Annual Report to Congress and the President

Fiscal Years 1998 - 2000

Preface

The first three years of the Chemical Safety Board's (CSB) existence have been marked both by notable successes and unfortunate management lapses. During the year 2000, CSB completed a major turnaround and finished the year on a significant upward trend. In FY 2000, the Board published two new comprehensive incident investigation report, issued its five-year strategic plan, and continued to hire skilled technical experts for our investigations and safety programs office. We also developed both incident selection criteria and a protocol for conducting investigations. All of these actions addressed priorities established by Congressional appropriators, and provided positive momentum as the Board began FY 2001.

February 5, 2001

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February 5, 2001

Hon. J. Dennis Hastert
Speaker of the House
232 U.S. Capitol
Washington, DC 20515

Dear Mr. Speaker:

In accordance with the provisions of the Clean Air Act Amendments of 1990, the U.S. Chemical Safety and Hazard Investigation Board hereby transmits to you its annual reports for 1998, 1998, and 2000.

Sincerely,

Gerald V. Poje, Ph.D. Irv Rosenthal, Ph.D. Andrea Kidd Taylor, Dr. P.H.

Introduction

The U.S. Chemical Safety and Hazard Investigation Board (CSB) is an independent, non-regulatory agency authorized under the Clean Air Act Amendments of 1990 (Public Law 101-549). Patterned on the National Transportation Safety Board, the CSB investigates the causes of serious chemical incidents and recommends measures to prevent future occurrences. By identifying root causes and targeting systemic weaknesses in process safety, CSB is working to reduce and prevent the thousands of chemical incidents that occur each year. These incidents are responsible for many deaths and injuries and annually result in billions of dollars of property damage. CSB also works to improve the efficiency of federal chemical safety programs by making recommendations to other government agencies. Through a multi-faceted, collaborative partnership with key stakeholders, risks can be reduced to make this country a safer place in which to live and work.

On January 5, 1998, the CSB opened its doors with a $4 million budget, two Board members, and two staff. This report is an account of the CSB's activities in its first three fiscal years and its direction for the future. The report lays out for those who fund the CSB and oversee its operations -- the taxpayers of the United States and the Congress -- the benefits that have begun to accrue from the Board's first efforts.

CSB's mission resonates powerfully among a broad cross-section of stakeholders. As a result, the CSB has received strong encouragement and valuable guidance from industry leaders, other government agencies, safety experts, companies site owners where incidents have occurred, emergency responders, labor unions, environmental advocates, community groups, and others. The CSB appreciates the expertise, information and experience shared by these partners and looks forward to their continued support. Outside participation is crucial to the adoption of the improvements in chemical safety that CSB is seeking.

To ensure that important information reaches a broad audience, the CSB provides a sophisticated website, http://www.chemsafety.gov, which is updated daily. This report is available for viewing and downloading on the CSB website. Printed copies of the annual report will be distributed to the public upon request.

Investigations & Recommendations for Action

Sierra Chemical
Mustang, Nevada

Sierra Chemical Co. operated a facility in Mustang, Nevada, which produced explosive boosters used in the mining industry. As the plant began daily operations on January 7, 1998, two massive explosions occurred in close sequence, killing four workers and injuring six. The jolts were felt twelve miles away in Reno (the larger was the equivalent of a magnitude 2.0 earthquake). The initial explosion occurred in a building that housed explosives mixing equipment, and it is likely that a mixing operation triggered the blast. Explosives used in making the boosters included TNT, Pentolite, and other materials. The facility was located in a remote, uninhabited area, and despite the severity of the explosions there appears to have been little impact off site. The facility was never rebuilt. CSB investigated this incident and issued a final report on September 28, 1998.[1]

Recommendations. CSB's investigation found serious flaws in how Sierra Chemical had implemented elements of the Occupational Safety and Health Administration (OSHA) Process Safety Management standard, which regulates hazardous chemical operations. Hazard analyses, worker training, and operating procedures were all found to be deficient. The Board noted that, despite the hazards, the plant had only been inspected infrequently by state regulators who were responsible for overseeing compliance with OSHA requirements. To promote accident prevention, the Board recommended that the Nevada Occupational Safety and Health Enforcement Section increase the frequency of inspections at explosives manufacturers statewide.

