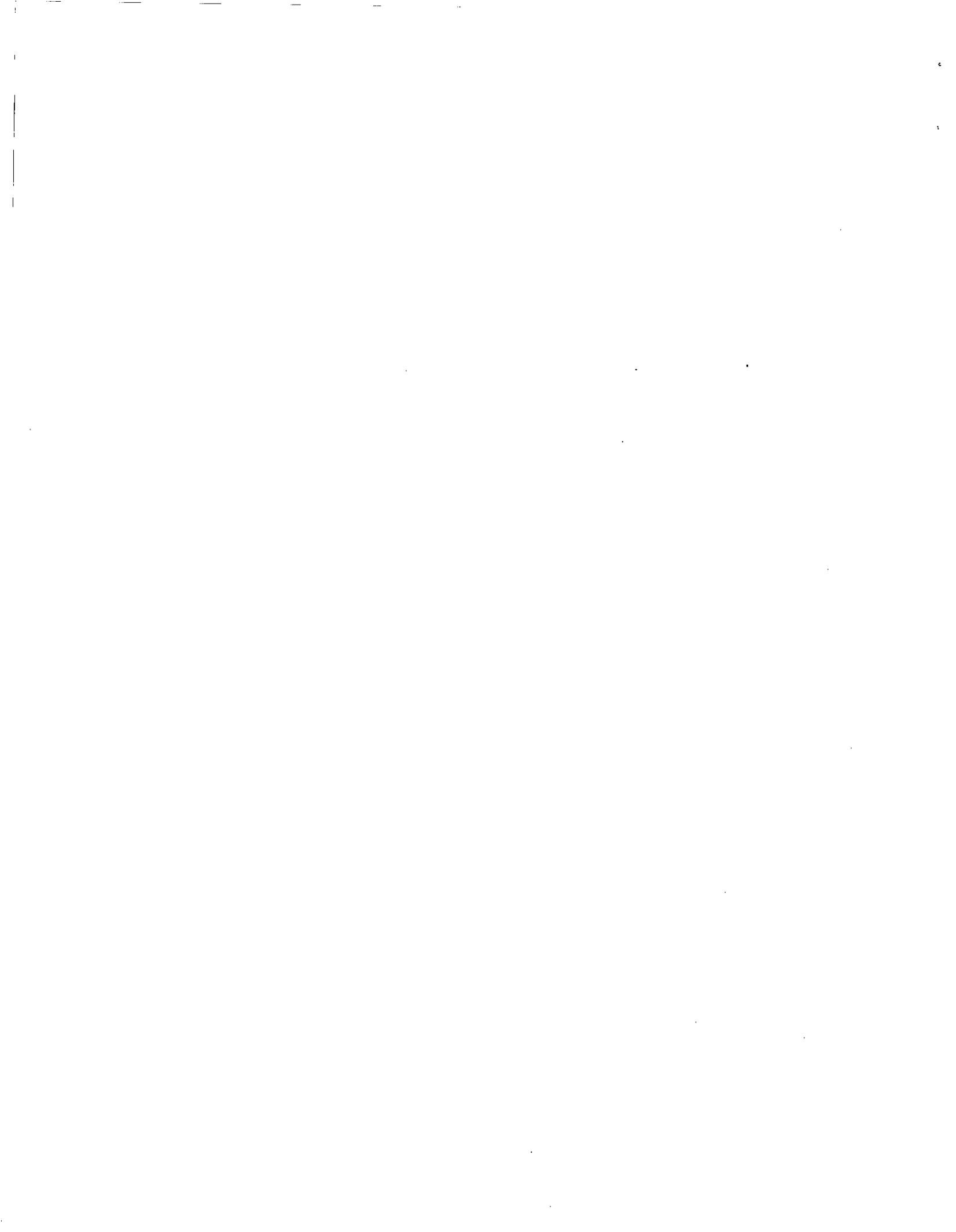




AN SAB REPORT: REVIEW OF EXPLOSIVES AND FLAMMABLES CRITERIA

**REVIEW OF THE OFFICE OF
SOLID WASTE AND EMERGENCY
RESPONSE/CEPPO ISSUES ON
CRITERIA FOR EXPLOSIVES AND
FLAMMABLES FOR SARA TITLE III**





UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

June 18, 1992

OFFICE OF
THE ADMINISTRATOR

EPA-SAB-EEC-92-020

Honorable William K. Reilly
Administrator
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

Subject: Science Advisory Board Review of the Proposed
Explosives and Flammables Criteria

Dear Mr. Reilly:

The Science Advisory Board (SAB) is pleased to submit its report on the review of the proposed explosives and flammables criteria which were developed in response to an August 27, 1990 Advanced Notice of Proposed Rulemaking (ANPRM) (40 CFR Part 355) pursuant to provisions of the 1986 Superfund Amendments and Reauthorization Act (SARA), Title III, Section 302. The Explosives and Flammables Criteria Subcommittee (EFCS) of the SAB's Environmental Engineering Committee (EEC) met on May 29-30, 1991 to review four major documents, (Technical Background Document for Explosives; Technical Background Document for Flammables; 62 Public Comments in Response to the ANPRM; and Issues Related to ANPRM on Explosives and Flammables;) consider technical arguments, and offer advice to assist the Agency in resolving issues raised in public comments made in response to the ANPRM and by its preparers, the Chemical Emergency Preparedness and Prevention Office (CEPPO) and Office of Toxic Substances (OTS) staff.

The SAB compliments the CEPPO and OTS staff and commends the Agency for undertaking efforts to examine means to ensure adequate protection of the public from harm when explosives and flammables are present. This is a particularly complex area that is confounded, among other considerations, by a need to reconcile statutorily mandated public awareness of potential emergency situations due to the presence of extremely hazardous substances (EHSs) with potential local community resource limitations that relate to planning activities that are necessarily triggered by EHS notifications.

General comments of the EFCS lie in three areas; data quality and modeling, regulatory efficiency, and the coordination of regulatory activity. The first item is scientific and technical in character while the second two commingle science and policy (and, for that matter, risk management). The SAB usually avoids policy comments, but the view of the SAB in this instance is that this issue is one in which the nexus between technical issues and regulatory policy is realized and is a critical link. It must be established whether guidance and/or regulations that are to be developed, are in fact reasonably likely to ensure a substantial and efficient reduction in any significant potential for harm or whether to the contrary, regulatory policies are likely to be ineffective or not optimal, for example, overly conservative and unnecessarily burdensome. Regulatory review on a continuing basis is warranted. As data and models are improved, the scientific merits (or not) of regulatory activity are more readily established, and a better degree of confidence in technical aspects of regulatory decisions can be assured. Based on the EFCS review, supplemented by discussions of the EEC and the SAB Executive Committee, the SAB makes the following recommendations.

In regard to explosives and flammables issues: The Agency should undertake further data base enhancement, reliability analyses of information, modeling upgrades and validation, regulatory efficiency analyses, and inter-agency harmonization of regulatory activity in this area. The EFCS cautions against use of the Automated Resource for Chemical Hazard Incident Evaluation (ARCHIE) or any other model absent additional considerations for the involved scenario. For example, data should be collected to allow careful model validation regarding factors such as delayed ignition effects, vapor cloud inhomogeneities, finite evaporation rates, multicomponent effects, ejected materials effects, pre-ignition upwind movement of vapor clouds, and confinement effects. This should not be accomplished by intercomparisons of models. Rather, this should be accomplished by comparison of model predictions against realistic (actual) event scenarios. These validation procedures are necessary in order to enable identification of model limitations and the extent to which consequences associated with complex event scenarios might be reliably predicted. Further, in establishing appropriate hazard criteria for modeling, the worst credible case which uses realistic conditions should be used for decision-making; account should be taken of instances where hazard conditions may be associated with delayed ignition effects, scenario inhomogeneities, confinement effects, etc. The EFCS cautions that the use of the 100-meter fence line distance in the analysis of potential for harm to the community may not be an appropriate basis for analysis in all instances. It is recommended that the Agency consider this matter further.

In regard to explosives only: Commercial barricades placed in the near-field are not relevant in most instances in addressing the consequences of far-field blast overpressures. If the Agency decides to list explosives as extremely hazardous substances (EHSs), low explosives should be examined with reference to the Alcohol, Tobacco and Firearms (ATF) Table of Distances. However, in cases of high degree of confinement of low explosives, fragmentation and other effects may be more of an issue than thermal radiation effects. Use of separate ATF Tables of Distances for high and low explosives is suggested. The Agency may wish to consider whether there is some merit to exploring potential incidence geometry effects, e.g., on buildings, in the impacted area, or whether such considerations are sufficiently taken account of implicitly through use of the Tables of Distances. Threshold Planning Quantities (TPQ) for explosives may be inferred by reference to the ATF Tables of Distances for Explosives. Consequence analysis modeling for explosives should be based on more representative examples of commercial explosives. Consistency of this approach with the United Nations (UN) classification scheme should be established.

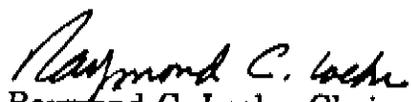
Further, in regard to specific explosive materials: the EFCS recommends against listing of fireworks taken as a whole. Any special cases that warrant further consideration should be identified and carefully examined. Coordination of classification schemes among agencies is recommended. Except in certain instances and involving amounts greater than some limiting quantity, the EFCS does not consider wet nitrocellulose to pose significant potential for harm. In addition, detonation of black powder is considered to be rare and likely to occur only under some very specific conditions. The Agency could explore the nature of any specific instances in which potential harm from wet nitrocellulose or black powder might prove or has been proven to be significant.

In regard to flammables: If flammables are listed at all under SARA Title III, Section 302, listing should be categorical. Individual listings of a large number of flammables could pose a significant regulatory burden and detract from other technical objectives aimed at mitigation, prevention and control of inherently toxic substances. When considering potential hazards posed by flammables in quantities less than 10,000 pounds, the Agency should examine the nature and ramifications of case-specific exposures, e.g., differences between potential effects upon the community taken as a whole and upon emergency response teams. In regard to flammable gases and very volatile flammable liquids as a special category of flammables, the EFCS recommends that further evaluations based on analyses of any special hazards posed by these substances for quantities less than 10,000 pounds should be undertaken, e.g., in relation to cloud inhomogeneities, delayed ignition effects, etc. On the matter of whether or not to list flammables as EHSs at all, prior to additional regulatory activity, further consideration of technical and

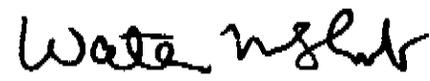
regulatory impact issues is advised, and should include additional examination of exposure scenario modeling, the utility of the historical information base, the nature of impacts to affected communities in potential exposure scenarios, regulatory efficiency, and inter-agency harmonization of regulatory activity, especially as relates to classification schemes. Agency staff is encouraged to continue to explore means to ensure an optimal balance between listing objectives and community resource limitations and protection requirements.

The SAB appreciates this opportunity to conduct this scientific review and looks forward to receiving your response to the scientific advice transmitted herein.

