REPORT OF THE
DEPARTMENT OF STATE POLICE

FEASIBILITY OF USING EXPLOSIVE TAGGANTS

TO THE GOVERNOR AND
THE GENERAL ASSEMBLY OF VIRGINIA

HOUSE DOCUMENT NO. 8

COMMONWEALTH OF VIRGINIA
RICHMOND
1999

COMMONWEALTH of VIRGINIA

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October 2, 1998

TO: The Honorable James S. Gilmore, III, Governor of Virginia
The Members of the General Assembly

Pursuant to House Joint Resolution No. 89 (1998), I have the honor of submitting herewith, a study entitled "*Feasibility of Using Explosives Taggants*". This study is a compilation of the efforts and coordination of federal, state and private entities.

I wish to express my appreciation to the Department of the Treasury-Bureau of Alcohol, Tobacco and Firearms, The Department of Mines, Minerals and Energy, the Department of Housing and Community Development-The State Fire Marshal's Office, The Institute of Makers of Explosives, and the Austin Powder Company for their assistance in producing this report. The efforts of their staffs and employees are to be commended in this effort.

Sincerely,

M. Wayne Huggins

Superintendent

MWH/lp

HJR No. 89 – Feasibility of Using Explosive Taggants

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Authority for Study

The 1998 Session of the General Assembly passed House Joint Resolution No. 89, requesting the Department of State Police, in cooperation with other federal, state and private entities, to conduct a comprehensive study on the need for state regulation of explosives and other dangerous substances to facilitate tracking, and when needed, criminal investigations.

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Acknowledgments

This study is the compilation of research conducted by the Department of Treasury - Bureau of Alcohol, Tobacco, and Firearms, the National Research Council - Committee on Marking, Rendering Inert, and Licensing of Explosive Materials and the Institute of Makers of Explosives. Much of the material contained within this document has been obtained through two studies: (1) Progress Report, *Study of Marking, Rendering Inert, and Licensing of Explosive Materials* (1997), and (2) *Containing the Threat From Illegal Bombings, an Integrated National Strategy for Marking, Tagging, Rendering Inert, and Licensing Explosives and Their Precursors* (1998).

The Department of State Police would like to express their appreciation to the United States Department of Treasury - Bureau of Alcohol, Tobacco, and Firearms, The Virginia Department of Mines, Minerals and Energy, the Virginia Department of Housing and Community Development - State Fire Marshal's Office, the Institute of Makers of Explosives and the Austin Powder Company for their cooperation and efforts in the compilation of this report.

Executive Summary

The 1998 Session of the General Assembly passed House Joint Resolution No. 89, requesting the Department of State Police, in cooperation with other federal, state and private entities, to conduct a comprehensive study on the need for state regulation of explosives and other dangerous substances to facilitate tracking, and when needed, criminal investigations. A committee was formed that reviewed the current research and regulations concerning explosives and other dangerous substances.

As a result of the research, the committee used two current studies concerning the stated issues conducted under the auspices of the federal government. One study, conducted by the Bureau of Alcohol, Tobacco and Firearms, reviewed the history of the issue of explosive taggants, including research and other countries' use of taggants. The other study conducted by the National Research Council evaluated the technical feasibility and practicality of using markers for detection, taggants for identification, and inertants for desensitization of explosives, and, in addition assessed the implications of imposing regulatory controls on a prioritized set of precursor chemicals.

Based upon the information contained within the studies, it became evident that much research had already been completed on the desired topic. Markers are already in use for certain explosives as defined in federal law. This law has been in effect since 1971, which essentially requires explosives manufacturers to mark explosive wrappers with a code identifying the manufacturer and the location, date, and shift of manufacturer. The concern with taggants is over the cost and effectiveness of their use. Based upon current technology, the taggants would double the cost of explosives, creating a burden upon the industry which would inevitably be passed on to the consumer.

The studies went on to review current regulations in the United States and those countries that have experienced a high terrorism rate with explosives. The research indicates that current federal regulations have been effective in curtailing the loss of explosives due to theft. What has been demonstrated in other countries, is that terrorists will adapt their tactics in response to the implementation of controls or shifts in the availability of particular chemicals or precursors. As such, the committee did not recommend any changes to the regulations currently in place for the Commonwealth of Virginia.

It was the conclusion of the committee that until the completion of the federal government's research, any changes by Virginia would not be conducive to alleviating the perceived problem of explosives not being regulated.