By executive order, Nevada governor Bob Miller directed officials to inspect explosives facilities at least twice yearly. The CSB is pleased by this action and expects it will help prevent similar explosives incidents in the future.

In one scenario for the explosion, foreign materials were present in the explosive feedstocks and caused detonation by impact or impingement within the mixing equipment. Some of the raw materials used at Sierra had been reclaimed from surplus military ordnance and may thus have been contaminated with solid debris. The CSB made two recommendations to the Department of Defense as the result of the incident: (1) to develop a program to ensure that reclaimed explosives are free of foreign materials; (2) to improve access to explosives incident reports and other safety information contained in Department records.

The Department of Defense, in a letter from Army Secretary Louis Caldera,[2] declined to implement the Board's recommendation on foreign material in explosives. The Secretary contended that the actual reclamation of explosive materials is conducted by private entities and is thus beyond government control. The Secretary also pointed out that the

[1]Final report is available at http://www.csb.gov/reports/1998/sierra_chem/sierra_fr01.htm
[2]Letter from Louis Caldera, Secretary of the Army, to Paul L. Hill, Jr., Chairman of the CSB, December 16, 1999.

presence of foreign material in the feedstock could not be conclusively established as the cause of the blast. On the matter of improving information dissemination related to explosives incidents, the Secretary laid out the dissemination mechanisms currently in place but noted that "improvements are possible, particularly if the [trade] associations take an active role."

Sonat Exploration
Pitkin, Louisiana

Four oil workers were killed in a March 4, 1998, vessel failure and fire at a Sonat Exploration Co. production facility near Pitkin, Louisiana. The incident occurred when an oil and gas separation vessel was ruptured by exposure to a high-pressure natural gas stream. The incident occurred during start-up procedures for the normally unmanned facility. It is not known how much natural gas was contained in the 45-foot vessel at the time of the blast. Although the facility sustained significant damage, no off-site consequences were noted. The facility is located in a remote wooded area. CSB investigated this incident and issued a final report on September 21, 2000.[3]

Recommendations. CSB's investigation showed that Sonat did not conduct an adequate hazard assessment prior to putting the facility in service. Process equipment had lacked key safety features, such as a pressure relief system to prevent catastrophic vessel failure. CSB also noted a lack of written operating procedures for facility workers, which may have contributed to the manual errors that caused the vessel overpressurization. CSB has conducted preliminary discussions with Sonat (now El Paso Production Co.) regarding implementation of the recommendations. CSB also made a broader recommendation to the American Petroleum Institute (API), the leading trade association for the petroleum industry. CSB recommended that API develop recommended practice guidelines for the safe start-up and operation of oil and gas production facilities. According to preliminary discussions, the API is proceeding with the development of the guidelines, which should help promote the use of appropriate hazard analysis and other safety tools in this sector.

Union Carbide
Hahnville, Louisiana

On March 27, 1998, two workers at a Union Carbide chemical plant in Louisiana were overcome by nitrogen, which although nontoxic is a potentially deadly asphyxiant. Nitrogen is an odorless and colorless gas, commonly used in industry to protect materials that are sensitive to oxygen or moisture. The two workers had erected a temporary enclosure over an open pipe to facilitate a black light inspection, unaware that the enclosure had the effect of trapping nitrogen contained in the pipe. One worker died in the incident, and the other sustained severe injuries. No significant environmental release occurred. CSB investigated this incident and issued a final report on February 23, 1999.[4]

[3]Final report is available at http://www.csb.gov/reports/2000/sonat1_01.htm
[4]Final report is available at http://www.csb.gov/reports/1998/union_carbide/98005lafr.htm

