# INTERMODAL EXPLOSIVES WORKING GROUP REPORT

## U.S. DEPARTMENT OF TRANSPORTATION

**With Participation Of:**

**Research and Special Programs Administration**

**United States Coast Guard**

**Office of the Secretary of Transportation**

**Federal Motor Carrier Safety Administration**

**Federal Railroad Administration**

**February 2003**

## EXECUTIVE SUMMARY

This paper examines the process used by USCG Captains of the Ports (COTPs) when petitioned to issue a permit for transportation and loading or unloading of commercial explosives through U.S. ports.

Commercial explosives, like many other hazardous materials, are essential to our way of life, but involve some risk when transported. DOT's Research and Special Programs Administrations (RSPA's) risk-based hazardous materials transportation regulations (HMR) are intended to mitigate this risk to an acceptable level.

Hazardous materials are permitted to move freely in commerce if the established requirements of the HMR are met. However, explosives, through the imposition of additional USCG COTP measures, are often required to meet a "zero public risk" safe separation requirement based on Department of Defense quantity-distance (Q/D) requirements for Military explosives facilities when a permit request is made to USCG COTPs.

At present there is no quantitative risk assessment tool specifically designed to support the COTPs in the port explosives permitting process. Instead the USCG policy document strives to promote the use of a risk-based assessment by it's COTPs ("*In issuing permits, the COTP should consider population density, property use, topography, quantity-distance tables, mission objective, consistency of the activity with the State's coastal zone* *management plan, state and local ordinances, and alternatives*."), but in practice this guidance is frequently negated by the application of DOD's Q/D standards, which, as earlier noted, are "zero public risk" in nature. The divergent nature of these two approaches results in inconsistency of approach among COTPs.

USCG COTPs strict application of DOD Q/D requirements raises concerns that they may have the undesirable effect of transferring risk to other modes as shipments are forced to offload in more distant ports and experience longer movements by barge, rail or highway transportation to get to their destinations. To address these concerns, a formal Department Working Group was chartered to review existing regulations and provide recommendations on the policy guidance involving the USCG permitting process for explosives shipments transported through U.S. ports. The Working Group involved representatives from RSPA, the USCG, the Federal Highway Administration, the Federal Railroad Administration, and the Intermodal Office in the Office of Secretary of Transportation.

Risk and cost implications of examples of rigid adherence to Q/D criteria were examined. In the examples explored, it was found that system-wide risks from such a course could be orders of magnitude higher than from allowing unloading in a port closer to the intended destination of the explosive cargo. This occurs because highway risk (crash and explosives transportation) more than offsets port risk if significant distances are involved. For example, based on risk data, if an offload at a preferred port with 100 people in the Q/D area were denied, the risk avoided at the preferred port would be offset after the shipment traveled only 10 miles from a more distant port in the particular examples examined if assumptions are correct. Apart from risk shifting, avoidance of small risks at extraordinary costs was also an issue. Department of Transportation guidelines balance the benefits of regulations against their cost. Three million dollars is the accepted value of a human life for such analyses. This would generally allow only $600. to be spent to avoid the entire risk from an operation where the average expected number of fatalities during that operation is 0.0002, the approximate level of risk that appeared to be encountered in the examples considered. The rough analysis underscored the need to take a comprehensive look at the effects on the overall transportation system that examines specific, credible alternatives when denial of port access is considered.

The Working Group determined that the Q/D criteria used by COTPs in making permitting decisions was unduly restrictive, and recommended the following additional factors be used to consider risk tradeoffs if strict Q/D requirements are not net:

- -The degree and duration of public exposure.
- -The nature of the transfer operation.
- -Acceptance of risk by the local community.
- -Other hazardous materials that may be present in port in significant quantities that would magnify the effects of an explosion.
- -Critical infrastructure within the port area that might be affected.
- -Development and use of sound industry practices.
- -The overall system risk of alternatives.
- -Cost.

-Security considerations.

The Working Group recommended that, ultimately, more formal, standardized tools and guidance be developed to enable the USCG to consider risk tradeoffs in making permitting decisions. While these may include the use of some variant of DOD's risk based software package, SAFER, there will still have to be an adjunct list of criteria considered by the COTP to make the best overall decision, which is repeatable over time given the existence of the same circumstances.

