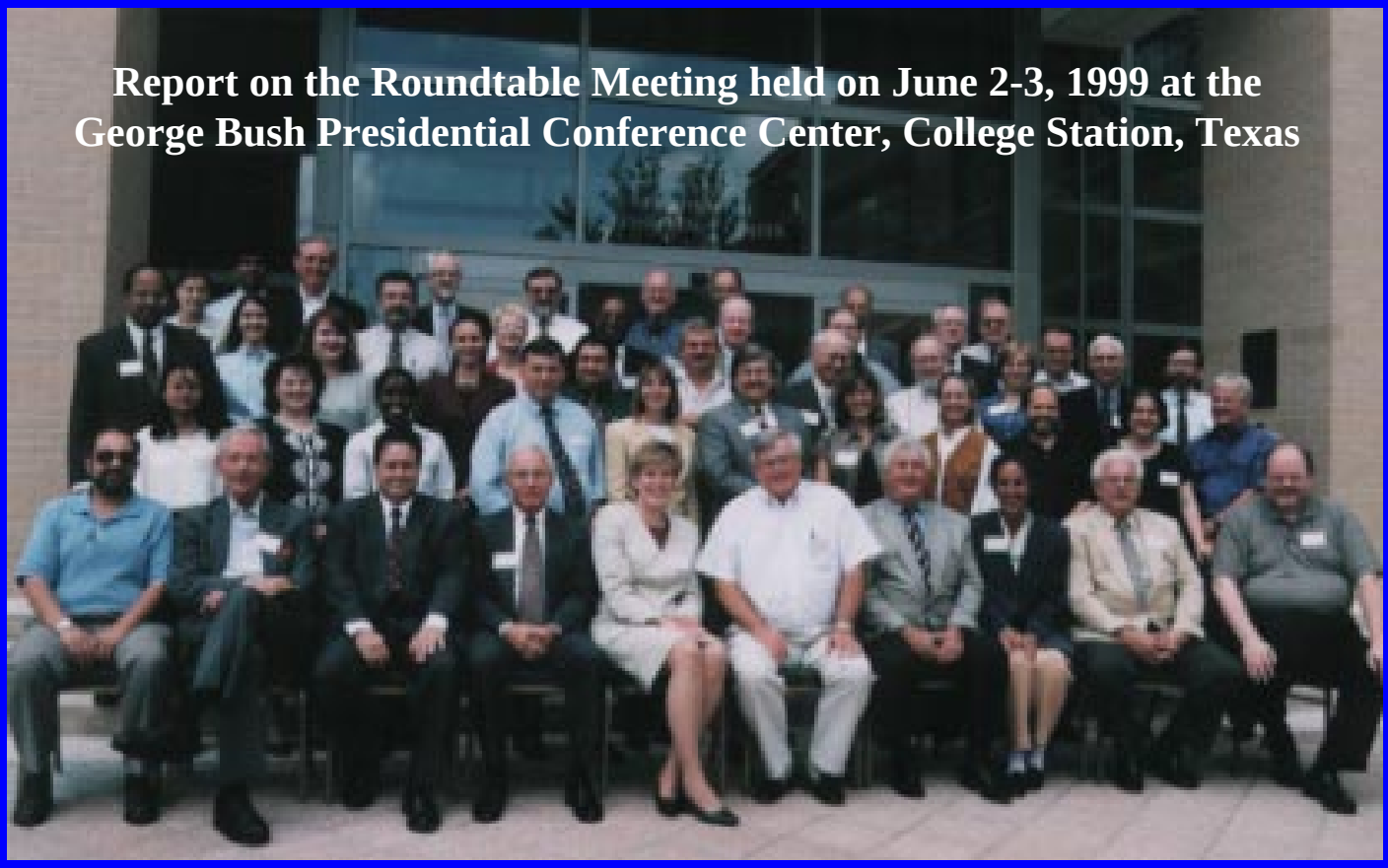
Chemical Safety Program Assessment Project

Report on the Roundtable Meeting held on June 2-3, 1999 at the George Bush Presidential Conference Center, College Station, Texas



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EXECUTIVE SUMMARY

The objective of the ***Chemical Safety Program Assessment*** project is to develop a methodology for chemical safety program assessment and to apply the methodology in an analysis of the impact of various programs for prevention of accidental releases of reactive, flammable and toxic chemicals from stationary sources. During the fifteen years that have passed since Bhopal, many organizations throughout the United States, and indeed the world, have taken major steps toward improving industrial safety. These steps have included actions dealing with response, preparedness, training, and prevention. It is clear that there are a great many stakeholders concerned with chemical safety – governments at all levels, research institutions, trade associations, labor organizations, environmental and public interest groups, colleges and universities, industry – and each organization has a unique and important role. What we have not yet accomplished is how to make all the pieces of the complex puzzle fit in a manner that brings out the best of them all and allows each organization – even individuals – to receive credit for their contribution.

The Mary Kay O'Connor Process Safety Center has undertaken this ambitious project that includes three objectives: identification of national chemical safety goals, identification and implementation of activities necessary to accomplish the goals, and establishment of a measurement system to help measure progress towards the national goals. The **national chemical safety goals** should be developed by stakeholder consensus based upon an analysis of the history of accident prevention activities, accident and injury statistics, and evaluation of other safety programs. The programs evaluated should include those required by regulatory authorities and industry standards. The goals necessarily should be achievable and measurable. **Activities** necessary to accomplish the goals also must be identified and implemented. It is relatively simple to agree on a goal, for example, of reducing the total number of accidents by a certain number of percentage points every year. However, putting in motion all the activities necessary to make the goal a reality within the specified time period is another matter. Finally, the **measurement system** should be implemented such that progress towards the national goals can be tracked relatively easily. The measurement system is meaningful only if a baseline assessment is available. In turn, the baseline assessment can be credible only if a reliable and comprehensive database is available. The ultimate intent of this project is to establish a system that not only helps evaluate the effectiveness of current programs and activities but also serves as the basis for establishing future goals.

The project team consists of a multidisciplinary group consisting of experts from plant operations, process safety and risk management practices, the development and application of metrics, and public policy issues. A diverse and representative stakeholder group guides the project team. The primary responsibility of the stakeholder group is to provide guidance on the direction and content of the project. In addition, the stakeholder group also reviews and comments on the methodology and the analyses.

It is apparent that the success of this ambitious and complex project depends upon wide stakeholder involvement with serious dialogue and commitment from all parties. For this reason, the Center has sought and openly welcomed input and participation from all stakeholders. The stakeholder input is being sought in two different forms. First, all information pertaining to the project is publicly available through the Center Website, the Center newsletter, and other media. All stakeholders can send their input regarding any of the issues identified in these publications. Second, as mentioned earlier, a modest-size core-group of stakeholders has been formed to chart each step of the project for execution by the project team and evaluate project progress. This group met recently, for the first time, in a Roundtable meeting in College Station, Texas to evaluate the preliminary

project work and develop plans for the immediate future. The goals of this Roundtable meeting were as follows:

- Arrive at a consensus on national chemical safety goals.
- Agree to pursue common measures of evaluation for national chemical safety goals. In addition, determine resources (people, funding, and information) needed to pursue these common measures. How and where do we get these resources?
- How does everybody involved find a way to get credit for their contribution towards accomplishing the national chemical safety goals?

Five briefing papers were prepared beforehand by the project team and presented during the meeting. The briefing papers did not provide specific conclusions but provided data and information, reasonable and sufficient, to stimulate discussion. Based upon the information presented and ensuing discussions, the Roundtable attendees individually listed National Chemical Safety Goals. A simple voting process then identified the consensus goals.