Feasibility of Using Explosive Taggants

House Joint Resolution No. 89 (1989)

I. Introduction

The 1998 Session of the General Assembly requested the Department of State Police to conduct a comprehensive study of the need for state regulation of explosives and other dangerous substances to facilitate tracking, and when needed, criminal investigations. As part of the study, the Department of State Police was directed to consider public health and safety concerns, being mindful of costs to the industry. The State Fire Marshal and the Department of Mines, Minerals and Energy were requested to provide technical assistance in this matter.

Upon completion of the study the Department of State Police was requested to provide their findings and recommendations to the Governor and the 1999 Session of the General Assembly.

In view of the mandate that was presented to them, the Department of State Police convened a committee composed of the aforementioned agencies, representatives of the federal law enforcement community and members of private industry who have a mutual interest in this topic.

II. Definitions

What is an explosive?

An explosion is a rapid expansion of matter into a greater volume. An explosive device may be mechanical[1], chemical, or nuclear. This study focuses exclusively on chemical explosives. A chemical explosive is a substance containing a large amount of stored energy that can be released suddenly, thereby converting the substance into rapidly expanding compressed gases (McGraw-Hill, 1992).

Chemical explosives are combinations of oxidizers and fuels. In some explosives, such as nitroglycerin (NG) and 2,4,6-trinitrotoluene (TNT), the

[1] For example, a device in which the internal gas pressure is increased until it causes the brittle rupture of a container.

oxidizer and fuel are compounds. Others are mixed together physically such as ammonium nitrate (AN) and fuel (fuel oil). The energy of the explosive is released by a self-sustaining chemical reaction that is usually initiated by heat or by a mechanical deformation of the explosive that produces heat.

High and Low Explosives

Once initiated, a reaction may proceed through the mass of an explosive at a relatively slow (subsonic) rate, called combustion, burning, or deflagration, or at a rate exceeding the velocity of sound in the particular explosive, called detonation. Explosives such as black and smokeless powders, propellants, and pyrotechnics that combust in normal use are called low explosives; those that detonate are called high explosives. However, given suitable conditions, some low explosives may detonate, and some high explosives may combust, even though these conditions may not occur in normal practice (McGraw-Hill, 1992).

A variety of factors influence whether a high explosive undergoes a transition from combustion or deflagration to detonation. These include intrinsic factors, such as the nature of the chemical reactions taking place inside the explosive, as well as extrinsic factors, such as the quantity of explosive present and the extent to which the explosive is confined inside a container or cavity.

Primary and Secondary Explosives

The sensitivity of explosives to initiation varies over a wide range. Explosives that are extremely sensitive to initiation are called primary explosives. The primary explosive compounds commonly used in the United States today include lead azide, lead styphnate, and diazodinitrophenol (DDNP). These are generally initiated by heat and are usually handled in small quantities for safety reasons.

Secondary explosives are less sensitive in that they require a shock wave for their initiation (detonation). They may be "cap-sensitive" (i.e., susceptible to initiation by a "blasting cap" or detonator) or non-cap-sensitive (i.e., require a booster for their initiation). Dynamite is an example of a cap sensitive secondary explosive, while ammonium nitrate/fuel oil (ANFO) is a non-sensitive secondary explosive, also called a blasting agent. The reduced sensitivity of secondary explosives means that they can be handled in larger quantities with relative safety.

Explosive Train

The characteristics of primary and secondary explosives are exploited in the design of the "explosive train." An example of an explosive train is an arrangement consisting of a detonator containing a small quantity of highly

sensitive initiator (primary explosive); a booster containing a larger quantity of less sensitive high explosive; and the main charge, which is the least sensitive component making up the bulk of the explosive energy.

ANFO and Improved Related Explosives

Generally, ammonium nitrate/fuel oil (ANFO) is the material of choice if blasting conditions are dry. ANFO is cheap, is easily loaded into boreholes, does not require expensive magazine storage, has good "heaving" ability (displaces rock into a neat muckpile), and does not waste energy by shattering the rock immediately around the borehole. However, ANFO lacks water resistance, and its low density limits the explosive power that can be packed into a borehole of a given size.

Beginning in the 1960s and continuing through the 1970s and 1980s, research led to the introduction of a new class of AN-based explosives that addressed the deficiencies of ANFO: water gels and emulsions.[2] These have excellent water resistance and higher density than ANFO, and like ANFO, lend themselves to bulk loading and delivery. However, they are more expensive. Blends of ANFO and emulsions are used to improve water resistance and increase energy density in the borehole.