## INTRODUCTION

Current U.S. Coast Guard (USCG) practice regarding commercial explosives (referred to as Class 1 materials under the Department of Transportation (DOT) Hazardous Materials Regulations) being loaded or offloaded at commercial ports applies the Department of Defense (DOD) explosive safety quantity-distance (Q/D) methodology developed in DOD 6055.9 for site approval of military explosives facilities. This practice is implemented through the USCG Marine Safety Manual (MSM), a guidance document used by the Captain of the Port (COTP) in overseeing a range of port operations, including loading and unloading of explosives and transit of ships carrying explosives through the ports. Industry has voiced concern about what they contend to be the resulting overly restrictive nature of transporting multi-modal movements of commercial explosives. There is concern in the Research and Special Programs Administration (RSPA) of DOT that the USCG's application of Q/D requirements may have the undesirable effect of transferring risk to other modes of transportation. Because of this, a formal working group was chartered (Attachment 1) to review and provide recommendations on the policy guidance on USCG permitting of Class 1 shipments. In preparing this report, the Institute of Makers of Explosives was given the opportunity to comment on their views with regard to the USCG Q/D policy and its implementation. Their principal concerns included the overly restrictive nature on use of ports, and the lack of consistency by successive COTPs in the issuance of permits which created difficulties in making long-term business plans.

This paper focuses primarily on the issue of explosives being transported through U.S. ports from a safety perspective. It presents and discusses the various issues that are pertinent to the subject, and ultimately presents a recommended approach for COTPs to follow when considering issuing a permit for transportation of commercial explosives through commercial ports that focuses on a decision process which poses the least overall risk to the U.S. public.

## COMMERCIAL EXPLOSIVES INDUSTRY

Commercial explosives are essential to the U.S. economy for purposes such as construction, mining and forestry. They are also transported internationally with an approximate 200 million dollar favorable trade balance of trade for this commodity. The U.S. consumes over 5 billion pounds of commercial explosives annually. This results in as many as 500,000 shipments, some involving U.S. ports. Considering the volume of movements, commercial explosives have established a good safety record during transportation. The last explosion during port handling occurred in 1913. No incidents involving commercial explosives were identified in a review of RSPA's Hazardous Materials Information System, which has records of hazardous materials transportation incidents dating back to 1971.

Advances in commercial explosives technology have allowed manufacturers to develop less sensitive explosives, which are thereby safer in transportation. In the early 1900's approximately 50 percent of the explosives consumed in the U.S. was black powder, a substance sensitive to heat, impact and friction. By the middle of the century, black powder accounted for only 3 percent, largely supplanted by dynamite, a much less sensitive material. Today the U.S. market for explosives has largely been captured by ammonium nitrate based explosives, accounting for 98 percent of all explosive material used. In addition to being less sensitive, ammonium nitrate based explosives typically contain 5 to 20 percent water, which provides substantial protection from fire because they are difficult to burn. Molecular explosives such as TNT have not changed greatly over time, but modern manufacturing, packaging and transportation methods have combined to make them less prone to compromise. The safety record is likely due to the success of incremental safety enhancements and the application of risk management by government, as well as the commercial manufacturers, commercial customers and commercial transportation companies.

**REGULATIONS**

The DOT Hazardous Materials Regulations in 49 CFR 100-180 govern the transportation of hazardous materials, including explosives by all modes of transportation. They include classification criteria for each type of hazard, packaging, compatibility, hazard communication (shipping paper, labeling, marking and placarding), training, emergency response and operational requirements. The regulations are based on risk management principles placing the greatest emphasis on the highest hazard materials. Recognizing that it is impossible to eliminate all risk with hazardous materials transportation, the program strives to minimize these risks and keep them at acceptable levels for society. The regulations include many risk management strategies, such as limiting the types of explosives that can be transported and the segregation of explosives in transport units. Even though safety is the primary goal of hazardous materials regulations, there is an inherent risk in transporting these types of materials, including explosives, which are essential to our economy and way of life when used in a controlled manner. Explosives can cause catastrophic damage in the event of an accidental detonation, generating a shock wave traveling in excess of six miles a second. Nevertheless, when explosives are classified, packaged and transported in accordance with regulations, they are considered to pose an acceptable level of risk. They are still more dangerous than many other commodities and merit increased scrutiny. If there is a catastrophic accident, everyone within the blast zone is in danger of being killed or injured. However, unreasonable barriers that inhibit transportation and shift risk to other venues or increase overall system risk are discouraged.

