INTEGRATED WORKER RISK EVALUATION SYSTEM

C. W. McGinn, Oak Ridge National Laboratory
J. H. Moyer, Ph.D, Oak Ridge National Laboratory
L. D. Bloom, University of Tennessee

ABSTRACT

This paper presents the concept for an integrated web-based system in support of the assessment and information needs associated with worker safety. We believe that there is a need for improvement in DOE's approach to worker risk and that the proposed integrated worker risk system is a sound foundation for continued growth in this area. The theme is that DOE has not been negligent in the area of worker safety, but that the Department is so focused on dealing with the day-to-day concerns that there has been little opportunity to consider issues on a broader scale.

Several key needs in the worker safety area are identified:

- There is a need for accurate predictive models to ensure the selection of the safest cleanup technologies. In addition, there is a need to integrate predictive worker risk models into the decision process to enable the transfer of risk from regulatory endpoints to workers to be addressed.
- The Integrated Safety Management System would benefit from a common support infrastructure and tools to enable worker safety integration to become a reality.
- There are many worker safety databases paid for by the DOE; however, accessing this data for predictive modeling or broader application is difficult. There is no single clearinghouse from which to obtain this information and it is often only available for internal use.

The objectives of a worker risk system are to provide an online repository for resources and applications, as well as the comprehension to identify and address critical data gaps in methods and science needed to improve the assessment process. Specifically, it will provide databases, tools and models enabling the consistent analysis of worker risks associated with exposures and accidents as a result of the implementation of remediation, waste management, or surveillance and maintenance activities.

The online capability to assess risks to workers involved in ongoing operations will enable the information to be easily accessed and provide a platform for the comparison of worker, public and environmental risks. This system would support the DOE mandate to work safely and ensure that risk information is readily available in support of the Integrated Safety Management Process. The importance and timeliness of this effort is emphasized by the fact that many EM facilities are rapidly heading into the clean-up phase when worker risks are drastically increased. There is no better time for such an invaluable tool.

INTRODUCTION

This paper presents the concept for an integrated web-based system in support of the assessment and information needs associated with worker safety. There is currently no single source for information and tools essential for the evaluation of worker safety and health. This system would make available, on-line, much of the data and models necessary for the evaluation of worker safety. We believe that there is room for improvement in DOE's approach to worker risk and that the proposed integrated worker risk system can be the foundation for continuing growth in this area.

This paper first addresses the current DOE approach to worker risk in general terms. This discussion presents the issue of worker risk within the context of operations and the relationship of worker risk to other attributes/impacts of DOE actions. The objective is to point out some likely areas for improvement in the current approach to worker risk. The final section will be a description of the integrated worker risk system and it's benefits to the assessment of worker risk.

CURRENT STATUS OF WORKER RISK

Worker safety is clearly a priority for the DOE. Worker safety is a focus of the Environmental Safety and Health (EH) program and all operations be they Research Laboratories or Environmental Management are made keenly aware of the importance of worker safety issues. As much as the department is doing to safe guard worker health there is room for improvement. The following discussion reviews the worker safety issue relative to the unacknowledged transfer of risk and from a functional and organization standpoint.

Unacknowledged Transfer of Risk

During the past decade DOE has been directed by regulations to protect human health and the environment. There is no debate that this is a noble goal and that DOE has strived to protect these endpoints. As we have moved to the implementation phase of remediation we are faced with the horrific realization that the proposed activities have now become reality and that risks to workers associated with cleanup are just as real. Remediation activities have resulted in multiple injuries and deaths across the complex (DOE Computerized Accident/Incident Reporting Systems). Based on injury rate statistics a significant injury potential is associated with some operations conducted by DOE; to the Department's credit there is an unwavering focus to reduce inherent risks in an attempt to eliminate injuries and fatalities. Many activities that result in risks to workers are clearly mandated by DOE's mission and it is very likely that the best option is to try to reduce those risks as much as possible while continuing operations. On the other hand, there are high worker risks associated with many of the activities conducted in the name of compliance. Does DOE take risks that it should not?

Clearly worker safety is of paramount importance to DOE; however, too often, regulatory requirements seem to devalue this receptor by strongly biasing the decision for cleanup or other action on ecological or hypothetical public risks. This is incomprehensible given the negligible probability and magnitude of risks to ecological and/or public receptors compared to the impacts to the workers conducting compliance related actions.

