Handling Derailment Accidents Involving Ammonia

Southern Railways has developed an emergency operations procedure to help prevent and control damaging effects to personnel, equipment, and the environment.

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Emergency systems for handling railroad derailments involving ammonia and other hazardous materials are designed to prevent and control damage from materials hazardous in both the traditional sense and to the environment.

By necessity, railroads have for years been organized and prepared to handle emergencies of all types. Unfortunately, these do occur rather frequently in transportation, and when they happen in rail transport, they can be catastrophic, involving huge volumes of materials, sizeable areas, and any of the thousands of materials frequently shipped in bulk by rail. Because of these many factors, the rail industry was the first to realize the need for proper plans and capabilities for handling emergency incidents.

Prevention, however, must be the primary goal for any successful management. Consequently, over 67 years ago, the industry established the Bureau of Explosives to perform a service for itself and the Interstate Commerce Commission to develop regulations, guidelines, policies, and emergency aid procedures to assist carriers in prevention and control of emergencies. For the past 35 years, the average fatality rate due to hazardous materials in rail transportation has been slightly over one per year. In view of the millions of tons of such materials carried annually, this is an outstanding record.

Southern Railway's management in 1968 began a project to develop an "emergency action plan" for the guidance of all personnel in the handling of hazardous materials on the railroad. This plan was first issued in 1969, and it included a "go team" consisting of trained people under an experienced leader in handling hazardous materials to coordinate, advise, and assist operating management in all hazardous materials activities on the system.

The plan originally was directed at traditionally hazardous materials. Fortunately, it incorporated provisions for handling routine spills and leaks as well as sudden rupture of containers or tank cars such as those which occur in derailment situations and which can threaten the environment.

In the past five years, this program on Southern has repeatedly been called upon to direct the handling and control of incidents where the environment is in jeopardy due to spills or massive leaks of materials that can be considered hazardous to the environment.

This program has resulted in numerous other railroads' developing similar plans and teams with programs, policies, guidelines, reference data, and mutual aid plans to handle all aspects of hazardous materials incidents. The recently reorganized and enlarged Bureau of Explosives of the Association of American Railroads is now devoting considerable time to developing new industry-wide plans and guidelines for handling these types of emergencies.

The Railway Systems Management Association has developed a hazardous materials manual based on this plan that promises to offer a great deal of assistance and guidance for emergency forces as well as carrier personnel. Shippers and their organizations have likewise developed several outstanding programs to aid carriers in emergencies in handling their materials and in providing the help and assistance of trained personnel in the proper handling of their materials. The original of such plans was the "Chlorep plan" of the Chlorine Institute and its member companies.

The Manufacturing Chemist's Association has instituted their "Chemtrec" program, which provides round-the-clock information services for carriers of any chemical commodity that has hazardous characteristics. Chemtrec also assists carriers by getting in touch with representatives of shippers and knowledgable personnel who can provide information and can advise on the proper handling of materials involved in any situation.

There are numerous agencies that also provide help for carriers when called upon. These include: the explosives ordnance disposal teams of the Dept. of Defense, the poison control centers of the Public Health Dept., and the Atomic Energy Commission and Dept. of Defense emergency response teams for radioactive incidents or nuclear weapons incidents. The Environmental Protection Agency provides aid and assistance in the field in advising on proper measures for decontamination, neutralization, and reduction of pollution damage potential from various materials. Its computerized bank of reference data will be of great help in handling emergencies.

Some State health departments offer aid when poisonous or radioactive materials are involved and, of course, the civil defense emergency organizations of the Office of Emergency Preparedness willingly offer their mutual aid assistance in these emergencies.

Southern realized that when emergencies or accidents do

occur on its system that they can be located anywhere throughout some 10,545 miles of railroad. The forces responding first in most of these situations are, of course, local emergency organizations, such as volunteer fire departments, state police, sheriff's departments, civil defense rescue units, and the like. To assist these people in establishing coordination with railroad personnel and improve communication and liaison with these agencies, Southern prepared a special fire department brochure. This contains numerous reference materials and recommended procedures to help insure proper planning of activities at the scene of an incident, to prevent exposing people needlessly to unknown hazards. At present, a follow-up distribution of the Bureau of Explosives' Manuals No. 1 and 2 is being made.

All these efforts, plans, and programs have been remarkably successful. We are confident of continued improvement of coordination of these services among all groups involved.