Sincerely,

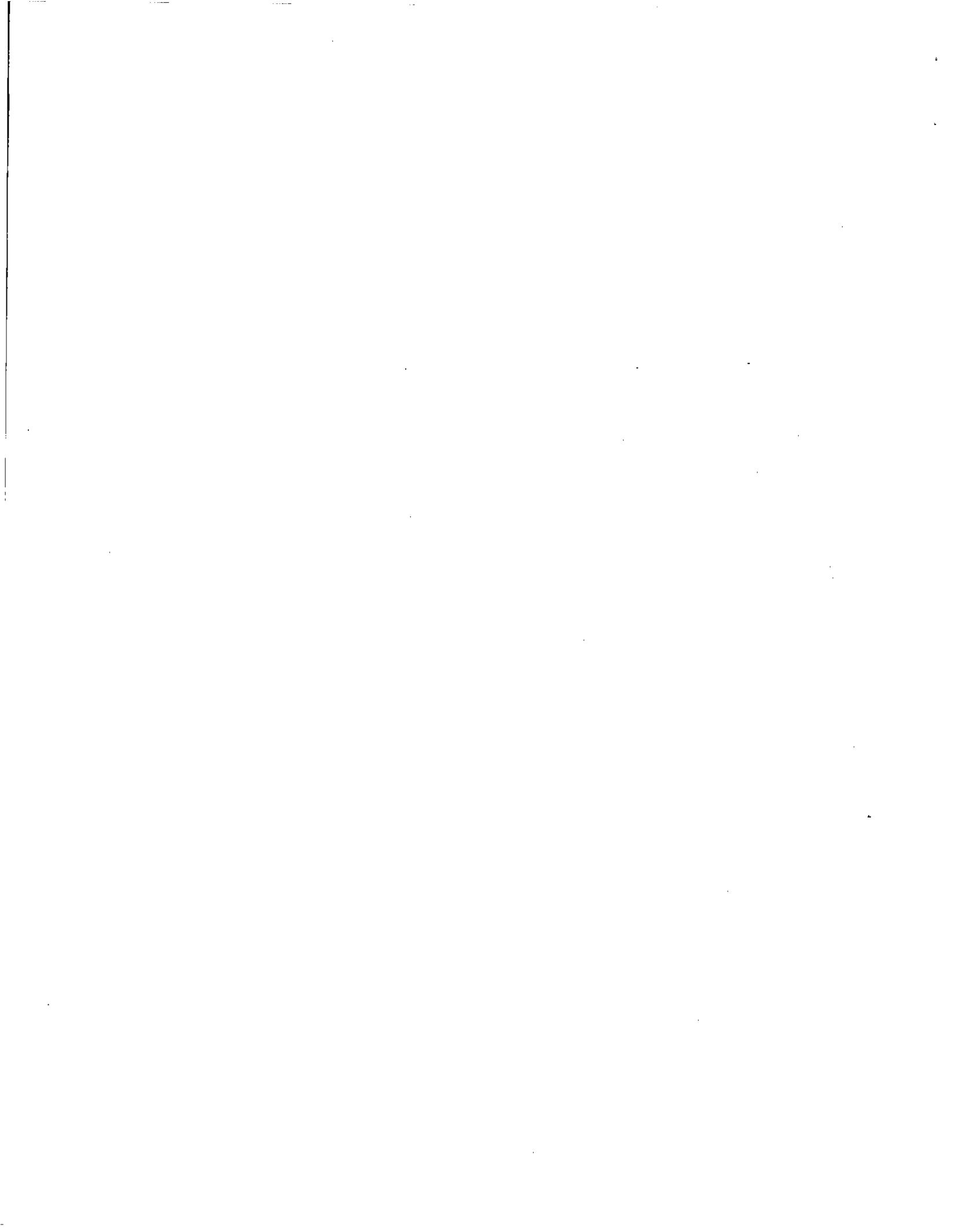

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NOTICE

This report has been written as a part of the activities of the Science Advisory Board, a public advisory group providing extramural scientific information and advice to the Administrator and other officials of the Environmental Protection Agency. The Board is structured to provide a balanced, expert assessment of scientific matters related to problems facing the Agency. This report has not been reviewed for approval by the Agency; hence, the comments of this report do not necessarily represent the views and policies of the Environmental Protection Agency or of other federal agencies. Any mention of trade names or commercial products does not constitute endorsement or recommendation for use.



ABSTRACT

The Explosives and Flammables Criteria Subcommittee (EFCS) of the Environmental Engineering Committee (EEC) of the EPA Science Advisory Board (SAB) has prepared a report on the Agency's explosives and flammables criteria which were developed in response to an August 27, 1990 Advanced Notice of Proposed Rulemaking (ANPRM) (40 CFR Part 355) pursuant to provisions of the 1986 Superfund Amendments and Reauthorization Act (SARA) Title III, Section 302. The EFCS met on May 29 and 30, 1991 and reviewed nine issues raised by over 60 commenters in the ANPRM.

The issues examined by the EFCS pertaining to explosives deal with whether explosives (low and/or high explosives) should be listed individually or categorically, setting the appropriate Threshold Planning Quantities (TPQ) for the explosives, examining the appropriate overpressures and tables of distances for explosives, whether fireworks should be listed or excluded, and specific comments in the technical background documents such as the appropriateness of the United Nations (UN) classification schemes, appropriateness of the consequence analyses, and specific objections to use of the Automated Resource for Chemical Hazard Incident Evaluation (ARCHIE) model as a means to evaluate potential exposure scenarios.

The issues examined by the EFCS pertaining to flammables deal with whether there are significant hazards posed to the community in quantities less than 10,000 pounds, whether flammables should be listed categorically or individually, whether specific flammable gases and very volatile flammable liquids should be treated as a special category of flammables, the appropriateness of the consequence analysis for flammables, the appropriate hazard criteria and scenarios to use for modeling, and specific comments in the technical background document for flammables, such as use of the 100-meter fence line distance and other factors to be used in the analysis.

Key Words: Explosives, flammables, extremely hazardous substances, community right-to-know, community planning, emergency response.



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1. EXECUTIVE SUMMARY

On May 29th and 30th, 1991, the U.S. Environmental Protection Agency's Science Advisory Board, Explosives and Flammables Criteria Subcommittee (EFCS) members, consultants and federal liaisons from four Federal agencies (Note: The DOT Federal Liaison was invited, but was unable to participate.) met to conduct a review to evaluate criteria and technical issues for explosives and flammables as extremely hazardous substances (EHSs) under SARA Title III. The EFCS reviewed four major documents, considered technical arguments presented, and considered possible resolution of several technical issues raised in public comments.

The EFCS commends Agency staff for the extensive effort that has been undertaken in considering the matter of listing (or not listing) explosives and flammables as EHSs. This is a particularly complex area that is confounded, among other considerations, by a need to reconcile statutorily mandated public awareness of potential emergency situations due to the presence of EHSs with potential local community resource limitations that relate to planning activities that are necessarily triggered by EHS notifications.

The contemplated regulatory development by Agency staff apparently is predicated on an assumption that under Title III Section 302, risk of event occurrence is assumed to be 1.0 and therefore (in relation to regulatory activity) it is merely a consequence analysis (i.e., analysis of potential impacts which may be realized when an event occurs - probability of risk of event occurrence is set to unity) that is necessary for proper regulation. EFCS members are concerned that this approach (in which probability of event occurrence is neglected), given potential local community resource limitations, and probably will not optimally serve local community protection objectives.

It is evident that Agency staff use a presumed probability of unity for event occurrence merely as a model assumption in order to examine event consequence. Agency staff recognize that in actuality a consequence analysis need not assume that the probability is unity, it need only suppose that the event has occurred, whatever its probability of occurrence may be.

However, if, following consequence analysis, probability analysis is not addressed in some complementary context, local communities could be tasked to undertake a difficult planning exercise. At a minimum, consensus concerning a description of necessary infrastructure that underlies probabilistic risk analysis for realistic event scenarios ought to be available in order to develop harmony, reduce inefficiencies, and minimize confusion in the planning process. The model assumption that probability is unity for purposes of consequence analysis without

subsequently readdressing probability characteristics of realistic event scenarios could thrust upon LEPCs, as part of the emergency planning process, the need to conduct and communicate the results of locally devised probabilistic risk analyses.

It is doubtful that with such a bottom-up approach, applied nationally, that efficiency or reliability of the planning process could generally ensue absent consensual harmonization of this issue. There does not appear to be persuasive evidence that LEPCs are prepared to undertake this task. To the contrary, deficiencies in capabilities appear evident. Consequently, assurance of optimization of public protection objectives should not be presumed by the Agency staff.

Procedurally, Agency staff constructs criteria which relate to the acceptability of potential consequences of event occurrence, and against these criteria (and possibly certain other policy considerations such as potential impacts due to projected costs associated with regulatory compliance) then makes judgement in relation to the necessity to list certain explosives or flammables as EHSs. Further, it appears that contemplated regulatory development is predicated on an assumption by Agency staff that the statute within which this regulatory activity works does not provide for regulating the methods of handling of explosives or any other hazardous compounds.

In regard to this contemplated regulatory activity, some of the technical issues examined by the EFCS appear closely, perhaps inextricably, associated with regulatory policy considerations. For example, the issue of who should conduct a risk assessment and who should conduct a consequence analysis of a potential emergency situation appears to substantially define the nature and breadth of responsibilities under the Community Right-to-Know Act. An additional example associated with regulatory policy considerations is the non-scientific issue raised by the public at the EEC's March 4 and 5, 1992 meeting. This issue concerns releasing information pursuant to SARA Title III Community Right-to-Know specifically pertaining to release of information concerning the exact location of explosives (or flammables) that could reach the hands of terrorists and criminals. The EFCS and the EEC did not address these concerns, but notes that the Program Office staff has been provided with this information and is now aware of the issue.

From a technical perspective, a regulatory approach focus that concentrates on the matter of listing of EHSs per se, does not appear to fully address the scope of technical issues of concern. Because EHS notifications will trigger Local Emergency Planning Committee (LEPC) planning activities, contemplated regulatory activity can have a potentially significant impact upon local community resource allocations and the uniformity and reliability of the technical nature of

the decision-making infrastructure that is brought to bear on the local community planning process.

Great care must be exercised in the conduct of regulatory development exercises which address the listing of explosives and flammables as EHSs, or a non-optimal regulatory burden may transfer to the local community. For example, if thousands of explosives and flammables were individually listed as EHSs, LEPCs may be faced with (and possibly ill-prepared for) a regulatorily imposed necessity to perform and communicate the results of thousands of risk analyses, many of which may merely address low probability, low consequence event scenarios. Agency staff is strongly encouraged to continue to explore means to ensure an optimal balance between listing objectives and community resource limitations and protection requirements.