Recommendations. CSB's investigation noted the two Union Carbide workers had no effective warning of the imminent danger of asphyxiation. Procedures for alerting workers to confined space hazards (particularly those arising from temporary enclosures) were inadequate. Union Carbide has since initiated corrective actions. More broadly, the Board recommended that the National Institute of Occupational Safety and Health (NIOSH) conduct a study of the feasibility of adding an odorant to nitrogen used in confined spaces. For example, natural gas and propane are odorized with trace sulfur compounds to allow ready detection of leakage. A warning smell in the nitrogen used at Union Carbide could have alerted workers to the danger of entering the temporary enclosure before they were overcome.

In March 1999, NIOSH Director Linda Rosenstock declined to initiate a feasibility study for nitrogen odorization.[5] Dr. Rosenstock cited the unreliability of odor as a warning indicator and the possible incompatibility of an odorant with the industrial delivery and use of nitrogen. In subsequent correspondence, Dr. Rosenstock also cited a lack of "existing process-specific expertise or resources" for conducting an odorization study. Although detailed meetings were held between CSB and NIOSH staff, no further progress has been made in implementing this recommendation.

Morton International
Paterson, New Jersey

An April 8, 1998, explosion at the Morton International chemical plant in Paterson, New Jersey, injured nine facility workers, two seriously. The explosion and subsequent fire occurred as the result of a runaway chemical reaction in a 2000-gallon reactor used to produce a yellow fuel dye (Automate Yellow 96). Shortly after the two chemicals used to make the dye were mixed, the reactor began to heat rapidly, eventually overpressurizing and rupturing. The reactor contents were released to the air and distributed into the surrounding urban area. The chemicals released included highly toxic *ortho*-nitrochlorobenzene. Fallout was noted as far as a half-mile from the plant, and residents of a ten square block area were required to shelter in place. Local authorities issued a health advisory to residents shortly after the incident, although the magnitude of any human exposure is not known. Damage to the plant has been repaired, but the production of Automate Yellow 96 was discontinued worldwide. CSB investigated this incident and issued a final report on August 16, 2000.[6]

Recommendations. CSB found that Morton's assessment of the hazards of the Yellow 96 process was deficient. The potential for a runaway reaction was not adequately considered, the reactor was not equipped with adequate safety equipment to control such a reaction, and operating procedures and safety information provided to workers were also inadequate. The new owner of Morton International, the Rohm & Haas Company, commented that the report was "a professional and thorough investigation" that was

[5]Letter from Linda Rosenstock, Director of the National Institute for Occupational Safety and Health, to Paul L. Hill, Jr., Chairman of the CSB, March 23, 1999.
[6]Final report is available at http://www.csb.gov/reports/2000/morton/morton_01.htm

"extremely helpful as a basis to ensure that the health and safety of employees at the Paterson plant is fully protected."

More broadly, the CSB report pointed out that reactive chemicals (like those that caused the Morton blast) are not addressed comprehensively in either OSHA's Process Safety Management standard or the Environmental Protection Agency (EPA) Risk Management Program. CSB recommended that EPA and OSHA jointly issue good-practice guidelines on handling reactive chemical hazards and work with CSB on a special investigation of reactive chemical safety. The investigation will review past reactive chemical accidents, survey current industry practice regarding reactive hazards, and make recommendations for further action. EPA and OSHA have endorsed both recommendations and are participating in the CSB-led hazard investigation.

Herrig Brothers Farm
Albert City, Iowa

On April 9, 1998, two volunteer firefighters were killed in a propane tank explosion at the Herrig Brothers turkey farm in Albert City, Iowa. In addition, seven personnel were injured. The explosion occurred as the result of a fire that ignited near an 18,000-gallon propane storage tank used to provide heating fuel for the turkey barns. The fire in turn was caused when two teenagers driving an all-terrain vehicle struck and ruptured propane lines connecting the storage tank to other heating components. At the time of the incident, the tank contained about 10,000 gallons of propane. The farm sustained significant damage, but there were no significant off-site consequences. The farm has since rebuilt using a modified propane system design. CSB investigated this incident and issued a final report on June 23, 1999.[7]

Recommendations. CSB's investigation attributed this fatal propane incident to (1) inadequate protection of the aboveground propane lines; (2) improper installation of an emergency shutoff system designed to arrest a catastrophic propane leak; and (3) inadequate training of firefighters on handling potential propane tank explosions. The report also noted that state of Iowa procedures for approving and inspecting propane systems were inadequate.