Classification

Under the regulations each explosive must be classified based on internationally agreed tests and criteria before it is allowed to be transported. Subjecting new explosives to the process of hazard classification is a key component of risk management. There are two significant steps in this process. First, there is an evaluation of the potential for an explosive to be accidentally initiated under severe conditions that may be encountered in transportation. The evaluation considers explosives' thermal stability, sensitivity to impact, sensitivity to friction, response to fire, and a packaged explosive's response to mishandling by dropping from a height of 12 meters. Explosives must pass all these tests. If they fail any one of these tests, they are considered too sensitive to transport, and are forbidden from transportation unless appropriate measure are taken to remove the cause of failures.

Second, there is an assignment of a division number and a compatibility group to indicate the characteristics of the explosives. Explosives are classified into five different divisions (categories) to indicate their main hazard properties: Division 1.1 for explosives with a mass explosion hazard; Division 1.2 for explosives with a projection hazard but no mass explosion hazard; Division 1.3 for explosives with a fire hazard but no mass explosion or projection hazard; Division 1.4 for explosives with no significant explosion, projection or fire hazard; Division 1.5 for explosives with a mass explosion hazard but so insensitive there is very low probability of initiation or of transition from burning to detonation under normal transport conditions. There is a sixth division for extremely insensitive explosives created for DOD which is not used. Explosives are further assigned to 13 compatibility groups. The combination of a division number and a compatibility group provide transport workers with better information to determine which explosives can be safely transported together.

Packaging

Since 1990, packagings used to transport explosives in transportation are subject to internationally agreed performance packaging standards. Under these standards, package design types used for explosives are subjected to drop tests of 2 meters in a variety of orientations, stacking tests, and pressure tests if applicable. These requirements significantly enhanced previous explosives packaging requirements and help to ensure that explosives are retained even under accident conditions.

In addition, the advent of containerization has also contributed to a reduction in risk. First the use of containers reduces the amount of handling and provides a level of physical protection. Second, there is less danger of simultaneous detonation of the entire shipment.

Segregation

Since most explosives require a means of initiation to generate an explosive effect, the regulations include rigorous segregation and separation requirements to preclude or limit inadvertent initiation in transportation. These requirements are based on the classification system and place limits on the types of explosives that may be carried in the same transport unit or specify minimum separation distances when loaded into ships.

Hazard Communication and Training

To alert transport workers and emergency response personnel of the presence of explosives, extensive hazard communication requirements apply to explosives. These include identifying materials on transport documents, providing specific emergency response information with the transport document and a 24-hour telephone number where more detailed information may be obtained, markings and labels on packagings and through placarding of transport units. Each hazardous material employee is required to be trained on the hazards of materials they handle and their specific responsibilities.

Modal Requirements

In addition to the multi-modal requirements for the transportation of explosives such as packaging, labeling and placarding, as well as condition of the transport conveyance, the regulations also include numerous requirements unique to each mode.

In the aviation mode, explosives are generally not permitted to be transported. Provisions for waivers do exist, however.

Regulations governing maritime transportation of explosives include extensive requirements on the handling of explosives and include the requirement for the COTP to issue a permit for the handling of Division 1.1, Division 1.2 and, in some cases, Division 1.5 explosives on waterfront facilities. The COTP uses guidance provided in Volume VI, Chapter 1 of the MSM which states, in part "*In issuing permits, the COTP should consider population density, property use, topography, quantity-distance tables, mission objectives, consistency of the activity with the State's coastal zone management plan, state and local ordinances, and alternatives. It is emphasized that no single standard is either absolute or appropriate for all situations. Each permit application should be evaluated in light of its unique characteristics*." However, the MSM goes on to reference DOD's Q/D standards for use in establishing safe separation distances. These standards are "zero public risk" by design, not lending themselves to the more comprehensive risk-based process implied in italic text above, and common to other aspects of the regulations pertaining to the transportation of hazardous material. They preclude other unrelated activities from taking place within a calculated distance based on the quantity of explosives onboard the ship. The MSM also outlines modifications to the explosive transfer operation that can be undertaken so as to meet Q/D limits.

Motor carrier requirements include routing requirements to avoid population centers, parking restrictions, and continuous attendance of the vehicle. Particularly significant to this issue, the motor carrier requirements in 49 CFR 397 include requirements for routing of Division 1.1, 1.2, and 1.3 explosives. These requirements, generally require that vehicles be operated in accordance with a route plan prepared by the carrier with the intention of avoiding populated areas and critical infrastructure. The regulation also acknowledges that these areas cannot always be avoided and permits reasonable exceptions at the discretion of the carrier or driver. For rail, there are requirements prohibiting placarded rail cars from being transported in a passenger train, and a requirement on the force associated with coupling. There are no routing requirements for transporting explosives or any other hazardous material by rail. Neither the highway or rail modes, however, are subject to any regulatory requirement similar to the one outlined in the preceding paragraph involving application for a transit permit from the USCG.