In addition to the above comments, the Subcommittee recommends that further exploration of several technical issues be undertaken by the Agency as follows:

1. Accident/incident data base enhancement and reliability analysis should be undertaken. The data base of information concerning explosives and flammables incidents must be improved. [NB This recommendation is further supported by correspondence received from Agency staff, which indicates that further database enhancements to include information on the location, time, weather, amount, release conditions, or chemicals involved in accidents would be very useful for modeling purposes.]
2. Harmonization of regulatory activity, especially inter-Agency coordination to establish a common frame of reference for categorization and characterization of explosives and flammables, and analysis of their potential or actual behavior in accident scenarios should be pursued further. In planning for potential emergencies, local communities may become confused by a multitude of regulatory initiatives.
3. There appears to be a need to make a more case-specific distinction between the community taken as a whole and the emergency responders. In regard to regulatory development, as a matter of policy, the Agency apparently takes the view that use of a 100-meter fenceline distance serves to differentiate a potential community catastrophe for purposes of triggering community planning activities, versus other potential concerns for on-site workers and first responders, for whom other planning activities may be invoked.

4. In regard to both explosives and flammables issues: The EFCS cautions against use of the ARCHIE (or any other) consequence model absent additional considerations for the involved scenarios; data should be collected to allow careful model validation regarding factors such as delayed ignition effects, vapor cloud inhomogeneities, finite evaporation rates, multicomponent effects, ejected materials effects, pre-ignition upwind movement of vapor clouds, and confinement effects. While not a subject brought up or discussed by the EFCS members, consultants and Federal liaisons, but based on discussions by the EEC at their March 4 and 5, 1992 meeting with the Agency and the public, the EEC makes the point that many of these factors could be of significant importance for site-specific situations, and if they are present they must be adequately dealt with both in the site-specific situation and the general analysis of hazards necessary to categorize materials as EHS. The Agency should assess these complexities not only for consideration of whether to rank but also to provide LEPCs guidance on conducting site-specific hazards analysis that will be required if the explosives and flammables are ranked. The more complete analysis must use validated models. This validation should not be accomplished by intercomparisons of models. Rather, this should be accomplished by comparison of model predictions against realistic (actual) event scenarios. These validation procedures are necessary in order to enable identification of model limitations and the extent to which consequences associated with complex event scenarios might be reliably predicted.
5. Further, in establishing appropriate hazard criteria for the above modeling, the worst credible case which uses realistic conditions should be used for decision-making; account should be taken of instances where hazard conditions may be associated with delayed ignition effects, scenario inhomogeneities, confinement effects, etc. The EFCS cautions that the use of the 100-meter fenceline distance in the analysis of potential for harm to the community may not be an appropriate basis for analysis in all instances. It is recommended that Agency staff consider this matter further.
6. In regard to explosives, commercial barricades placed in the near-field are not relevant in most instances in addressing the consequences of far-field blast overpressures. If Agency staff decide to list explosives as EHSs, low explosives should be examined with reference to the Alcohol, Tobacco and Firearms (ATF) Table of Distances. However, in cases of high degree of confinement of low explosives, fragmentation and other effects may be more of an issue than thermal radiation effects. Use of separate ATF Tables of Distances for high and low explosives is suggested. Agency staff may wish to consider whether there is some merit to exploring potential incidence geometry effects, e.g., on buildings, in the impacted area, or whether such considerations are sufficiently

implicitly taken account of through use of the Tables of Distances. Threshold Planning Quantities (TPQs) for explosives may be inferred by reference to the ATF Tables of Distances for Explosives. Consequence analysis modeling for explosives should be based on more representative examples of commercial explosives. Consistency between this approach and the United Nations (UN) classification scheme should be established.

7. Further, in regard to specific explosive materials: the EFCS recommends against listing of fireworks taken as a whole. Any special cases that warrant further consideration should be identified and carefully examined.
8. Coordination of classification schemes for explosives among agencies is recommended. Except in certain instances and involving amounts greater than some limiting quantity, the EFCS does not consider wet nitrocellulose to pose significant potential for harm. In addition, detonation of black powder is considered to be rare and likely to occur only under some very specific conditions. Incidents involving black powder have been documented by the United States Department of Defense Explosives Safety Board (DODESB). Agency staff could explore the nature of any specific instances in which potential harm from wet nitrocellulose or black powder might (or has) proven significant.
9. In regard to flammables: If flammables are listed at all under SARA Title III, Section 302, listing should be categorical. Individual listings of a large number of flammables could pose a significant regulatory burden and detract from other technical objectives aimed at mitigation, prevention and control of inherently toxic substances.
10. When considering potential hazards posed by flammables in quantities less than 10,000 pounds, Agency staff should examine the nature and ramifications of case specific exposures, e.g., differences between potential effects upon the community taken as a whole and emergency response teams. In regard to flammable gases and very volatile flammable liquids as a special category of flammables, the EFCS recommends that further evaluations based on analyses of any special hazards posed by these substances for quantities less than 10,000 pounds should be undertaken, e.g., in relation to cloud inhomogeneities, delayed ignition effects, etc.
11. On the matter of whether or not to list flammables as EHSs at all, prior to additional regulatory activity, further consideration of technical and regulatory impact issues is advised. This should include additional examination of exposure scenario modeling, the utility of the historical information base, the

nature of impacts to affected communities in potential exposure scenarios, regulatory efficiency, and inter-agency harmonization of regulatory activity, especially as relates to classification schemes.

The SAB is pleased to have been asked to review this important issue and thanks the Agency staff, regulated community participants, and other Federal agencies for their participation and cooperation.

2. INTRODUCTION

2.1 Background

The 1986 Superfund Amendments and Reauthorization Act (SARA) Title III, Section 302 lists 360 substances on the Extremely Hazardous Substance (EHS) list that trigger emergency planning by local emergency planning committees (LEPCs) across the United States. These substances were all selected based on their potential to cause lethality in accidentally exposed persons due to inherent toxic properties. SARA also includes, however, a provision to list explosive and flammable substances at the option of the EPA Administrator. The Office of Solid Waste and Emergency Response (OSWER) and Office of Toxic Substances (OTS) have jointly prepared an Advanced Notice of Proposed Rulemaking (ANPRM) to address explosives and flammables in the context that they may be listed, with OSWER as the regulation development lead and OTS providing technical support.

The ANPRM (55 Federal Register 35012-35021) solicited comments on the proposal to list commercial explosives, to not list flammables, and to defer decisions on non-commercial explosives and reactives until a more complete strategy could be developed for these difficult-to-evaluate substances. Further, the EPA requested the Science Advisory Board (SAB) to consider technical arguments presented in the:

- a) Technical Background Document for Explosives (TBD-E);
- b) Technical Background Document for Flammables (TBD-F);
- c) 62 Public Comments in Response to the ANPRM; and
- d) Issues Related to ANPRM on Explosives and Flammables.

In the EPA's request to the SAB (see Appendix A, as well as Appendix I as an attachment to Appendix A), the Office of Toxic Substances (OTS) requested that the SAB consider technical arguments in the above listed documents, and especially to consider possible resolution of the nine technical issues raised in the public comments (see especially Appendix I as an attachment to Appendix A, which identifies five (5) issues for explosives and four (4) issues for flammables).

On May 29th and 30th, 1991, the U.S. Environmental Protection Agency's Science Advisory Board, Explosives and Flammables Criteria Subcommittee (EFCS), gathered in Washington, D.C. to conduct a review of the Agency's technical issues relating to explosives and flammables criteria. The EFCS consisted of SAB members,

consultants and Federal liaisons from the concerned Federal agencies. (Note: The DOT representatives were invited, but were unable to participate). The EFCS reviewed the four documents, considered technical arguments presented, and considered possible resolution of several technical issues raised in public comments.

Specifically, as identified and explained by Agency staff (refer to the technical document: Issues Related to ANPRM on Explosives and Flammables), the EFCS considered the following technical issues raised in public comments:

Issues related to explosives:

1. Low explosives:
 - 1.1 Whether EPA should list low explosives as extremely hazardous substances (EHSs)
 - 1.2 Whether EPA should set threshold planning quantities (TPQs) for low explosives based on a Table of Distances for high explosives or low explosives.
 - 1.3 Whether EPA should list fireworks as EHSs
2. Listing explosives by category or individually
3. Consequence analysis for explosives:
 - 3.1 Appropriate overpressure level for analysis
 - 3.2 Other methodologies
4. Appropriate TPQs for explosives
5. Specific comments on the TBD-E:
 - 5.1 Objections to examples of explosives used for consequence analysis
 - 5.2 Comments on tests cited in the TBD-E
 - 5.3 Objections to the use of the ARCHIE model
 - 5.4 Effect of barricades and commercial magazines on blast overpressure levels
 - 5.5 Whether wet nitrocellulose should be listed as an EHS
 - 5.6 Whether black powder detonates
 - 5.7 Definition of gunpowder
 - 5.8 Other comments

Issues related to flammables:

6. Consequence analysis for flammables:

- 6.1 Appropriate hazard criteria to use for modeling
- 6.2 Appropriate modeling scenarios
- 6.3 Methodology

7. Listing of flammables as a category

8. Specific comments on the TBD-F:

- 8.1 Hazards posed by flammables in quantities less than 10,000 pounds
- 8.2 Flammable gases and very volatile flammable liquids as special category of flammables
- 8.3 Use of 100-meter fence line distance in analysis
- 8.4 Other factors that should be considered in analysis.

The response of the EFCS which is developed in this report consists of general comments and comments specific to the public's response to technical issues in the ANPRM. In addition, in regard to the issue of whether or not to list flammables or explosives at all as EHSs (i.e., to list or not, regardless whether by substance or category), the EFCS members decided to provide technical guidance to Agency staff on the merit of the collective expertise of the Subcommittee. This report expresses a composite representation of Subcommittee member views.

2.2 Process

In constructing this report, the EFCS proceeded according to a methodology designed to ultimately establish a consensus report. The effort has accomplished a harmonization of views, i.e., a consensus that a composite representation of member views has been developed.

First, a meeting was held, as described in part in the discussion presented above. At the time of this meeting the EFCS heard presentations from EPA Chemical Emergency Preparedness and Prevention Office (CEPPO) staff and EPA OTS staff on the scientific rationale supporting the TBD-E and TBD-F. The EFCS then heard public comments on the issues before the Subcommittee. The EFCS members discussed issues among themselves and with Agency staff who were present at the meeting. EFCS member discussions concerning the individual technical issues raised in public comments (noted above), were led by members assigned together with a submatrix of technical experts chosen from among the EFCS membership. Each group [leader/submatrix] examined a specific public comment technical issue and then reported to the entire Subcommittee for further discussions, preliminary group findings and opinions at the time of the May 29th and 30th, 1991 meeting.

These discussions led to a series of summarization exercises held during the time of the meeting in which a preliminary delineation of general views of the EFCS members was established. Further, a preliminary delineation of group [leader/submatrix] findings and opinions was established for each public comment technical issue. Agency staff present at the May 29th and 30th meeting were then apprised of the preliminary findings and opinions of the EFCS.