Emergency response systems in the railroad industry are faced with an unique problem, especially when one realizes that railroad accidents can occur anywhere on the systems at any time day or night, and usually in remote locations: where normal emergency services are not immediately available, where access can be very difficult, with large quantities of many materials involved, and with a limited number of people at hand who are frequently not familiar with the materials involved nor their characteristics and hazard potentials. It soon becomes apparent how large and complex is the challenge. An apt descriptive comment is to say that when you are really in the swamp and up to your elbows in alligators, it can become difficult to remember that your original intent was to drain the swamp.

The Office of Hazardous Materials of the Dept. of Transportation requires that a report be submitted by carriers of every spill of a hazardous material that occurs accidentally during transportation. These reports during 1973 indicated a total of 7,651 spills reported. The breakdown of these spills among various modes of transportation is as follows: water carriers 12, air carriers 48, rail carriers 412, private highway carriers 450, pipelines 1,637, for-hire highway carriers 5,092.

Southern, in 1973, had 82 incidents of hazardous materials being spilled. Spills of other materials, not regulated as hazardous and yet which could pose a pollution threat, have also been tabulated on Southern for 1973. These raise the total to 131 incidents for the year. Of these, 33 were reported to the EPA for information, and 7 of the 33 actually resulted in varying degrees of pollution of streams and waterways.

These figures indicate that 75% of Southern's spill or leak incidents posed no pollution threat. The 25% that could possibly have posed a threat were reported to the EPA. One in 20 of our incidents (5.3% to be exact), actually resulted in some degree of pollution to streams and waterways. These seven incidents involved diesel fuel oil in four cases, sulfuric acid in one, beer in one, and caustic soda in one.

The materials involved in all 131 incidents break down into the following classes: corrosives (acids and caustics) 50, flammable liquids 20, flammable gas 17, compressed gas 8, Class "B" poisons 4, non-regulated 32.

As can be seen, the majority of these materials can imply a threat for water pollution if they are not controlled and disposed of properly. We are convinced that the primary concern in handling hazardous materials on the railroads must be to prevent the materials being released from their containers. Prevention is the activity that must be given priority, particularly in an industry where there are many basic causes of accidents or incidents that can result in the spilling or loss of material while in transit. Southern's management, fortunately, has given across-the-board priority to the prevention of all accidents or incidents on the system that can interfere with our service, injure our personnel, or cause unintentional releases of commodities during transportation.

Analysis of causes of spills and leaks during 1973 resulted in the following breakdown (numbers are actual quantities): fill covers/gaskets loose 29, bottom outlets 21, derailments 15, safety vents ruptured or loose 12, drums/containers 11, valves and plugs loose 7, tank shell corrosion 6, overloads 5, and miscellaneous 25.

The preceding shows that prevention and control of the causes of leaks and spills in rail transportation is a mutual challenge to both shippers and carriers. Southern is working with its shippers on each incident by notifying them of the circumstances and asking their assistance in correcting the situation to prevent recurrence. Trade associations, the Bureau of Explosives, and the Federal Railroad Administration are all cooperating to bring about needed improvements. It should be pointed out that the 131 incidents mentioned earlier were also responsible for 22 injuries to railroad personnel during 1973, and have resulted in third-party liability suits in several cases.

The series of photographs in Figures 1 through 11 will provide some more vivid illustration of the magnitude and complexity of several incidents involving tank cars of anhydrous ammonia. #

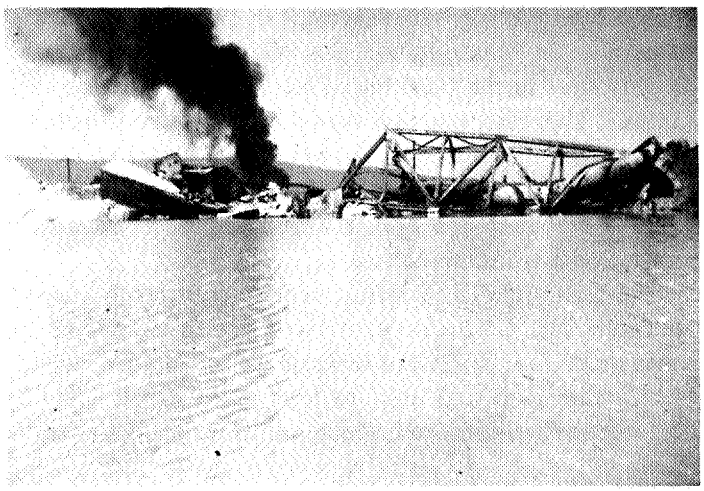


Figure 1. Derailments have all aspects of hazards: fires; toxic materials; explosions; and potential water, air and soil pollution, usually in an isolated location with limited access and facilities.