Application of the Q/D methodology to highway or rail transport would essentially preclude all full container or truckload shipments of 1.1 and 1.2 explosives by these modes.

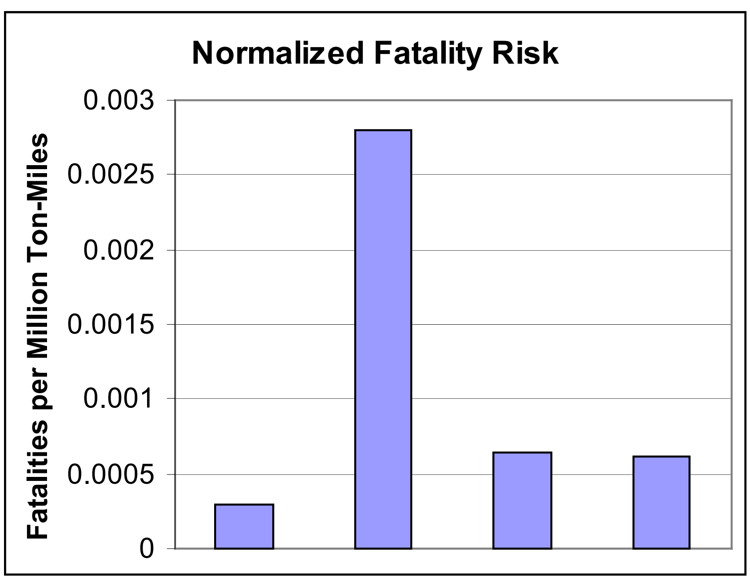
Modal Comparison of Most Dangerous Materials

Although the record of hazardous materials transportation has been good over the years when compared with other societal risks, one of the most difficult judgments relates to system risks involving low probability, high consequence events. A violent explosion of a shipload quantity of Division 1.1 explosives in a heavily populated area is an example. In order to better understand the contribution of low probability, high consequence events to overall risk, RSPA sponsored a multi-year research effort conducted by Argonne National Laboratory.

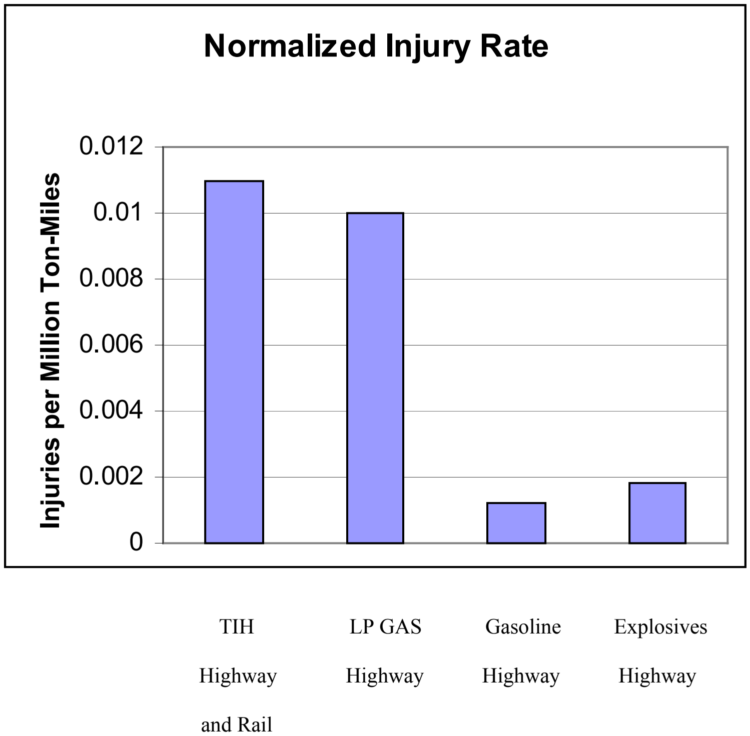
The assessment modeled the hazardous materials transportation system in order to define the national risk associated with rail and highway transportation of selected hazardous materials. Six toxic by inhalation (TIH) chemicals (anhydrous ammonia, chlorine, sulfur dioxide, hydrogen fluoride, fuming sulfuric acid, and fuming nitric acid) which account for 90 percent of the total TIH risk, flammable materials (liquefied petroleum gas and gasoline), and explosives were considered in the study. The Argonne National Laboratory Report entitled "A National Risk Assessment for Selected Hazardous Materials in Transportation," December 2000, documents the result of the study.

