Goal Setting: A Systematic Approach to Chemical Safety Improvements

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Abstract

This paper explores a novel approach for improving chemical safety in the United States by establishing National Process Safety Goals. Process safety initiatives in the recent years have given rise to significant increases in process safety technical and management knowledge and promising new process safety regulatory requirements. However, serious deficiencies 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.

Future developments in the US with regard to process safety and risk management programs may quite likely be based on risk-benefit analyses. There is also number of efforts underway to develop stakeholder dialogue and arrive at consensus opinions regarding national safety goals and targeted improvements in safety performance. It is quite clear that the need to operate safely is recognized as a competitive advantage and a positive contributor to the bottom line. The regulatory regime and requirements will also keep changing as more information becomes available. Thus, industrial programs and practices will have to keep pace with changing clime and consensus standards and targeted safety goals. This paper presents an update on the efforts to-date on a project with wide stakeholder participation. The objectives of the project include adoption of national chemical safety goals and implementation of activities necessary to accomplish those goals. Another objective of the project is the development and implementation of a measurement system to measure progress towards the established national chemical safety goals.

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. This paper explores the pros and cons of establishing national process safety goals and evaluation approaches. The advantages of such an approach include the following:

1. Stakeholder consensus on national chemical (process) safety goals.
2. Identification of where we want to be and by when in relation to national chemical safety goals.
3. List of activities that need to be implemented to accomplish step 2 above?
4. Agreement on some common metrics for measurement of progress towards national chemical safety goals.

The Mary Kay O'Connor Process Safety Center launched an ambitious project in early 1999, which involves establishment of National Chemical Safety Goals, identification of activities necessary to accomplish the goals, and development of a measurement system to measure progress towards achieving the goals.

Background

Chemical process safety was not a major public concern in the United States prior to 1984. As far as chemical hazards were concerned, public fears focused on disease (cancer) and environmental degradation. Even a series of major process accident tragedies (Flixborough in 1974, Seveso in 1976, Three Mile Island in 1979, Cubato in February 1984, and Mexico City in November 1984) did not translate into widespread public concerns about major accidents in US chemical plants that might disastrously affect the public. This situation changed completely after the December 1984 disaster at the Union Carbide plant in Bhopal.

Not only was the public's confidence in the chemical industry shaken; the chemical industry itself questioned whether its provisions for protection against major accidental releases were adequate. After all, the company involved was Union Carbide, which had an excellent engineering and safety reputation in the industry.

The recognition of the chemical industry's need for technical advances led to a number of initiatives. For example, in 1985, the Chemical Manufacturers Association (CMA) published its guidelines on Process Safety Management and the American Institute of Chemical Engineers (AIChE) created the Center for Chemical Process Safety (CCPS) with significant financial support by industry. Over the next several years many other Centers such as, the National Institute for Chemical Safety, the National Environmental Law Center and the Mary Kay O'Connor Process Safety Center also came into existence. During this same period, EPA and OSHA started several technical initiatives aimed at gathering information about major accident risks.

Based on the increased number of technical conferences, books, journal articles and even new journals dealing with process safety, a strong case can be made that these initiatives have been successful and have led to significant increases in knowledge about process safety engineering and management.

The increased national concerns about the potential consequences of process safety accidents also triggered a series of legislative actions at the State and National level that led to increased process safety regulatory requirements. At the national level, Congress initially enacted Title III of the Superfund Amendments and Reauthorization Act (SARA) in 1986. This act required states to establish state and local emergency planning committees (LEPCs) and mandated that facilities must make information on hazardous chemicals available to the public. In addition, starting in 1985, a number of states, Delaware, California, Nevada and New Jersey, to name a few, also enacted legislation mandating minimum process safety management practices. In the late 1980's, further catastrophic process failures provided the political leverage to cause inclusion of provisions addressing process safety in the 1990 Clean Air Act Amendments.

Under 112(r) of these Clean Air Act Amendments, Congress enacted legislation that led to several major process safety actions, namely:

1. A general duty obligation in regard to process safety.
2. The OSHA Process Safety Management (PSM) rule (February 24, 1992)
3. The EPA Risk Management Program(RMP) Rule (June 20, 1996)
4. The formation of the Chemical Safety and Hazard Investigation Board.

Complete compliance with the OSHA regulations was required by May 26, 1997 and the requirements of the EPA Rule must be met by June 20, 1999.

Observations on potential goals targeted at improvements in process safety.

As mentioned earlier, a valid question that may be asked is 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?

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.

In a recent publication, Rosenthal and Mannan[2] argue that for the present it may be more productive to pursue national initiatives aimed at generating tools, studies and programs that address areas of major process safety deficiencies such as the following:

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.

When progress has been made on objectives in these more pedestrian areas, it may be opportune to tackle larger, overarching national goals such as 'A 10% annual reduction in accidental releases.'