The task then before the EFCS at the conclusion of the meeting was to construct a report for the EPA Administrator in response to the charge to the EFCS, as described above in this report. This report, which has undergone multiple reviews by EFCS members and extensive revision, represents the product of the report development exercises that were undertaken subsequent to the May 29th and 30th , 1991 meeting, to synthesize EFCS member views. Taken as a whole, this report presents a composite representation of EFCS member views on the issues put before the Subcommittee and on the issues which the EFCS chose to examine.

3. GENERAL COMMENTS

General comments of the EFCS can be categorically grouped as follows: data quality and modeling, regulatory efficiency, and coordination of regulatory activity. These comments are infrastructural in nature, i.e., they address general underlying issues that relate to listing of explosives and flammables as EHSs.

These comments indicate how the Subcommittee attempted to view the complex interrelationship between technical and regulatory policy issues. The Subcommittee generally felt that for purposes of its examination of public comment issues, a clear separation of technical and regulatory policy considerations was difficult to achieve in view of the complex issue of regulatory burden optimization that could potentially arise in carrying out the intent of the statute. The following sections indicate EFCS views of these general areas.

3.1 Data Quality and Modeling

It appears that the data (on accidents caused by explosives and flammables) used to exercise models and support Agency staff regulatory development are largely of limited utility and of uncertain reliability. This situation must be improved. To some degree, either desired data appear to be missing, or it is unclear to what extent data have been validated. This significant lack of available and reliable data is considered both by the EFCS and Agency staff to be an impediment to decision making efforts. For example, Agency staff has noted that background data in support of regulations or guidance are insufficient for intended development purposes, absent other regulatory support activities, e.g., modeling efforts. Thus, Agency staff has identified a need to accomplish further data base development. It appears that both Agency staff and the EFCS recommend that continuing efforts should be undertaken to improve the quality, reliability and utility of support documentation in regard to data which detail explosives and flammables incidents.

Agency staff should further examine the availability of current data. For example: insurance companies as well as regulatory agencies in other countries such as the United Kingdom should be fruitful areas; commercial data bases are also available in Europe; and the DODESB has a file containing data on over 2,400 incidents involving ammunition and explosives accidents which are available for Agency staff to review. [NB Further searching is currently being undertaken by Agency staff to determine to what extent accident histories exist which can be helpful.]

While Agency staff modeling exercises are commendable, absent model validation, it is not apparent whether models exercised can reliably and realistically address explosives and flammables behavior (e.g., delayed ignition effects, vapor cloud inhomogeneities, effects due to the physical state of ejected material such as gaseous versus aerosol droplet ejection, pre-ignition upwind movement of vapor clouds, confinement effects, etc.).

The EFCS cautions against use of the ARCHIE (or any other) model absent additional considerations. For example, it should be established through careful model validation procedures whether factors such as delayed ignition effects, vapor cloud inhomogeneities, finite evaporation rates, multicomponent effects, ejected materials effects, pre-ignition upwind movement of vapor clouds, confinement effects, etc. are reliably and appropriately addressed. This should not be accomplished by intercomparisons of models. Rather, this should be accomplished by comparison of model predictions against realistic (actual) event scenarios. In this latter respect, reliable data are critically needed.

These validation procedures are necessary in order to enable identification of model limitations and the extent to which consequences associated with complex event scenarios might be reliably predicted. Further, in establishing appropriate hazard criteria for modeling, the worst credible case which uses realistic conditions should be used for decision-making; account should be taken of instances where hazard conditions may be associated with delayed ignition effects, scenario inhomogeneities, confinement effects, etc. In sum, additional efforts are advisable to expand understanding of the practical limitations for use of models to evaluate the nature of community exposure in explosives and flammables release incidents.

Leaving aside the issue of regulatory activity, proper equipment inspection and maintenance programs, along with the development and implementation of effective operational systems with appropriate training, should prove essential to significantly reduce potential for harm. The practice of anticipating and preventing potential accidents before they occur will always be preferable as a first course of action compared to reacting to and controlling accidents once they are underway or have already occurred. Notwithstanding the reliability of individual data, taken as a whole, data that are available appear to indicate that documented events frequently involve either operational or equipment failure or are associated with transportation incidents. Diligence to ensure the efficient and effective conduct of equipment inspection and maintenance programs and the development and implementation of effective operational systems with appropriate training appears warranted.

Periodic review of data requirements is recommended. Information needs relative to understanding the nature, causes or probability and impact of explosive or

flammable incidents and appropriate methodology for reporting data, should be clearly established and continually reviewed to ensure that necessary data requirements can be anticipated and satisfied. In the future, careful examination of reliable and harmonized data may enable opportunities to prevent undesirable incidents. Information requirements in support of contemplated regulatory activity should be clearly established, and methods should be developed to ensure that the data collected are reliable. For example, in relation to the issue of whether or not to list commercial explosives, analyses should be based to the maximum extent practicable on data and experiences related to actual commercial explosives.

3.2 Regulatory Efficiency

It appears that contemplated regulatory development is predicated on an assumption by Agency staff that under Title III Section 302, risk of event occurrence is assumed to be 1.0 and therefore (in relation to regulatory activity) it is merely a consequence analysis (analysis of potential impacts which may be realized if an event occurs - probability of risk of event occurrence is set to unity) that is necessary for proper regulation. In other words, for regulatory development purposes, unit probability of event occurrence must be assumed, and event consequence, not risk of event occurrence, must be evaluated in making listing decisions. EFCS members are concerned that this approach (in which probability of event occurrence is neglected), given potential local community resource limitations, may not optimally serve local community protection objectives.

It is evident that Agency staff use a presumed probability of unity for event occurrence merely as a model assumption in order to examine event consequence. Agency staff recognize that in actuality a consequence analysis need not assume that the probability is unity; it need only suppose that the event has occurred, whatever its probability of occurrence may be.

However, if, following consequence analysis, probability analysis is not addressed in some complementary context, local communities could be tasked to undertake a difficult planning exercise. At a minimum, consensus concerning a description of necessary infrastructure that underlies probabilistic risk analysis for realistic event scenarios ought to be available in order to develop harmony, reduce inefficiencies, and minimize confusion in the planning process. The model assumption that probability is unity for purposes of consequence analysis without subsequently readdressing probability characteristics of realistic event scenarios could thrust upon LEPCs, as part of the emergency planning process, the need to conduct and communicate the results of locally devised probabilistic risk analyses.

It is doubtful that with such a bottom-up approach applied *nationally*, that efficiency or reliability of the planning process could generally ensue absent consensual harmonization of this issue. There does not appear to be persuasive evidence that LEPCs are prepared to undertake this task. To the contrary, deficiencies in capabilities appear evident. Consequently, assurance of optimization of public protection objectives should not be presumed by the Agency staff.

Procedurally, Agency staff assumes that the probability of an adverse event occurring when (candidate) EHSs are present is unit probability, constructs criteria which relate to the acceptability (or not) of potential consequences of event occurrence, and against these criteria (and possibly certain other policy considerations such as potential impacts due to projected costs associated with regulatory compliance), then makes judgement in relation to the necessity to list or not list certain explosives or flammables as EHSs. Further, it appears that contemplated regulatory development is predicated on an assumption by Agency staff that the statute within which this regulatory activity works does not provide for regulating the methods of handling of explosives or any other hazardous compounds.

In regard to this contemplated regulatory activity, some of the technical issues examined by the EFCS appear closely, perhaps inextricably, associated with regulatory policy considerations. For example, the issue of who should conduct a risk assessment and who should conduct a consequence analysis of a potential emergency situation appears to substantially define the nature and breadth of responsibilities under the Community Right-to-Know-Act.

From a technical perspective, a regulatory approach focus that concentrates on the matter of listing of EHSs per se, does not appear to fully address the scope of technical issues of concern. Because EHS notifications will trigger Local Emergency Planning Committee (LEPC) planning activities, contemplated regulatory activity can have a potentially significant impact upon local community resource allocations and the uniformity and reliability of the technical nature of the decision-making infrastructure that is brought to bear on the local community planning process.

Certainly, the public should know about the presence, nature and behavior of any EHSs which may pose significant harm to the community. Carefully performed analyses should strive to ensure that reliable knowledge that can serve this need is readily available and transferred to the public in a timely manner. As data and models become more demonstrably reliable and validated, together with expert judgement, it should be possible on an ongoing basis to construct improved guidance and/or regulations that serve to quantify and where necessary, ensure appropriate reduction of any unacceptable potential for harm to a community or to emergency responders in circumstances in which explosives and flammables are present.

It must be established whether guidance and/or regulations that are to be developed, are in fact reasonably likely to ensure a substantial and efficient reduction in any significant potential for harm or whether to the contrary, regulatory policies are likely to be ineffective or not optimal, for example, overly conservative and unnecessarily burdensome. Regulatory review on a continuing basis is warranted. Here is an example of an instance in which the nexus between technical issues and regulatory policy is realized and is a critical link. As data and models are improved, the scientific merits (or not) of regulatory activity are more readily established, and a better degree of confidence in technical aspects of regulatory decisions can be assured.

Regulatory efficiency analysis must be undertaken. How effective is any proposed regulation or elements thereof actually likely to be in reducing potential adverse public impacts? Will LEPCs be faced with (and possibly ill-prepared for) a regulatorily imposed necessity to perform and communicate the results of thousands of risk analyses, many of which may merely address low probability, low consequence event scenarios?

Consider the example of non-optimal, overly conservative policies. While well-intended, in view of potential community resource limitations, these may ultimately be less protective of a local community (or less likely to satisfy community concerns and objectives) than regulatory policies based on best (reliable and validated) estimates of potential for harm. In this regard the foregoing discussions of the previous section that address data quality and modeling, especially model validation, are relevant. Scarce community resources and effort wasted on planning for reduction or mitigation of comparatively insignificant, low probability, harmful exposure scenarios may hamper the ability of society to plan ways to reduce or mitigate other higher probability scenarios that may pose more substantial potential for harm to human health and the environment. [NB For example, consider that if explosives and flammables were required to be listed separately, a composite of various current lists of explosives and flammables indicates more than 3,000 individual listings are possible. By comparison, there are about 360 chemicals currently listed as EHSs on the basis of toxicity. Consequently, the potential to dilute the ability of the public to focus on chemicals regulated according to toxicity may arise if many individual explosives and flammables are added to the current EHS list. An argument could be made that if listed, a categorical basis, such as the U.N. Classification scheme, may be more appropriate than individual listings.]

Thus, great care must be exercised in the conduct of regulatory development exercises which address the listing of explosives and flammables as EHSs, or a non-optimal regulatory burden may transfer to the local community. As previously suggested, if thousands of explosives and flammables were individually listed as EHSs, LEPCs may be faced with (and possibly ill-prepared for) a regulatorily imposed

necessity to perform and communicate the results of thousands of risk analyses, many of which may merely address low probability, low consequence event scenarios. Agency staff is strongly encouraged to continue to explore means to ensure an optimal balance between listing objectives and community resource limitations and protection requirements.