Long-term average fatalities due to the inherent dangers of hazardous materials are estimated to be about 18 per year for all of the materials indicated in the study when the effects of normal mitigative measures such as sheltering or evacuation are considered. This compares with an average of 11.5 fatalities per year for surface modes for the period 1991 through 2000. Total risk appears to be about 1.5 times higher than normal annual averages evidenced in RSPA data when the effects of high consequence, low probability events are factored in. The results would appear to support a conclusion that, overall; the hazardous material transportation system is functioning well.

Another conclusion that can be drawn from the study is that the risk of transporting explosives by highway compares favorably with transportation of other hazardous materials on a normalized (per ton-mile) basis. The following charts clearly depict this. Similar data is not available for the marine mode.




TIH Highway | LP GAS Highway | Gasoline Highway | Explosives Highway and Rail




**COSTS VS. BENEFITS ISSUES**

Based on the relatively good accident history of explosives, additional measures controlling shipments can be difficult to justify on the basis of cost and benefits. Marginal improvements that come at significant cost may be the most tenuous. It should be noted, however, that low-probability, high-consequence events are difficult to assess. Because a given type of catastrophic event has not occurred over a relatively short history of a few decades does not mean that it cannot occur in the future. Regardless of how remote the probability, the consequences can be enormous, and sometimes lead to considerations that go beyond the statistical analysis or long-term averages. For instance, when there are many deaths involved in a single event, there are additional dimensions that must be considered. Society typically is very adverse to these types of risks – even when amortizing those fatalities over time might suggest the effects are not as drastic. It is a challenge to make sure safety regulations consider these possibilities and take reasonable measures to guard against their occurrence.

Benefits from a safety program are most commonly measured in terms of fatalities and injuries that are avoided. Although saving an identifiable life is often regarded as a moral imperative on which no monetary value can be placed, prevention of every possible accidental death would be intolerably costly in terms of both money and the quality of life. The term value of a statistical life is widely used to emphasize that value is placed, not on a particular life, but on safety measures that reduce the statistically expected number of accidental fatalities by one. The value of a statistical life measure is necessary to ensure prudent management of public and private resources. DOT currently uses a figure of $3,000,000 for the value of a human life in these analyses.

Table 1 further translates this to fractional values of a statistical life and can be used to illustrate how imposition of measures that involve extraordinary costs to avoid a relatively insignificant risk are difficult to justify in the regulatory environment. According to the general DOT guidelines, measures that impose a cost on society greater than $300 to eliminate fatality risks, on the average, of $1x10^{-4}$ lives would not be justified. The Department of Defense Explosive Safety Board (DDESB) risk acceptance criteria that attempts to lower risk to the public to less than $1x10^{-5}$ equates to a limit of $30 of societal resources that can be justified in the regulatory environment to eliminate this level of risk in its entirety.

Table 1

| General DOT Guidelines on the Value of a Statistical Life | |
|---|---|
| Fatalities Avoided | Value to Society |
| 1 | $ 3,000,000 |
| .1 | $ 300,000 |
| .01 | $ 30,000 |
| .001 | $ 3000 |
| .0001 | $ 300 |
| .00001 | $ 30 |

In the next section, alternatives are evaluated in an example to illustrate how decisions made to reduce or eliminate risk can have the unintended effect of simply shifting risk or, worse, increasing overall transportation system risk. In this example, one case considers the in-port risk where strict Q-D requirements are not met and another case considers use of an alternate port at great distance that meets Q-D requirements but requires significant highway transportation of explosives. (Note that cautions as discussed later on assumptions, data, and alternative selection apply.)

Apart from risk shifting, it is illuminative to look at cost implications. One of the alternatives of the case in question involves an additional 1200 miles of highway transportation. Assume there is no additional highway risk as outlined in the case and just look at the cost ramifications. An in-port risk of .0002 fatalities per year is eliminated at a cost of an additional 432,000 highway miles of truck transportation by going to the alternative port that meets Q/D requirements. This would equate to a cost of $432,000 per year (at $1.00 per mile for truck transportation) to save .0002 statistical lives per year. It is apparent from Table 1 that (if the assumptions, data, and assessment of risk are correct) the alternative case could not be justified.