Based on the latter finding, the Board recommended that the Iowa State Fire Marshal (ISFM) take steps to improve its regulatory procedures relating to propane. Specifically, it was recommended that the state fully implement National Fire Protection Association (NFPA) requirements for installation, modification, and inspection of liquefied gas storage facilities.

The ISFM has endorsed the Board's recommendation to make improvements in its oversight of propane facilities. Thus far, however, the Marshal's office has been unable to obtain adequate funding for the activity from the legislature, even though the underlying NFPA standard was previously adopted into state code.

[7]Final report is available at http://www.csb.gov/reports/1999/herrig/list_reports.htm

CSB's investigation of the Herrig Brothers incident showed that better firefighter training might have prevented the two fatalities and seven injuries to emergency response personnel. In this incident, an 18,000-gallon cylindrical propane tank exploded as the result of an earlier leak and propane fire. Volunteer firefighters arrived at the scene to find the tank intact but engulfed in flames. Believing they would be safe from an explosion if they avoided the two ends of the tank, they approached within a hundred feet of the tank to set up firefighting equipment.

When the tank exploded minutes later, it sent large fragments and shrapnel in all directions, resulting in the deaths and injuries. The propane tank had experienced what is known as a boiling liquid expanding vapor explosion (BLEVE). A BLEVE can occur when fire weakens the metal of a vessel containing a pressurized substance like heated propane. In such cases tank failure can initiate anywhere (particularly in the upper section of the tank where there is no stored liquid to provide cooling). When a BLEVE occurs the sides of the tank do not provide a safe haven, and if a BLEVE is threatened all personnel should be withdrawn to a safe distance.

CSB determined that the training furnished to Albert City firefighters by the National Propane Gas Association (NPGA) and the Iowa State University Fire Service Institute did not adequately prepare them to respond to a potential BLEVE. The training led to an erroneous impression that the ends of the tank were the most significant hazard and that the sides could be approached in relative safety. The Board made recommendations to both the NPGA and the Fire Service Institute to modify their training materials and programs to adequate cover response to BLEVEs. Both responded positively and made the requested changes.

The CSB report also noted a pertinent error in the U.S. Department of Transportation's *North American Emergency Response Guidebook*. The *Guidebook* is widely carried and used by personnel responding to hazardous material releases, although it was not directly consulted by firefighters during the Herrig incident. The 1996 version of the *Guidebook* stated that responders should "*always* stay away from the ends of tanks" when fighting flammable liquid tank fires. This advice could give the erroneous impression that the sides of the tank are safe in such cases. In the wake of the Board's investigation, DOT revised the year 2000 guidebook, which now counsels to "*always* stay away from tanks engulfed in fire."[8]

Independence Professional Fireworks
Osseo, Michigan

On December 11, 1998, an explosion at the Independence Professional Fireworks (IPF) manufacturing facility in Osseo, Michigan, destroyed a processing building, killed seven workers and injured thirteen. No other buildings on the site were seriously damaged. There were no significant off-site consequences, such as injuries to the public or evacuations.

[8]U.S. Department of Transportation, *2000 Emergency Response Guidebook*, p. 195.

Several governmental agencies responded to this incident, including the CSB, the Bureau of Alcohol, Tobacco, and Firearms of the Department of the Treasury (ATF) and Michigan OSHA (MIOSHA). Following a second incident at the facility on March 29, 1999, which killed the owner, his wife and three workers, the ATF coordinated the removal of explosive materials from the site. All explosive manufacturing licenses were subsequently surrendered to the ATF, permanently halting operations.

