available. Right from the start of transfer, an exothermic reaction occurred in the vacuum tank. The  
 delivery truck was isolated but 3 m<sup>3</sup> of liquid was released through the vacuum tank's vent and bursting disc.  
 The resulting HCl cloud was dispersed by the wind but a stringent odour was observed in the neighbourhood.

The emergency services that were informed 30 min after the start of the accident monitored the situation for five hours. Four employees were poisoned.

**ARIA 12164 - 23/12/1997 - 38 - SAINT-QUENTIN-FALLAVIER**  
 49.41 – *Road transport of freight*  
 23 m<sup>3</sup> of caustic soda leaked from a tank truck and spread to the platform and shoulder. The product as well as 120 m<sup>3</sup> of polluted soil was recovered. Road traffic was diverted and the accident area was covered with sand. The material comprising the tank truck (aluminium) was incompatible with the transported product.

       **ARIA 15096 - 17/03/1999 - 50 - GUILBERVILLE**  
 49.41 – *Road transfer of freight*  
       An exothermic reaction occurred in one of the compartments of a tank truck transporting liquid waste (3,000 litre  
       waste nitric acid bath containing 150 g/l of tin and lead, 200 l of ammonia water containing ammonium chloride  
       and 150 g/l of copper) in a parking area. The tank pressure increased causing a vent to open and the liquid to  
 project outside and spread all over the parking area. The driver parked the vehicle aside and exposed the  
 compartment in question to open air. Fire-fighters and a CMIC unit specialised in chemical emergencies  
 monitored the vehicle for several hours. The liquid phases were separated, neutralised and transferred to another tank. The operation  
 lasted for 28 hours. Incompatible products were mixed due to an identification error. The principle of general acceptance renewed every  
 year for a product type has been called to question (routine).




## ARIA 20095 - 09/12/2000 - 02 - CHAUNY

### 20.14 - Manufacture of other basic organic chemicals

In a tank truck loading area of a chemical plant, 5,700 l of 55% waste sulphuric acid leaked while a 42 m<sup>3</sup> tank truck was being filled in a pitched retention area. The operation was stopped and the alert sounded. The internal contingency plan was triggered for 2 hours and 30 minutes. A rescue team diluted the acid with water and channelled the corrosive effluent to an 80 m<sup>3</sup> floating retention tank where it was subsequently neutralised with sodium hydroxide and sodium bicarbonate. The content of the tank truck was collected in the retention tank. The accident occurred due to the corrosion of the steel tank without coating as H<sub>2</sub>SO<sub>4</sub> at 55% is far more corrosive to steel than at higher concentrations. The acid remaining at the bottom of the tank after an incomplete draining operation may have been the cause of the corrosion. The tank truck supplier carried out an additional technical expertise. The operator drafted a new guideline on ordering empty tank trucks from suppliers requesting them to specify in the order slip the quality of the waste acid to be loaded. The use of tank trucks with an internal coating was preferred for such type of transport.

## ARIA 29942 - 01/06/2005 - 27 - EVREUX

### 21.20 – Manufacture of pharmaceutical preparations




   Methyl methacrylate vapours leaked when a tank truck was being filled with liquid waste (methanol, ethanol, isopropyl alcohol, acetone, acetonitrile and water) at a pharmaceutical site. A third party, duly commissioned by the operator, transferred the waste stored in barrels using a vacuum pump at 9.20 am. The air in the tank was expelled to draw the waste via a hose but the emitted vapours were collected around 9.35 am by an air-conditioning device in the building near the transfer area.

The transfer operation was stopped at around 10.00 am and the building evacuated. The driver of the private company informed the operator that the methyl methacrylate emissions surely originated from its transit on 31/05 during waste transfer in another industrial site. On the previous day, the tank was only rinsed with water. The analysis carried out by several laboratories confirmed the presence of methyl methacrylate in the waste samples from the tank truck (ratio > 60 between the barrels and truck). The cleaning operation was inadequate and not carried out in an authorised facility. Acute poisoning with methyl methacrylate in concentrations greater than 2,000 ppm could result in neurological disorders along with symptoms like headache observed in the employees. Out of nine people poisoned, eight were hospitalised (four were discharged the same evening and the remaining four on 02/06). One person received medical attention onsite. Two people were on medical leave for 10 and 20 days.

A visit by inspection authorities revealed that five provisions were not respected: accident not declared by the operator, clean-up certificate not produced before transfer of waste as provided for by the safety protocol between the industrialist and the service provider, compliance with safety protocol and state of cleanliness of tank before authorising transfer not verified by the industrialist, technicians not trained in the application of safety protocol and ensuring compliance, safety protocol not drafted in form of an operating procedure. The inspection authorities took note of these facts. The prefect was advised to issue a formal notice demanding compliance with the recommendations of the prefectural order.