It is gratifying to note that in addition to agreeing on the National Chemical Safety Goals with overwhelming plurality, the Roundtable attendees unanimously adopted a vision for chemical safety in the United States. This was even more remarkable given the broad viewpoints and diversity of the attendees. The vision statement adopted unanimously is:

> ***Reduce chemical process accidents to zero while building public trust through community interaction.***

The Roundtable also agreed on the following three consensus goals:

1. ***Develop a comprehensive national data system for collection of near-misses and incidents which can be related to actual causes and to establish chemical safety baselines.***

2. ***Establish metrics that relate safety performance and business objectives.***

3. ***Establish targeted reduction goals for chemical safety incidents.***

The Roundtable attendees then divided into three breakout groups and concentrated on three separate issues, infrastructure/process, database/metrics, and activities. The **infrastructure/process** breakout group provided recommendations for the infrastructure and process necessary to accomplish the goals. The **database/metrics** breakout group provided recommendations for the accident database needed, baseline assessment, and development of a measurement system; all aimed at measuring progress towards the goals. Finally, the **activities** breakout group provided recommendations on the activities and time frame necessary to accomplish the goals. All three breakout groups were charged to develop an appropriate action plan addressing questions such as: What? How? Where and Who? Resources Needed?

The project team now is working on implementation of the stakeholder recommendations. An organizational structure is being established based upon breakout group recommendations. Committees will soon begin to define further the goals and develop plans to implement them. A second Roundtable meeting is being planned for the fall in conjunction with the Center's annual symposium.

1.0 INTRODUCTION

Regulatory programs and industrial standards and practices in the United States have quite often been reactive, i.e., in response to catastrophic accidents or other events. In addition, currently it is difficult if not impossible to identify the programs which are contributing to the improvement of chemical safety. Finally, the journey towards improved safety performance is impossible to chart because of lack of a baseline assessment and agreement on national chemical safety goals.

The industrial revolution brought prosperity and along with it the use of hazardous processes and complex technologies. Growing economies and global competition has led to more complex processes involving the use of hazardous chemicals, exotic chemistry, and extreme operating conditions. As a result, a systematic and well-thought approach to chemical safety is necessary. All stakeholders realize the importance of improved chemical safety and its positive impact on the bottom line. However, lack of identifiable and understandable national goals has created some confusion with regard to the direction of chemical safety. In addition, it is not clear which of the myriad of programs and activities are accomplishing their stated objectives. The systematic approach taken in this project consists of development of a baseline assessment and establishment of clearly identifiable national chemical safety goals. It follows then that a measurement system is necessary to chart the progress towards the established goals. Finally, activities necessary to accomplish the goals must be identified and implemented.

Given this background, the Mary Kay O'Connor Process Safety Center at Texas A&M University initiated this project with wide stakeholder participation to achieve consensus decisions with regard to chemical safety. The project team consists of a multidisciplinary group consisting of experts from plant operations, process safety and risk management practices, the development and application of metrics, and public policy issues. A diverse and representative stakeholder group guides the project team. The primary responsibility of the stakeholder group is to provide guidance on the direction and content of the project. In addition, the stakeholder group also reviews and comments on the methodology and the analyses.

2.0 PROJECT OVERVIEW

The overall objectives of this project are as follows:

1. Stakeholder consensus on national chemical (process) safety goals. Identification of where we want to be and by when in relation to national chemical safety goals.
2. Agreement on some common metrics for measurement of progress towards national chemical safety goals.
3. Identification and implementation of activities needed to realize the national chemical safety goals.

This is a formidable task. However, the National Institute for Occupational Safety and Health (NIOSH) has successfully launched an even broader based initiative on a National Occupational Research Agenda (NORA). Faced with a similar but, perhaps more difficult challenge, national pollution prevention, Neltner[1] called for the creation of a new metric. "A National P2 Index" that would be a composite of five to ten measures that reflect broad trends in pollution prevention." Is a somewhat similar 'process accident index' needed to really measure progress? Such an index might reflect leading indicators such as near misses, use of inherently safer technology, levels of training, as well as incidence and consequences.

The methodologies developed in this project can also be useful for safety program assessment; namely the

Neltner, T., and K. Zarker, "The P2 Measurement Challenge, Part I: A National P2 Index," Prevention First, vol. 1, Spring 1999, pp. 11-13.

analyses of the impact of various programs for prevention of accidental releases of reactive, flammable and toxic chemicals from stationary sources. The programs that might be evaluated include those required by regulatory authorities and industry standards. The idea is to determine and eliminate overlaps in programs, identify and recommend remedial measures for gaps, and finally identify programs and activities that contribute towards improvement in chemical safety.

3.0 STAKEHOLDER PARTICIPATION

It is important to harness the intellectual resources of all stakeholders and apply them to this project. All stakeholders have an interest and investment in chemical safety and thus improvements in chemical safety can only be realized by a concerted effort. Much can be gained by working as a team with common goals and vision rather than working at cross-purposes. It is also essential that we establish and develop the means to recognize and give credit where credit is due for accomplishments that improve chemical safety.

The project team worked diligently to establish a core group of stakeholder representatives to serve as an ombudsman group. Given the stakes of the project, this was an important step. While a very large group would be unwieldy, every effort was made to include all stakeholders. The role of this ombudsman group is unique in the sense that they not only evaluate and critique the project team's work but they also are instrumental in charting the future course of action.

In addition to the ombudsman group, anyone can provide inputs or comments on the project on a regular basis. Through reports like this and other publications, the project scope and progress is available widely. Detailed descriptions of project activities, briefing papers, and other information is available on the Internet (http://process-safety.tamu.edu).

4.0 ROUNDTABLE MEETING

Even though input from various stakeholder representatives was transmitted to the project team from the very early stages of the project, it was also clear that a more formal input mechanism was essential. The idea of a Roundtable meeting thus developed. Bringing together the ombudsman group together to focus solely on this issue was deemed critical to the success of the project.

4.1 Selection of Invitees

As stated earlier, the project team was diligent in ensuring that all stakeholder groups were represented at the Roundtable meeting. The project team identified the following broad stakeholder groups that should be included.

- Academicians and Researchers
- Citizens' Groups
- Chemical Plant Insurance Representatives
- Environmental Groups
- Federal Government Agencies
  - Agency for Toxic Substances and Disease Registry (ATSDR)
  - U.S. Chemical Safety and Hazard Investigation Board (CSB)
  - U.S. Environmental Protection Agency (EPA)
  - Occupational Safety and Health Administration (OSHA)
- Industry
- Industry Associations (Representing large multinational companies as well as small and medium-sized enterprises)

- Local Emergency Planning Committees
- Public Interest Groups
- Select Overseas Organizations
- State Agencies

Every effort was made to identify the appropriate individual in these organizations for invitation to the Roundtable meeting. In many instances, a priori discussions and exchange of ideas took place. Formal letters of invitation stating the scope and objectives of the project were then sent out. Follow-up telephone calls and discussions were also made. A complete list of all the invitees is included in Appendix A.

4.2 Roundtable Attendees

While all invitees expressed interest and support for the project, some of them declined participation because of prior commitments or workload and availability of appropriate personnel. Nevertheless, the final list of attendees constituted a diverse and impressive group representing all stakeholder interests. A complete list of attendees is provided in Appendix B.

Two weeks prior to the Roundtable meeting, a briefing binder was sent to all the attendees in preparation for the meeting. The cover letter requested the attendees to review the material in the briefing binder, which represented work accomplished by the project team to-date. The briefing binder also included information from various organizations about their chemical safety goals and evaluation approaches. The table of contents from the briefing binder is provided in Appendix C.