In view of these facts, the Board decided not to issue a full investigation report on this incident. Instead the Board determined it would be more beneficial to correspond with the ATF, the National Fire Protection Association and certain other organizations regarding possible improvements in safety practices that may be needed based on the findings of the CSB's investigation.

Tosco Corporation
Martinez, California

A fire at the Tosco Avon Oil Refinery killed four workers on February 23, 1999. Workers were attempting to replace piping attached to a 150-foot- tall distillation tower while the unit remained in operation. The piping contained pressurized naphtha, a highly flammable liquid hydrocarbon. In the course of the operation, the piping was cut. Shortly thereafter, about 90 gallons of naphtha surged from an incision in the piping. The naphtha ignited by contact with nearby hot process equipment, killing the four workers. No off-site consequences were reported, and the fire was brought under control shortly thereafter. CSB investigated this incident and expects to issue a final report in early 2001.

Condea Vista
Baltimore, Maryland

On October 13, 1998, an explosion occurred during maintenance of a chemical reactor at the Condea Vista Co. chemical manufacturing plant in Baltimore. The reactor was used for the production of linear alkyl benzene (LAB), a raw material for synthetic detergents. During maintenance, it was found that the reactor contained a residual sludge that was difficult to remove. In an effort clear the sludge, water and steam were introduced into the reactor, leading to a chemical reaction of unanticipated severity. Conditions in the reactor exceeded temperature and pressure safety limits, and the reactor exploded. Five employees were injured and the subsequent fire released benzene and hydrochloric acid into the air, but no serious injuries or damage were reported off site. CSB investigated aspects of this incident and expects to issue a related safety bulletin in early 2001.

Sonat Exploration
Bienville Parish, Louisiana

Seven workers were killed and four injured in an explosion and fire at a Sonat Exploration natural gas well on October 24, 1998. The explosion occurred during a specialized contract operation known as snubbing, i.e. the insertion of tubing or tools into

petroleum well. In this case, buckling of the tool under pressure led to a sudden release of pressurized natural gas from the well, resulting in the fatal blast. The amount of gas released is not known, but no off-site consequences were reported. CSB investigated aspects of this incident and expects to issue a related safety bulletin in early 2001.

Equilon (Puget Sound Refining Company)
Anacortes, Washington

On November 25, 1998, an explosion at the Equilon (Puget Sound Refining Co.) refinery claimed the lives of six workers. The explosion occurred due to the autoignition of a gaseous hydrocarbon cloud released from a coke production vessel. That vessel, known as the delayed coker unit, had been partially filled with hot feed hours earlier when a temporary power outage halted the operation. Subsequent opening of the vessel without properly cooling its contents resulted in the gas release and explosion. No off-site consequences were reported, and the quantity of gas released and ignited is not known. The facility was since repaired and improvements were made to the coker unit. CSB investigated aspects of this incident and expects to issue a related safety bulletin in early 2001.

Concept Sciences
Allentown, Pennsylvania

On February 19, 1999, a chemical explosion at this start-up facility killed five, including four company workers and a worker at a neighboring firm. The explosion involved hydroxylamine, an unstable chemical used in the semiconductor industry. At the time of the incident, hydroxylamine was being purified by vacuum distillation; the blast appeared to originate from a 2,500-gallon tank containing a high concentration of the chemical. The facility was heavily damaged and has not been reconstructed. CSB investigated aspects of this incident and expects to issue a bulletin on hydroxylamine safety in early 2001.

Safety Bulletins

The CSB conducted limited investigations of the foregoing four incidents. In three cases (Condea Vista, Sonat, Equilon), the Board found that deficiencies in the Management of Change – a key element of process safety management – may have contributed to the incidents. Management of Change includes formal procedures for assessing and controlling hazards associated with significant modifications to a chemical process. In all three cases, it appears that personnel were confronted with unforeseen process conditions and may have responded with actions whose safety implications had not been fully considered. The Board is preparing a Safety Bulletin highlighting significant lessons from the three incidents and stressing the general importance of effective Management of Change procedures. The bulletin will be released in early 2001.