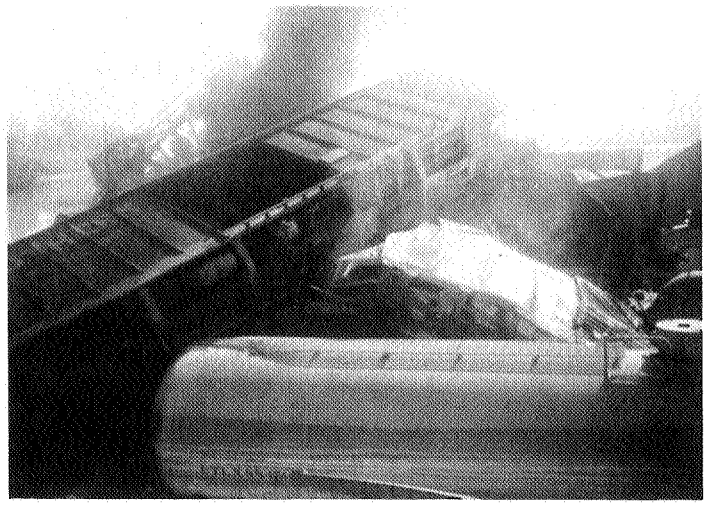


Figure 2. Puncture of two 33,000-gal. cars of anhydrous ammonia. Control goal was to prevent greater loss and to restore operation.

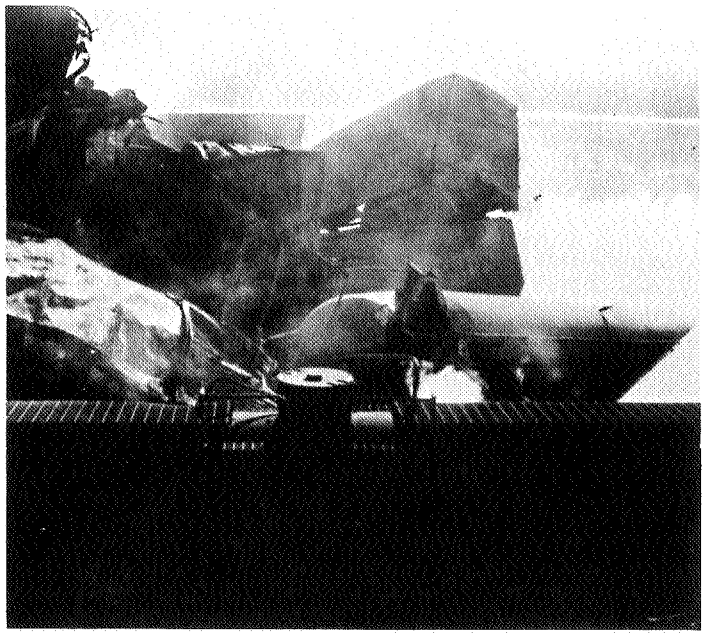


Figure 3. Both of the anhydrous ammonia cars punctured in the derailment vented into water and air, killed fish, and made the area inaccessible except for personnel with self-contained breathing apparatus.

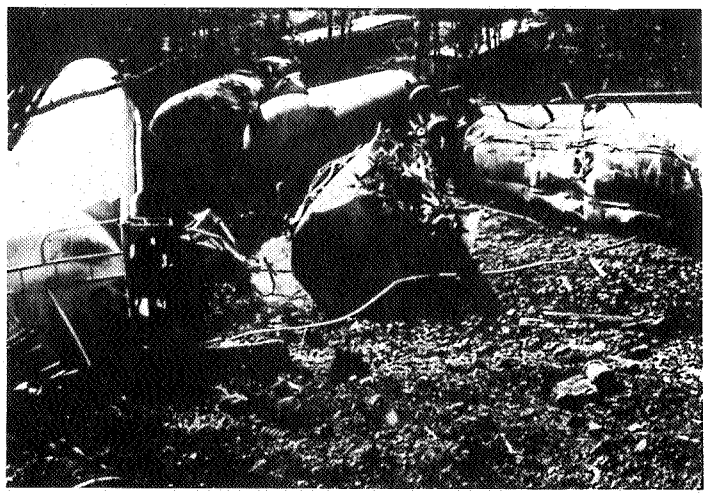


Figure 4. A major derailment in April, 1973, involved three tank cars of anhydrous ammonia, one of which had two valves knocked off and the gauging device flange lifted. This permitted 8,000 gal. of liquid to leak along with two caustic soda cars which were ruptured and allowed 30,000 gal. of that liquid to escape. A total of 100 families were evacuated for two days during recovery operations.