The Chemical Safety Assessment Project

The Chemical Safety Assessment project has been underway for more than a year and much progress has been made. The project began with the objective 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. At the first meeting of the Roundtable in June 1999, agreement was reached as follows:

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

This agreement came, of course, after a great deal of discussion on a variety of alternatives and the sorts of characteristics the project should possess. With this background and the initial discussions within three workgroups, a second session of the Roundtable was convened in October 1999.

In October 1999, group discussion focused on how progress towards the First Roundtable Agreement could be accomplished, measured, and demonstrated. A variety of parameters and metric tools were presented for discussion by the workgroups. Intense discussion followed on the means by which the First Roundtable Agreement would be implemented.

A Steering Group was formed to identify the steps necessary to implement the First Roundtable Agreement. The Steering Group recognized that the objective of this project needed to be clarified in order to ensure all stakeholders are working toward the same goals. It was also acknowledged that an expanded understanding of the First Roundtable Agreement was needed to make the project relevant to the different audiences interested in this project. These audiences include diverse groups such as the general public, local community, employees of the facility, shareholders of a company, emergency response agencies, government regulatory agencies and others.

In several meetings over the next few months following the October 1999 Roundtable meeting, the Steering Group worked to expand and clarify the First Roundtable Agreement in an effort to advance the project. The Steering Group adopted the First Roundtable Agreement as the Mission Statement. As a result of First Roundtable Agreement, a National Goal was adopted as follows:

> ***Chemical incidents are zero; chemical enterprises have earned the public's trust; and public, government, and facility interactions improve safety and reduce risks.***

It should be clarified that while the members of the Roundtable have identified a National Goal we can all work toward, in is not the responsibility of the Roundtable itself to ensure the accomplishment of that National Goal. Rather, it is the responsibility of the individual stakeholders within the Roundtable to work toward accomplishing the National Goal and provide their results to the Chemical Safety Assessment process in order to evaluate the overall improvement in chemical safety in this country. It is the responsibility of the Roundtable to assess the accomplishments of the stakeholders in the context of the National Goal. Thus, this project will assist us all in identifying the successes and areas for improvement in chemical safety.

The national goal can be broken into three sub-goals and measurement systems for tracking progress on these three sub-goals are needed:

- A method to track progress in reducing incidents to zero
- A method to track progress in building public trust
- A method to track the effectiveness of public, government, and facility interaction

Potential measures/indicators to track progress in reducing incidents to zero

The indicators for measuring progress with respect to this goal will be:

1. Trend in total number of incidents
2. Trend in the number of facilities reporting incidents including the percent of facilities reporting (this, of course requires knowing the universe of facilities).
3. Trend in publicizing near-misses.
4. Trend in the use of safety culture building programs
5. Trend in the level of effort to install prevention programs

As to the indicator, "Trend in total number of releases", the group agreed that the criteria and characteristics that will make up the report on an incident should include:

- The appropriate items from the definition of incident
- Quantities released
- Severity of consequences

- Ownership
- Those items that are in the various reports submitted to governments

Potential measures/indicators to track progress in building public trust

It is important to note here that if there was a reliable incident database, and it showed improvement, that would by itself have a positive effect on public trust. While there are some indicators that could be measured or tracked, there is general agreement that information from the repository as well as surveys may be needed to track progress in building public trust.

Surveys to track trends could be targeted to specific audiences

- First responders
- Employees
- Media
- Local community

Negative measurements, which would indicate lack of progress, are as follows:

- Number of complaints to government agencies (i.e., the use of hot lines)
- Disputes over permits, rezoning, expansions
- Citizen lawsuits not damage suits
- Rapid employee turnover
- Injuries, evacuations
- Number of FOIA's

Positive measurements indicating progress in building public trust include:

- Percent of people living in a certain radius who are comfortable with where they live
- Facilities and local governments who contribute resources (dollars, equipment, people) to LEPCs/SERCs[1]
- Number of opportunities for public participation
  - CAPs, public hearings, environmental justice programs
- Property values – up or down because of proximity to a facility
- Percent of facilities that allow independent third party audits and make information publicly available.

Important indicators that are especially hard to measure are:

- The tax structure, which should reward "good actors." Public perceptions of those tax exemptions as funds being withheld from the community.
- Number of sources public can use to verify information.

[1] State Emergency Response Commissions are agencies at the state level who are responsible for coordinating emergency response activities throughout the state.

- Product sales trends. Public support or boycott of a product.
- Attitude of the press.
- Level of person from company/government/community who show up to address a concern. Does the facility have a face?
- Improvement in relationships between labor/management and government.
- Number of programs supported by parents who allow their children to spend time on-site at a facility – summer employment.
- Percent of companies who take pro-active measures to go beyond compliance (e.g., early RMP rollouts, public release of RMP executive summary).
- Number of community outreach and education programs and dollars spent on those programs.
- Number of facilities that train with local responders.
- Distances of plant manger's/senior managers' homes from the facilities.
- Number of facilities with on-site child-care centers.

