

Special Permits for the Transportation of Bulk Materials Used for Blasting

A Model of Efficiency in Government

The special permits (SP) program administered by the US Department of Transportation's (DOT) Pipeline and Hazardous Materials Safety Administration (PHMSA) is often held up by the Institute of Makers of Explosives (IME)¹ as a model for other agencies to follow. The most vital special permits to the industrial explosives industry are those granted for the transportation of bulk Division 1.5 and 5.1 materials used for blasting from storage and manufacturing locations, over highways, to job sites in multipurpose bulk trucks (MBT). MBTs further process and sensitize the bulk materials at the job site ensuring that less sensitive, safer materials are transported on highways.

In 2007, the industrial explosives industry in the United States (US) provided 6.93 billion pounds of explosive and explosive precursor materials² to fuel the greatest economic engine in the world. Ninety-five percent of this material was delivered to the jobsite in bulk and a significant quantity of that material was transported under a PHMSA SP at some point in time. The highway is the only modal option to deliver blasting materials to worksites.



¹ The IME is the safety and security institute of the commercial explosives industry. Our mission is to promote safety and the protection of employees, users, the public and the environment; and to encourage the adoption of uniform rules and regulations in the manufacture, transportation, storage, handling, use and disposal of explosive materials used in blasting and other essential operations. The IME represents U.S. manufacturers of high explosives and other companies that distribute explosives or provide related services. IME's member companies produce over 98 percent of the commercial explosives consumed annually in the United States. These products are used in every state in the union and are distributed worldwide. The ability to manufacture and distribute these products safely and securely is critical to this industry.

² <http://minerals.usgs.gov/minerals/pubs/commodity/explosives/myb1-2007-explo.pdf>



A management advisory issued by the DOT Office of Inspector General (OIG) to PHMSA has called the safety of MBTs into question.³ The premise for the advisory is flawed. The facts about the explosives industry's use and safety record with MBTs follows:

1. The incredible advancements in the safety of industrial explosives are directly linked to bulk materials.

One hundred years ago, the nation consumed about 500 million pounds of explosives annually, half of it black powder and the other half dynamite. Records from this time are sketchy, but it is safe to say that hundreds of people died annually in explosives incidents. By the 1950's, consumption increased to 800 million pounds and nearly all of it was dynamite. Because dynamite was not sensitive to stimuli that would ignite black powder, accidents were reduced dramatically. But explosives work was still a very dangerous occupation. Data at the time indicates that, on average, one industrial mineral miner died in an explosives accident for every 14 million pounds consumed in industrial mineral mining.⁴ Since the 1950's insensitive ammonium nitrate (AN) based explosives have taken over the market and annual fatalities in the US from industrial explosives in manufacturing, use, storage, transportation, and disposal have fallen to miniscule numbers, some years even zero. As compared to black powder and dynamite, AN's unique mix of reactivity, insensitivity and low cost allowed the US economy to grow immensely in the latter half of the 20th century. Consumption of industrial explosives increased 20 times in the 50 years from 1950 to 2000 than from 1900 to 1950. In the same century, fatalities from explosives accidents have been reduced by more than a factor of 100. Factoring the combined growth and increased safety of the 20th century, it would be safe to say that the industrial explosives industry today is thousands of times safer than it was 100 years ago.

Although explosives comprised of AN plus a liquid fuel were patented in the 1800's, it was not until the 1950's, when technology allowed the production of abundant supplies of AN in prilled form, that the use of ANFO (AN plus fuel oil) increased dramatically. ANFO's limitations were quickly realized however. It cannot break very hard rock well and is very incompatible with water. Many methods have been tried

³ Management Advisory from OIG to PHMSA, dated July 28, 2009.

⁴ An Analysis of Recent Accidents During Use of Commercial Explosives, Santis, ISEE 2003

to overcome these limitations over the years with AN-based emulsions and watergels (ANE) eventually becoming today's choice. ANEs are inherently resistant to combustion because of their high water content (5 to 15 percent), further enhancing the safe transportation these products over ANFO. The latest step in maximizing the safety of blasting operations has been to incorporate Class 8 material into the ANE just before loading. This allows transport and loading of a non-explosive, waterproof material that acquires its explosive properties in minutes, and only after it is loaded in the borehole. These safety enhancements entirely depend on bulk delivery, and PHMSA's SPs have allowed this technology to evolve. MBT technology has been a leading factor in the industry's attainment of zero deaths or injuries during transportation.