4.3 Briefing Papers

The sole objective of the briefing papers was to stimulate discussion and encourage attendees to think about the issues involved and arrive at their own conclusions. The five briefing papers identified by the project team based on informal discussions with some stakeholders are:

1. Chemical Process Safety – National Goal Setting
2. History of Federal Process Safety and Risk Management Regulation Under the Clean Air Act Amendments of 1990
3. Accident History Databases—What Do They Tell Us?
4. Benchmarking Process Safety Programs
5. The 21st Century: Process Safety and Factory Mutual

4.3.1 Briefing Paper No. 1: Chemical Process Safety – National Goal Setting

A brief summary of the first briefing paper and the discussions surrounding the paper are provided in the next two subsections. An unabridged version of the briefing paper as well as the complete transcript of the subsequent discussions is available on the Center website (http://process-safety.tamu.edu).

4.3.1.1 Summary of Briefing Paper No. 1

The first briefing paper, "Chemical Process Safety – National Goal Setting," co-authored by Dr. Irv Rosenthal and Dr. Sam Mannan outlined the objectives of the meeting and put forth some specific initiatives in the hope of stimulating Roundtable participants thinking on goals that they might wish to propose. As background to these possible process safety initiatives, the authors briefly examine the series of notorious accidents in the 1970's and 80's and other developments that have shaped and are continuing to shape process safety practices to date. The paper notes that while these developments have given rise to significant increases in process safety technical and management knowledge and promising new process safety regulatory requirements, serious de-

ficiencies still exist in regard to needed tools and practices. Among the more important general areas of deficiency noted are:

1. The absence of adequate data on whether progress is being been made in reducing the incidence of process accidents and the extent of their consequences.
2. Less than desired application of established principles for managing process safety in many industry facilities.
3. Gaps in process safety training, particularly in small to medium sized facilities and less than adequate levels of process safety research in areas such as inherently safer processes.

Dr. Rosenthal reminded the participants in the Roundtable that they had been asked to complete their own assessment of national needs and decide whether setting national goals for process safety will be productive and if so, what the character of such goals should be. For example, would it be productive to set a national goal calling for a 10% annual reduction in releases or evacuations, etc.? Would setting such a goal be desirable and productive even if one can not monitor progress given the inadequacies of our present data collection systems? Should one instead focus on monitorable, perhaps more pedestrian initiatives leading to improved process safety practice?

The briefing paper argues that for the present it may be more appropriate to pursue national initiatives aimed at generating tools, studies, metrics and programs that address problems in areas of major process safety deficiencies such as the three noted above. In this regard, and in order to stimulate participant discussions at the Roundtable, the paper discusses the following specific areas that might be considered as the subject of a national initiative.

1. Establishment of a national data system that would allow one to calculate the incidence of process accidents and the extent of their consequences and to relate the system's findings to the demographics of the covered facilities. A valuable added feature of such a system would be information on at least the proximate cause of the process failure being reported.
2. Creation of a national system for the anonymous collection of 'near-miss' reports and the wide dissemination of such data.
3. Evaluation of the putatively adverse process safety effects ascribed to the restructuring and downsizing of companies and recommendations on their mitigation.
4. Program to arrive at recommendations on how to reduce barriers to better implementation of established principles for managing process safety.
5. Creation of increased awareness and/or incentives that would lead to increased activities promoting process safety by insurance firms, public interest organizations, labor, trade associations, etc.
6. Establishment of National Process Safety Centers whose mission would encompass all aspects of training, with a particular focus on the needs of small and mid-sized firms, and in addition, process safety research on problems not being adequately addressed elsewhere.
7. Programs for prioritized assistance and/or auditing focused on achieving improved compliance with regulatory or good practice codes by higher 'at risk' firms.

4.3.1.2 Summary of Discussions Based on Briefing Paper No. 1

Discussions surrounding the Rosenthal-Mannan briefing paper mainly focused on how goals could be developed and implemented in practice. The general consensus seemed to be that the first goal that should be addressed was the development of an improved data system. One of the questions that was posed was whether anyone had data showing that the accident rate has decreased. There were many comments and responses to this question, most addressing the issue, "accident rate decrease based on measurement of what?" One opinion that was voiced by a number of people is the significance and need for the measurement of accidents, as well as near-misses, and precursor events.

There was considerable discussion and interest about means of measuring, reporting, and compiling near-miss data or precursor events. The point was made that an exact definition of near-miss that everyone could agree on probably could not be made. The subject of looking at management systems and measuring their effectiveness as the precursor to accidents was also brought up. In some cases, management may not want or be able to adjust to measuring and reporting of near-misses. The most prominent reasons for this were job security, retaliation on the "snitch," loss of license, liability suits, and a decrease in public relations due to increased reportables.

Another issue that was posed concerned how much of a financial benefit have the regulatory activities resulted in. The only response to that was that there were no hard factual numbers available, but that the effort had saved lives and was therefore worth the regulatory activities.

There was some discussions about the effect of mergers on process safety. A major concern was the increasing use of contractors, including contract operators, and the turnover involved with these contract workers. Is the level of process safety training for these contractors equal or close to that of company employees? Another issue was the downsizing and restructuring of plants without reengineering. Another idea dealing with management was to deal with safety not as a project but as a process, therefore making sure that it is continuous and not like a project that has a beginning and an ending.

The next topic was about the implementation of process safety management principles. Also, are there insurance incentives to reducing the risk of having a major accident? A conclusion was made that good operational performance leads to good process safety performance, which leads to an increase in productivity, which then translates into increased capital. This therefore is a management issue. The Voluntary Protection Program (VPP) was suggested as a means of supporting the management of good process safety.

The next topic of discussion was the establishment of national process safety centers of excellence. This was compared to the National Institutes of Health, and how they are funded very well and can therefore provide more research. Again the management issue was brought up, and centers that implement training into business and management skills were recommended. It was mentioned that the National Institute of Standards and Technology has manufacturing centers that look at management issues, but it could be extended to smaller companies. The centers of excellence could be spread around the country and develop training and other support programs, especially for small and mid-sized enterprises. In addition, these centers could conduct research in emerging areas of process safety.

4.3.2 Briefing Paper No. 2: History of Federal Process Safety and Risk Management Regulation Under the Clean Air Act Amendments of 1990

A brief summary of the second briefing paper and the discussions surrounding the paper are provided in the

next two subsections. An unabridged version of the briefing paper as well as the complete transcript of the subsequent discussions is available on the Center website (http://process-safety.tamu.edu).

4.3.2.1 Summary of Briefing Paper No. 2

The second briefing paper, "History of Federal Process Safety and Risk Management Regulation Under the Clean Air Act Amendments of 1990," presented by Mr. Jonathan Averback discussed the history behind the development of the federal regulatory programs that implement the accident prevention provisions of the 1990 Clean Air Act Amendments.

The briefing paper states that in the aftermath of the 1984 Bhopal, India chemical accident and subsequent incidents in the United States, the Federal government assumed a larger role in chemical safety issues affecting workers and people in communities around facilities that handle chemicals. Initially, both the Environmental Protection Agency (EPA) and the Occupational Safety and Health Administration (OSHA) used a combination of existing statutory authorities and voluntary programs to improve response planning and to promote accident prevention. Congress's first legislative action in response to Bhopal was to pass the Emergency Planning and Community Right-to-Know Act (EPCRA) in 1986. EPCRA primarily addressed emergency planning and public information, but also included a requirement for a study on accident prevention. Subsequently, Congress included mandates for both OSHA and EPA to develop accident prevention regulations as part of the Clean Air Act Amendments of 1990 (CAAA).