The Board also will issue a Safety Bulletin addressing the specific hazards associated with the manufacturing of hydroxylamine, a highly reactive chemical which appears to

have been involved in several serious accidents. Although Concept Sciences was the last U.S. manufacturer of the substance, continuing demand in the semiconductor industry is likely to attract new entrants in the future. CSB's safety bulletin will discuss the kinds of process safety information companies should collect and review prior to initiating production of hydroxylamine.

Achievements and Future Actions

The Board is pleased by Nevada's adoption of increased inspections for explosives facilities and by the Iowa State Fire Marshal's support for improved regulatory oversight of gas storage facilities. The Board is also particularly pleased by EPA and OSHA's development of reactive process guidance and their active participation in the CSB's reactive hazard study. The Board has also worked cooperatively and successfully on recommendations with private companies. Companies like Morton International and Union Carbide (whose facilities have remained in operation after the investigated incidents) have generally been responsive to Board recommendations.

The Board however recognizes the need for significant additional work to promote the implementation of other recommendations. As the Board continues to build its Investigations and Safety Program, it hopes to dedicate additional staff specifically to recommendations work. CSB intends to work more collaboratively with the parties to its recommendations, following the highly successful model of the National Transportation Safety Board (NTSB). Informal discussions prior to the issuance of recommendations, together with diligent follow-up and tracking thereafter, enhance the probability that recommendations will be successfully implemented.

Priorities for Study and Investigation in 2000-2001

Reactive Hazards

In the wake of CSB's Morton investigation, completed in August 2000, the Board initiated a new special investigation on reactive hazards. EPA and OSHA are both participating in the investigation, which is expected to be completed in September 2001. CSB is aware of a number of serious incidents involving reactive chemicals, such as the 1995 Napp Technologies explosion in Lodi, NJ, and the 1997 Georgia-Pacific Resins explosion in Columbus, Ohio. Like the Morton incident, these two fatal events involved uncontrolled chemical reactions which caused sudden, catastrophic increases in pressure and temperature in a production vessel. The more recent Concept Sciences and Condea Vista incidents also fit the definition of reactive chemical incidents.

The Board's special investigation on reactive hazards will review past events, survey the practices of selected companies, and examine current EPA and OSHA regulations and policies. The report will seek to determine common causes of reactive incidents and likely make recommendations for reducing future occurrences.

Accident Data Program

From the beginning the CSB recognized the importance of accumulating data concerning chemical accidents and their consequences. The data would be important in measuring the effectiveness of accident prevention programs and targeting future resources more effectively. A number of agencies have jurisdiction over various kinds of data records for accidental events; however, no single source of comprehensive chemical accident data exists in the federal government. During its first two years, the CSB attempted to take existing accident databases from five agencies (OSHA, EPA, the Department of Transportation, the National Response Center, and the U.S. Fire Administration) and produce a single integrated data source, known as the Composite Database. The CSB used the new database to begin to draw inferences about accident trends and causes, disseminating a preliminary study called *The 600K Report* in February 1999.

After the Board was reorganized in 2000, the agency reevaluated validity and usefulness of the Composite Database, which had been assembled under the personal direction of former Board Chairman Paul L. Hill, Jr. [9] Finding large gaps in the information that was received and tabulated by the agencies, the Board ultimately determined that the quality of the Composite Database was too low to support meaningful conclusions about the universe of chemical accidents. The Board withdrew *The 600K Report*, tabled work on the Composite Database, and began a multi-year effort to develop new, high-quality data in close coordination with other agencies and interested stakeholders in the private sector. The Board believes there is widespread support for data development among a broad

[9] During the Board's first two years, the agency was run by then-Chairman Paul L. Hill, Jr., with little consultation of the Board Members. Since Dr. Hill's resignation as Chairman on January 12, 2000, the Board has been governed collectively by the Members under majority voting rules. Certain day-to-day functions were delegated. Dr. Hill has since resigned from the Board entirely.

spectrum of constituencies. During 2001, the Board plans to have expert staff develop a data strawman proposal, and to convene a stakeholder roundtable to refine the proposal.