As discussed earlier, other factors, such as public acceptance or non-acceptance of risk, aversion to single events with a large number of fatalities, the fear of certain types of catastrophic events, and special infrastructure impacts may enter into an assessment. It is also important to remember that people do not die in .0002 increments, but rather in whole numbers. The general guidelines on the value of a statistical life provide a foundation for the analysis, but is only one part of the decision process. Decisions on the regulatory requirements to impose on unloading of commercial explosions should be rooted, to the extent practicable, in an understanding of the benefits that will accrue and the costs that will result while considering special factors that may be important in the ultimate judgments to be made.

**RISK TRANSFER**

Decisions made on the basis of strict application of Q/D requirements to transportation of commercial explosives through ports can shift risks to other modes of transportation. Regulations require that explosives be routed so as to avoid population centers, to the degree possible. However, population centers have tended to develop around our Nation's transportation links. Identifying movement routes that avoid population centers can prove difficult, if not impossible. In fact, some explosives are used in urban areas for purposes of construction and demolition. And by avoiding population centers, they will likely involve a longer total travel distance, with the obvious attendant risk increase. It is important to be aware that avoiding risk in one area may increase it in another, and care must be taken to understand overall system effects and possible risk transfer. Representatives of the Institute of Makers of Explosives, for example, contend that in some instances explosives bound for magazine storage in Arkansas were offloaded in Canada due to strict application of the DOD Q/D criteria. This kind of assertion is difficult to verify, and there are many other factors that go into the decision on where to offload explosives. It is informative, however, from a hypothetical standpoint to assume this assertion to be true and to evaluate the overall risk implication.

During a preliminary internal analysis, we examined what could occur if Q/D requirements are applied in a "zero public risk" manner. In this case, Q/D requirements in a specific port could not be met because public exposure could not be completely eliminated. Unloading large vessels in the harbor to smaller vessels that would meet Q/D requirements in port was evaluated as an option along with use of an alternative port meeting Q/D requirements but involving an additional 1200 miles of highway transportation. Entire operations over the course of a year were considered. Results are shown in Table 2.

Table 2

| Expected Fatalities, $E_f$ | | |
|---|---|---|
| Case A<br>Unload Large Vessel<br>In Port | Case B<br>Unload Large Vessel in Harbor<br>and Transport Smaller Vessels<br>to Port for Unloading | Case C<br>Use Alternate Port with Additional<br>Highway Shipments of 1200 Miles |
| $E_f$ (port risk) = .00020 | $E_f$ (port risk) = .00011 | $E_f$ (crash risk) = .013 |
| | (harbor risk) = .00010 | (expl. trans. risk) = .012 |
| (total risk) = .00020 | (total risk) = .00021 | (total risk) = .025 |

A DOD explosion rate for explosives handling was used for unloading operations in Cases A and B. In-port and lightering operations were assumed to have the same hourly rate of explosions (more favorable materials handling conditions in port may not support this assumption). Both considered worker and general population exposure. The overall fatality risk for these two options are relatively close and, depending on how one values worker and general public risk, judgments may vary on which is the more desirable option.

Case C considered additional highway transportation crash risk and explosives transportation risk. The former was based on National Highway Traffic Safety Administration fatality rates for large trucks. The latter was based on fatalities per million ton-miles from the "National Risk Assessment for Selected Hazardous Materials in Transportation," December 2000, Argonne National Laboratory. If options and assumptions are accurate, a decision to deny port access and force use of an alternate port meeting Q/D requirements but at substantially greater distances from the destination would be an unwise one. Total system risk appears to increase dramatically. The total additional highway risk (crash risk plus highway explosives transportation risk) is roughly two orders of magnitude higher than the port risk that was avoided.

While this assessment only evaluates risk on the basis of human lives, it should also be noted that the longer transportation route also has the potential of endangering additional critical infrastructure. Transportation from Canada to the United States by highway, for example, would involve one of the bridges connecting the United States and Canada.

At the same time, requiring lightering may reduce risk to the public (as opposed to workers who are presumably compensated for the risks they are taking.)

Risk decisions may be more sensitive to highway transportation distances than to public exposure near ports, depending on the specifics (such as population densities) involved. Both involve potential pubic exposure – and desire to completely eliminate public exposure in ports may in fact merely shift that public risk to the highway. Increased risks from highway transportation of explosives appear to offset port risk when substantial distances are involved.