The focus of this paper is on the development of Federal regulatory programs implementing the CAAA accident prevention provisions. Special emphasis is placed on the development of EPA's risk management regulatory program, which implements the mandates of Clean Air Act (CAA) section 112(r). To a lesser extent, important efforts of other stakeholders are referenced. This "history" identifies key decisions and policy choices that may be measurable to demonstrate how well the regulatory structure is working toward the declared purpose of section 112(r), "to prevent the accidental release and to minimize the consequences [of] any such release of any [listed regulated substance] or any other extremely hazardous substance." A general measurement issue reflected throughout this paper is whether the combination of flexibility and accountability in both agencies' programs is balanced in a way that meets the goal of preventing catastrophic accidents.

After a brief overview of the rulemaking process, this paper generally tracks the organization of EPA's regulations. Thus, the discussion of OSHA's Process Safety Management (PSM) rule is split between the Program 3 and the Applicability portions of this paper, and follows comments on the development of Program Level (Tiers) and Hazard Assessment requirements. In each section, after explaining the basis for key policy choices, the paper identifies possible ways to measure whether the rule provision works as intended.

4.3.2.2 Summary of Discussions Based on Briefing Paper No. 2

Following the Averback briefing paper, several questions were posed regarding the development and effectiveness of regulations. First, do regulations do any good in terms of accomplishing the objective, which is to improve safety? If the answer is yes, then is the rulemaking process that we have in place now the best process we have, or how can we improve it? The following comments were made in response to these questions.

There was general agreement that various safety regulations over time have yielded different benefits. However, it is difficult to make a direct correlation of safety benefits with regulations because of lack of appropriate

data. It is clear that there needs to be a focus on sources outside the government as well to drive the changes in culture, practice, management systems, and technology; needed to improve chemical safety. Regulations should be set as the floor rather than trying to define good practices in terms of the statute because the system is too complex to define in a rigid sense. It was expressed that the command and control regulatory approach does not do a very good job in setting goals or providing incentives to go beyond the standards. There needs to be a better way of rewarding the people and/or companies that go beyond the standards.

It was suggested that we focus on the worst-case scenario data as a useful measurement tool in the achievement of safety goals. In response however, some of the other Roundtable attendees felt that the wide variation in the results obtained from the different vapor dispersion modeling procedures makes it very difficult, if not impossible, to use as an effective measurement or comparative tool. Thus, more attention should be given to improvements in accident history and near-misses as compared to worst-case scenario information. In this respect, it was also pointed out that focusing on the worst-case scenario alone translates to focusing on one regulation or part of one regulation. We must find a way to consider the impact of all safety regulations. In addition, even if the worst-case scenario is decreased, that does not necessarily mean that the overall safety program has improved. Real gains in safety can only be made if the overall risk to the population is reduced.

The identification and availability of good operating practices has a positive effect on chemical safety. We need to be able to identify these good operating practices and provide a library of this information that could be used by facilities as needed.

Rules and regulations have multiple dimensions; therefore the competency of staffing of regulatory agencies is a major part of the system of safety. Inspectors must be capable to do more than just inspecting a company's written plan. The agents must be skilled, competent, and knowledgeable of present-day good practices.

4.3.3 Briefing Paper No. 3: Accident Databases: What Do They Tell Us?

A brief summary of the third briefing paper and the discussions surrounding the paper are provided in the next two subsections. An unabridged version of the briefing paper as well as the complete transcript of the subsequent discussions is available on the Center website (http://process-safety.tamu.edu).

4.3.3.1 Summary of Briefing Paper No. 3

The third briefing paper, "Accident Databases: What Do They Tell Us?" presented by Ms. Eboni McCray consisted of an analysis of the various accident databases available through different sources. The following databases were analyzed to determine their ability to provide data useful for determining the National Chemical Safety Goals and/or establish measurement systems.

- OSHA Statistics of Workplace Injuries Annual Survey - Bureau of Labor and Statistics (1974-1991)
- Census of Fatal Occupational Injuries - Bureau of Labor and Statistics (1992-1997)
- Office of Pipeline Safety (1986-1998)
- Hazardous Materials Incidents - U.S. Department of Transportation (1987-1996)
- Bureau of Transportation Statistics (1987-1996)
- National Board of Boiler and Pressure Vessel Inspectors Incident Report (1992-1997)
- Emergency Response Notification System - EPA (1987-1998)
- Accidental Release Information Program – EPA (1986-1997)

The briefing paper concludes that, in general, the number of workplace accidents, injuries, and fatalities has not changed significantly in the past decade. Despite new legislation and safety programs, the safety statistics remain stagnant. This leads to the question, "Is it realistic to expect dramatic changes in workplace safety after

only a few years of program implementation?" Before this question can be answered, we should define and set realistic goals in order measure progress.

Another major conclusion of this briefing paper is that the information collected in different databases is varied and complex. Analysis of these databases does not give a detailed picture of the state of workplace safety. This is because the databases have different data-collecting methodologies, objectives, and chronologies. There are some questions about the integrity of some of the data with regard to duplication and accuracy. Therefore, the briefing paper opines, "It is imperative that stakeholders pick a starting point on the continuum from which to measure changes in chemical safety."

4.3.3.2 Summary of Discussions Based on Briefing Paper No. 3

Following the McCray briefing paper, there was a general discussion about the accident databases. There was general agreement that these databases do not provide sufficient information that is useful for the activities in this project, i.e., baselining and development of measurement systems. This is because each database possesses one or more of the following flaws:

- Insufficient data due to only a few years of collection
- Inconsistent data-collection methods
- Erroneous data recording
- Lack of pertinent details regarding accidents
- Poor categorization of accidents.

Despite these flaws, the databases do tell us a few important things. The chemical industry must develop well-defined safety objectives that will be a basis upon which a new more accurate accident database system can be built. Additionally, the industry has indeed made strides in accident investigation and prevention, but more needs to done to document the results of those efforts.

There are three important factors that are prevalent in some of these databases. First, in order to find the right information and draw accurate conclusions, one really must delve deep into these databases and know exactly what they contain and how to use them. Thus, superficial or frivolous use, analysis, and conclusions from these databases can lead to confusion and misconceptions. Second, there is a big problem with integrity and accuracy of the data in many cases. Some of the data are very good, but some of these databases have significant problems with integrity and accuracy. Third and most importantly, the taxonomy of the data is a major issue. In some cases, the databases do not even contain the parameters needed to be able to help establish goals or establish measurement systems, or move towards a measurement system.

It was quite clear from the discussion that the database effort was viewed by the Roundtable participants as one of the major efforts. It is essential for the stakeholders to agree on and accept one single database that can be used for everything with respect to **Chemical Safety Program Assessment**; whether it is baselining or measurement of progress towards national chemical safety goals. Otherwise, we will have situations where people will be using different databases according to their motivation and agenda.

Given the general agreement that a common and appropriate database was essential, the discussion then focused on how, where, and when to make it happen. There were suggestions that an independent organization (not viewed as threatening to any institution, organization, or company) like the Mary Kay O'Connor Process Safety Center was the logical place. In addition, use of a "carrot and stick" approach that might encourage companies to report incidents and near-misses was suggested. A "carrot option" that was pointed out was that if a company voluntarily participated in the database program, they would be exempt from OSHA PSM or EPA RMP inspections for the duration of their participation unless they had an incident resulting in fatality or multiple injuries.

There was agreement by everyone that the common goal of all stakeholders is reduction in risks in industrial accidents. The divergence in conclusions results from the use of different databases. We ought to use databases and develop goals and/or metrics that everyone is comfortable in measuring against.