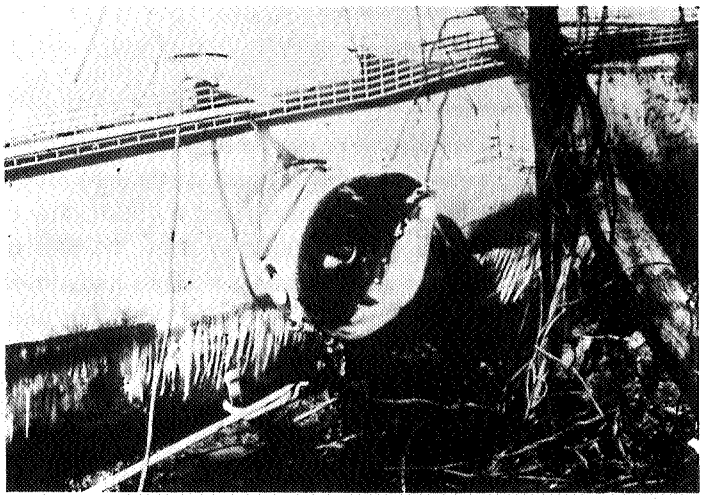


Figure 5. The leaking anhydrous ammonia tank car had a vapor and liquid eduction valve knocked off during the derailment. Fortunately, they were both equipped with check valves which seated. The liquid spill came from a 1/4-in. lifting of the flange of the gauging device which was outside the tube that is protected with a check valve.

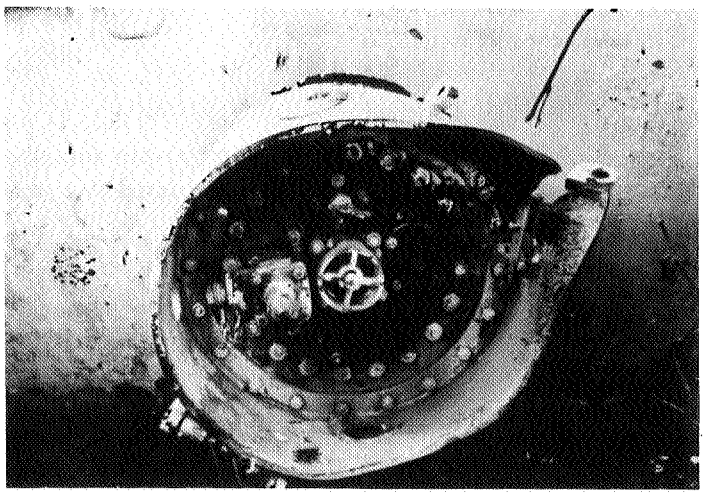


Figure 6. Liquid vented for 4 hr., during which 8,000 to 10,000 gal. of anhydrous ammonia was lost. After the liquid level fell below the leak, it was possible to inspect the car dome using air-packs, rain suits, and fire hose spray for protection. By using a length of chain looped through the access ports and a bumper jack, personnel were able to force the flange back into position, pull the stripped studs, and replace and tighten the flange down with new nuts. Blank flanges were installed in the same way over missing valve seats to stop venting from check valve equalizing vents. A garden hose spray of water was used to absorb ammonia and improve working conditions.

Figure 7. The loaded cars were too far away from the track to permit lifting without excessive strain on the tank shells. It was decided that a portable pump and a 150-ft. line of welded pipe would have to be built to allow transfer of contents of the three cars. All ammonia truckers had moved north with the start of the fertilizer season and thus were not available. Tanks were rolled upright for unloading.

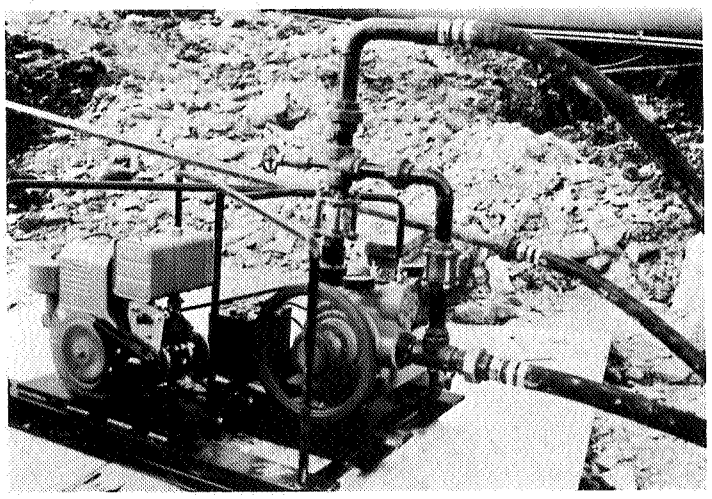


Figure 8. A portable Blackmer LGL-3 anhydrous ammonia pump, driven by a 15-hp. engine, was constructed by a local refrigeration contractor.