Further, note that one of the things that listings do is to implicitly or otherwise make an initial, short communication to various people of various technical skills backgrounds -- both specialists and nonspecialists -- about the risks associated with the items listed. It follows that it is very important that this initial communication be as clear as possible. Agency staff may wish to engage specialists in risk perception and communication to assist them in their further deliberations. This could also be helpful in interagency harmonization.

In sum, in view of a need for regulatory policies to efficiently enable mitigation of any substantial and unacceptable potential for harm, the EFCS, in addition to concerns about data quality and model validity, was concerned that Agency staff should closely examine the issue of whether listing of too many substances as SARA Title III, Section 302 EHSs might confound emergency planning exercises and dilute local community efforts aimed at first and foremost anticipating, preventing, and mitigating the most potentially serious (e.g., highest probability, greatest consequence) community exposure scenarios.

Further, to ensure adequate and efficient protection of the public, inclusive of the community taken as a whole, as well as emergency responders, it should prove useful to distinguish between the protection requirements of different affected groups of individuals. For example, the behavior and knowledge requirements of on-the-scene emergency responders in the event of an emergency exposure incident involving explosives or flammables is likely to be significantly different from the behavior and knowledge requirements of the community taken as a whole. [NB Although acknowledging the arbitrariness of a 100-meter fenceline distance, as a matter of policy, the Agency takes the view that use of a 100-meter fenceline distance serves to differentiate between a potential community catastrophe for purposes of triggering community planning activities, and other potential concerns for on-site workers and first responders, for whom other planning activities may be invoked.]

The behavior and knowledge requirements of personnel who are working with explosives and flammables are likely to be significantly different from those requirements for the community as a whole. In an emergency incident, the community as a whole needs to have information or receive a simple, easily understood message that can ensure immediate movement out of harm's way. On the other hand, emergency responders may require highly detailed information that

can ensure maximal protection and safety in responding to an emergency incident as it develops. Irrespective of the issue of choice of appropriate guidance and/or regulatory mechanisms for notification of the public, common sense dictates that appropriate notification of storage of explosives should be made to local planning authorities and emergency response personnel. Note that the ramifications of some discussions which follow in this report may be different in impact depending upon whether or not a distinction is made between the community taken as a whole and emergency responders.

3.3 Coordination of Regulatory Activity

In response to various legislative initiatives concerned with public protection and fostering proper public knowledge of opportunities to prevent or mitigate substantial, potentially harmful exposures, various governmental agencies, e.g., EPA, OSHA, BuMines, DOD, DOT, ATF, etc., have taken on regulatory and guidance responsibilities within their respective areas of authority. These responsibilities include, but are not limited to timely construction, collection, transfer, and dissemination of knowledge concerning potential for harm which may ensue from the presence of explosives or flammables. It appears that, at present, different regulatory bodies with authority in different operating areas utilize differing criteria and schemes to classify explosives and flammables.

Further, note that one of the things that listings do is to implicitly or otherwise make an initial, short communication to various people of various technical skills backgrounds – both specialists and nonspecialists – about the risks associated with the items listed. It follows that it is very important that this initial communication be as clear as possible. Agency staff may wish to engage specialists in risk perception and communication to assist them in their further deliberations. This could also be helpful in inter-agency harmonization.

In some instances there apparently is overlap of objectives and consequences of regulatory activity, e.g., in regard to classification schemes for explosives and flammables. In other instances there are apparently regulatory deficiencies, e.g., regarding what to and how best to communicate information to the public. Based upon correspondence received from Agency staff, on the matter of potential regulatory overlap, Agency staff considers that except as statutorily mandated by the Community Right-to-Know Act, no specific reporting requirement currently exists that would routinely inform local communities of potential hazards of explosives and flammables in a timely fashion. [NB Organizations such as the National Fire Protection Association (NFPA) and the International Fire Code Institute (IFCI) have considered the issue of community notification and have included requirements that address this issue in their respective standards/codes. For example, Agency staff

should note and consider the utility of NFPA 495, Explosive Material Code, 1990 edition, which states in paragraph 2-1.2, "The local fire department and other local emergency response agencies shall be notified of the location of all magazines and shall be notified of any changes in location." This requirement has been incorporated into many state and local regulations.]

Presently, explosives and flammables regulatory issues are addressed at inter-agency meetings on a case-by-case basis as the need arises. It appears that federal agencies have not currently fully harmonized views concerning the nature of regulatory overlaps, deficiencies and other matters, although progress is being made in these areas. If not resolved, this discordance may not best achieve the goal of establishing appropriate and adequate public protection and planning requirements. Further coordination of activities among federal agencies prior to notification of proposed rulemaking appears warranted. Coordination activities should seek, both in regard to planning and reporting purposes, to harmonize activity in order to minimize duplication of effort (explosives and flammables are presently listed according to numerous schemes). Especially in regard to planning activities that will be triggered by EHS notifications, such coordination should seek to ensure the timely and unambiguous communication of needed information to the local community and emergency responders. It is essential to avoid promulgation of conflicting or inefficient regulations and optimize the regulatory burden on regulated communities.

Differences among agencies concerning issues such as how to establish criteria for analysis of harm, how to list or classify explosives and flammables, or how to interrelate lists and classification schemes that have been developed by different agencies may confound and cause to be inefficient, public protection objectives and local community planning efforts.

[NB In regard to coordination of listing schemes for planning and emergency response purposes, according to one observer of this issue:

The nation's fire fighters, volunteer and paid alike, are invariably the ones to respond to an emergency. If a fire officer is told, "The stuff that's burning is a Class IB flammable liquid!", he knows what to expect. If he is told, "The stuff that's burning is hexamethyl burlap!", how well do you think he'll understand the problem he's faced with?]

Such inefficiency and confusion can cause and has caused uncertainties regarding how and whether to list or not list explosives and flammables categorically or individually. The issue of listing (or not listing) by Agency staff of explosives or flammables aside, in regard to federal agency activity in general, categorization of explosives and flammables should be harmonized among agencies.

Agencies have been and should further act together to examine and consider the merits of establishing a common reference basis for classification purposes. If listed, these materials should be categorized and referenced according to the United Nations (UN) classification scheme. The UN classification scheme can provide a common frame of reference against which to calibrate other classification schemes, regardless whether explosives or flammables are considered in listing schemes categorically or individually.

An additional example associated with regulatory policy considerations is the non-scientific issue raised to the EEC by the public at the EEC's March 4 and 5, 1992 meeting. This issue concerns releasing information pursuant to SARA Title III Community-Right-to-Know specifically pertaining to release of information regarding the exact location of explosives (and flammables) that could reach the hands of terrorists and criminals. The EFCS and the EEC did not address these concerns, but notes that the Program Office staff have been provided with this information and is now aware of the issue.

4. COMMENTS SPECIFIC TO PUBLIC RESPONSE TO ANPRM

NOTE: The following EFCS remarks on specific technical issues should not be construed to constitute EFCS endorsement (or lack of endorsement) of the listing of explosives and flammables as EHSs. The view of the EFCS is that the issue of whether or not to list explosives or flammables transcends purely technical considerations and necessarily involves policy determinations that are not within the purview of the Subcommittee.

In the charge to the Subcommittee, the EFCS was asked by Agency staff to examine specific technical issues raised by commenters to the ANPRM, and to consider possible resolution of some or all of the issues raised. Public comment issues were indicated in technical documents provided to the EFCS by Agency staff. Specific technical issues raised in public comments that were examined are listed earlier in this report (for full details refer to documents entitled: "62 Public Comments in response to the ANPRM"; and Issues Related to ANPRM on Explosives and Flammables). The following discussion is a composite representation of EFCS views concerning public comment issues.

4.1 Issues Related to Explosives

ISSUE 1.1 - Whether EPA should list low explosives as extremely hazardous substances (EHSs): The EFCS suggests that if explosives are listed, low explosives should be examined for listing purposes. The United Nations classification scheme, rather than the somewhat vague concept, "low explosive," may be useful as a principal frame of reference. The "ATF Tables of Distances" can be used as one reference point in development of guidance. However, in cases of high degree of confinement, fragmentation may be more of an issue than thermal radiation effects. [NB According to correspondence received from Agency staff, if low explosives are modeled on the ATF Table of Distances for low explosives (thermal radiation) then it would take over 100,000 lbs to have significant adverse effects at 100-meters. Therefore, if low explosives were to be listed, it would have to be based on additional factors, such as confinement. According to correspondence received from Agency staff, the statute that this regulatory activity works within does not provide for regulating the methods of handling of explosives or any other compounds.]

ISSUE 1.2 - Whether EPA should set threshold planning quantities (TPQs) for low explosives based on a Table of Distances for high explosives or low explosives: The EFCS recommends the use of the "ATF Table of Distances for Low Explosives." However, it is further suggested that consistency between this

approach and that which could follow from employment of the United Nations classification scheme should be harmonized. This consistency may foster increased clarity and efficiency of evaluations.

ISSUE 1.3 - Whether EPA should list fireworks as EHSs: The EFCS does not consider that fireworks, taken as a whole, should be listed as EHSs. However, in some specific instances, the EFCS suggests that some fireworks, in view of historical information, should be considered as comparable to low explosives in potential to cause harm. [N.B. Some regulations presently treat some fireworks in such a manner. According to one scheme presently in use, special fireworks are listed, but not common fireworks.] Therefore, the EFCS suggests that in regard to Agency staff activity, these cases should be identified and treated accordingly, consistent with a harmonization of classification schemes among regulatory authorities. [NB According to correspondence received from Agency staff, the statute within which this regulatory activity works does not provide for regulating the methods of handling of explosives or any other hazardous compounds.]

ISSUE 2 - Listing explosives by category or individually: If explosives are listed, they should be listed by category following the United Nations scheme of classification. The use of the United Nations scheme is consistent with harmonization objectives. [NB In correspondence received from Agency staff, use of the UN Classification scheme for explosives is suggested.] The categorical rather than individual listing of explosives is warranted, as this can ensure triggering of SARA Title III Section 302 objectives without overwhelming the EHS list with a substantial number of individually identified explosives, a circumstance that poses the potential to distract public attention from consideration of opportunities to mitigate unacceptable potential for harm associated with toxic substances. The EFCS notes that some explosives are already listed individually in view of the inherent substantial toxicity of certain of these substances. Further, note that one of the things that listings do is to implicitly or otherwise make an initial, short communication to various people of various technical skills backgrounds -- both specialists and nonspecialists -- about the risks associated with the items listed. It follows that it is very important that this initial communication be as clear as possible. Agency staff may wish to engage specialists in risk perception and communication to assist them in their further deliberations. This could also be helpful in inter-agency harmonization

ISSUE 3.1 - Appropriate overpressure level for analysis: The choice of an appropriate overpressure is implicitly established if the "ATF Table of Distances for High Explosives" is used for evaluation of High Explosives and Blasting Agents and if the "ATF Table of Distances for Low Explosives" is used for evaluation of Low Explosives. [NB Agency staff suggest that to simply use the Table would

mean using an overpressure as low as 0.4 psi, which is felt to be overly conservative for the purpose of this regulation. The current situation appears to be that there is a range of views concerning damage potential that should be harmonized.] It is further suggested that in evaluating the potential for harmful effects, incidence geometry should be examined. For example, ensuing consequences associated with an "appropriate overpressure level" established assuming a side-on incidence overpressure should be distinguished from ensuing consequences associated with establishment of a reflected incidence overpressure. [NB One observer suggests that ATF distances are tagged to side-on overpressures (which have a corresponding reflected overpressure.)] Further, the dynamics of a release event warrant consideration, e.g., the duration of the overpressure pulse. [NB The ATF Table of Distances does not explicitly take into account incidence geometry. Consideration of impulse or incidence geometry effects would have to be studied separately when making an analysis of individual building/structural response.] Reflection and refraction characteristics of waves in site-specific or case-specific event scenarios are important factors. For example, detonation or shock waves, reflecting back along their incident paths, reach much higher peak pressures than do the incident waves.