Potential measures/indicators to track the effectiveness of public, government, and facility interaction

Public, government, and facility interaction may take place in various forms. The effectiveness of these interactions could be judged by improvements in plant operations and overall safety performance. Additionally, the successful collaboration of government, industry, and the public can be shown through expanded promotion of chemical safety and understanding of chemical risk nationally. Examples of indicators include:

- Facilities that have reduced their chemical risk by practicing inherently safer approaches. Some examples include:
    - replacing hazardous chemicals with less hazardous chemicals
    - reducing chemical inventories
    - improving chemical processes
    - improved safety activities

- Reduction of risk factors (i.e., chemical accidents, high inventories) at facilities that participate in safe practices/chemical safety programs (i.e., OSHA's voluntary protection program; RMP audits, ISO 14000, EMS, Responsible Care)

- Reduction of
    - chemical incidents
    - amount of chemicals released
    - environmental effects

- Improved chemical safety at facilities that:
    - have active LEPCs on which they participate
    - voluntarily provide chemical information
    - participate and provide information to the Chemical Safety Assessment project

- Percent increase in government/facility partnerships, (i.e., audits, outreach, etc.)

- Increase by state government in promotion of chemical safety at local level through training, funding, and other appropriate activities.

- Increase in number of communities which have infrastructures in place to
    - promote facility/government/public interactions, and/or
    - promote access to chemical information to the public

- Increased interactions between industry, government, and/or public, which result in reduced chemical risk to the community.

- Percent increase in quality of commitment to chemical safety activities (i.e., LEPC/SERC participations, etc.)

Work Plan

In order to track progress towards the national goal, several activities are needed. It must be pointed out that the efforts of the Roundtable attendees cannot directly accomplish the National Goal. In fact, in order to attain any degree of progress towards the National Goal, activities and tasks must be accomplished by many others at the local and the national level. The work plan outlined here addresses some of the activities, which in opinion of the Roundtable are essential to move forward.

Repository design for incidents, public trust, community/facility interactions

In order to track progress in accomplishing the national goal, the first thing that is needed is a repository of information for the various indicators. The factors that should be considered in developing the repository design are as follows:

1. What are good, available indicators for the national goal?

2. Are there good repositories that contain information on these indicators?

3. Who owns the repository for this information?

4. Who manages the repository for this information?

Some of the activities that need to be accomplished before a satisfactory repository can be functional are as follows:

1. Refine the repository development process
2. Develop proposed data, input criteria and characteristics
3. Interaction with agencies: inform and ask for access and cooperation in coordinating the development of an integrated national system

4. Use RMP 5-Year data and put in place a mechanism to make it available to public via LEPCs
5. Develop a proposal to establish a process so that when an accident occurs, it is possible to select inputs (elements) from existing data bases/sources to which an accident is reported, and creates an acceptable tracking system.

It is clear that in order to track progress in accomplishing the national goal; a repository of information is necessary. However, a repository itself may not be sufficient to track progress in each of the three parts of the national goal (i.e., progress in reducing accidents, progress in building public trust, and progress in community interaction). The repository described below can provide complete information for tracking progress in reduction of incidents. In order to get complete information regarding progress in building trust and community interaction, focused and directed surveys may be necessary.

The following definitions apply to incidents and all other aspects of this assessment project.

> "Chemical Enterprise" includes production, packaging, storage, distribution, use and disposal of chemicals at fixed facilities and in transportation.
>
> "Incident" includes any sudden unintended release of or exposure to chemicals that does or could reasonably have resulted in injuries, death evacuation, shelter-in-place, or significant environmental or property damage (exceeding $25,000, where damage is defined as replacement cost for property and equipment on-site and off-site that is damaged in the incident. Business interruption loss, product loss, and environmental clean-up costs are not included).
>
> "Near miss" is an "incident" avoided by chance. This definition is not intended to exclude near-misses where the consequences were avoided because of location, such as releases from a pipeline or unoccupied facility in a remote area.
>
> "Public" includes everyone interested in the process or procedures represented in these goals.

The repository will consist of incidents covered by the definition given above. In the future when consensus regarding the definition of near-misses is reached and collection of near-miss data becomes routine, the repository might be expanded to include the near-miss data.

Repository taxonomy

For each entry in the repository, the following information shall be considered for inclusion. The following items reflect a combination of items included in the definition of "incident," items suggested during the June 13-14, 2000 Roundtable meeting, and items commonly reported in various incident databases. Also, an effort was made to

cover all items needed to track progress towards the national goal. The following first set was selected primarily for tracking progress in reduction of incidents.

