

## GENERAL DISCUSSION

### Some thoughts on storage and spills of ammonia

**JACK REED**, ICI, Billingham, England: As a large producer of ammonia, we get involved in the transport business, and move ammonia round in ships and also by road and rail. It is inevitable, therefore, that we get approached from time to time by such people as harbor boards and local authorities and they ask us what happens if there is a spill in the river or if a road or rail tanker is involved in a collision which results in ammonia being spilled.

Also from time-to-time we hear some statements from people which we think are fundamentally incorrect. Two of these statements go something like this: Cold water will dissolve a third of its own weight of ammonia; therefore, if a ship is holed, the ammonia will be rapidly dissolved and rendered harmless because of the large quantity of water present. Also, we've a thousand ton sphere which is semi-refrigerated at about 50 lb./sq.in. with a 100% dike around it; even in the worst case, if the sphere suffered a catastrophic failure, all we would lose is about 100 tons by evaporation and the dike would catch the other 900 tons.

We feel there is a fallacy in both the foregoing statements and made a film of some very simple laboratory experiments. Originally, we made this film because we wanted to slowdown the action to observe the mechanics of some of the experiments, but the results seemed to us so interesting that we eventually put the whole thing together in a film entitled, "Some Aspects of Ammonia Spillage."

**Q.** Are any others besides ICI using double tank construction, with either a concrete outer tank or a steel outer tank?

**ANON:** We are commissioning a 10,000 metric ton double-walled tank. The cost of the outer concrete wall runs about \$100,000 extra.

**JIM SHERMAN**, DuPont Co.: We have used the double wall construction in two of our tanks. They are 20,000 ton. They have a double steel wall with the exterior wall designed to contain the liquid in the event of the failure of the inner wall.

**Q.** What caused the fogging in the one spill in the film?

**REED:** Spilling from an atmospheric source and a pressure source are two different things. When you spill from an atmospheric tank into a diked area, evaporation takes place at the surface and is relatively slow. When you spill from a pressure source, the liquid sort of explodes and atomizes very quickly. This presents a very large surface area to the atmosphere with the consequence that it cools very rapidly, and the atmosphere is chilled suddenly below its dew point.

The fog that was seen was chilled water vapor, not ammonia.

**Q.** Are your rail tankers and road tankers and your ocean tankers insulated?

**REED.** We bring ammonia in and out of the river both fully refrigerated and in semi-pressure ships and in both cases the tank containing the ammonia is insulated. In common with other carriers, our road and rail tankers are not insulated, and we carry ammonia around warm. There are two schools of thought. If the ammonia is cold and there is an accident, the amount of evaporation is minimized. However, if the contents are reduced down to minus 30 degrees, it does increase the possibility of the tanker failing.

**Q.** What is the economic justification for adding the second wall in the storage tank?

**REED.** There is absolutely no economic justification whatsoever. The price of our concrete wall around the tank puts the price of the installation up by about 7 or 8%, but we think there are times when you have to accept public responsibility and spend this sort of money.

**Q.** Had you attempted to evaluate the risk in terms of possible people hazard and repercussions to the company in terms of possible damage suits?

**REED:** We did try and made some calculations, but it is extremely difficult to get a firm idea. While it is relatively easy to calculate the amount of vapor which will evaporate, it's not very easy to calculate what the toxic concentration will be.

**Q.** Could you tell me how much polyurethane insulation you have on the 12,000 ton tanks?

**REED:** Yes, it's three inches thick. The first tank was foamed, mixing by hand. The second tank was froth-foamed.

**Q.** Is there a five-foot spacing between the steel shell and the concrete outer wall?

**REED:** Yes.

**Q.** Why so much?

**REED:** Just because it's practical to have a gap of that sort. We built the concrete wall first, and therefore, people have to get inside to build the tank and insulate it.