Commercial ANFO is produced in one of three ways: (1) oiled and bagged at a distributor's facility; (2) oiled by the supplier as the AN prills[3] are being delivered into storage bins at the mine site (the oiled prills are then loaded into high-capacity trucks and carried to the blast site); or (3) delivered as AN prills and stored unoiled in the mine's bins, and then loaded into trucks and oiled as the prills are augered or blown into the borehole. The preferred method depends primarily on the size of the user's operation, going from method 1 to 3 with increasing mine size.

Detection Markers

Detection markers (sometimes referred to as detection taggants) are materials added to explosives that can be sensed before a blast by an instrument designed for that purpose. Markers may be active (by continuously emitting a signal such as a chemical vapor or radioactivity) or passive (emitting a signal in response to probing radiation, e.g., a dye molecule that emits visible fluorescent light when probed by ultraviolet light [JASONs, 1994]). Technologies also exist

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[2] Water gels are explosive materials containing substantial portions or water, oxidizers, and fuel, plus a cross-linking agent. Emulsions are explosive materials containing substantial amounts of oxidizer dissolved in water droplets, surrounded by immiscible fuel, or droplets of an immiscible fuel surrounded by water containing substantial amounts of oxidizer.

[3] Prills are defined as a particle-like form of ammonium nitrate manufactured in a gravity-fed, evaporative "prilling tower".

to detect unmarked explosive materials, including dual-energy x-ray, x-ray computed tomography, thermal neutron activation, vapor/particle detection, and the use of canines (NRC, 1993). Detection marker schemes may improve the specificity and efficiency of these detection technologies or make new methods possible.

Identification Taggants

Identification taggants are additives designed to survive an explosive blast, to be recoverable at the site of a bombing, and to provide pertinent information, such as last legal purchaser(s), to aid law enforcement personnel in identifying the perpetrator. Identification taggants can encode information in a variety of ways and can be added at various points in the production and distribution of an explosive material. Macroscopic plastic particles-originally developed by the 3M Corporation-are the most widely known form of identification taggant (Rouhi, 1995). The sequence of colors in the layers that compose the particles is used to encode various items of information. Other approaches to tagging include the use of polymeric microbeads of various sizes and colors, rare-earth elements in a synthetic matrix blended with fluorescent pigments and iron powder, isotopic methods, and immunoassay techniques (Wu, 1996).

A detection taggant is designed to be identified by a suitable detection device even when the explosive is contained or concealed in a package. Detection machines at airports or other sites could signal any effort to introduce tagged explosive materials into the area.

From 1977 to 1980, a taggant feasibility demonstration program was conducted in the United States for the Treasury Department's Bureau of Alcohol, Tobacco, and Firearms by the Aerospace Corporation. The program evaluated the addition of identification taggants then manufactured by the 3M Corporation to 6.4 million pounds of packaged, cap-sensitive explosives manufactured by four companies. The program evaluated addition of taggants during manufacture, record keeping, and taggant recovery and analysis procedures (Aerospace, 1980).

It should be noted that since 1980, the Swiss government has required that all manufactured explosives contain identification taggants to aid in criminal investigations. The Swiss have not identified one case solved by the recovery of taggants (Schärer, 1996). As a sidenote, Switzerland uses 4,000 to 5,000 metric tons (1 metric ton = 2,200 pounds) of commercial explosives annually, of which 20 percent is dynamite. The United States uses 500 times that amount—5 billion pounds of AN and 100 million pounds of dynamite. Virginia uses, or consumes almost 440 million pounds of explosives.

III. History

On April 24, 1996, the Federal government enacted the *Antiterrorism and Effective Death Act of 1996* (the Act). Section 732 of the Act mandates the Secretary of the Treasury (the Secretary) to conduct a study of: the tagging of explosive materials, rendering common chemicals used in the manufacture of explosive materials inert, imposing controls on certain precursor chemicals and, State licensing requirements for the purchase and use of commercial high explosives. As such, the federal government through the Department of Treasury conducted a study of "*Marking, Rendering Inert, and Licensing of Explosive Materials* (1997)". The study was to review and provide a report to congress on the possible use and exploitation of new prevention technologies.