- Date and time
- Facility name
- Dun and Bradstreet number
- SIC code
- On-site property damage
- Off-site property damage
- Chemicals released
- Quantity released
- Release description (i.e., to air, water, or ground)
- Source
- Duration
- Number of serious injuries
- Number of fatalities
- Use of off-site responders
- Was general public notified (Y/N)
- Population protection measures
- Short description
- Initiating event
- Root cause
- Contributing causes
- Changes introduced
- Covered by PSM
- Covered by RMP
- Last regulatory enforcement
- Status of process line at time of spill
- How release was discovered
- Number of facility employees injured
- Number of facility employees hospitalized
- Number of facility employee deaths
- Number of contractors injured
- Number of contractors hospitalized
- Number of contractors deaths
- Number of general public injured
- Number of general public hospitalized
- Number of general public deaths
- Number of responders injured
- Number of responders hospitalized
- Number of responder deaths
- Number of contractors evacuated
- Number of contractors sheltered-in-place
- Number of employees evacuated
- Number of employees sheltered-in-place
- Number of general public evacuated

- Number of general public sheltered-in-place
- Frequency of hazard analysis studies
- Date of last hazard analysis
- Prevention program description
- Release location:
    - Process Vessel:
        A) Wall
        B) Overflow
        C) Vent
        D) Drain
        E) General

    - Storage
        A) Wall
        B) Overflow
        C) Vent
        D) Drain
        E) General

    - Valve
        A) Flange
        B) Seal
        C) Body
        D) General

    - Piping
        A) Flange
        B) Joint
        C) Elbow
        D) Wall
        E) General

    - Pump
        A) Flange
        B) Seal
        C) Body
        D) General
        E) Other

The following items (needed primarily for tracking progress in building public trust and community interaction) may or may not be available. Potential methods for acquiring the information should be determined. Most of the following are not available from existing data sources. Voluntary surveys and/or benchmarking exercises should be considered.

- CAP existence
- Average number of CAP meetings per year

- LEPC existence
- Average number of LEPC meetings per year
- LEPC has reviewed facility RMP (Y/N)
- LEPC revised local emergency plan based on facility input
- LEPC has a community right-to-now program
- Number of lawsuits against company
- Number of complaints by public to company
- Number of complaints by public to regulatory agencies
- Number of community events in the last year
- Number of facility tours for the public in the last year
- Total hours of volunteer activities by facility in last year
- Existence of agreements with community (Y/N)
- Average management turnover in years
- Age of facility
- Average distance of management team residence from the plant
- Number of employees at the site
- Part of a larger corporation (Y/N)
- Average number of hours of professional activity (conferences, seminars, workshops)
- Average number of training hours for employees
- Average years of experience for employees
- Safety is part of incentive package for all employees (Y/N)
- What percent of compensation for management is tied to safety
- What percent of compensation for employees is tied to safety
- Age of near-miss program
- Number of near-misses in last 5 years
- Reduction of chemical inventory
- Improvements in chemical processes
- Replacing chemicals with less hazardous chemicals
- Improved safety activities

Information Collection

The following approach to developing a repository is being considered. This approach recognizes the significant resources that are currently expended by numerous agencies and the desire to take advantage of these efforts and the data that has been collected for some years in the past. It also recognizes that there are shortcomings in these systems, including lack of root cause, inconsistent taxonomy, limitations to public access, limitations and overlap in scope, and duplicate reporting requirements.

Information Flow

Incidents are normally reported to the National Response Center (NRC), which enters them into a database. This would become the starting point for tracking incident reporting and investigation through the relevant agencies. The Repository Manager would insure that all incidents that were appropriate to a particular agency passed through

that agency and were then incorporated into the integrated system. The Repository Manager would handle incidents that did not fall in the jurisdiction of any agency. The Repository Manager would supplement the reporting as needed and vet the information. The Repository Manager would also monitor news media and other sources for incidents that were not reported to the NRC. The Repository Manager would then electronically submit these incidents to the NRC.

Integrating the Systems

The Repository Manager with input from the Roundtable would identify all the existing data sources and compare the scope and content of each. This overall scope would then be compared to the desired scope as expressed by the Roundtable.

Authority

The CSB has a statutory authority to collect data regarding chemical incidents. If the CSB chooses to exercise this authority, it could be used to collect additional data (about certain incidents or about incidents) not normally covered by the other agencies. Incident reporting already addressed under NRC requirements or other regulations should not require additional redundant reporting.

Reporting Agencies

Those agencies identified to date are summarized in Table 1.

The Mary Kay O'Connor Process Safety Center is currently working on two tasks:

- To further develop the repository development plan described above.
- To make a detailed evaluation of the existing data sources, the scope of incidents covered and the information reported and identify their shortcomings, gaps and overlaps. Recommendations will be developed for improving public access, and consistency amongst the data sources.