Incident Selection

The size of the Board's staff and budget limit the number of accident investigations that can be undertaken in a year. The CSB estimates that each year there are perhaps a hundred serious chemical incidents, i.e. those causing deaths, injuries, evacuations, or serious damage to property or the environment. Of these hundred, CSB currently has resources to investigate fully only two annually. CSB must identify those incidents whose investigation will have the highest benefit in preventing future accidents. Selection must be accomplished quickly (i.e. within 24-48 hours of the event) in order to preserve vital evidence. However, it is often difficult to determine the full ramifications of an incident in the first hours after its occurrence.

During calendar 2000 the Board finalized new incident selection criteria. These semi-quantitative criteria should allow the rapid identification of incidents of significant concern to the CSB. In November 1999 and July 2000, the CSB presented sets of draft criteria to multi-stakeholder roundtables, which included representatives of industry, public interest groups, labor, government, and academia. The stakeholders suggested important changes and simplifications to the criteria to allow for their rapid use after an accident. The new criteria focus more closely on the known consequences of an incident (death, injuries, etc.) coupled with the potential consequences to the safety of the public. In 2001, CSB will continue to apply the new rating system to chemical incidents and will refine the system based on practical experience.

Investigation Protocol

CSB made a number of deployments to the sites of chemical incidents during 1998-99. Owing to the lack of trained investigative staff at the agency over this period, contractors were frequently used to initiate or facilitate field investigations. There was little harmony in the investigative methods and oversight practiced at the various sites. The lack of uniform procedures led to investigation records that were of uneven quality, delaying completion of many of the investigation reports.

An important priority in FY2000 has been the development of a detailed protocol for investigations. The protocol helps ensure that field interviews, evidence collection, interagency cooperation, and other matters are handled in a planned and efficient manner. For example, in the case of interviews, the protocol contains guidelines on the presence of witness attorneys, assertions of confidential information, and coordination (where appropriate) of witness interviews. A preliminary protocol was drafted during early FY 2000. During FY 2000 many further refinements were pursued, incorporating extensive legal research and the opinions of outside experts. The protocol will be used by field investigation teams during all future investigations and will be further refined based on experience.

Additional Issues

Progress in the Development of Risk Reduction Technologies

The Union Carbide investigation highlighted a common industrial hazard, i.e. confined space entry. Entry into confined areas that contain unfit atmospheres is a recurrent problem and regularly results in fatalities both among workers and would-be rescuers. Nitrogen gas, for example, is routinely used in industry and is odorless, tasteless, and colorless. An atmosphere which is enriched with nitrogen (and thus poor in oxygen) may cause loss of consciousness within 20 seconds, followed by death, with no warning to the victim. CSB's recommendation for a federal study of the feasibility of odorizing nitrogen has not thus far been implemented.

The CSB views the hazards of confined space entry to be a significant safety hazard. Recently, the *Loss Prevention Bulletin*, a British journal, devoted an entire issue to the hazards of confined space entry. One article noted that "nitrogen probably still holds its reputation as the process industries' number one killer." This article went on to review issues concerning the use of odorants to reduce nitrogen-related casualties. The subject of inert gas odorization has been studied for some time (see for example W.S. Cain et al., *Am. Ind. Hyg. Assoc. J.* **1987**, *48*, 47-55). Accordingly, the CSB will monitor the latest research and advocate further study as appropriate.