ISSUE 3.2 - Other methodologies [for analyzing potential hazards of explosives]: The EFCS suggests that employment of the United Nations classification scheme as a common frame of reference, in concert with the "ATF Tables of Distances" should prove useful in assessing and harmonizing evaluations of potential hazards of explosives. [NB Apparently, Agency staff agree that inter-agency harmonization should exist, assumes that this has been achieved and further suggests use of the United Nations classification scheme for explosives. The EFCS felt that further efforts in this area are advisable.]

ISSUE 4 - Appropriate TPQs for explosives: If explosives are listed, a basis for establishment of threshold planning quantities (TPQs) is implicit in use of the "ATF Tables of Distances for Explosives." Further, in assessing TPQ requirements, the EFCS suggests that benefits may be realized through a program of continually updated information evaluations that, for example, may derive from future improvements in the data base used by Agency staff [this is discussed further in the general comments section above] and from conduct of several case studies, i.e., a careful and detailed examination of the historical nature of incidents that have occurred at facilities or other locations adversely impacted by the presence of explosives. [NB Significant lack of available and reliable data is considered both by the EFCS and Agency staff to be an impediment to decision-making efforts. For example, Agency staff has noted that background data in support of regulations or guidance are insufficient for intended development

purposes, absent other regulatory support activities, e.g., modeling efforts. Thus, Agency staff has identified a need to accomplish further data base development.]

ISSUE 5.1 - Objections to examples of explosives used for consequence analysis: The EFCS recommends that as the proposed objective of contemplated Agency staff guidance and/or regulatory activity is to regulate or guide emergency planners in regard to the management of commercial explosives, it makes sense that examples utilized in analyses should be commercial explosives. Further, the EFCS notes that the explosives actually selected for analysis, as described in the TBD-E, are not commonly considered to be examples of readily available commercial explosives. This circumstance is inconsistent with the observation that commercial explosives should be considered. There is some concern that the public may become confused, i.e., may perceive the example cases to be representative of commercial explosives. Therefore, the EFCS recommends that examples that are properly representative of commercial explosives should be analyzed. [NB In correspondence received from Agency staff, there is agreement with this observation, and more representative examples of commercial explosives will be analyzed.]

ISSUE 5.2 - Comments on tests cited in the TBD-E: In view of and on consideration of public comments, the EFCS recommends that further examination of tests cited should prove useful in order to clarify limitations of tests. With a view toward harmonization of information content, it is further recommended that test results should be considered in the perspective of the United Nations explosives classification scheme [and possibly other comparable schemes]. Further, employment of TNT equivalency tests may prove useful in refining analyses of explosives effects and in assessing the corresponding equivalency of blast overpressures.

ISSUE 5.3 - Objections to the use of the ARCHIE model: The ARCHIE (Automated Resource for Chemical Hazard Incident Evaluation) computer program is based on the scaling law and was developed for and is used widely by FEMA, DOT, and EPA to provide emergency planning personnel with the tools necessary to assess the vapor dispersion, fire and explosion impacts associated with hazardous materials accidents. Contained within the program are several methods for evaluating the consequences of an explosion, depending on the type of material involved. [NB According to correspondence received from Agency staff, results of comparisons among ARCHIE, the scaling law and the Table of Distances show good agreement between the methods.] As with all such models, ARCHIE is an approximation that is not expected to be exact in all situations. Common sense dictates that to the extent practicable, these departures from exactness, these approximations, these differences from reality, must be identified, must be

understood, and their effects must be known and must be accepted. The EFCS cautions against use of the ARCHIE (or any other) model absent additional considerations. For example, it should be established through careful model validation procedures whether factors such as delayed ignition effects, vapor cloud inhomogeneities, finite evaporation rates, multicomponent effects, ejected materials effects, pre-ignition upwind movement of vapor clouds, confinement effects, etc. are reliably and appropriately addressed. This should not be accomplished by intercomparisons of models. Rather, this should be accomplished by comparison of model predictions against realistic (actual) event scenarios. These validation procedures are necessary in order to enable identification of model limitations and the extent to which consequences associated with complex event scenarios might be reliably predicted. Further, in establishing appropriate hazard criteria for modeling, the worst credible case which uses realistic conditions should be used for decision-making; account should be taken of instances where hazard conditions may be associated with delayed ignition effects, scenario inhomogeneities, confinement effects, etc. [NB According to correspondence received from Agency staff, to discard the ARCHIE Model would be tantamount to a recall or public discrediting of the method involving over 3,500 LEPCs and other private sector groups as well as two other Federal Agencies that sponsored its development. This observation notwithstanding, in the context of the validation exercise suggested, it does not appear at present that Agency staff have presented an acceptable analysis of the appropriateness of the ARCHIE model relative to what would ensue as a result of an actual release incident. It is also not apparent whether models used are appropriately conservative judged against actual event scenarios. Again, note the critical need for reliable actual event data. In sum, validation of models is lacking, leaving open to question whether use of, e.g., the ARCHIE model is appropriate for regulatory purposes or in reliably identifying potential damage or injury "absent additional considerations". In other words, the ARCHIE model must be used with caution.]

ISSUE 5.4 - Effect of barricades and commercial magazines on blast

Overpressure levels: From the point of view of assessing potential for harm to a community (far-field), consideration of barricades and commercial magazines in the near-field close to the point of origin is not relevant in most instances and does not address blast overpressures. The location of the point of origin of an explosive incident is likely to be so removed from the point of impact, [e.g., of blast wave overpressure in the vicinity of a community] that probably only far-field overpressure blast wave effects are likely to be realized. Predominantly, effects realized in the far-field are insensitive to the presence of barricades, etc. in the near-field of the point of origin of the explosion. Barricades do not stop nor do they completely absorb pressure waves. They merely deflect the wave as it travels through the atmosphere. A very short distance downfield of the barricade the

pressure wave will be present and will continue to move in all directions. As this propagating wave moves downfield it will impact buildings, humans, etc. in its path. Being dynamic the impact will be both side-on and reflected overpressures. Reflection and refraction characteristics of waves in site-specific or case-specific event scenarios are important factors. For example, detonation or shock waves, reflecting back along their incident paths, reach much higher peak pressures than do the incident waves. The EFCS is concerned with the secondary consequences of the collapse of a building on its occupants as a result of this overpressure. Concern about building collapse should be a major consideration in defining hazards associated with either explosives or flammables. In this context, near-field barricades are not relevant, although they may offer some shrapnel protection.

ISSUE 5.5 - Whether wet nitrocellulose should be listed as an EHS: Except in certain specific instances and involving amounts greater than some limiting quantity, the EFCS does not consider wet nitrocellulose to pose significant potential for harm. A further resolution of the nature of circumstances or of limiting amounts of material for potentially harmful conditions to be likely to occur is suggested. Agency staff may wish to seek additional information in order to determine the nature of any specific instances in which potential harm from wet nitrocellulose might (or has) prove(n) to be significant. [NB The DOD Liaison to the SAB's EFCS offers the following opinion: wet nitrocellulose is hazard classified in the UN scheme by the DOT and should not be singled out for special consideration by the EPA. Packaged wet nitrocellulose is either in Class 1 (explosives) or not based on water content.]

ISSUE 5.6 - Whether black powder detonates: Detonation of black powder is considered by the EFCS to be extremely rare and likely to occur only under some specific conditions. However, black powder is very sensitive to friction, heat, and impact, and may react violently when not handled properly. [NB Incidents involving black powder have been documented by the DODESB]. A further resolution of the nature of circumstances or of limiting amounts of material for potentially harmful conditions to be likely to occur is suggested. Agency staff may wish to seek additional information in order to determine the nature of specific instances in which potential harm from black powder might (or has) prove(n) to be significant.

ISSUE 5.7 - Definition of gunpowder: The EFCS observes that the definition of gunpowder is very "loose" in practice, and according to one member of the Subcommittee, usually refers to smokeless powder. A suggestion for resolution of this issue, is to not use the term "gunpowder", selecting instead to establish a meaning that would cause the understanding of "gunpowder" to be consistent with

implications inherent in the meaning of the categorization, "low explosive" or in an analogous manner, to United Nations classification, UN 1.3.

ISSUE 5.8 - Other comments: No discussion concerning other related public comments was undertaken by the EFCS as a whole.

4.2 Issues Related to Flammables

ISSUE 6.1 - Appropriate hazard criteria to use for modeling: Taken as a whole, the EFCS recommends that the hazard criteria used for modeling should be more realistic and case-specific, i.e., should consider the nature (duration of event, intensity, geometry, etc.) of potential exposure scenarios. Thus, there is some concern, for instance, in regard to the following considerations:

- a) Use of a somewhat subjective 1.0 psi overpressure in all instances, for example, specific geometries and incidence of overpressure waves can have an influence on analysis of the outcome. The current situation appears to be that there is a range of views concerning damage potential that should be harmonized.
- b) The observation that the nominal assumption of effects based on one-half of the lower flammability limit (LFL) as a limiting value for an incident to occur, does not realistically account for development and propagation of reactive behavior, e.g., in a vapor cloud. Fuel/oxidant distributions in a vapor cloud can be very irregular, and the distributions are dynamic.
- c) The suggestion that the heat flux to an exposed object should be considered in terms of the intensity and duration of an exposure event. In regard to this latter issue, the nominally selected event parameters (12.5 kilowatt per square meter exposure for 30 seconds) are unlikely in most instances to be realized when a BLEVE (Boiling Liquid Expanding Vapor Explosion) occurs. [NB Apparently, vapor cloud explosions and BLEVEs involving less than 10,000 pounds of flammable material have historically done little if any damage outside plant boundaries. In regard to BLEVEs, it is questionable whether if one were close enough for serious thermal burns one would survive the missile and overpressure effects.]

Modeling of potential hazards should involve considerations which extend beyond the primary (e.g., effect of overpressure on the human body) hazards to include

considerations of secondary hazards such as the potential for collapse of a building on the occupants.