Use of repository information

Some of the expected uses of the repository information are as follows:

1. Preparation of periodic Chemical Safety Assessment Reports
2. Assessment of credits for improvements in safety
3. Targeting of risk reduction measures
4. Assessment of effectiveness of programs and activities and identification of gaps in improving chemical safety

TABLE 1
Summary of US Chemical Release Incident and Injury Databases

Lead Agency	NRC	EPA	EPA	EPA	DOT/OHM	DOT/RSPA OPS	OSHA/BLS	OSHA/BLS	ATSDR	MKO-PSC	C
Database Name	**IRIS**	**ERNS**	**RMP**	**ARIP**	**HMIS**		**IMIS**	**CFOI**	**HSEES**	**NBIRS**	
Time Period		87-99	94-99	87-92	87-96	86-99	72-92?? 92-98 good	92-98	90-97	"all"	
Scope	"All" fed	"all" fed plus regions	Fixed fac Listed chem Quantity	Fixed fac Listed chem	Trans not pipeline	Pipelines	Workplace Injury Survey	Workplace Fatal Census	Trans & Fixed Not Petroleum 14 states	"all" Near misses	M c
Primary Limitations	Preliminary Incomplete Dups	Preliminary Incomplete Dups	No transport Only listed che 5 year cycle	Select criteria varied			Access	Access Occupat only	No Cause No petroleum States vary	News based	N
Public Access	Query (limited) or download	By download	Yes, limited	By download, need text	Summaries downl 93-99	Summ 86-99 downl 70-99	Summaries ftp downl	Summaries ftp downl	Summaries	Soon	N
Database Content											
Location	Yes		Yes	Yes	?			No	No	Yes	
When, Where, Who	Yes		Yes	Yes	?			No	No	Yes	
Product, Process, Ind.	Maybe		Yes	Yes	NA			Yes	No	Usually	
Material Released	Maybe		Yes	Yes	?			Yes	Yes	Yes	
Cause of release	No		Yes	Yes	Yes			No	No	Varies	
Prevention	No		Yes	Yes	No			No	No	No	
Consequences	No		Yes	Yes	Yes			Yes	Yes, Detail	Yes	
Quality Control	No		Yes	Some	?			Yes	Yes	No	

NRC	National Response Center, operated by Coast Guard
IRIS	Incident Reporting Information System
EPA	Environmental Protection Agency
DOT/OHM	Department of Trasnportation/Office of Hazardous Materials
DOT/RSPA	Department of Trasnportation/Research Services Program Administration
OSHA/BLS	Occupational Safety and Health Administration/Bureau of Labor Statistics
ATSDR	Agency for Toxic Substances and Disease Registry
MKO-PSC	Mary Kay O'Connor Process Safety Center
CCPS	Center for Chemical Process Safety
USFA	United States Fire Administration

It must be pointed out here that this project started because of the need to develop a Chemical Safety Assessment Report. The information that exists currently is not reliable or accurate. However, it is not advisable to wait till a "completely reliable and accurate" repository is available. The project group is working on preparing and releasing the first Chemical Safety Assessment Report in about six months. The objective is to develop a routine of being able to publish this report periodically. However, the first report should not be viewed and used as a "baseline" against which all future activities would be measured. Because of the time constraints and limitations on the data available for the first report, it would be unfair and inaccurate to use it as a "baseline." The advantages and compelling reasons for starting publication of assessment reports are:

1. In order to be able to win approval and support of others not involved or familiar with the Roundtable activities, we must be able to demonstrate concrete and tangible progress.

2. Vacuums are usually filled with hot air and debris. Thus, data that is imperfect should be used prudently to avoid the predicament. In using the imperfect data, methods for validating or correcting the information can be developed.

3. The first report should be able to provide glimpses to all stakeholders how the information can be used for analysis and improvement of their own operations. Thus, the first report and the subsequent reports would not only help accomplish buy-in to the project but more importantly in the long run cause stakeholders at all levels to work towards making the national goal a reality.

The preliminary contents of the Chemical Safety Assessment Report are shown in Table 2. The content of the report may change as we gain experience and more information becomes available. However, it is important that the following characteristics be maintained:

- Easily understood by all stakeholders
- Easily accessible
    - internet
    - printed version
    - easily copied
- As appropriate, explore the need for publishing the report in other languages
- Less text - More graphs
- Use of columns
- Further information page - web hot links
- Feedback via the internet as well as through the printed version
- List of participants - acknowledgement of Roundtable participation

As mentioned earlier, the content and format of the Chemical Safety Assessment Report will quite naturally evolve in the future. The goal would be to publish this report annually. However, it should be recognized that at the beginning as efforts to streamline repository development are underway, it may not be meaningful to publish the reports