4.3.4 Briefing Paper No. 4: Benchmarking Process Safety Programs

A brief summary of the fourth briefing paper and the discussions surrounding the paper are provided in the next two subsections. An unabridged version of the briefing paper as well as the complete transcript of the subsequent discussions is available on the Center website (http://process-safety.tamu.edu).

4.3.4.1 Summary of Briefing Paper No. 4

The fourth briefing paper, "Benchmarking Process Safety Programs," presented by Mr. John Noronha discussed the need for methods to measure and assess chemical safety and risk management programs. The briefing paper presented a similar benchmarking exercise suggested for the Design Institute for Emergency Relief Systems for two-phase flow relief valve sizing.

4.3.4.2 Summary of Discussions Based on Briefing Paper No. 4

Following the Noronha briefing paper, there was a lot of discussion about the meaning of benchmarking, the benchmarking methodology, and its application to chemical safety. Nobody knows what the baseline for chemical safety is in the United States. A lot of people have some ideas. Some say it's terrible, some say it's great. Everyone agrees that it needs to be improved, we just don't know where we're starting. That's the first part of it. The second part of it is to somehow envision where we would like to be. Many of us would like to say that the only acceptable ultimate goal is zero accidents. Then we need to look at organizations, methods, and companies that have approached, individually, the goal that we established and determine what they are doing to reach that. And we need to agree, as part of that, on what things we need to measure. Measuring fatalities is an overly simple approach and we should be beyond that pretty quickly.

We need to be very careful when we look at the term best practices, because if we use that term, we get very prescriptive in what a particular organization has to do. We need to recognize that safety culture varies from organization to organization and, "What works for you as far as a particular practice may be such a radical change for another organization, that it has a detrimental affect."

When we talk about measurement systems, we should be careful whether we are measuring "an individual facility feeling safer" or "are we talking about a public health issue?" In a public health issue we're talking about a statistical movement that may not offer comfort to a particular industry or individual in that population. Regulations establish a minimum, in terms of standards or measurement system for individual facilities. For example, regulations require that certain processes need to go through a process hazard analysis. It can be a HAZOP, a What-If, a fault-tree, a checklist or something equivalent. We could specify or increase the floor for these particulars. In contrast, in setting national goals we have to consider this as a public health issue. The statistical occurrence of accidents is probably an insignificant factor to any individual. Accidents are interests of public health just as some other disease. And in those cases we have to set the goal in terms of what we think is achievable with the resources we have to bring to bear on it. We can offer goals for the individual, if we wish to set goals as what constitutes good practice or best practice, we can do that in a set of exercises; but it's a different thing.

Any goal we set has to define the measuring instrument, the starting point, how we're going to sample, how we're going to determine progress. Benchmarking probably provides a way to determine best practices but does not lend itself to being a measurement system applicable to ***Chemical Safety Program Assessment***.

Suggestions were made that the companies who had established goals and measurement systems should be asked to share that information with the project team so that we do not have to reinvent the wheel. What the Roundtable and the project team needs are detailed presentations from people about the guts of their real safety metric system. We should be able to use and revise the methodology used by various companies. For example, Dow Chemical Company has very specific goals for chemical safety by the year 2005. These include reduction of OSHA recordable injuries and illnesses per 200,000 work hours by 90%. This is a worldwide goal for Dow. If a Dow facility had 10 OSHA recordable injuries and illnesses, when these goals were set, then they can only have one by 2005. Similarly, if a Dow facility had 100 of these injuries and illnesses when these goals were set, they can only have 10 by 2005. Other Dow goals include reduction of the loss of primary containment instances, leaks, breaks and spills; reduction of transportation incidents per 10,000 shipments; reduction of process safety incidents, i.e., fires and explosions; and reduction of motor vehicle incidents. Many other companies have established similar programs. The challenge though is how to learn from these individual company approaches and develop a national system of developing goals, baselining, developing measurement systems, and then measure progress towards these goals.

4.3.5 Briefing Paper No. 5: The 21st Century: Process Safety and Factory Mutual

A brief summary of the fifth briefing paper and the discussions surrounding the paper are provided in the next two subsections. An unabridged version of the briefing paper as well as the complete transcript of the subsequent discussions is available on the Center website (http://process-safety.tamu.edu).

4.3.5.1 Summary of Briefing Paper No. 5

The fifth and final briefing paper, "The 21st Century: Process Safety and Factory Mutual," presented by Mr. Paris Stavrianidis discussed the role of insurance providers in improving safety in the chemical industry. This paper presents a brief history of safety in the process industries during the 20th century. It identifies the emergence of performance-based standards and regulations and discusses the potential impact of these on industry. In parallel, the paper gives a brief history of Factory Mutual, and discusses the business challenges of the insurance industry in the 1990's. Finally, the paper describes what the author sees as the technical and business challenges of the 21st century both for industry and Factory Mutual.

The focus on safety in the 20th century can be characterized by a few significant milestones:

- Pre-1930's focus on safety was to identify who caused the loss and punish the guilty.
- Pre-1970's focus was on finding breakdown in and fixing man-machine interface.
- The 1970's saw the development of qualitative and quantitative risk assessment techniques.
- In the 1980's, systemic approach gained credibility, and was accepted by leading industries and government agencies.
- The 1990's are characterized by broadened acceptance of the systemic approach and by the development of performance-based or risk-based standards and regulations (national and international).

4.3.5.2 Summary of Discussions Based on Briefing Paper No. 5

It was pointed out that some insurance companies do not provide comprehensive general liability. There are companies that provide this service, but there are also companies that only provide property damage and business interruption coverage. It was also noted that competition has affected the insurance business by reducing their influence on safety while also reducing the dollar amounts of premiums.

Another key point that was brought up was whether it was more profitable to pay premiums rather than to replace faulty equipment themselves. No hard data or evidence is available to support either point of view. The Y2K issue was also addressed.

The next issue that was discussed was a global approach to process safety, and the response is that many companies around the world are taking interest in process safety and following many of the same rules and guidelines set forth by the U.S. and U.S. companies. This does not mean that these rules and guidelines are followed everywhere, though. The question was raised as to whether or not companies are following appropriate guidelines set forth by government regulations and the insurance companies, such as having fire extinguishers in flammable areas. The response to that was that companies with a corporate culture that included process safety were more likely to follow the insurance company's recommendations and guidelines and regulations.

The issue of merging companies also was discussed. There is no evidence as to whether an insurance company would have influence over these industries because of their size. These larger companies are usually self-insured and are practicing a process safety culture with process safety management.

4.4 National Chemical Safety Vision and Goals

Each member of the Roundtable was asked to provide one proposal each for a national chemical safety goal. These proposed goals as written on flip charts are reproduced here verbatim:

1. Reduction in property damage.
2. Reduce the barriers to implementation of PSM/RMP programs
3. Safety is inherent and included in budget.
4. Increased implementation of PSM linked to improved local emergency preparedness.
5. Develop OSHA/VPP counterpart in EPA.
6. Demonstrate continued improvement in safety, health and environment.
7. Consensus around performance measures.
8. Process safety incidents should go to zero.
9. Develop mechanisms for process safety implementation for small and mid-sized enterprises.
10. Quality PSM program for every facility based on risk.
11. Eliminating offsite impacts.
12. National scorecard showing reduction in worst-case scenario and alternative release scenario based on inherent safety.
13. Insure active Local Emergency Planning Committees and Citizen's Advisory Panels.
14. Establish broad-based permanent national safety goals organization.
15. National data systems for collection of near-misses & accidents which can be related to actual causes.
16. Establish 20%/yr goal for all metrics.
17. Assure that contract employees have same skills/knowledge as the host employer.
18. Involvement of all stakeholders in process here (at the Roundtable) as well as plants.