## ARIA 32540 - 17/11/2006 - 38 - LE PONT-DE-CLAIX




### 38.22 - Treatment and elimination of hazardous waste

   A technician detected a leak on opening a transfer valve while transferring 2.58 tonnes of chloroprene from a tank truck to a waste treatment site. He reduced the pressure of the tank truck to shut the valve on the mobile tank. 1,200 tonnes of chloroprene spilt onto the drains and the retention area. After having stopped the leak and sounded the safety alert in the facility, the operating team alerted the watch room and the team on standby duty.

The use of absorbent products helped curtail the evaporation of the liquid. The watch room failed to register complaints of odour from the neighbouring sites. However, the fire-fighters and a team from the gas department arrived onsite to look for the gas leak. The comparison of the two events led to the establishment of an emergency unit by the staff in compliance with procedures. The transfer of chloroprene was carried out under nitrogen pressure using a rising main due to the regulatory obligation of transporting this chemical in a tank truck that is filled and emptied from the top. Seven tank trucks (i.e. 117.8 tonnes of chloroprene) were already emptied without any major problem using the same procedure specifically drawn up for this tank. After analysing the incident, the leak was found at the joint between the tank truck and transfer pipe. The air-tightness of all pipes, transfer components and tank truck was tested the following day at around 10.00. The satisfactory results obtained authorised the transfer operation that ended at 3.20 pm. Since there were problems in obtaining total air-tightness due to the joints used and space available in the tank truck caisson, the tanks were modified and the quick-fitting unions were replaced by flat faced flange unions used for transfer operations under pressure.

## ARIA 32574 - 29/12/2005 - GERMANY - STUTTGART




### 38.22 - Treatment and elimination of hazardous waste

   During the vacuum transfer of liquid wastes from steel drums, hydrogen sulphide (H<sub>2</sub>S) leaked through the vent of the receiving tank in a hazardous waste treatment plant. Since the hazardous waste could not be treated onsite, they were received in drums, mixed in a tank and transported to another site. A forklift truck operator was found dead in the vicinity and five other people poisoned by H<sub>2</sub>S were hospitalised. The fire-fighters upon arrival were unable to detect the significant concentration of H<sub>2</sub>S and left the premises. The police ordered the contents of the suction pipe to be emptied into the tank. The vacuum pump was restarted and the H<sub>2</sub>S that was released again caused the truck driver to faint. Consequently, the police ordered the operations to stop and the fire-fighters and a doctor on emergency duty were called on site. The total number of casualties included one death and six cases of poisoning requiring hospitalisation (2 employees, 2 members of the emergency department and 2 agents from another company). The emission of H<sub>2</sub>S triggered a chemical reaction between the two liquid waste products: an organosulphur compound and an organic acid.

This accident revealed an organisational problem: identification, evaluation and documentation on handling containers carrying hazardous products were not adapted, the operating modes for the vacuum transfer of waste from drums into tanks do not specify the order of transfer, there was no safety system to detect gas produced due to a secondary chemical reaction and released from the tank vent. A legal investigation was carried out. The vacuum mixing of hazardous substances in tanks was stopped, and the drums were treated on another site. The administrative authorities put forth preventive measures: identify hazardous waste on their own or in mixtures, define safety criteria to plan out their treatment (pH, etc.), ensure compliance of product storage procedures with safety criteria, specify transfer order for mixtures according to the properties of its hazardous constituents, ensure that the tank vent is connected to a gas treatment unit, restrict access to vacuum transfer zone.

## ARIA 34236 - 13/02/2008 - 62 - COURRIERES

### 38.22 - Treatment and elimination of hazardous waste

   In a waste treatment plant, an explosion that occurred around 1.30 pm destroyed a 5-tonne tank truck containing waste water with low concentrations of sodium coming from a chemical plant. Six people were reported injured including one person who sustained severe injuries. Pieces of the truck were projected as far as 250 m from the site of the accident. The operator took charge of ground clean-up operations.

The ensuing investigation revealed that the carrier had violated regulations on transportation of hazardous substances: defects observed during the previous technical inspection of the vehicle, engine oil leak, etc. Several assumptions were made to explain the reasons behind the explosion: defective vehicle, (oil leak), possible overpressure in the tank (no hydraulic test certificate), combination of some molecules contained in the various waste products transported before the accident (no clean-up certificate before the last loading operation), etc.