In line with this regulatory charge is often the unconscious assimilation of an attitude considering worker risk to be accepted as part of "getting the job done". In the past DOE's mission identified very specific activities that must be conducted. Decisions were based on how to get the job done with minimal impact to workers, the public, and the environment. The focus has changed somewhat under the current cleanup mission: DOE is to protect the public and the environment. However, there is need to balance the risks between all endpoints, which includes workers. True there are operations that must be conducted that put workers at risk, however, differentiating between those and activities that are not necessarily mandated has become difficult.

A change in the attitude that compliance means putting workers at risk is a must; however, just as important is to be able to understand the trade offs and balance risk between endpoints. This requires data on future activities, predictive modeling, and the ability to compare risks across various endpoints. At this time there is very little predictive modeling done to help in the evaluation of the risks to workers versus public or environmental endpoints.

DOE Organization and Worker Safety

The size and complexity of the DOE poses problems for the implementation of safety. The functional structure of the Department's organization often means that several divisions are involved in an activity. Although worker safety is considered everyone's business there is a concern that some issues could fall between the cracks. In addition, lack of continuity in worker safety may become a problem as responsibilities are transferred between organizations. The Integrated Safety Management System (ISMS) was introduced in 1996 to address many of these issues.

The Integrated Safety Management System Guide Vol. 1 (DOE G 450.4-1A) states the objective of ISMS as:

> The objective of an ISMS is to incorporate safety into management and work practices at all levels, addressing all types of work and all types of hazards to ensure safety for the workers, the public, and the environment.

To briefly summarize, the focus of the ISMS is documentation that DOE contractors must complete to demonstrate how they will integrate worker, public, and environmental safety. Five core functions are defined in the process: 1) define scope of work, 2) analyze hazards, 3) identify and implement controls, 4) perform work, and 5) feedback and improvement. The guiding principles which help to define the core functions are 1) line management responsibility, 2) clear roles and responsibilities, 3) competence per responsibilities, 4) balanced priorities, 5) identification of safety standards, 6) tailor hazard controls to work, and 7) operations authorizations. Table I shows the relationship between the core functions and guiding principles.

Table I. Relationship Between Integrated Safety Management Core Functions and Guiding Principles

Core Functions	*Guiding Principles*
1. Define Scope of Work	▪ Balanced Priorities ▪ Line Management Responsibility ▪ Clear Roles and Responsibilities ▪ Competence per Responsibilities
2. Analyze Hazards	▪ Line Management Responsibility ▪ Clear Roles and Responsibilities ▪ Competence per Responsibilities
3. Develop and Implement Controls	▪ Identification of Safety Standards ▪ Tailor Hazard Controls to Work ▪ Line Management Responsibility ▪ Clear Roles and Responsibilities ▪ Competence per Responsibilities
4. Perform Work	▪ Operations Authorizations ▪ Line Management Responsibility ▪ Clear Roles and Responsibilities ▪ Competence per Responsibilities
5. Feedback and Improvement	▪ Line Management Responsibility ▪ Clear Roles and Responsibilities ▪ Competence per Responsibilities

In addition, as illustrated in figure 1, there should be cross communication at the organizational level (activity, facility, institution) between the core functions/guiding principles. The product is ISMS documentation at the project or program level describing the implementation of each of the core functions relative to the integration of worker, public and environment and the communication across organizational levels.