19. Comprehensive chemical incident reporting to measure trends in progress and establish baselines, etc.
20. Significant year-to-year reduction (15%) in spills and leaks.
21. Recognize and support through policies and practices that all stakeholders have responsibilities and duties for chemical accident reduction.
22. Establish metrics that relate safety performance and business objectives.
23. Establish targeted reduction goals for chemical safety incidents.

A. Guarantee public access to performance information.
B. National goals must promote community based risk solutions.
C. Development of a universal & comprehensive database.
D. Mechanism for ensuring regulatory compliance.
E. Industry will make a public commitment to reducing releases to environment and injuries by 90% from 1996 baseline by 12/31/05 with a goal of no releases which impact community or its employees.
F. Cost benefit business case for PSM.
G. Identify metrics that relate PSM performance to business objectives.
H. Establish national centers of safety that are academically based and multidisciplinary in nature for training, service, research, and education.
I. Facilitate working relationships between industry, government, and the community to manage chemical hazards and risks.
J. Establish a phase-out program for grandfather clauses in regulations and standards.
K. Measure and reduce releases or losses of containment.
L. Determine the role of 3rd party inspectors/auditors.
M. Spills, leaks, injuries – 3 years to go to zero. Develop program elements to get there. Develop audit tools to make sure you're getting it right!

The two different numbering schemes (1-23 and A-M) do not represent any preferences or classification. Since there were two scribes writing the proposed goals, two separate numbering schemes were used.

After the proposed goals were all written on flipcharts, there was considerable discussion on how some of these could be combined because of overlap or commonality. There was also some discussion on the issue of zero accidents. Some suggested that we have to be careful in setting a goal of zero because with the first accident the goal is wiped out. However, there was a widespread agreement that the ultimate national safety goal has to be that we don't hurt anybody and we don't expose anybody to chemical releases. Whether we reach it in our lifetime is a good question, but to aim and work towards anything less is unacceptable. However, setting zero accidents as a goal is an untenable proposition at this time because we do not have the baseline, the databases, and measurement systems needed. Thus, it seems that zero accidents is a vision we hope to accomplish through the national chemical safety goals. The goals in turn will be accomplished by identification and implementation of various activities and tasks. The following was therefore adopted as the vision for chemical safety in the United States:

VISION

Reduce chemical process accidents to zero while building public trust through community interaction

To reduce commonality and overlap, several proposed goals were combined after considerable discussion. Following that, each of the Roundtable attendees was asked to provide their top three picks from the list of the proposed goals. The collated results are presented in Table 1.

TABLE 1
BALLOTING RESULTS FOR NATIONAL CHEMICAL SAFETY GOALS

No.	Proposed National Chemical Safety Goals	Votes Received
1.	Develop a comprehensive national data system for collection of near-misses and incidents which can be related to actual causes and to establish chemical safety baselines.	25
2.	Establish metrics that relate safety performance and business objectives.	22
3.	Establish targeted reduction goals for chemical safety incidents.	21
4.	Establish national centers of safety that are academically based and multidisciplinary in nature for training, service, research, and education.	9
5.	Develop mechanisms for process safety implementation for small and mid-sized enterprises.	4
6.	Recognize and support through policies and practices that all stakeholders have responsibilities and duties for chemical accident reduction.	4
7.	National scorecard showing reduction in worst-case scenario and alternative release scenario based on inherent safety.	4
8.	Quality PSM program for every facility based on risk.	3
9.	Assure that contract employees have same skills/knowledge as the host employer.	3
10.	Involvement of all stakeholders in process here (at the Roundtable) as well as plants.	3
11.	Reduce the barriers to implementation of PSM/RMP programs	3
12.	Cost benefit business case for PSM.	3
13.	Facilitate working relationships between industry, government, and the community to manage chemical hazards and risks.	3
14.	Guarantee public access to performance information.	2
15.	Establish broad-based permanent national safety goals organization.	2
16.	Increased implementation of PSM linked to improved local emergency preparedness.	2
17.	Eliminating offsite impacts.	1
18.	Establish a phase-out program for grandfather clauses in regulations and standards.	1
19.	Measure and reduce releases or losses of containment.	1
20.	Determine the role of 3rd party inspectors/auditors.	1
21.	National goals must promote community based risk solutions.	1
22.	Mechanism for ensuring regulatory compliance.	1
23.	Consensus around performance measures.	1

As shown in Table 1, the Roundtable by an overwhelming consensus agreed on the top three proposed goals. These goals were therefore adopted as the ***national chemical safety goals***. However, Roundtable attendees agreed that the remaining proposed goals should be considered during breakout group discussions and could quite likely be adopted as activities that need to be implemented in order to accomplish the national chemical safety goals.

National Chemical Safety Goals

1. ***Develop a comprehensive national data system for collection of near-misses and incidents which can be related to actual causes and to establish chemical safety baselines.***
2. ***Establish metrics that relate safety performance and business objectives.***
3. ***Establish targeted reduction goals for chemical safety incidents.***

4.5 Breakout Sessions

The Roundtable then divided into three breakout groups: the infrastructure/process group, the database/metrics group, and the activities group. The infrastructure/process group was asked to concentrate on infrastructure and process issues, i.e., how we will we get together and implement the activities and internal processes. The database/metrics group was asked to evaluate and make a report on the database/metrics issues needed to support the three national chemical safety goals. The activities group was asked to evaluate and recommend a list of activities needed to help accomplish the national chemical safety goals.

4.5.1 Charge to Breakout Groups

The three groups were charged with coming back with an action plan. Even though the time allotted was limited, it was agreed that an action plan was essential. It was recognized that the action plan might have to be revised and refined, even during implementation. In the action plan, the following information was requested from the groups:

- **What** should be done?
- **How** should it be done?
- **Who** should do it?
- **Where** should it be done?
- **Resources Needed**?

4.5.2 Reports from Breakout Sessions

The breakout group participation is listed in Appendix D. The facilitator and reporter provided the following summary reports from their respective groups.

4.5.2.1 Report from Breakout Session #1 (Infrastructure/Process)

The breakout group on Infrastructure and Process addressed several key issues for the future development of the Chemical Safety Program Assessment Roundtable.

WHO: Assuring a balance of stakeholders involved in the project is key to its success. Committee activities should depend upon volunteer contributions. Government representatives should contribute to committee activities, but not control or direct the committees. For some non-governmental representatives this may require additional financial support, such as for travel.

Additional representation should be solicited. Absent or under-represented at the initial meeting were the following:

a. Small and Medium Sized Enterprises (SMEs)
b. Chemical users
c. Chemical transportation companies
d. Grassroots community representatives, including environmental justice communities
e. International representatives (initially to focus on Mexico and Canada)
f. Other Federal entities: Coast Guard, NTSB, Department of Transportation.

WHAT: To support the on-going project, an infrastructure of committees should be developed to enhance the development and decision-making of the larger group. Committees should seek to have a balance of stake-holder representation with technical competency for the committee purpose. Work products should be drafted through a transparent process, and ultimately reviewed and approved through the larger group of project participants. Committees should sunset once their goal is achieved.
Several such committees were recommended:

a. Administrative Coordinating Committee – gathers volunteers for committees; identifies need for new committees; serves as the primary body for assuring coordination and communication among project participants/committees (quarterly communication with committees); plans future meetings; should be limited to a manageable size (perhaps 8 individuals)
b. Outreach Committee – involves missing stakeholders; develops marketing strategies for project work products
c. Content Committee(s) – develop draft work products ('white' papers) for content issues of the project, for example national goals or database initiatives
d. Standing Committee – all participants in the project; meets annually

WHERE: The virtual organization should be administered through the Texas A&M University, Mary Kay O'Connor Process Safety Center. The Center should help with research, coordination and contractor needs.