As part of the Omnibus Consolidated Appropriations Act for Fiscal Year 1997 (Amendment), the Department of Treasury also entered into a contract with the National Academy of Sciences (NAS) to conduct a separate study on black and smokeless powders, which is separate from the taggant study. This study is entitled "*Containing the Threat from Illegal Bombings – An Integrated Strategy for Marking, Tagging, Rendering Inert, and Licensing Explosives and their Precursors* (1998)".

As part of their research, the Department of Treasury in their report "Marking, Rendering Inert, and Licensing of Explosive Materials," noted that since the 1970s, there have been various proposals to mark or "tag" explosive materials for purposes of pre-blast detection or post-blast identification for use in investigating criminal bombings or attempted bombings. A "taggant" or "tracer element" can be a solid, liquid, or vapor emitting substance put into an explosive material for the purposes of detection or identification before an explosion occurs or for identification after an explosion occurs.

Since 1971, the federal explosives law and regulations require licensed manufacturers of explosive materials to legibly identify, by marking, each cartridge, bag, or other immediate container of explosive materials manufactured for sale or distribution. The marks required must identify the manufacturer and the location, date, and shift of manufacture. Licensed manufacturers must keep records of sale or distribution by the marks of identification (date-shift-code), description (brand name), size, and quantity. Licensed distributors also must maintain records of acquisition and disposition of explosive materials. A trace can be undertaken to compile a list of the last legitimate purchasers of all or part of a particular batch of explosives manufactured on a specific date and during a specific shift. However, while this has proven useful in investigations of criminal bombings, its utility is limited to instances where the explosive is recovered before detonation, or, in some cases, where a low-order detonation does not destroy the cartridge.

In a similar vein, the NAS study noted that licensed manufacturers are required to place identifying markings on the packaging for explosives that can assist in tracing them for law enforcement purposes.[4] However, there is no requirement that the explosives themselves contain tracer elements--markers or taggants--that could be used to assist pre- or post-blast law enforcement.

Other State Studies

In an attempt to determine what other states had done in this subject-area, the Department of Mines, Minerals and Energy contacted the Interstate Mining Compact. This review did not provide any additional insights or information, nor were any state studies available for review. Further review indicated that approximately six other states had reviewed this subject, but literature is unavailable.

Taggants for Pre-blast and Post-blast Identification of Explosives

The NAS study examined a variety of concepts for identification taggants, additives that can provide information, both before and after a blast, about the nature and source of an explosive. The benefit of a taggant program to law enforcement depends on many factors. A taggant must survive a large blast and be recoverable by investigators. If a taggant is found, it can be traced from the manufacturer to the last legal purchaser of the explosive. The ATF is currently testing the survivability of the various taggant technologies. In its assessment, the study focused particularly on the ability of a taggant to supply post-blast information that would be useful to law enforcement in identifying and prosecuting bombers, and that therefore might have a deterrent effect.

It is also important to recognize that only 1-2% of the bombs made by criminals use commercially manufactured high explosives. Therefore, a taggant program would need to cover a wide range of explosives and precursor chemicals to be of much benefit or to have any deterrent effect.

The various taggant concepts described in the report can be classified broadly as particulate, isotopic, or biological. Although a number of these appear promising, the information currently available about nearly all of the taggant concepts is inadequate to evaluate their effectiveness in real operational or economic terms. More research and development are needed to find new approaches and to improve those that currently hold the most promise for future use before implementation could be advised.

Only one taggant has been subjected to extensive testing in the United States

[4] The ATF is charged with enforcement of relevant regulations: 18 U.S.C., Chapter 40, "Importation, Manufacture, Distribution, and Storage of Explosive Materials."

(Aerospace, 1980), and this taggant, now manufactured by Microtrace, Inc., is currently in use by the Swiss explosives industry (Schärer, 1996). The study went on to comment that it would recommend the use of any "ideal" taggant that met all of the necessary technical and economic requirements, if the threat to society justified the costs of its implementation. At the time of the study, no known taggants met this standard.

Rendering Explosive Materials Inert

Many common chemicals could potentially be used as explosives in bombs, but a careful review by the committee showed that ammonium nitrate, used in the bombing of the Murrah Federal Building in Oklahoma City, is by far the most commonly accessible explosive material. The study provided special attention to steps that might reduce the danger from large bombs with ammonium nitrate as the main component.