The MBTs used to deliver bulk materials to the worksite are as diverse as the mines, quarries and construction sites serviced. MBTs employ technologies that meet risk assessments and strict engineering and design standards. Not only do the MBTs transport hazardous materials, they must carry a diverse array of equipment such as pumps, meters, and equipment to remove water from the boreholes before loading explosives. They serve as a mobile work platform for thousands of blasters daily in some of the harshest conditions imaginable. These units must be capable of going from paved interstate, to unpaved mine roads, to blast sites. Over the years, PHMSA has shown remarkable ability to maintain the modifications to the SPs necessary to keep the technology advancing, while at the same time, maintaining safety not only in transport, but also in manufacture, storage and use. We cannot afford to lose the advantages provided by bulk materials to our society and economy.



2. The transport of bulk materials for blasting over highways is safe.

An objective assessment of industry's safety record shows that the transportation of bulk materials for blasting under PHMSA SPs is safe, perhaps one of the safest activities that PHMSA regulates. It is irrational to find any incident, or the possibility of any incident, unacceptable. The goal of the HMTA is not "zero risk." Any activity, including the transportation of hazardous materials, involves risk. The only way to achieve zero risk is to not engage in the activity. While we seek to learn from incidents and strive to be more vigilant, the goal is to manage risk.

Under its statutory authority, PHMSA is directed to regulate "unreasonable risk to health and safety or property."⁵ (Emphasis added.) PHMSA espouses a risk-based approach that considers the probability of the event happening with the consequences of that event happening. Taking a consequence-only approach to managing hazards could lead to the end of all hazmat transportation and the end of commercial motor vehicles (CMV) as we know them. After all, in a car/CMV collision, the consequence

⁵ 49 U.S.C. 5103(a).

will almost always be much worse for the occupants of the car. Due process is not served when explosives are held to a consequence-only standard, while likelihood is a factor considered for other hazardous materials.

Comparisons of the risk of commercial, regulatory-compliant bulk materials used for blasting to the materials rigged by Timothy McVeigh in the Oklahoma City act of terrorism are inflammatory. Likewise, using an industry trade name to sensationalize the issue, despite repeated requests to the contrary is improper. The public interest is not served by an appeal to emotion when objective analysis rooted in science is required.

Although there has been attention drawn to the number of serious incidents involving the SPs used to transport bulk materials for blasting, there has not been sufficient attention paid to the absence of any fatalities or injuries from these incidents or development of metrics that allow fair comparisons to other transportation activities. Any incident involving Class 1 or AN usually results in a road closure. A road closure triggers the designation of the incident as “serious.”⁶

To our knowledge, there has never been a fatality or injury from the transportation of commercial explosives or precursors by MBT. During the 1999-present timeframe used in the OIG advisory, only two incidents resulted in injury from Class 1 materials in transportation, neither incident involved SPs for transport of bulk materials. DOT data for the decade 1999-2008 show that there have been no incidents resulting in injury from Class 5 materials used in blasting in transportation. On the other hand, 87 fatal incidents have occurred from bulk Class 3 materials in transportation since 1999.

The vast majority of the Class 3 incidents involve gasoline, and in fact, there have been 108 transportation incidents resulting in fatality or injury from gasoline since 1999. In this period, there have been about 100 million highway shipments of gasoline⁷ which equates to an incident with fatality or injury rate of 1 every 900,000 shipments. In the same period, about 3.5 million shipments of bulk materials for blasting have been made without a single incident resulting in death or injury from the hazmat. Even if the first incident occurred tomorrow, based on incidents per shipment, the shipment of bulk materials for blasting would still be 3 to 4 times safer than the shipment of gasoline.

An objective assessment the industry’s performance on the highways would compare the number of crashes, incidents or citations to miles driven, vehicles operated or inspections conducted. IME searched data from the DOT SAFER website for the last two years on 24 of the largest explosives service companies using bulk SPs. These companies reported a total fleet of 1,841 vehicles that drive over 40 million miles annually. These companies had 40 reported crashes for a rate of 2.17 percent. These companies also sport a median vehicle out-of-service (OOS) rate of 10.1 percent, driver OOS rate of 2.35

⁶ DOT defines a “serious” incident as one where the release of a hazardous material results in one or more of the following: death, major injury resulting in a hospitalization, an evacuation of 25 or more persons, closure of a major transportation artery, alteration of an aircraft flight plan or operation, failure of a Type B radioactive packaging, release of over 11.9 gallons or 88.2 pounds of a severe marine pollutant, or release of a bulk quantity (over 119 gallons or 882 pounds) of a hazardous material.

⁷ http://www.phmsa.dot.gov/staticfiles/PHMSA/DownloadableFiles/Files/app_b.pdf

percent, and a hazmat OOS rate of 3.2 percent. These metrics indicate a sector that significantly outperforms the majority of other motor carriers in every metric.