Table 3 illustrates the tradeoff between in-port risk and highway transportation risk for the earlier example. In this case, the number of the public exposed in port is traded off with the additional highway transportation distance that may be required. An average public population density of 100 people per square mile equates, in the case of a 900-ton ship carrying commercial explosives with an evacuation distance of 2990 feet, to 100 people being within the exposure zone. The additional highway risk from an additional 10 miles of highway transportation from an alternate port meeting Q-D requirements would offset the risk savings. If 1,000 people are within the exposure zone, up to an additional 100 miles of highway transportation might be justified. If 10,000 people are within the exposure zone, an additional 1000 miles of highway transportation might be justified.

<u>Table 3</u>

| **Risk Equivalency Based on Expected Fatalities** | |
|---|---|
| *Unload Large Vessel In Port*<br>Number of Public within Evacuation Distance | *Use Alternate Port with Additional Highway Travel*<br>Additional Distance Justified Based on Risk |
| 100 | 10 miles |
| 1,000 | 100 miles |
| 10,000 | 1000 miles |

These numbers should not be taken as definitive or precise in general application -- but rather as illustrative of the type of things to consider. Circumstances and conditions may not match this example. This rough analysis, however, underscores the need to take a comprehensive look at the effects on the overall transportation system that examines specific, credible alternatives when denial of port access is considered. It is also important to consider that in almost all situations, regardless of the choice one makes, an accident is not likely to occur.

**RISK MANAGEMENT**

At present there is no quantitative risk assessment tool specifically designed for ports and transportation to make permitting decisions. The Coast Guard's Risk Based Decision Making (RBDM) model does a good job in comparing risks from one port to another in qualitative terms (i.e. Port A is more risky than Port B), but there is nothing on which to make a decision as to whether or not to issue a permit in the first place. In the absence of a quantitative model, a qualitative judgement must be made. Explosion rates are extremely difficult to ascertain because of their rarity. Population concentration around the perimeter of the zone, rather than uniform throughout, may point to less severe consequences. Factors such as risk aversion to exposure of high numbers of the public in a specific case, even if risks and averages may be low, must also be considered. A degree of judgment is involved in any decision. Although Q/D is useful in defining the area that may be impacted should an explosion occur during a port operation, its application as the sole decision tool for approving a loading or unloading port appears to be unduly restrictive.

Consideration of risk should take an expansive approach that considers alternatives and effects of actions both in ports and across the entire transportation system. This is consistent with efforts in recent years by the DDESB to move to a risk based approach as an alternative to use of the Q/D formula.

The following factors should be used by COTPs to consider risk tradeoffs in decisions on issuing approvals for explosives shipments if strict DOD Q/D requirements are not met:

- The degree and duration of public exposure. For instance, a relatively low population density at the peripheral of the exposure zone poses less risk than a high population density in major portions of the exposure zone.
- Nature of the transfer operation, i.e. break-bulk vs. container
- Acceptance of risk by the local community. The local community (through their political leadership) may actively communicate support for explosives unloading operations when there are economic benefits to the community. This acceptance of risk should be given great weight; however, it is incumbent for the COTP to ensure there is a full understanding of the nature of the risks involved when such views are expressly stated.
- Other hazardous materials that may be present in port in significant quantities that would magnify the effects of an explosion.
- Critical infrastructure within the port area that might be affected.

- Development and use of sound industry practices.
- The overall system risk of alternatives. For example, transportation of explosives long distances by highway may pose risks an order of magnitude or more higher than those avoided if use of a closer port is denied. Alternatives must be realistic and credible.
- Cost is a factor. Imposition of measures that involve extraordinary costs to avoid an insignificant risk should be avoided. Benefit-cost is a factor in the justification of regulations. One should be cognizant of the value of eliminating the level of risk that may be present and whether this is in the range of DOT guidelines on the value of a human life.
- Security considerations. These should be factored into any decision. For example, the attractiveness of the operation as a terrorist target, the ability to provide adequate security, and the MARSEC level are all issues that are relevant.

A major difficulty in utilizing a qualitative methodology is the lack of consistency. Different COTPs invariably see the world differently, and what may appear acceptable to one Captain of the Port, may seem as an unacceptable risk to another. For all its failings, the current Q/D methodology does provide a standard, consistent and quantitative approach for defining the area impacted by a worst case explosion and provides a useful starting point in making decisions. As indicated earlier, however, other factors should be weighed. Ultimately a quantitative methodology should be adopted. The Department of Defense has a more sophisticated computer model called SAFER 2.0 that can be adapted for port use. The model has limitations, but does quantify risk and is the closest thing to a standardized, repeatable consistent methodology that currently exists. The key issue in using this model will be the level of acceptable risk. It is conceivable that decision criteria for the DOD and hazardous materials transportation may differ. However, SAFER 2.0 should provide a better quantitative framework to understand the level of risks involved and in which to make these decisions.