Ammonium nitrate is produced in enormous quantities for use both as a fertilizer and as an ingredient in legitimate blasting agents, and so it is difficult to prevent its acquisition by bombers. Despite considerable international effort to reduce fertilizer-grade ammonium nitrate's effectiveness as an explosive or to render it inert, no currently known technique or technology would drastically reduce its explosive potential in large illegal bombs without seriously affecting its use as a fertilizer.

In principle, explosive chemicals might be rendered inert by adding a chemical suppressant or diluent or by changing the explosive's physical form. Alternatively, energetic materials might be desensitized to reduce their explosive potential or make them more difficult to detonate, much as textiles or polymers are made less flammable by the addition of fire retardants. In fact, many methods have been attempted for making ammonium nitrate fertilizer inert to detonation, including the addition of limestone in Northern Ireland. None have been successful.

Following the bombing of the Murrah Federal Building, methods to render ammonium nitrate non-detonable were discussed in congressional hearings. One such method was based on a patent issued in 1968 to S.J. Porter. The patent claims a method of rendering fertilizer-grade ammonium nitrate resistant and insensitive to detonation by adding 5 to 10 percent of mono- and diammonium phosphate or a mixture thereof with potassium chloride or ammonium sulfate.[5] However, subsequent tests showed that mixtures of ammonium nitrate containing the Porter additives were detonable when tested in sufficiently large diameters (Eck, 1995). The original Porter tests had been performed on small charge sizes, with minimal booster materials. This result

[5] Porter, Samuel J., "*Method of Desensitizing Fertilizer Grade Ammonium Nitrate and the Product Obtained*," U.S. patent number 3,366,468.

demonstrates the importance of performing evaluation testing under appropriate test conditions.

Clearly, there is a great incentive to identify an additive that, when added in small percentages, could render ammonium nitrate or other energetic chemicals inert to detonation. Research is now being conducted in the United States and in Great Britain, but no such additive has been found.

Data Concerning Explosives Incidents

Of the approximately 4,011 thefts of explosives reported between 1978 and 1995, approximately 52 percent occurred at the user level. In addition to licensees and permittees, "users" are defined in the ATF's EIR (Explosives Incident Report) as any individuals who purchase and use explosives within their State and are not therefore required to obtain a Federal license or permit. Explosives are not generally sold in less than case lots, which may result in purchases of more explosives than actually required by the purchaser.

From the 5-year period 1976-1980, to the five-year period 1991-1995, the number of incidents of stolen high explosives and blasting agents decreased from 1,700 to 481. From the 5-year period 1976-1980 to the five-year period 1991-1995, the number of pounds of stolen high explosives and blasting agents decreased from 636,238 pounds to 58,040 pounds. These decreases are primarily due to the explosives industry's improvements in security and compliance with ATF-administered security regulations which are enforced by regulatory inspections.

IV. Virginia Response

At the current time, Virginia has numerous regulations concerning explosives, mainly concerning coal mining, environmental control, and mining safety. These regulations are promulgated in the Virginia Administrative Code and the Statewide Fire Prevention Code under different sections. For instance, explosive regulations governing certification and training of mine blasters will be found in the Certification Requirements for Mineral Miners (4 VAC 25-35-50 through 90); Board of Coal Mining Examiners Certification Requirements (4 VAC 25-20-80 and 90); and the Coal Surface Mining Reclamation Regulations (4 VAC 25-130, Part 850). Regulations governing the safe use of explosives on mines will be found in the Safety and Health Regulations for Mineral Mining (4 VAC 25-40-780 through 930 and 3325 through 3478); Rules and Regulations Governing Blasting in Surface Mining Operations (4 VAC 25-110 et seq.); and the Coal Surface Mining Reclamation Regulations (4 VAC 25-130-780.13, 816.61 through 816.68, and 817.61 through 817.68). Other regulations governing the use of explosives on gas and oil exploration and production operations will be found in the Gas and oil Regulations (4 VAC 25-150-250).

Statutory authority over the use of explosives on mines is found in § 45.1-161.28 of the *Code of Virginia* for certification of blasters on coal mines; §§ 45.1-161.126 through 132 for use of explosives in underground coal mines; § 45.1-161.247 for use of explosives on surface areas of underground coal mines; §§ 45.1-161.284 through 286 for use of explosives on surface coal mines; § 45.1-161.292:19 for certification of blasters on mineral mines; § 45.1-161.294 for regulation of explosives in underground mineral mines; § 45.1-161.305 for regulation of explosives on surface mineral mines; and § 45.1-256 for training and certification of blasters on surface coal mines.