ISSUE 6.2 - Appropriate modeling scenarios: Worst credible case analyses should be the basis for decision-making. Selected exposure scenarios and events should be representative not only of the possibility that harm may occur, but further, in view of limitations of local community resources and capabilities, should enable opportunities for a reasonable quantification of the probability for events to actually occur. In other words, regulatory activity should provide an understanding of and be responsive to differences between the possibility of an event taking place and the probability that an event may actually take place. [NB According to correspondence received from Agency staff, under Title III Section 302, risk is assumed to be 1.0 and therefore it is merely a hazard analysis that is necessary for proper regulation, the objective being simply to inform the community (irrespective of community resources) of the location of hazards for assistance in the construction of their emergency plans. This approach appears to pass responsibility for risk assessment and risk communication on to the LEPCs. The EFCS members are concerned that while Agency staff may interpret the Community Right-to-Know-Act to impart statutory authority to take this course of action, it may leave the LEPCs faced with tasks they are ill-prepared to address.]

ISSUE 6.3 - Methodology: The EFCS considers that continual progress has occurred in understanding of and access to methods that can be employed to ascertain probable consequences of credible exposure scenarios. Further, this progress has been manifested in the scientific and engineering journal literature and is accessible. In light of these observations, the EFCS recommends that Agency staff should consider undertaking further examination of the possibilities for utilization of other available methodologies. This effort may afford opportunities to enhance assessments of potential for harm to the public when explosives and flammables are present.

ISSUE 7 - Listing of flammables as a category: The issue aside of whether or not to list flammables in the first place, the EFCS observes that individual listing of flammables could impose a non-optimal regulatory burden upon emergency planners and others that may become unwieldy and detract from other technical objectives, e.g., the anticipation, prevention, control, and mitigation of effects of substances that are regulated due to inherent toxicity. [NB For example, consider that if explosives and flammables were required to be listed separately, a composite of various current lists of explosives and flammables indicates more than 3,000 individual listings are possible. By comparison, there are about 360 chemicals currently listed as EHSs on the basis of toxicity. Consequently, the potential to dilute the ability of the public to focus on chemicals regulated

according to toxicity may arise if many individual explosives and flammables are added to the current EHS list. An argument could be made that if listed, a categorical basis, such as the U.N. Classification scheme, may be more appropriate than individual listings.] This matter is a significant concern and appears to relate to the administrative rather than technical nature of the regulatory process. However, in view, for example, of:

- a) regulatory impact uncertainties on LEPC planning activities;
- b) the prospect that harmonization of explosives and flammables categorical classification schemes appears possible; and
- c) the possibility that public access to information is not necessarily limited by categorical listing schemes in view of public options to request additional information.

It appears reasonable to suggest that if flammables are listed at all under SARA Title III, Section 302, then such listing should initially be by way of some harmonized, categorical classification scheme, rather than by individual listings (such a scheme may not necessarily be inclusive of all flammable substances - again possibility versus probability of harmful events should be examined). The EFCS suggests that Agency staff could consider these comments and explore further how these observations relate to community and emergency responder protection objectives. Further, note that one of the things that listings do is to implicitly or otherwise make an initial, short communication to various people of various technical skills backgrounds -- both specialists and nonspecialists -- about the risks associated with the items listed. It follows that it is very important that this initial communication be as clear as possible. Agency staff may wish to engage specialists in risk perception and communication to assist them in their further deliberations. This could also be helpful in inter-agency harmonization.

ISSUE 8.1 - Hazards posed by flammables in quantities less than 10,000 pounds: The EFCS opined that except for certain materials under specific conditions and exposure scenarios, flammables do not usually appear to pose a substantial hazard to the public when present in amounts under 10,000 pounds. [NB Again, a significant regulatory burden may ensue. For example, 10,000 pounds of home heating oil or diesel fuel corresponds roughly to about 1,100 gallons of fuel. This is not an uncommon size for home heating oil tanks in some parts of the country. The NFPA 31-1987 Standard for the Installation of Oil Burning Equipment, specifically allows two 660 gallon tanks for fuel oil storage in the basement of a building, including residences.] The EFCS recommends, therefore, that Agency staff should undertake additional examinations to establish further the nature and ramifications of case-specific instances. Further, note discussions [and ramifications] which appear above in the general comments section, concerning

distinctions between special groups, e.g., emergency response teams, and the community taken as a whole.

ISSUE 8.2 - Flammable gases and very volatile flammable liquids as special category of flammables: The EFCS suggests that any contemplated special categorization of flammable gases, very volatile liquids, or other liquids that might be heated significantly above their flash point as a special category of flammables, should be evaluated based on a reliable analysis of any special hazards posed by these flammables for quantities less than 10,000 pounds. A major concern with flammables in terms of community protection objectives is with vapor clouds. This requires not only that the material be flammable, but that it also be capable of producing relatively stable mixtures in air that are within the flammable concentration range or that at least part of the mixtures are within the flammable range. A range of properties, flash point, boiling point or vapor pressure, molecular weight, and diffusivity define the capability to form vapor clouds which may be of concern. Identification of these properties may enable specification of a class of flammables of concern. Alternatively, absent such an identification, some consideration of individual materials may be warranted. [NB Some flammables have never been known to form dangerous vapor clouds. Further, while some materials may be eliminated from consideration based on flash point, they are capable of forming vapor clouds that may warrant concern when they are handled at elevated temperatures and/or pressures. To identify these as a class will take some evolution. In addition, some materials that are not classed as flammables within the Agency staff definition are capable of BLEVEing under some conditions which may warrant examination. In sum, further discussion and thought is warranted.]

ISSUE 8.3 - Use of 100-meter fenceline distance in analysis:

As has been indicated in the foregoing discussions, exposure scenarios and the potential for community harm can be and in fact are case-specific. In some situations the selected fenceline distance may not be conservative and has the potential for leading to erroneous conclusions. Thus, the assumption of a 100-meter fenceline may not be an appropriate basis for analysis in all instances. Therefore, the EFCS recommends that Agency staff should further seek to determine whether more case specificity should be incorporated into analyses. This determination should fully address historic data and incorporate validated modeling procedures that reflect current knowledge and advances.

If models are shown by validation exercises to be inexact, conservative models should be used. [NB As a matter of current policy, the Agency takes the view that use of a 100-meter fenceline distance serves to differentiate a potential community catastrophe for purposes of triggering community planning activities, versus other

potential concerns for on-site workers and first responders, for whom other planning activities may be invoked. The Agency recognizes that the distance is arbitrary but cites previous regulatory precedent for use of this distance. As indicated by an Agency official, in reality, fenceline distances are "all over the map."] It appears that there is no technical or scientific basis that supports use in all instances of the 100-meter fenceline criterion or that this quantity is conservative in all instances - a potential for erroneous conclusions in regard to public safety may arise [NB Albeit an example that addresses military explosives, the following approach is instructive: In the Department of Defense, explosive safety distances for different types of exposures are determined by the quantities and classes of explosives in the maximum credible event (MCE). Distances are based on airblast, fragment, debris, firebrand, thermal, and groundshock effects from explosions. The MCE, e.g., from a hypothesized accidental explosion or fire, is the worst single event that is likely to occur from a given quantity and disposition of material. The event must be realistic with a reasonable probability of occurrence, considering the explosion propagation, burning rate characteristics, and physical protection given in the items involved. The MCE evaluated on this basis may then be used as a basis for effects calculations and causality predictions.]

ISSUE 8.4 - Other factors that should be considered in analysis: The EFCS suggests that further examination of available literature should indicate other factors that could be considered, at a minimum, in case-specific analyses. For example, it is known that delayed vapor cloud explosions can occur, that containers containing flammable substances can "rocket", etc. These factors should be identified, and included, where appropriate, in analyses of the potential for community harm.

ISSUE 9 - Should flammables be listed as EHS or not, and why or why not? In regard to the issue of whether or not to list flammables or explosives at all as EHSs (i.e., to list or not, regardless whether by substance or category), the EFCS members decided to provide technical guidance to Agency staff on the merit of the collective expertise of the Subcommittee. These comments may be beneficial in view of potentially non-optimal regulatory impacts that may be realized if a large number of flammables are listed. Based on these discussions, the EFCS suggests that:

- a) Major technical considerations should be more thoroughly examined and addressed before Agency staff act to make a determination concerning this issue. This includes, but is not limited to, a need to continue to more thoroughly develop and or reliably evaluate any information indicative of likely consequences of and the nature of impacts beyond the local point of origin of adverse flammable release events involving less than 10,000 pounds of flammable material. [N.B.

The EFCS members discussed among themselves whether there was historical evidence that could lead to substantial concerns regarding the presence of properly managed flammables in amounts less than 10,000 pounds. With respect to concerns regarding properly managed materials, the EFCS felt that within the limits of knowledge brought forth by the discussions which were carried out by Subcommittee members, significant evidence that could justify regulatory concern was not evident]. Some current concerns regarding deficiencies in analyses that have been carried out are noted in the text of this report;

- b) In seeking to make any determination whether or not to list flammables, Agency staff should carefully seek to understand who is affected by the presence of flammable materials in amounts less than 10,000 pounds, i.e., Agency staff should discriminate among on-site personnel, emergency responders, and the community in general. Given this discrimination, Agency staff should further establish the nature of any benefits or consequences to these groups from contemplated regulatory action;
- c) Analogous to Agency staff concerns, the EFCS indicates strong concern regarding potential non-optimal regulatory impacts upon affected parties if flammables are listed. In view of perceived, potentially large and burdensome regulatory requirements that may seriously affect the efficiency of local community response capabilities, the EFCS asserts that Agency staff should establish clearly what complexities may ensue from contemplated regulatory action and whether such complexities are likely to be a hindrance to rather than a benefit to public protection objectives; and
- d) Lastly, a harmonization of classification schemes (as discussed in this report) among all federal, state and local governing or regulatory bodies having responsibilities in this area should be achieved. The EFCS considers that absent realization of this objective, regulatory requirement of the nature contemplated (i.e., listing of flammables) may lead to confusion and duplication of efforts which could be seriously counterproductive in regard to public protection objectives.

FEB 08 1991

Project Title:

Review of Explosion and Flammability Hazard Issues

Client Office:Office of Toxic Substances (OTS)
Contact: Dr. Paul S. Tobin (202) 382-3736Background:

The 1986 Superfund Amendments and Reauthorization Act (SARA) Title III, Section 302 lists 360 substances that trigger emergency planning by local emergency planning committees across the U.S. These substances were all selected based on their potential to cause lethality in accidentally exposed persons due to inherent toxic properties. SARA also includes, however, a provision to list explosive and flammable substances at the option of the EPA Administrator. OSWER (Office of Solid Waste and Emergency Response) and OTS have jointly prepared an Advanced Notice of Proposed Rulemaking (ANPRM) to address explosives and flammables, with OSWER as the regulation development lead and OTS providing technical support. The ANPRM solicited comments on the proposal to list commercial explosives, to not list flammables, since analyses showed lower concern for quantities under 10,000 lbs (above which amount reportable information is available under Sections 311 and 312 of the Act), and to defer decisions on non-commercial explosives and reactives until a more complete strategy could be developed for these difficult to evaluate substances. The SAB is being requested to consider technical arguments presented in the 1) ANPRM, 2) Technical Support Document for Explosives, 3) Technical Support Document for Flammables, and 4) 62 Public Comments, from which nine major technical comments have been summarized to facilitate the SAB's efforts (Please see Appendix I; Please note that a complete package of information on each issue is now being prepared for the SAB that will abstract commentor and technical support information and model equations that relate to each of the nine issues). The Proposed Rule is being scheduled for completion sometime between July and October. Non-commercial explosives and reactives are not a major concern for now, but any comments addressing these substances would, of course, be welcome.