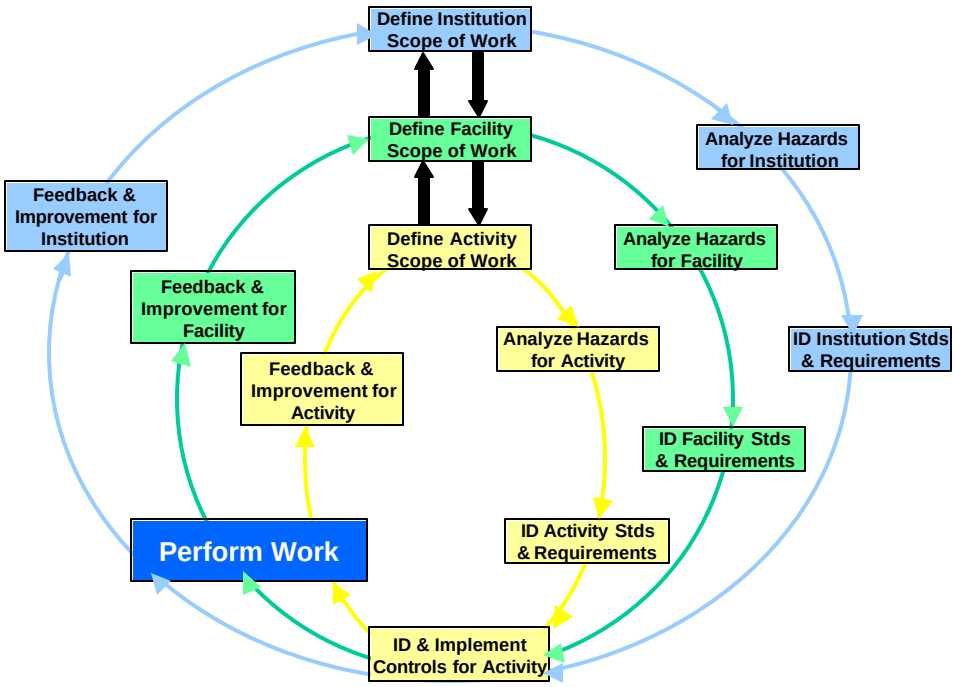

Fig. 1. Interaction Between Organization Level and SMS Core Functions

There is clearly a need for a strategic plan such as ISMS for dealing with safety on a broad scale. The guidance provides an ample level of detail on the required ISM documentation. In addition, the guidance appendices reference many resources that are helpful to completing the core function evaluation and producing the ISM document. However, ISMS is not a physical system, it is a framework of required documentation for the integration of worker safety in all aspects of operation. There is no support infrastructure or tools to aid in this integration process nor is a metric provided that would allow effectiveness to be quantified at various organizational levels. There is no method prescribed that would support the prediction of worker risks or enable risk managers to weigh various risk endpoints within the decision process. Lastly the quality of this type of evaluation is dependent on data and access to information, the ISMS would benefit greatly by a corresponding data resource tool. By means of a similar tool feedback could be made available as a basis for improvement on a complex-wide scale.

Worker Safety Information Resources

The evaluation of worker risk is undertaken to meet different objectives, which are often the responsibility of different organizations within DOE. For example the compliance assessments involving worker risk conducted under the Comprehensive Environmental Resource Compensation and Liability Act (CERCLA) are the responsibility of Environmental Management; however, and the Integrated Safety Management System and Safety Assessment Reports are the responsibility of Environment Safety and Health (EH). As a result, the age-old problem of compartmentalization becomes an issue: there may be little communication between organizations, methods are likely to differ for assessing the same endpoint, duplication of effort, and a lack of continuity to how worker safety is addressed in substantial activities spanning several divisions. This is exacerbated by multiple field offices, which are independent to an extent in the assessment of worker safety. As a result, there are numerous databases and tools that have

been developed by almost every organization dealing with worker risk. Consequently, there is a plethora of information, but it is collected to meet the very narrowly defined objectives of each organization.

Currently access to worker risk information is controlled by individual organizations. There is no clearinghouse that provides links to all or some of this information. In order to provide an idea for the types of information that are available the following section describes a few of DOE's databases that were located on the internet. Most of these are for internal use only.

DOE Computerized Accident/Incident Reporting Systems (CAIRS)

Used as a centralized collection of DOE accident data for users to perform various analyses, including developing trends and identifying potential hazards. Collects and analyzes DOE and DOE contractor reports of injuries, illnesses, and other accidents that occur during DOE operations in accordance with DOE Order 231.1.

Corrective Action Tracking System (CATS)

The CATS is a Web-based database used to maintain the documentation associated with safety assessments. Serves as the DOE's institutional resource for identifying and tracking the closure of issues related to safety management

CEDR (Comprehensive Epidemiologic Data Resource) Program

Most of the data are from epidemiologic studies conducted by DOE-funded researchers as part of the DOE Worker Health and Morality Study. Contains analytic data file sets from health and mortality studies conducted for Fernald, Hanford, Los Alamos, Linde Plant, Mallinckrodt Site, Mount Facility, K25 facility, X10 facility, Y12 facility, OR Site (all 3 facilities), Pantex, Rocky Flats, Savannah River Plant, Zia Plant, and multiple site studies.

DOE Occurrence Reporting Binned Information Trending Tool (DOE/ORBITT)

The DOE/ORBITT is seen as a DOE quality assurance vehicle. The DOE/ORBITT is a web-based trending and lessons-learned tool to provide an analysis and feedback mechanism for the DOE complex for determining the performance of facility management and work controls and to promote continuous improvement in defining and planning work.