Table 2
Contents of Chemical Safety Assessment Report

0 Executive Summary
- Audience
- What the report is/isn't

1 Background
- Purpose
- History and summary of the project and the CSAR
- Strategy - vision, mission, national goals, and indicators

2 Where we are in the nation in the area of chemical safety
- Analysis of data based on indicators
- Status of chemical safety
- National trends
- Accident causes, problem areas
- Prevention techniques/ideas
- Specific examples
- Databases – pros/cons - quality of data, data gaps
  - How complete are the data, what do we know, what don't we know?
  - Need for a national chemical incident repository

3 Where we are going
- Next steps - with analysis/databases/etc.
- Future reports
- Feedback opportunities

annually. As the repository of information discussed earlier becomes operational, mature, and reliable, future Chemical Safety Assessment Reports will potentially have the following additional features:

- More in-depth trend reports
- How stakeholders are using data/report
- Comparison of data from previous reports
- Status report of Roundtable
- Changes/adjustments to indicators
- Begin measuring success driven by report
  - how are stakeholders using data and is that improving chemical safety
- Recommendations/successes/gaps
  - key elements of successful programs
  - institutional barriers

Performance Improvement and Project Outreach

The impact of this project in accomplishing the national goal will depend to a large extent on getting all stakeholders at the local and national level to do their part. In this respect, it is essential to get the Federal Emergency Management Agency involved in the project. In addition, it is also quite essential to get all reporting agencies involved in the project. In order to increase awareness about the project and provide a simple and immediate medium for communicating the data trends, reports, and other information, a website for Chemical Safety Assessment Project has been established.

Appropriate incentives are necessary to get all stakeholders to participate in Chemical Safety Assessment project. Examples of such incentives include:

- Facilities learn where they stand in comparison to their industry group and others
- Facilities may be able to benchmarking various activities (e.g., average time for resolution of HAZOP recommendations)
- LEPCs could learn about work of other LEPCs
- Series of "what works" reports

The Repository Development Plan

The following represents incomplete work-in-progress on the repository development plan and should be viewed as such. The repository is to serve two basic functions:

1. Track progress in reducing chemical incidents.

   Especially, to determine if existing programs of government, industry and other organizations are effective in reducing the number and consequences of chemical incidents.

2. Learning from past incidents to help reduce incidents in the future.

   Especially, to identify **patterns** of system failure to guide and prioritize efforts in the areas of investigation, legislation, regulation, management, operation, training, and research.

Currently there are many federal, state and local agencies collecting and reporting chemical incidents. However, each agency can only collect information on incidents within their legislative authority. Rulemaking further limits the scope in many cases. Also, because of the varying focus amongst agencies the data collected and the terminology employed vary widely. The agencies are generally limited to certain chemicals, above threshold quantities, in particular facilities or transportation modes. These limitations stymie efforts to gain an overview of all chemical incidents.

Many of the systems rely on self-reporting of incidents by companies involved. While the reporting is mandated by law it is not known how many incidents go unreported. Independent means of checking for completeness are generally not available. Some agencies do use proactive means of searching for incidents, however, their scope is limited in other ways. The NRC/ERNS systems focus on early notification of incidents but lack accurate and detailed follow-up information.

Because of the patchwork of collecting and reporting there are undoubtedly overlaps and gaps. The development of an integrated system must address this problem. Additionally, it is desirable to eliminate redundant reporting to multiple agencies.

Integration of Existing Sources versus A New "Perfect System"

While it is easy to be critical of the existing systems it should be recognized that substantial resources are involved in data collection, vetting, investigation and reporting. These incident investigation and reporting efforts are often integral to the agency's function. OSHA for instance has a database that summarizes all the accidents that they investigate. Thousands of these involve chemicals. This content cannot be captured by a new reporting system; it has to be integrated into the system.

Because of the close coupling of the data gathering and investigation to the agency's function it appears impractical to replace the existing systems with one new system. In addition there are generally 5 to 25 years of previous data in these systems. Integrating the systems should allow for effective use of these existing resources.

Technical advancement is also making it easier to integrate data from diverse resources. Most database systems are or will be updated to systems that can convert data to commonly available standard formats. This data can then be readily transferred by electronic means to the integrated system.

This proposed plan seeks to capitalize on the existing data and systems while bringing them together in an integrated system, making them more complete, consistent, and accessible.

The plan also addresses the flow, tracking, filtering, and vetting of information from initial reporting, through the relevant agencies and into the repository.

Accessibility of incident reporting systems has improved dramatically in the last few years as information is made available on the internet. However, there is still a great deal of progress that can be made simply by making information available online. This report makes recommendations in this regard that can be implemented in the short term while the integrated system is being developed.