Tentative Charge:

The SAB/EEC is requested to review the four documents listed above and especially to consider possible resolution of the nine technical issues raised in the public comments. All documents are planned to be supplied to SAB/EEC by the Executive Secretary.

Tentative Location and Schedule:

Washington, D.C. in March, 1991.

Appendix I. Nine Public Comment Issues

Explosives

1. Low Explosives
 - o Listing/exclusion of low explosives
 - o Setting TPQ's for low explosives based on Table of Distances for high explosives or low explosives
 - o Listing/exclusion of fireworks
2. Listing explosives by category or individually
3. Consequence analysis for explosives
 - o Appropriate overpressure level for analysis
 - o Other methodologies
4. Appropriate TPQs for explosives
5. Specific comments on technical background document for explosives
 - o Objections to examples of explosives used for consequence analysis
 - o Comments on tests cited in technical background document
 - o Objections to use of ARCHIE model

Flammables

6. Hazards to the community of flammable chemicals
 - o Hazards posed by flammables in quantities less than 10,000 lbs
 - o Flammable gases and very volatile flammable liquids as a special category of flammables
7. Consequence analysis for flammables
 - o Appropriate level of consequence to consider
 - o Appropriate hazard criteria to use for modeling
 - o Appropriate modeling scenarios
8. Listing of flammables as a category.
9. Specific comments on technical background document for flammables
 - o Use of 100-meter fenceline distance in analysis
 - o Other factors that should be considered in analysis

APPENDIX B - ACRONYMS/TERMS

AHEDB	-Acute Hazardous Events Data Base
ANPRM	-Advanced Notice of Proposed Rulemaking
ARCHIE	-Automated Resource for Chemical Hazard Incident Evaluation
ATF	-Bureau of Alcohol, Tobacco and Firearms
BLEVE	-Boiling Liquid Expanding Vapor Explosion
BuMINES	-United States Bureau of Mines
CEPPO	-Chemical Emergency Preparedness and Prevention Office EPA/OSWER)
CHMIRS	-California Hazardous Material Incident Reporting System
CORRE	-The Corporation on Resource Recovery and the Environment
DODESB	-United States Department of Defense Explosives Safety Board
DOD	-Department of Defense
DOT	-Department of Transportation
EEC	-Environmental Engineering Committee (SAB/EPA)
EPA	-United States Environmental Protection Agency (US EPA, or "The Agency")
EFCS	-Explosives and Flammables Criteria Subcommittee (EEC/SAB/EPA)
EHS	-Extremely Hazardous Substance
FEMA	-Federal Emergency Management Agency
IFCI	-International Fire Code Institute
LEPC	-Local Emergency Planning Committee
LFL	-Lower Flammability Limit
MCE	-Maximum Credible Event
NB	-Note well ("Noté Bené")
NFPA	-National Fire Protection Association
OSHA	-Occupational Safety and Health Administration
OSWER	-Office of Solid Waste and Emergency Response
OTS	-Office of Toxic Substances (EPA)
psi	-Pounds per square inch
RMPP	-Risk Management and Prevention Program
SAB	-Science Advisory Board (EPA)
SARA	-Superfund Amendments and Reauthorization Act
SERC	-State Emergency Response Committee
TBD-E	-Technical Background Document for Explosives
TBD-F	-Technical Background Document for Flammables
TNT	-Trinitrotoluene
TPQ	-Threshold Planning Quantity
UN	-United Nations

APPENDIX C - A LISTING OF BRIEFINGS AND HANDOUTS
PRESENTED TO THE SAB'S EFCS ON MAY 29 and 30, 1991

- 1) California, Governor's Office of Emergency Services, Chemical Emergency Planning and Response Commission, Exposure Committee, 48 Chemicals Recommended for Further Investigation, A Fact Sheet Provided to the SAB's EFCS by Dr. Frederick A. Lercari of the State of California Governor's Office of Emergency Services, dated November 1, 1990
- 2) California, Governor's Office of Emergency Services, Hazardous Material Division, booklet entitled "Hazardous Material Emergency Planning and Community Right-to-Know, A Comparison of California and Federal Requirements," Revised April 1991
- 3) California, Governor's Office of Emergency Services, Hazardous Material Division, entitled "Hazardous Material Incidents, January - December, 1989," A Summary of Data Collected through the California Hazardous Material Incident Reporting System (CHMIRS), February 1991
- 4) California, Governor's office of Emergency Services, Hazardous Material Division, booklet prepared by Dr. Frederick A. Lercari, Principal Author, entitled State of California, Guidance for the Preparation of a Risk Management and Prevention Program (RMPP), dated November 1989
- 6) Hercules Incorporated, Oral Testimony of R.E. Athey and C.C. Gardner before the U.S. Department of labor, Occupational Safety and Health Administration on Proposed Rulemaking, Process Safety management of Highly Hazardous Chemicals, 29 CFR 1910.119, Public hearing Beginning Tuesday, February 26, 1991
- 7) IME Comment Package: Letter of Transmittal with Issues and Attachments by the Institute of Makers of Explosives to Mr. James Makris, Director of the Chemical Emergency Preparedness and Prevention Office USEPA, dated March 7, 1991. The same package was provided on May 20, 1991 to Dr. K. Jack Kooyoomjian, SAB Staff on May 20, 1991 from Thomas P. Dowling, Manager of Technical Services of the IME and contains the following:

- 7A) Comments from the American Mining Congress to the Superfund Docket Clerk on Docket No. 300PQ, dated November 30, 1990
- 7B) Comments of the American Petroleum Institute to the Superfund Docket Clerk on Docket No. 300PQ, dated October 26, 1990
- 7C) Comments of the American Pyrotechnics Association to the Superfund Docket Clerk on Docket No. 300PQ, dated December 3, 1990
- 7D) Comments of the Associated General Contractors of America to the Superfund Docket Clerk on Docket No. 300PQ, dated November 30, 1990
- 7E) Comments of the Institute of Makers of Explosives to the Superfund Docket Clerk on Docket No. 300PQ, dated November 26, 1990
- 7F) Comments of the International Association of Geophysical Contractors to the Superfund Docket Clerk on Docket No. 300PQ, dated October 26, 1990
- 7G) Comments by the National Coal Association to the Superfund Docket Clerk on Docket No. 300PQ, dated November 30, 1990
- 7H) Comments of the National Stone Association to the Superfund Docket Clerk on Docket No. 300PQ, dated November 26, 1990
- 8) US EPA Briefing by Dr. Paul Anastas of the Office of Toxic Substances, Untitled, but with the first page entitled "Background on Current Scheme," (for listing of Explosives by Category or Individually), May, 1991
- 9) US EPA Briefing by Ms. Gail Froiman of the Office of Toxic Substances, entitled "Consequences of Accidents Involving Commercial Explosives," dated May 29, 1991
- 10) US EPA Briefing by Mr. John P. Ferris of the Chemical Emergency Preparedness and Prevention Office, entitled "Regulatory Requirement to the EHS List, Emergency Planning and Community Right-to-Know Act (SARA Title III)," May 1991

- 11) US EPA Briefing by Nahn T. Nguyen, Office of Toxic Substances, entitled "Consequences of Accidents Involving Flammable Gases and Liquids," dated May 30, 1991
- 12) US EPA Briefing by Dr. Roger Garrett, Office of Toxic Substances, entitled "History, also "Legislative Mandates for Implementing Emergency Response Planning," May 1991
- 13) US EPA Briefing, by Dr. Paul Tobin of the Office of Toxic Substances, Untitled, Dealing with SARA Title III Planning Steps and Plan Requirements, Purpose of Hazard Analysis, Steps of a Hazards Analysis, Hazard Identification, Purpose of Vulnerability Analysis, Likelihood Factors in the Consequence Analysis for Toxics and Explosives, May 1991
- 14) US EPA, SARA Title III Fact Sheet entitled "Emergency Planning and Community Right-to-Know," Revised February 1990 December 3, 1990

APPENDIX D - RESOURCE MATERIAL AND REFERENCES CITED

- 1) ANPRM on Extremely Hazardous Substances, Federal Register, Vol. 55, No. 166, August 27, 1990, pages 35012-35021
- 2) California, Governor's Office of Emergency Services, Chemical Emergency Planning and Response Commission, Exposure Committee, 48 Chemicals Recommended for Further Investigation, A Fact Sheet Provided to the SAB's EFCS by Dr. Frederick A. Lercari of the State of California Governor's Office of Emergency Services, dated November 1, 1990
- 3) California, Governor's Office of Emergency Services, Hazardous Material Division, booklet entitled "Hazardous Material Emergency Planning and Community Right-to-Know, A Comparison of California and Federal Requirements," Revised April 1991
- 4) California, Governor's Office of Emergency Services, Hazardous Material Division, entitled "Hazardous Material Incidents, January - December, 1989," A Summary of Data Collected through the California Hazardous Material Incident Reporting System (CHMIRS), February 1991
- 5) California, Governor's office of Emergency Services, Hazardous Material Division, booklet prepared by Dr. Frederick A. Lercari, Principal Author, entitled State of California, Guidance for the Preparation of a Risk Management and Prevention Program (RMPP), dated November 1989
- 6) USEPA Booklet entitled "Chemicals in Your Community, A Guide to the Emergency Planning and Community Right-to-Know Act," dated September 1988
- 7) USEPA Draft Comment Response Summary Document entitled "Issues Related to ANPRM on Explosives and Flammables for SAB Consideration," draft dated March 14, 1991
- 8) USEPA Draft Report, entitled "Categorization and Summary of Comments Received on Advance Notice of Proposed Rulemaking Under Section 302 of the Superfund Amendments and Reauthorization Act of 1986, August 27, 1990," draft dated February 1, 1991

- 9) USEPA Draft Technical Background Document entitled "Consequences of Accidents Involving Commercial Explosives," draft dated July 5, 1990 (Also referred to as TBD-E)
- 10) USEPA Draft Technical Background Document entitled "Consequences of Accidents Involving Flammable Gases and Liquids," draft dated July 5, 1990 (Also referred to as TBD-F)
- 11) USEPA, Science Advisory Board, Resolution on Use of Mathematical Models by EPA for Regulatory Assessment and Decision-Making, EPA-SAB-EEC-89-012, January 1989

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U.S. Occupational Safety and Health Administration