Toxic Release Inventory (TRI) Data

DOE sites required to report under EPCRA 313 prepare and submit a Form R on each listed toxic chemical to EPA annually. OEPA receives copies of these reports and performs a Department-wide data analysis.

DOE Performance Indicator Data (PIDS)

Includes data for performance indicators from Occurrence Reporting and Processing System, which include electrical safety, industrial operations safety, transportation safety, radiological events, safety system actuations, inadequate procedures/procedures not followed, safety equipment degradation, near misses and safety concerns, and reports occurrences of releases to the environment.

Occurrence Reporting and Processing System (ORPS)

The Department of Energy's Occurrence Reporting Program provides timely notification to the DOE complex of events that could adversely affect public or DOE worker health and safety, the environment,

national security, DOE's safeguards and security interests, functioning of DOE facilities, or the DOE's reputation.

DOE Radiation Exposure Monitoring System (REMS)

The REMS retains occupational radiation exposure data for all individuals monitored at DOE facilities. This includes DOE personnel, contractors, visitors, and members of the public.

There are many worker safety resources that are not on the web, such as the accident reporting data contractors retain to provide more specific information than what is required by DOE. In addition to DOE information resources on worker safety there are a myriad of databases produced by other government agencies and private companies, many of them in the public sector. However, many of these valuable resources are for internal use or otherwise inaccessible to many involved in worker safety concerns. This information is difficult to locate and there is no single source providing worker safety information.

Conclusions of DOE Worker Safety Needs

Worker safety is given the highest priority by the DOE. There are constant reminders, most recently via Integrated Safety Management, of the importance of safety in all operations. However, the above discussions highlight the need to augment the current worker safety approach.

- There are no predictive models in use nor is the needed data readily available. There is a need for accurate predictive models to ensure the selection of the safest cleanup technologies. In addition, without such models and their integration into the decision process, we are unable to quantify and address the transfer of risk from regulatory endpoints to workers.
- The Integrated Safety Management System provides a vision of how the integration of worker safety should take place; however, it would be beneficial to provide a common support infrastructure and tools to enable this integration to become a reality.
- The organization of DOE requires that each program have it's own worker safety plan and data which are mission-specific. As a result there are many worker safety databases paid for by the DOE; however, accessing this data for predictive modeling or broader application is difficult. There is no single clearinghouse from which to obtain this information and it is often only available for internal use.

Due to the importance of this issue and the very real safety concerns that are faced, it has become customary to turn an introspective eye to the latest practices and constantly evaluate the need for improvement. As part of this review process the DOE Center for Risk Excellence conducted an evaluation of worker safety data resources as part of an effort to develop a site and national summary level report on worker safety. The following bullets are some of the results and conclusions from that evaluation included in *Risk Profiles and National Risk Communication Issues* (DOE 2000):

- Worker safety is a top priority. The trends observed suggest that worker safety will continue to be better in the future. Sites are currently focused on acute problems and solving safety issues as they arise. The desire exists to improve safety in the long-term; however, no comprehensive predictive models are currently being used.

- Significant worker safety related databases exist but are not specific to cleanup activities. Site contractor information is required to augment EH historical data. Some sites, because of their complex organizational structures will require more effort than others to interpret the data. It really depends upon the organizational structure of a site to delineate the worker safety data associated with cleanup activities.

- Different sites tend to use site-specific database management systems to augment CAIRS. The information in these site-specific databases is only available through designated site representatives.

- Data obtained from the CAIRS database is reflective of past operations for each facility. The CAIRS data is not representative of on-going and projected future EM activities. However, actions can be taken based on lessons-learned that will assist in the improvement of safety conditions on site.

These issues do not illustrate the DOE to be negligent in the area of worker safety. On the contrary, the Department is so focused on dealing with the day-to-day concerns of worker safety that there has been little opportunity to consider issues on a broader scale. However, the time has come to look beyond the project, program, or even site level and address those issues that do or will impact worker safety at the broadest level. It is proposed that a web-based integrated worker risk evaluation system would be a sound foundation for such an effort.

INTEGRATED WORKER RISK SYSTEM

An easy to use accessible worker risk evaluation system would be an integral element of the Integrated Safety Management System and DOE's continuing efforts to safeguard worker health and do work safely. It is proposed that this tool be development as an attachment to an established system, the Risk Assessment Information System (RAIS), to take advantage of existing databases and platforms as well as creating a site that provides "one stop shopping" for risk assessment tools. The RAIS is a service-oriented environmental risk assessment expert system, which provides tools essential for performing basic risk assessment activities such as preliminary remediation goals, toxicity values and profiles, Federal and State drinking water guidelines, human health risk models, and ecological benchmarks. The RAIS also provides the latest risk guidance and directs the user to specific EPA and State guidance necessary for performing risk analyses. The RAIS streamlines the risk assessment process and eliminates the need for costly duplication of effort. RAIS users are from nearly every state, many agencies, industries, and foreign countries.