## CONCLUSIONS

Advances in industry practices and regulatory requirements have progressively enhanced the safety of explosives in transportation.

Commercial explosives pose a risk that is of the same order of magnitude as other hazardous chemicals which pose low probability high consequence risk but for which the USCG imposes no restrictions of the significance of DOD Q/D.

The strict application of DOD Q/D has the potential of transferring risks to other portions of the transportation chain.

## RECOMMENDATIONS

Identify ways to permit transportation of commercial explosives that are viable and safe, and that pose the least overall risk to society.

Emphasize USCG guidance material in the MSM recognizing that other factors besides Q/D should be taken into account in authorizing a loading or unloading port. One way to do this would be to modify the MSM to explicitly list the factors identified in the previous section for consideration by COTPs in decisions on issuing approvals for explosives shipments if strict DOD Q/D requirements are not met.

Develop more formal, standardized tools and guidance in the long-term to enable COTPs to consider risk tradeoffs in decisions on issuing approvals for explosives shipments. While these may include the use of some variant of DOD's risk based software package, SAFER, there will still have to be an adjunct list of criteria considered by the COTP to make the best overall decision, which is repeatable over time given the existence of the same circumstances.

**ATTACHMENT 1.**

# Explosives Permitting

# Intermodal Working Group Charter

Purpose

**Review and update the Policy Guidance Regarding Coast Guard Permitting of Class 1 (Explosives) of Divisions 1.1, 1.2 and 1.5.**

**Background**

Current regulations (33 CFR 126.19, 49 CFR 176.100 and 176.415) require that the Captain of the Port issue a permit for the handling of Division 1.1, Division 1.2 and, in some cases, Division 1.5 explosives on waterfront facilities. Existing policy guidance calls for the COTP to rely primarily on the Department of Defense Quantity – Distance Tables (Q/D) as contained in DOD 6055.9-STD to make permitting decisions regarding the amounts that can be present/handled at one time. The tables are relatively inflexible and may not account for improvements in explosive stability, packaging, handling and other safety enhancements in the transportation system. In addition, the Department of Defense, as well as some foreign authorities, are beginning to adopt a risk based approach as these techniques have become more refined. Finally, the Coast Guard, when making permitting decisions, considers only the immediate port operation. This is of concern to the Research and Special Programs Administration as it does not address the total transportation system risk. In light of these improvements and concerns, the Coast Guard wants to incorporate a risk assessment process in its permitting procedure.

**Deliverable**

The intermodal working group will make recommendations to update policy utilizing a risk management approach so as to provide a tool for Captains of the Port to make permitting decisions regarding explosives handling at port facilities. This tool should be primarily quantitative in nature, and provide for a consistent national approach for authorizing explosive loading and unloading in ports.

**Process**

The working group will consider the following steps to produce the deliverable:

(1) Review existing policy guidance;

(2) Identify how the risk of transporting explosives is managed by each mode of transportation and quantify the degree of risk posed in each mode of transport. Put explosive transportation risk into perspective with other hazardous materials in transportation. Consider operational practices, classification, and packaging requirements that may have reduced transport risks.

(3) Examine whether the DOD Explosives Safety Board SAFER 2 program can be modified to make it adaptable to ports.

(4) Develop a methodology for assessing the risk of a particular proposed explosive handling operation in a port for purposes of comparing alternative ports or operating practices and to ensure that the overall transportation risk is kept within acceptable levels.

(5) Provide qualitative guidance on how security in transportation should be taken into account.

Structure

The working group is chartered by the Assistant Commandant for Marine Safety, Security, and Environmental Protection and will be co-chaired by a representative from G-MSO and RSPA. It will consist of representatives of the following organizations:

U.S. Coast Guard / Commandant (G-MSO), (MSE), (MP) and (MO)
Research and Special Programs Administration
Federal Motor Carrier Safety Administration
Federal Railroad Administration
Office of Intermodalism

Submitted.

/S/
M. W. BROWN, Captain, USCG
Chief, Office of Operating and Environmental Standards

Approved.

/S/
P. J. PLUTA, RADM, USCG
Assistant Commandant for Marine Safety, Security and Environmental Protection

# INTERMODAL EXPLOSIVES WORKING GROUP – PARTICIPANTS

| NAME | ORGANIZATION |
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