Government officials have stated that MBTs are prone to rollover without providing objective data to prove their point. Stating that a certain number of rollovers have occurred is meaningless without the context of how many times the rollover did not occur or comparing that rate to other sectors. For example, if a particular motor carrier had half the rollovers but traveled three-fourths the total mileage, that carrier would be a stellar performer. MBTs cost hundreds of thousands of dollars so, aside from safety, industry has additional incentive to prevent a roll-overs (which usually “total” the vehicle). Although the IME is taking steps to add measures in its standards to address the major causes of roll-overs, it does not believe that MBTs are any more prone to roll-over than other bulk material transport vehicles. DOT should generate comparative roll-over metrics if it believes otherwise.

Recent transportation incidents involving Class 1 materials in the US and Mexico have been held up as examples of what can go wrong in MBT accidents. In fact, these incidents illustrate how the system can succeed and fail, but have little direct bearing on the safety of MBTs operating under SPs. In 2005, an incident in Utah involved the transportation of Division 1.1, a material more sensitive than the Division 1.5 or 5.1 materials transported in MBTs. Proper emergency response was followed for this incident. As a result, there was no loss of life in the subsequent explosion that occurred during this incident. The material being transported in the 2007 incident in Mexico was a truckload of packaged, not bulk, Division 1.5 material. In this incident, in which there also was a subsequent explosion, emergency responders were not able to keep onlookers at a safe distance and bystanders were too close to the scene when the explosion occurred. The photograph to the right was taken 10 minutes before the Mexican explosion. Ironically, if transport of bulk materials were reduced, these Division 1.1 and packaged Division 1.5 materials would replace them on the highways.



There have been several off-highway incidents where MBTs have been totally consumed by fire without detonation. To our knowledge, there has never been an accidental explosion of an MBT in transportation or elsewhere.⁸



⁸ There have been minor explosions of explosive materials in the vicinity of MBTs while they were off-highway, but none of these events resulted in propagation to the bulk material containers or were related to transportation activities. These events further prove the safety of the engineering and design of MBTs.

Although remote, the possibility of an explosion can never be eliminated. MBTs provide the materials necessary for mining and construction in the safest manner possible. Transportation risks are minimized by adhering to the most rigorous set of regulatory requirements of any hazardous material class, developing effective emergency response, and encouraging the transport of safer materials.

Class 1 materials are one of the most highly regulated commodities in the US. Class 1 is the only hazard class that shippers must obtain approval from DOT before these materials can be transported. Quite often, third-party testing is required to prove that a candidate explosive is safe to transport. A considerable number of other regulatory requirements apply only to explosives or to explosives and a few other hazmats. The Federal Motor Carrier Safety Administration's Hazardous Materials Safety Permit (HMSP) ensures that only the best performing motor carriers transport explosives. For example, a motor carrier cannot have an average of more than 1 hazmat OOS violation for every 22 roadside inspections to qualify for an HMSP. Special parking, routing and attendance rules apply as well to Class 1 materials.

PHMSA and the IME have partnered over the years to provide comprehensive training materials for emergency responders on explosives and guidance in the Emergency Response Guidebook. A training video cosponsored with PHMSA and an instructor's booklet are available from the IME.⁹ Every firehouse in the Federal Emergency Management Agency's database was provided a copy of these training aids by IME and PHMSA in 2003. The payoff from this proactive approach to emergency response is evident from the lack of injuries or deaths from Class 1 materials in transportation.

PHMSA's SPs have fostered a US industry that transports the safest and least sensitive energetic materials possible, while at the same time, becoming the world leader in explosives technology. Obtaining SPs from PHMSA for bulk materials involves close scrutiny and technical review. Rarely has PHMSA met the 180-day statutory requirement to process SP applications involving explosives. For example, SP 11579 took three years of evaluation by PHMSA before it could be revised. There is no basis to suggest that PHMSA has not provided sufficient oversight of SPs.

Other regulatory agencies have purview over bulk explosives operations and do not have major concerns over the safety of these operations. For example, the Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF) has jurisdiction over the storage of explosives remaining in any MBT parked overnight because the unit is considered a storage magazine. Since the MBT cannot meet some of the regulatory requirements for a magazine, ATF licensees had to obtain a waiver seeking alternative compliance from ATF. This practice has become so ubiquitous, safe, and secure that ATF recently issued a ruling eliminating the need for these waivers and spelling out the alternative conditions necessary for compliance.¹⁰

⁹ Responding to Trucking Incidents Involving Commercial Explosives with Leader's Guide, 2003 IME and PHMSA, Washington, DC.

¹⁰ http://www.atf.gov/explarson/rules/atf_ruling2007-3.pdf

3. Without PHMSA's SPs for transportation of bulk materials, accidents will increase and the US economy would be devastated.

If PHMSA revoked the SPs for transportation of bulk materials for blasting, explosives manufacturers would not be able to meet consumer demands for the amounts of material needed to continue mining and construction. Productivity in these industries would be reduced dramatically, perhaps initially by half. Some mining sectors would be virtually shut down. The products that would replace bulk are more sensitive and the positive trend in safety experienced through the 1900's would be reversed as accidents in manufacturing, storage, transportation, use and disposal would be expected to increase.