HOW: The organization of additional committee and other project activities should employ a variety of communication technologies:

a. phone conferences,
b. video conferences,
c. e-mail and facsimile exchanges of draft and final documents,
d. website
e. smaller group interactions at opportunistic venues, such as other major meetings
f. planned project meetings

4.5.2.2 Report from Breakout Session #2 (Database/Metrics)

This breakout group voiced a concern regarding the vision of "zero accidents", from a credibility standpoint.

A database should be built from scratch. The reason is that existing databases are designed for other purposes, and are already compromised, with the possible exception of the EPA RMP 5-year accident history database, which can be useful, although it may not contain everything we want. If a database is developed from scratch, we should define incidents with broad stakeholder consensus, with one possible basis being the EPA RMP definition.

WHO: Who might build the database, collect the data, sponsor the database, report from the database, access the database?

Options for "keeper" of the database:

- Mary Kay O'Connor Process Safety Center
- U.S. Chemical Safety and Hazard Investigation Board
- Center for Chemical Process Safety
- U.S. Environmental Protection Agency
- Occupational Safety and Health Administration
- Agency for Toxic Substances and Disease Registry, Centers for Disease Control
- Integrated (some combination of the above)
- Insurance business

WHAT: Sole purpose of the database is to be a repository of valid statistical data.

To include cause of incident (e.g.: PSM elements), and corrective actions taken, plus others. Criteria for elements of this database should be independent of regulations, but should consist of good data elements.

May need a baseline survey.

Question: how much of information submitted is anonymous vs. public information?

Must be accessible by public (electronically available).

WHEN: To be determined.

HOW: Reports of actual incidents could be according to regulatory requirements, and system would be set up to automatically populate this database from the regulatory databases, and vice-versa.

Non-reportable incidents and near-miss reporting would be voluntary.

Question: anonymity for reporting of near-misses and non-reportable incidents.

Question: Would only companies report, or could an employee or a member of community report an incident?

Question: quality control of data in, maintenance of database, universe represented, initiate baseline surveys?

RESOURCES: (People, time, money)

- Academic
- Government
- Industry
- Consultants
- Industry association(s)
- Advocacy groups
- Labor
- Combination of the above

Couple of closing comments:

1. The group was uncomfortable at the end that it did not have enough time to adequately resolve some of the issues listed above, or adequate time to think of everything that should be on the list.
2. The group did not agree on a definition of near-miss.

4.5.2.3 Report from Breakout Session #3 (Activities Needed to Accomplish Goals)

The group was chartered to determine "Activities needed to achieve the goals." The group established two immediate and overarching activities necessary to all the goals and consistent with the Vision statement:

1. Establishing transparent communication of performance data to the public, government, and other facilities, is the responsibility of each company.
2. All stakeholders must encourage business and engineering educational institutions to include process safety and community involvement in their risk management curriculum.

Other activities along the who, what, and how sort of format, are as follows:

1. The National Response Team should lead an effort, with additional participation by Chemical Safety Board, the public, Small Business Association, Synthetic Organic Chemical Manufacturers Association, Chemical Manufacturers Association, and other stakeholder groups, to establish a "one report" procedure for chemical accident reporting and database unification.

2. This "one report" approach should be based upon the current regulatory floor with additional voluntary elements. With the participation of the Chemical Safety Board and others in this process, it is intended that the Chemical Safety Board's rulemaking efforts on accident reporting will go a great deal of the distance to establishing a comprehensive database. It is recognized that additional statutory authority may be required to perfect this approach.

   The "one report" approach is expected to be an electronic database with Internet availability. This should include voluntary links to company or association-maintained web pages so that supplementary or explanatory materials can be provided.

3. The group expects that a consensus building organization such as the Mary Kay O'Connor Process Safety Center will be necessary to this process. This group believes that the Center should re-convene the workgroups in the near-term to work on and refine additional activities. The Center should then provide some opportunity for the larger group to convene again in October, around the time of the currently scheduled conference, in order to maintain momentum. The agenda in October would include reports by the National Response Team, the Chemical Safety Board and others on progress that has been made and difficulties encountered.

4. Most importantly, the Mary Kay O'Connor Process Safety Center should take a forceful role in working with all stakeholders to maintain momentum. This includes pushing both the companies and the government players to building and refining consensus.

5. FUTURE PLANS

In March 1998, when the Technical Advisory Committee of the Mary Kay O'Connor Process Safety Center met to develop the Center's Research Agenda, the ***Chemical Safety Program Assessment Project*** was voted the highest priority project. Immediately following that meeting, plans were put in motion to develop the scope and start implementing the project elements. The Roundtable meeting and the consensus developed are giant steps forward in the right direction. However, an incredible amount of work remains to be done. The project team is now working on developing the next steps of the project for implementation.

At the recommendation of the Roundtable attendees, a second Roundtable meeting has been scheduled in conjunction with the Mary Kay O'Connor Process Safety Center's 1999 Annual Symposium[1]. The Roundtable meeting will be held at the George Bush Presidential Conference Center on Thursday, October 28, 1999. Workgroups and subcommittee structures are being organized so that some work can be accomplished before the Roundtable meeting.

6. SUMMARY AND CONCLUSIONS

The ***Chemical Safety Program Assessment Project*** proposes a unique but simple approach to improvements in chemical safety in the United States. The project provides for broad-based stakeholder participation, consensus building, and systematic approach.

A critical element in the process is the development of a reliable and comprehensive national database of near-misses and incidents which can be related to actual causes and to establish chemical safety baselines. Only then can we move towards the establishment of metrics and targeted reduction goals for chemical safety incidents.

George Bush Presidential Library
College Station, Texas

[1] The 1999 Annual Symposium of the Mary Kay O'Connor Process Safety Center will be held on October 26-27, 1999 at the George Bush Presidential Conference Center in College Station, Texas. Refer to http://process-safety.tamu.edu/Symposiums/Mkopsc-1999/day1.htm or call (409) 845-3489 for program details and registration information.

APPENDIX A
LIST OF INVITEES TO THE ROUNDTABLE MEETING

Adams,	Bill	Celanese, Ltd.
Allmond,	William E.	National Association of Chemical Distributors
Arango,	Luis	HSB Industrial Risk Insurers
Ashford,	Nicholas	Massachusetts Institute of Technology
Austin,	Hank	American Society of Safety Engineers
Averback,	Jon	USEPA Region 1
Baldini,	Reginald	NJ Dept of Environmental Protection Bureau of
Barrett,	Kari	Chemical Manufacturers Association
Barrish,	Robert	State of Delaware - DNREC
Barton,	Delilah	Thompson Publishing Co.
Beswick,	Paul	Metropolitan Water District of Southern California
Bissett,	Wayne	Environmental Emergencies
Blakely,	Craig	PPRI
Borkovic,	Matthew	Synthetic Organic Chemical Manufacturers Association
Bradshaw,	Jerry	Mary Kay O'Connor Process Safety Center
Brock,	Kennith	HSB Industrial Risk Insurers
Brodbeck,	Nancy	Tosco Refining Company
Brouillard,	Steve	Conoco, Inc.
Cable,	Stephen	Paper & Allied Industrial, Chemical & Energy Workers
Chipkevich,	Bob	National Transportation Safety Board
Clark,	Donald	Texas A&M University
Cogan,	Phil	Chemical Safety and Hazard Investigation Board
Coulson,	Beth	Department of Transportation
Danks,	John	Texas Propane Gas Association
Davies,	Elaine	U.S. Environmental Protection Agency
Dufy,	Richard	International Association of Firefighters
Earl,	Anthony	Quarles & Brady
Epstein,	Lois	Environmental Defense Fund
Feldstein,	Lee	National Safety Council
Fisher,	Timothy R.	American Society of Safety Engineers
Frodyma,	Frank	US Department of Labor
Fruchtman,	Steve	Summit Technologies
Gablehouse,	Tim	Colorado Emergency Planning Commission
Goddard,	Keith	Occupational Safety & Health Administration
Ham,	Koos J.M.	TNO-Department of Industrial Safety
Holler,	Jim	Agency for Toxic Substances and Disease Registry
Ignatowski,	Al	WHARTON School of Business
Jennings,	Kim	US Environmental Protection Agency
Jones,	Irene	Huntsman Corporation
Kaster,	Pam	Citizens for a Cleaner Environment
Kearns,	Peter	Organization for Economic Cooperation and Development
Keeports,	Greg	Rohm & Haas Company
Kirchsteiger,	Christian	Major Accident Hazard Bureau
Knudson,	Myron	US Environmental Protection Agency
Kutchin,	Joe	US Coast Guard
Laplante,	Allyson	U.S. PIRG