The objectives of a worker risk module are to provide an online repository for resources and applications, as well as the comprehension to identify and address critical data gaps in methods and science needed to improve the assessment process. Specifically, it will provide databases, tools and models enabling the consistent analysis of worker risks associated with exposures and accidents as a result of the implementation of remediation, waste management, or surveillance and maintenance activities.

The creation of a worker risk system has been limited to this time. The planning for this effort has revolved around several key areas that stem from the needs mentioned earlier. These are databases, current tools, predictive tools, comparative risk, and feedback information. There are near and long-term goals associated with each of these development areas. To this point there has been a search for worker safety related data within DOE and the public arena. The intent is, at a minimum, in the near term to link to these resources and others as a clearinghouse for this type of information. Preferably, many of the databases can eventually be obtained and maintained in the worker module in a searchable and downloadable format. A web site has been established within the production area of the RAIS with tools in support of worker exposure risk assessment. Figure 2 is an illustration of how the web page is organized; will include accident risk information and tools in the near future. The development of comparable models to address the transfer of risk is seen as a far-term goal.

The following is an overview of how this system may be used to support and benefit the 5 core functions of the Integrated Safety Management Process. Figure 3 illustrates the specific support applications of a worker risk system to the core functions and various organizational levels of ISMS.

Define Scope

Features:

- User selects activity-specific exposure and accident parameters or to use default parameters based on common activities/technologies at the DOE, Institution, or Facility level.

Additional Benefits:

- Data collected from this tool would provide specific exposure and accident parameters to support the improvement of default parameters used for planning and for the development of predictive worker risk models
- Data rollup by Activity, Facility, and Institution

Analyze Hazard

Features:

- Databases of regulatory standards for screening etc.
- Accident rate databases (Computerized Accident/Incident Reporting System (CAIRS), local site data bases, Bureau of Labor Statistics…..) used with specific risk equations and scope input to determine worker accident risk.
- Models used with online toxicity information to calculate health risk from exposure.
- Evaluation of multiple accident/exposure scenarios

Additional Benefits:

- Provide consistent approach at the Facility, Institution, and/or National level
- Models/Databases supporting the gamut of regulatory drives for work safety (CERCLA, OSHA…)
- Development of models to allow the prediction of risk associated with remediation or other activities for which we do not have sufficient data to model directly.