The following table estimates that the nation would suffer a 30 percent reduction in capacity to deliver explosives to consumers if PHMSA revoked the SPs for transportation of bulk materials for blasting. This analysis only considers the final segment of transportation which ends in delivery down the borehole. Additionally, there would be negative impacts in the distribution chain upstream from this segment.

Type of Commercial Explosive	2007 Consumption (tons)	Annual Capacity without DOT Bulk SPs (tons)
Bulk ANFO	1,640,000	2,000,000 ¹¹
Bulk ANE	1,640,000	50,000 ¹²
Packaged Division 1.5 and 5.1	139,000	278,000 ¹³
Packaged Division 1.1	45,100	90,200
Total	3,464,100	2,668,200

Although the industry could deliver 2 million tons of explosives to users as ANFO, many of them could not use ANFO due to site conditions or would suffer significant productivity losses. Blasting with packaged products is much less efficient than with bulk materials, so efficiency would be reduced anywhere packaged product use increased.

Aside from the laws of supply and demand, the impact of PHMSA revoking the SPs for transportation of bulk materials for blasting would have varying effects on different sectors and regions as shown below.

¹¹ IME estimates that the current fleet of MBTs could deliver about 60% of current demand for bulk materials as ANFO. About 40% of the fleet can only deliver ANE.

¹² An SP is needed to transport bulk ANE on highways. This number reflects the current capacity to manufacture ANE on-site.

Type of Sector	Unique Factors	Consequences of Revocation of SPs
MN Iron Range and other mineral mining	Packaged products impractical. ANFO not effective. Foreign competition.	Nearly complete shutdown of sector.
Construction and Quarries	ANFO marginally effective. Dependant on ANE. High population density.	Increased public exposure to risk. Dramatic decrease in productivity.
Powder River Coal	Packaged products impractical. Dependant on ANE.	Made noncompetitive with other coal fields.
Appalachian Coal	ANFO somewhat effective. 1/3 of usage is ANE. Higher population density.	Increased public exposure to risk. Dramatic reduction in production.
Power Generation	Dependent on coal.	Dramatic reduction in capacity to generate electricity with coal.
All Other Industries	Dependent on sectors listed above.	Severe, perhaps unprecedented, economic downturn.

If PHMSA revoked the SPs for transportation of bulk materials for blasting, the long-term solution would be to move manufacturing and storage of raw materials on-site. This would result in thousands of locations where these security-sensitive materials are stored and thus would create a security vulnerability where one did not exist before. It would take up to 20 years to migrate from the centralized distribution system of today to one based on on-site manufacturing. One IME member company has estimated that the cost of maintaining its customer base in this manner would cost them nearly 300 million dollars and 145 jobs. The loss of bulk products would be offset somewhat by an increase in packaged products, a trend that would also increase the nation's security vulnerability. Although bulk materials for blasting have never been used in a criminal bombing, packaged explosives have been used.

If PHMSA revoked the SPs for transportation of bulk materials for blasting, traffic accidents would increase because two or more vehicles would be needed to transport what was previously transported on one vehicle.

4. Industry Efforts to Achieve and Maintain Safety & Security of Explosive Materials

The industrial explosives industry is one of the most proactive safety advocates in the US. At the explosives industry's bequest, Congress passed the first hazmat transportation act in 1908. Interestingly, although the bill was titled a hazmat bill, it only regulated explosives because other chemical producers advocated keeping their materials out of the bill. It would be decades before the transportation of other hazmats became regulated. This cooperative and proactive nature lives on

today through the IME. IME standards call for a much higher level of performance than do the regulations. In fact, nearly every explosives regulation has its roots in IME standards. Today, IME, in partnership with the Department of Defense, is at the forefront of developing quantitative risk assessment modeling methods for explosives risk management.

Further proving the commitment to safety held by explosives manufacturers, IME members have had an average DART rate from the US Occupational Safety and Health Administration below the national average every year since 2003. A DART rating is given by OSHA and factors several different statistics on an employer to provide a single, overall safety rating for their workplace.

When PHMSA came to industry in 2008 to discuss MBT safety enhancements, industry developed recommendations to directly address the root causes of incidents involving MBT. The root causes were determined to be driver error and tire issues. Despite our belief that no significant problem existed, and in pursuit of continuous improvement, the industry task force decided to recommend modifications to IME's construction standard for MBTs, SLP-23. These modifications will enhance the standard's recommendations which already go considerably beyond what is required by the SPs. Industry's substantial compliance with the recommendations of SLP-23 is another example of industry's self-motivated pursuit of the safest practices possible.