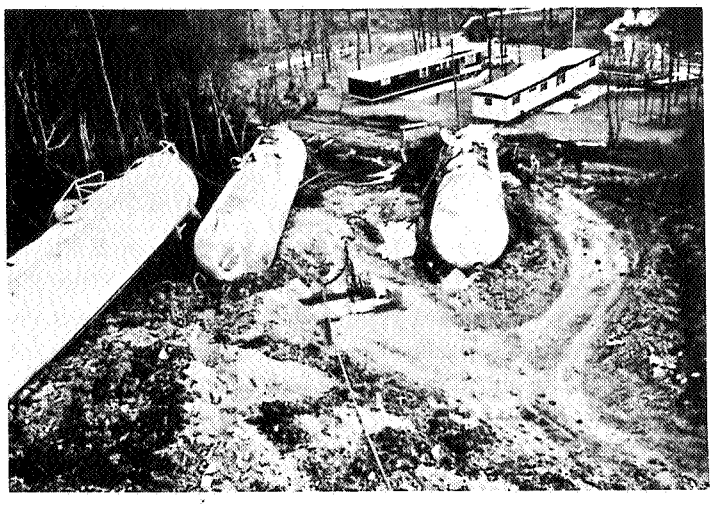


Figure 9. The 150-ft. length of welded steel pipeline built to reach the track from the pump site. Flexible ammonia hoses, 50 ft. long, with valves, were fabricated to allow unloading all three tank cars from one pump location.

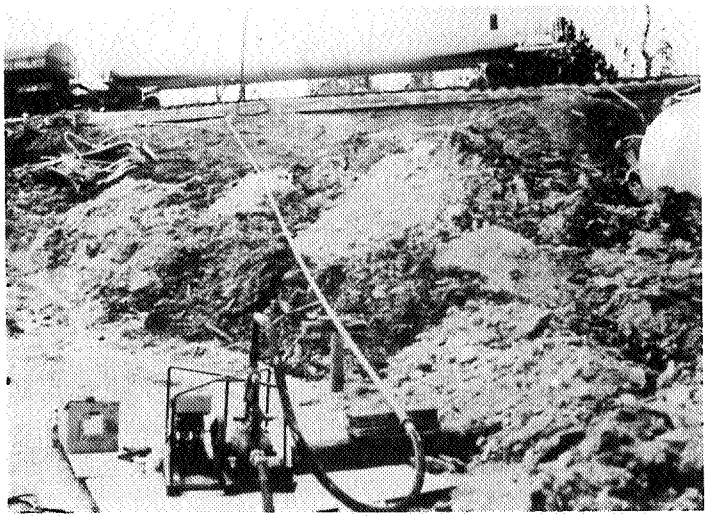


Figure 10. Contents of the three tank cars were transferred to replacement cars for delivery of the product in 12 hr.

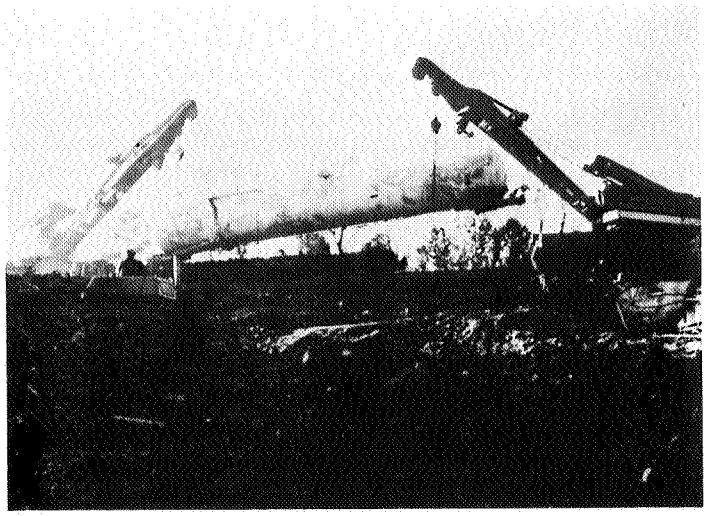
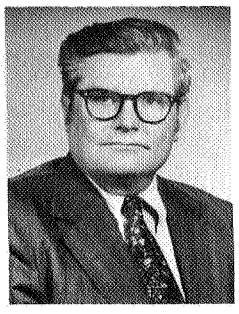


Figure 11. The empty cars were then removed by two, 250-ton derricks and loaded onto flat cars for return to the owner's shop for repair.



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