The proposed repository will also include collection of news accounts of incidents. This will serve several purposes. It will provide a check to see if all significant incidents are being reported to the NRC. It can also provide additional information that is not

otherwise being collected, especially incidents that do not fall within the jurisdiction of any particular agency. It may also provide some insight into public and media perception of chemical incidents.

Flow of Information

Current System

Initial federal reporting of incidents is primarily through the NRC. Approximately 30,000 cases per year are reported in this manner. The NRC maintains these initial reports in a database called the IRIS Incident Reporting Information System. The NRC uses three different reporting formats. A standard discharge report, a railroad report and one for oil spills from ships.

The NRC selectively forwards this initial information to approximately 16 other federal agencies and to state agencies. Most of the agencies discussed in this report receive notifications from the NRC. It appears that OSHA and USFA do NOT receive notification. OSHA relies on self-reporting of injuries by the employer. The USFA relies on reporting by local fire departments and Hazmat teams. Some agencies such as ATSDR employ a number of additional sources such as local fire departments, industry, medical providers and news media. The EPA may also collect additional reports from its regional offices, incorporating them in the ERNS database.

The various agencies process portions of this information, conduct investigations, and make reports within the scope of the agency. There is no overall summary or evaluation of the information.

Agencies such as the Mine Safety and Health Administration, Department of Energy and Department of Defense maintain their own separate reporting systems.

A flow chart showing the current flow of information is shown in Figure 1.

Proposed System

The NRC should be the focal point of all reporting regarding chemical incidents. Other agencies that receive independent notifications of incidents should be required to notify the NRC so that the NRC receives a complete set of reported incidents. The database manager would notify the NRC of any incidents that were found through news media and other sources and not previously reported. Every incident could then be followed through the system based on its NRC assigned number.

Each agency would continue to perform its normal functions of collection, filtering vetting, investigation and reporting. The processed information would then flow into the Repository. The Repository manager would perform additional filtering, vetting, translation of non-standard data, and identify and merge duplicate reports. Vetting would include telephone, fax and written follow-ups to confirm and correct data as needed.

The resulting repository would then be made available on-line in a fully searchable system and for download or distribution on CD-ROM in standard formats.

A flow chart showing the current flow of information is shown in Figure 2.

Repository Manager's Functions

The repository manager would play an important role in tracking, filtering, vetting, merging, and translation of data. The protocol is currently under development; however, the different steps involved are expected to be as follows:

1. Tracking Incidents through System
2. Filtering Incidents
3. Vetting Incident Data (including expert appraisal or correction)
4. Merging Incident Data from Various Sources
5. Translating Data from other Sources
6. Comparing News Reports to Government Reporting
7. Providing Access to the Public

All incidents meeting the definition given earlier will be included in the repository. Hazardous substances are all chemicals that due to their toxicity, reactivity, flammability, pressure or temperature present a potential hazard to people, the environment or property. Some specific inclusions and exclusions of incidents from the repository are as follows.

- Inherently illegal activities such as illicit drug manufacturing, arson, and terrorism.
- Residential fires unless caused by natural gas or LPG distribution systems, but excluding an attached appliance.
- Vehicle fires and spills of the vehicle's fuel tanks are excluded. Incidents involving fuel carried as cargo would be included.
- Drug overdoses and poisonings would be excluded.
- Drowning in water would be excluded, unless other chemicals are involved.

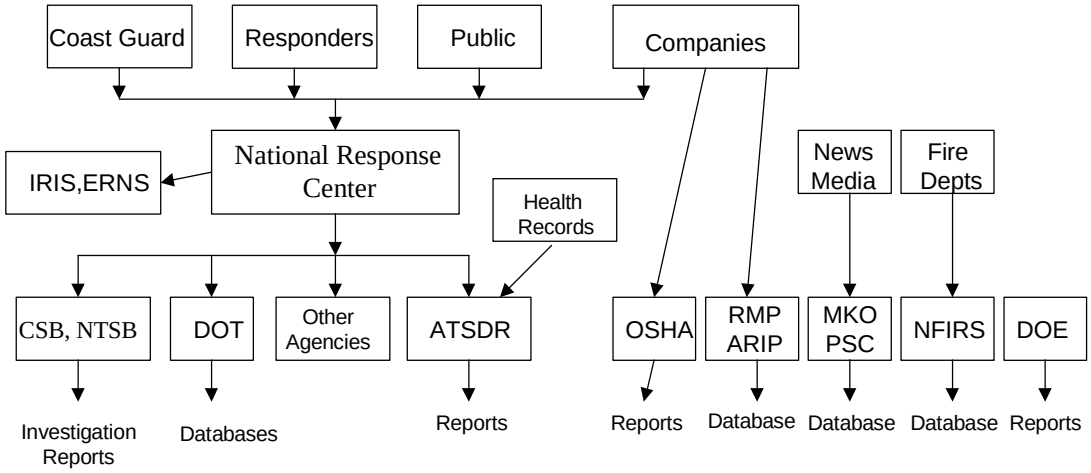

FIGURE 1: CURRENT FLOW OF INFORMATION
NATIONAL CHEMICAL INCIDENT REPOSITORY DEVELOPMENT PLAN

Legend:

IRIS – Incident Reporting Information System
ERNS – Emergency Response Notification System
CSB – Chemical Safety and Hazard Investigation Board
NTSB – National Transportation Safety Board
DOT – Department of Transportation
ATSDR – Agency for Toxic Substances and Disease Registry
OSHA – Occupational Safety and Health Administration
RMP – Risk Management Program
ARIP – Accidental Release Information Program
MKOPSC – Mary Kay O'Connor Process Safety Center
NFIRS – National Fire Incident Reporting System
DOE – Department of Energy

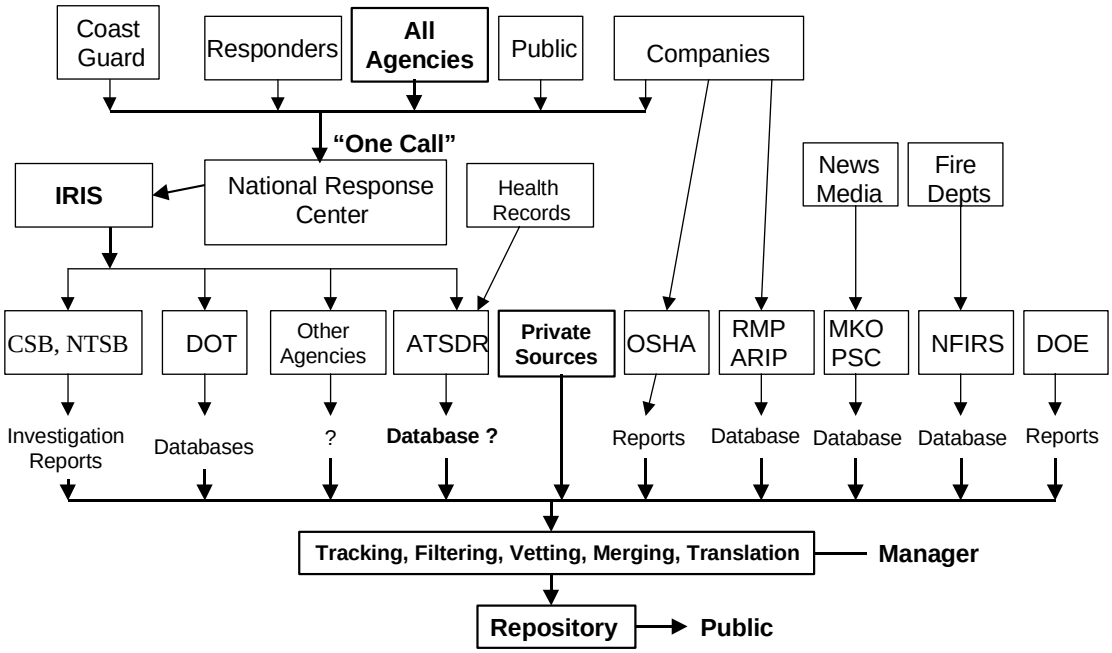

FIGURE 2: PROPOSED FLOW OF INFORMATION
NATIONAL CHEMICAL INCIDENT REPOSITORY DEVELOPMENT PLAN

Legend:

IRIS – Incident Reporting Information System
CSB – Chemical Safety and Hazard Investigation Board
NTSB – National Transportation Safety Board
DOT – Department of Transportation
ATSDR – Agency for Toxic Substances and Disease Registry
OSHA – Occupational Safety and Health Administration
RMP – Risk Management Program
ARIP – Accidental Release Information Program
MKOPSC – Mary Kay O'Connor Process Safety Center
NFIRS – National Fire Incident Reporting System

- Poisoning due to carbon monoxide as a result of poor combustion in a residence or vehicle would be excluded.

- Incidents in private residences involving consumer products used by the occupants would be excluded.

- Mine fires and explosions involving naturally occurring gases would be excluded. An explosion of leaking hydraulic fluid in a mine would be included.

- Incidents on offshore platforms off the US coasts and in the Gulf of Mexico would be included.

- Incidents at government facilities would be included.

- Incidents involving radioactive materials would be excluded unless a chemical reaction caused or significantly contributed to the incident.

- Long term, slow, leakage such as from underground gasoline storage tanks would be excluded.

Conclusions

Identification and establishment of national process safety goals is not a trivial task and should be approached quite seriously with input from all stakeholders. However, this seems to be a unique and novel method to build a consensus approach to improving chemical process safety in the United States. Once goals are established, it follows that activities needed to accomplish those goals should also be established and finally measurement systems to measure progress towards established goals must also be established.

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