CONTINUED - APPENDIX A
LIST OF INVITEES TO THE ROUNDTABLE MEETING

Leibowitz,	Rayna	Maine Emergency Management Agency
Leonard,	V. Kenneth	American Petroleum Institute
Levitt,	Shelley	U.S. Environmental Protection Agency
Makris,	Jim	US Environmental Protection Agency
Mannan,	Sam	Mary Kay O'Connor Process Safety Center
McCray,	Eboni	Mary Kay O'Connor Process Safety Center
McHale,	Mike	Air Products & Chemicals
McNulty,	Pat	WHARTON School of Business
Milk,	Benjamin	Association of Refrigerated Warehouses
Millar,	Fred	
Monroe,	Haskell	Texas A&M University
Murphy,	Kenneth G.	Department of Energy
Noronha,	John	
O'Connor,	T. Michael	O'Connor Ventures
Olson,	Erik D.	Natural Resources Defense Council
Orum,	Paul	Working Group on Community Right-to-Know
Overman,	Jim	Dow Chemical Company
Parker,	Dennis	Conoco, Inc.
Perry,	Bob	Center for Chemical Process Safety
Pizatella,	Tim	National Institute of Occupational Safety & Health
Poje,	Jerry	Chemical Safety and Hazard Investigation Board
Renn,	Ortwin	Center for Technology Assessment
Rosenthal,	Irv	Chemical Safety and Hazard Investigation Board
Rotter,	George	Akzo Nobel Chemicals, Inc
Salter,	Russ	Federal Emergency Management Agency
Scannell,	Gerald F	National Safety Council
Schultz,	Hilary	ChemicalSafety and Hazard Investigation Board
Skinner,	Ray	OSHA-US Department of Labor
Smerko,	Robert	Chlorine Institute
Solyst,	Jim	Chemical Manufacturers Association
Stavrianidis,	Paris	Factory Mutual Research Corporation
Stephens,	Doug	Paper & Allied Industrial, Chemical & Energy Workers
Summers,	Angela E.	Premier Consulting + Engineering
Susil,	John	Celanese, Ltd.
Swiecicki,	Bruce	National Propane Gas Association
Talcott,	Fred	U.S. Environmental Protection Agency
Terry,	Larry R.	Chemical Week
Thompson,	Phyllis	Chemical Safety and Hazard Investigation Board
Thorman,	Jan	Department of the Interior
Weaver,	Jack	Center for Chemical Process Safety
West,	Harry	Shawnee Engineers, Inc.
White,	David	Industrial Fire World
Willette,	Dave	Mary Kay O'Connor Process Safety Center
Woodrick,	Jim	Texas Chemical Council
Wright,	Johnny	Amoco Corporation

APPENDIX B
LIST OF ROUNDTABLE MEETING ATTENDEES

Arango,	Luis	HSB Industrial Risk Insurers
Austin,	Hank	American Society of Safety Engineers
Averback,	Jon	USEPA Region 1
Barrett,	Kari	Chemical Manufacturers Association
Barrish,	Robert	State of Delaware - DNREC
Barton,	Delilah	Thompson Publishing Co.
Bissett,	Wayne	Environmental Emergencies
Bradshaw,	Jerry	Mary Kay O'Connor Process Safety Center
Brouillard,	Steve	Conoco, Inc.
Cable	Stephen	Paper & Allied Industrial, Chemical & Energy Workers
Clark	Donald	Texas A&M University
Cogan	Phil	Chemical Safety and Hazard Investigation Board
Epstein,	Lois	Environmental Defense Fund
Feldstein	Lee	National Safety Council
Gablehouse,	Tim	Colorado Emergency Planning Commission
Holler,	Jim	Agency for Toxic Substances and Disease Registry
Jennings	Kim	US Environmental Protection Agency
Jones,	Irene	Huntsman Corporation
Kaster,	Pam	Citizens for a Cleaner Environment
Keeports,	Greg	Rohm & Haas Company
Levitt,	Shelley	U.S. Environmental Protection Agency
Makris,	Jim	US Environmental Protection Agency
Mannan,	Sam	Mary Kay O'Connor Process Safety Center
McCray,	Eboni	Mary Kay O'Connor Process Safety Center
McHale,	Mike	Air Products & Chemicals
McNulty,	Pat	WHARTON School of Business
Millar,	Fred	
Monroe	Haskell	Texas A&M University
Noronha,	John	
O'Connor,	T. Michael	O'Connor Ventures
Overman,	Jim	Dow Chemical Company
Perry,	Bob	Center for Chemical Process Safety
Poje,	Jerry	Chemical Safety and Hazard Investigation Board
Rosenthal,	Irv	Chemical Safety and Hazard Investigation Board
Rotter,	George	Akzo Nobel Chemicals, Inc
Scannell,	Gerald F	National Safety Council
Skinner,	Ray	OSHA-US Department of Labor
Stavrianidis,	Paris	Factory Mutual Research Corporation
Summers,	Angela E.	Premier Consulting + Engineering
Susil,	John	Celanese, Ltd.
West,	Harry	Shawnee Engineers, Inc.
White	David	Industrial Fire World
Willette	Dave	Mary Kay O'Connor Process Safety Center
Wright,	Johnny	Amoco Corporation

APPENDIX C
TABLE OF CONTENTS, BRIEFING BINDER—ROUNDTABLE MEETING

APPENDIX D
BREAKOUT GROUP PARTICIPATION

Breakout Group No. 1 (Infrastructure and Process)
Jon Averback
Kari Barrett
Wayne Bissett
Jerry Bradshaw – Facilitator
Mike McHale
Mike O'Connor
Jerry Poje – Reporter
Harry West

Breakout Group No. 2 (Database and Metrics)
Luis F. Arango
Steve Brouillard
Steve Cable
Lois Epstein
Jim Holler
Irene Jones – Facilitator
Steve Mason
Eboni McCray
Pat McNulty
John Noronha
William Rogers
Irv Rosenthal
George Rotter
Ray Skinner
Paris Stavrianidis
John Susil - Reporter
Johnny Wright

Breakout Group No. 3 (Activities Needed to Accomplish the Goals)
Delilah Barton
Lee Feldstein
Tim Gablehouse - Facilitator and Reporter
Pam Kaster
Greg Keeports
Jim Makris
Fred Millar
Jim Overman
Bob Perry
Dave Willette