In all of the above, most of the concern is over public health or public safety issues. The laws are particular to blasting notification, methods of blasting, and particularities of blasting sites. More directly, many of the regulations and some statutory authority derive from federal regulations. As an example, the U.S. Bureau of Mines in R 18507 publishes a standardized blast frequency and a table of maximum particle velocity which is incorporated into the regulations promulgated by the Department of Mines, Minerals, and Energy and the State Fire Marshal's Office.

The regulations likewise pertain to blasting safety and concerns to the public. In the vein of safety, there are numerous regulations concerning the certification of blasters including, but not limited to: surface blasting, and underground shot firer. Each of these job activities requires specific experience in one or more areas.

At the federal level, explosives currently are controlled under Title XI of the Organized Crime Control Act of 1970.[6] The central feature of the existing federal regime is that it requires a license for engaging in the interstate manufacture, importation, or distribution of explosive materials and a permit for the interstate transportation of such materials for one's own use. The explosive materials subject to the federal explosives law are listed annually by the ATF (Federal Register, 1997). The list, which includes commercial and military explosives, black and smokeless powders above a minimum quantity, pyrotechnic compositions and special fireworks, many explosive materials, and urea nitrate, is quite comprehensive for materials that are themselves explosive. It does not include non-explosive precursor chemicals or pure ammonium nitrate.

Adopting Uniform National Regulation for the Purchase of High Explosives in the United States

The National Research Council recommends that uniform national regulations

[6] See "Regulation of Explosives," Title 18, United States Code, Chapter 40. The implementing rules and regulations are detailed in Title 27, Code of Federal Regulations, Part 55, "Commerce in Explosives."

for the purchase of commercial high explosives be developed and implemented. These regulations should apply to both intra- and interstate distribution of explosives. This recommendation was developed after reviewing what other countries have experienced. In general, the lessons learned from other countries' laws and procedures for domestic use of explosives are straightforward: typically, the laws derive directly from the level of threat experienced, and so the higher the threat, the tighter and (in most cases) the more costly and inconvenient the controls. Northern Ireland, Great Britain, and Israel, all of which have a high threat level, have made commercial explosives less accessible to terrorists, who must improvise, steal, or otherwise obtain these materials from out-of-country sources. In contrast, Canada and the United States control explosives to varying degrees at the federal level, but such control may be compromised by exceptions to federal jurisdiction.

The report went on to state that it made no recommendations as to whether states should remain free to impose controls stricter than the federal ones. It did urge, that consideration be given to ways to minimize the additional costs to the industry, if any, if controls are imposed. Federal Preemption of state laws or federal minimum standards governing the purchase of explosives (creating a single, uniform federal system) may be one way to achieve cost minimization. The Institute of Makers of Explosives has supported this concept for many years.

At a minimum, the recommended uniform national regulations would extend current interstate controls (i.e., federal requirements for licensing and for verification of compliance with storage requirements) to intrastate transactions involving explosives. These uniform national regulations would significantly add to the expenses of individuals seeking to purchase explosives, particularly in those states that have few controls. Such prospective purchasers would face the additional time and effort of applying for a license and would have to demonstrate that the explosives would be transported in an approved manner and stored in an approved magazine. Costs to state administrative and law enforcement agencies, and the ATF would also rise for the processing of license and permit applications, and for the investigation of applicants and inspection of their magazines. Presumably, these additional program costs would be offset wholly or partially by fees paid by the applicants. Coordination among state and federal regulatory programs would become critical to minimize overall costs and would help ensure effective enforcement and minimize duplication of effort.

Uniform national regulations might well change some of the economics of explosives use in the United States. For example, to avoid increased costs, individuals might have to hire blasting companies to perform work that they formerly did themselves. Such a change would likely be opposed by farmers and other individuals who have legitimate uses—such as removal of tree stumps—for explosives that would be regulated.

Needless to say, Virginian farmers are a significant factor in regulating explosives. This is noted by the exemptions that are placed within the Statewide Fire Prevention Code for farm use of explosives.[7] According to the SFPC, an exemption exists whereby, a bond is not required for blasting on real estate parcels of five or more acres conforming to the definition of "real estate devoted to agricultural use" or "real estate devoted to horticultural use" in § 58.1-3230 of the *Code of Virginia* and conducted by the owner of such real estate. In addition, an exemption also exists for requiring a bond using the same criteria.