Year 2000 Technology Problems

Beginning in March 1998, the Board researched the status of the Year 2000 (Y2K) technology problem and the chemical handling industry. At the request of the U.S. Senate Special Y2K Committee convened an expert meeting to evaluate:

- the extent of the problem pertaining to automation systems and embedded systems that monitor or control the manufacture of chemicals, or safety systems that protect processes;
- the Y2K awareness of large, medium, and small companies within the industry;
- their progress in addressing the Y2K problem; and
- federal agencies roles in preventing Y2K problems.

The Board issued an investigative report[10] that recommended: (1) providing easy-to-use assessment and planning tools; (2) promoting accessible resources, and (3) providing attractive incentives for Y2K compliance efforts. In advocating these recommendations, the Board testified twice before the U.S. Senate on this safety issue. The Board worked with seven trade associations of the chemical handling industries and the EPA to produce and distribute a special guidance document for small and mid-sized enterprises[11] and a

[10]Report is available at http://www.csb.gov/y2k/docs/y2k01.pdf
[11]Guidance document is available at http://www.csb.gov/news/1999/docs/smefinal.pdf

safety alert to these entities.[12] The report and the guidance were transmitted to the governors of states and territories, as well as to the major associations of emergency responders and firefighting organizations. The Board helped to plan and convene a focused roundtable on chemical safety convened by the President's Council on Y2K.

In addition the Board helped to develop, promote and execute worker training efforts sponsored through the National Institute of Environmental Health Sciences.[13] More than 25 major addresses on Y2K and chemical safety were presented by the Board to businesses, labor and public interest organizations, governmental agencies, academic institutions and professional safety groups. The Board also coordinated its efforts internationally, involving the Intergovernmental Forum on Chemical Safety, the World Health Organization's International Programme on Chemical Safety and the Organization for Economic Cooperation and Development.

[12]Safety alert is available at http://www.csb.gov/news/1999/docs/CEF.pdf
[13]See for example http://204.177.120.20/wetp/clear/y2k/index.htm

Future Directions and Conclusion

To be sure, starting a new enterprise is no easy task, and establishing a new, independent federal agency is no exception. The new CSB inherited no infrastructure or staff and had limited fiscal resources. At the same time, it confronted a broad safety mission. We acknowledge the CSB made management errors during its first three years.

With the reorganization of the Board in January 2000, the CSB began a turnaround that continued throughout the remainder of FY 2000 and into FY 2001. Following the directions of Congressional appropriators, the Board and its new management team have focused staff and resources onto accomplishing priority tasks. Since then, the CSB has published two new comprehensive incident investigation reports, issued a five-year strategic plan, implemented its hiring plan by adding a number of skilled investigators and technical experts, and developed incident selection criteria and a protocol for conducting investigations. CSB is also proceeding with a revamped accident data program and is in the process of hiring a data expert and convening a stakeholder roundtable on data issues.

Certainly the CSB can point to some accomplishments: constituents have roundly praised its investigation reports for their technical soundness, readability and contributions to the system of chemical safety. The CSB has been welcomed into the already existing community of organizations -- both private and governmental -- that are committed to addressing industrial chemical safety here in the United States and overseas. The Board has been successful in attracting talented investigative and support staff to its team and the CSB's most successful communications tool, its website, has been singled out as being among the best in the federal government.

As it ended FY 2000 the CSB had a clear vision of its priority investigative tasks for the coming year: to launch and complete a widely-anticipated investigation of reactive chemical hazards, with the participation of EPA and OSHA; to complete two safety bulletins based on CSB investigations; and to develop a technical training program for its staff.

The CSB intends to be judged not by its plans but by its deeds. During FY 2001 the Board seeks the support of both constituents and the Congress so that it can demonstrate what a well-managed, focused CSB can achieve in furtherance of its mission to protect workers, the public and the environment by reducing the occurrence of industrial chemical accidents.

The Board has put the mistakes of the past behind us. We have turned the corner and are moving in a positive direction to fulfill our mission. Now we ask Congress to provide the resources to enable us to succeed. As set forth in our strategic plan, the goal is in sight. With the support of the Congress we will reach it.