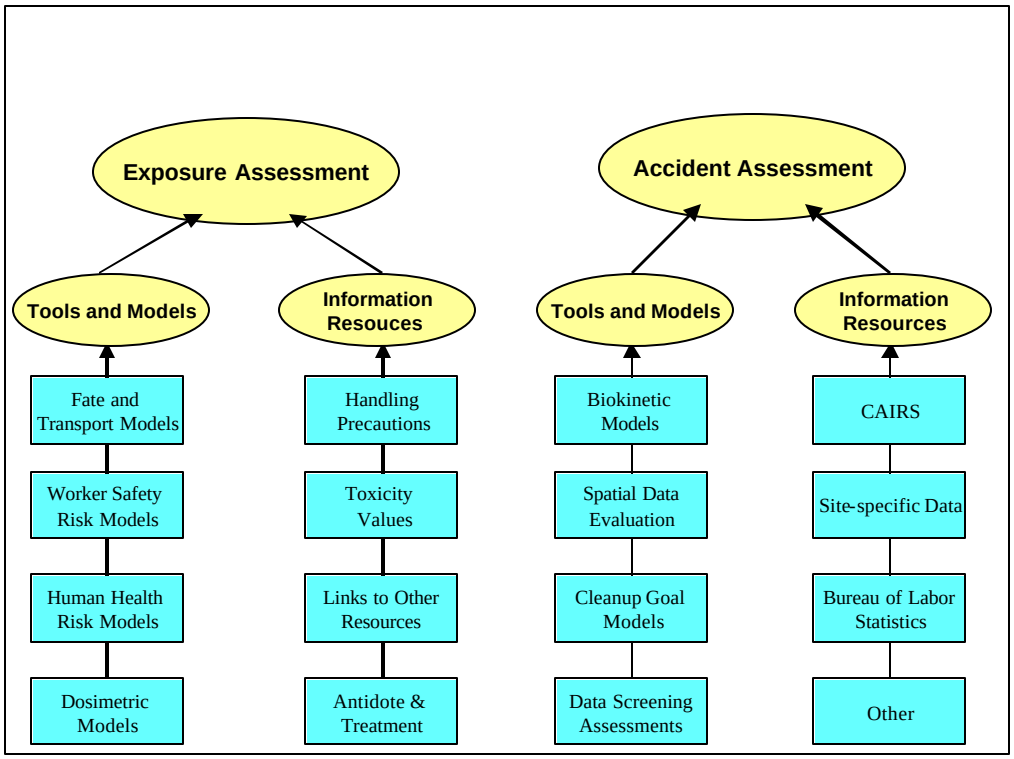

Fig. 2. Overview of Worker Risk Web Site

Core Functions	Activity	Facility	Institution
Define Scope of Work	Determine activities/technologies, identify potential accident/exposure scenarios and receptors	Rollup by Activity	Rollups by Activity and Facility
Analyze Hazards	Provide specific data and tools to support Hazard Analysis,	Provide consistent/standardized approach	Provide consistent/standardized approach
Identify Standards & Requirements	Development of risk-based activity-specific requirements. Database of risk requirements and regulatory standards of frequent activities.	Database of risk requirements and regulatory standards of activities used for screening and guidelines for preliminary selection and cost estimates	Database of risk requirements and regulatory standards of common activities used as mgmt tool
Identify & Implement Controls for Activity	Use of risk tools to evaluate controls to ensure selection of the safest and most cost effective controls	Development of consistent methods for the evaluation to ensure the selection of safest and most cost effective controls. Rollup by Activity.	Development of consistent methods for the determination of the safest and most cost effective controls. Rollup by Activity and Facility
Perform Work	Real time risk information providing feedback during activity	Rollup by Activity	Rollup by Activity and Facility
Feedback & Improvement	Record by specific activity: accident rates etc, to improve worker risk databases. Identify data gaps and needed improvements in approaches, methods and science	Provide quantitation of risk benefits of dollars spent. Rollup of rates by Activity	Risk benefit of $ spent. Data gaps, needed improvements in methods and science with national relevance. Rollup of rates by Activity and Facility

Fig. 3. Incorporation of risk tools into the ISMS

Develop and Implement Controls

Features:

- Databases of regulatory standards
- Development of risk-based activity-specific requirements from hazard analysis:
- Evaluate options for controls
- Selection of the safest and most cost effective controls

Additional Benefits:

- Database of risk requirements and regulatory standards of frequent activities
- Development of consistent methods to ensure the selection of safest and most cost effective controls.
- Data rollup by Activity, Facility, and Institution

Perform Work

Features:

- Real time evaluation during activity

Additional Benefits:

- Data rollup by Activity, Facility, and Institution

Feedback and Improvement

Features:

- Record specific activity accident rates etc, to improve worker risk databases.

Additional Benefits:

- Identify data gaps and needed improvements in approaches, methods and science with site and national relevance.
- Quantify risk benefit of dollars spent.
- Data rollup by Activity, Facility, and Institution

CONCLUSIONS

We believe that there is a need for improvement to DOE's approach to worker risk and that the proposed integrated worker risk system is one step necessary to move in the right direction. A worker risk module maintained by the DOE Center for Risk Excellence would provide a component critical to the comprehensive evaluation of hazards associated with DOE operations. The online capability to assess risks to workers involved in ongoing operations will enable the information to be easily accessed and provide a platform for the comparison of worker, public and environmental risks. This system would support the DOE mandate to work safely and ensure that risk information is readily available in support of the Integrated Safety Management Process. As evidence that such a system would not only make information available but would actually be used, one only need look at the web-based Risk Assessment Information System, which averaged approximately 40,000 users per month.

The benefits from such a system are:

- to ensure tools to evaluate worker risks are accessible to every site,
- ensure the quality of the data and models by putting system under configuration control,
- reduce costs by eliminating the need for duplication of effort for each site to collect this information,
- provide a consistent approach for the evaluation of risks,
- improve the injury databases for use in predictive modeling, and
- data rollups by activity, facility, and institution

The importance and timeliness of this effort is emphasized by the fact that many EM facilities are rapidly heading into the clean-up phase when worker risks are drastically increased. There is no better time for such an invaluable tool.

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