Costs

House Joint Resolution No. 89 also requested that costs to implement any new or different regulations be included. In discussions on this topic, it became readily apparent that costs to the industry will become significant. This was also discussed in both studies.

According to the Institute of Makers of Explosives, in 1997, the United States consumed over 5 billion pounds of explosives. As can be seen in Table 1 below, Virginia consumed almost 440 million pounds of explosives in 1997.

Table 1
Total Explosives Consumed in 1997 (by Pounds)[8]

	Virginia	United States
Permissible	672,000	5,534,700
Other HE	2,559,120	64,846,756
Bulk	408,916,570	4,779,428,363
Packaged	27,478,210	653,901,190
Total	439,625,900	5,503,711,009

Virginia ranks third in consumption in the United States behind Kentucky and West Virginia (7.9% of the US consumption).

It is estimated that using current technology, the cost in the United States for taggants would be $1,300,000,000. Using the 7.9% as an estimate, the cost to add taggants in Virginia would total $102,700,000. This would be a significant cost to explosives consumers within the Commonwealth.

The most significant consumer of explosives in Virginia is the mining industry, particularly, coal mining. In 1997, the National Mining Association completed an economic analysis of the impact of mining in the United States. This study estimates Virginia's economic gain from mining to be over $11 billion. The estimated job gain, indirect and direct, is 124,800 jobs. A Virginia State

[7] State Fire Prevention Code, Chapter 30, Section F-3001.1.
[8] Source: Institute of Makers of Explosives (1998).

requirement for placing taggants in explosives, without any federal requirement, will significantly raise the cost of mining in Virginia as compared to states, which do not require taggants in explosives. This cost increase would be likely to reduce income from mining to the State and eliminate jobs related to mining.

If taggant legislation were to be recommended at some point in the future, it should be done at the federal level to avoid unfair economic impact on the Commonwealth of Virginia.

V. Conclusions

It is apparent that the federal government has been actively involved in the same issues that House Joint Resolution No. 89 sought to address. There has been a steady decrease in the amount of thefts of high explosives over the past five-year period that has been attributed to increased ATF-administered regulations. The deadly explosions experienced within the last few years have been caused by precursor chemicals- ammonium nitrate, etc., that are not on the list of explosives maintained by the ATF. The use of taggants in these situations would not have been of benefit. It has been demonstrated that the use of taggants in explosives, the primary emphasis of this study, has not reached the point, technologically, where they would be cost effective for the consumers of explosives.

The committee asserts that additional regulations established by the individual states will not be as effective as the recommendations and suggestions contained in the two federal studies that have been noted throughout this report. Until the final reports have been completed, it is recommended that Virginia maintain their current regulations, updating any that are out-dated or inconsistent with current technology and regulations.

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ATTACHMENT

summary

HOUSE JOINT RESOLUTION NO. 89

Requesting the Department of State Police to study the feasibility of mandatory explosive tagging.

Agreed to by the House of Delegates, March 12, 1998
Agreed to by the Senate, March 10, 1998

WHEREAS, the tragedy of the Oklahoma City bombing and the complexities of the investigations which followed heightened awareness of the need for a comprehensive system of regulations to facilitate the tracing of dangerous materials and substances which are capable of causing such widespread death and destruction; and

WHEREAS, the Federal Bureau of Alcohol, Tobacco and Firearms has been studying the issue and is in the process of formulating recommendations; and

WHEREAS, the states should develop a plan to assist federal agencies in implementing these recommendations or develop alternative recommendations to preserve the public safety; now, therefore, be it

RESOLVED by the House of Delegates, the Senate concurring, That the Department of State Police be requested to conduct a comprehensive study of the need for state regulation of explosives and other dangerous substances to facilitate tracking and, when needed, criminal investigations.

In conducting its study, the State Police shall take into consideration public health and safety concerns and costs to the industry.

Technical assistance shall be provided to the State Police by the Department of Mines, Minerals and Energy and the State Fire Marshall.

All agencies of the Commonwealth shall provide assistance to the State Police for this study, upon request.

The Department of State Police shall complete its work in time to submit its findings and recommendations to the Governor and the 1999 Session of the General Assembly as provided in the procedures of the Division of Legislative Automated Systems for the processing of legislative documents.

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