USBM SO122023 MOD. 1B

SAFETY ANALYSIS SYSTEM STUDY

THEODORE BARRY AND ASSOCIATES

USBM CONTRACT FINAL REPORT SO122023 MOD. 1B

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DEPARTMENT OF THE INTERIOR
BUREAU OF MINES
WASHINGTON, D.C.

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Department of the Interior
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CHAPTER 1

INTRODUCTION

Under Modification 1B of Contract No. S0122023 the U. S. Bureau of Mines contracted with Theodore Barry and Associates for the performance of a Safety Analysis System Study to develop a plan for the organization and operation of a "Bureau Safety Analysis Center."

Before the completion of the study, the Bureau established such a center, the Health and Safety Analysis Center (HSAC), under the direction of the Assistant Director of Health and Safety for Technical Support. HSAC is headquartered at the Denver Federal Center, Denver, Colorado.

This study was contracted to Theodore Barry and Associates as a result of an announcement by Health and Safety to form a Safety Analysis Center. This Center is an outgrowth of a recommendation resulting from an Industrial Engineering Study of Hazards in Underground Coal Mining.

APPROACH

A simple concept of HSAC's role formed a foundation for the entire study: HSAC should provide services which will improve the decision-making processes of health and safety decision-makers. This means that HSAC's outputs should not be ends in themselves. The only sound justification for HSAC's existence is to improve mining safety—to prevent accidents and to save lives. HSAC cannot improve safety by itself, but the users of HSAC's services can. Many of these users are health and safety decision-makers—that is, they take actions which can result in improved mining health and safety.

Within this concept of HSAC's role, an assessment of any of HSAC's services must be made primarily on the basis of their value as inputs to the decisions of these users. More specifically, for each potential HSAC acitivty we should ask: "What health and safety decision-maker might act differently because of information produced by this activity?" and "How might this activity affect a user's health and safety decision?"

Theodore Barry and Associates utilized this approach throughout the study. In defining user requirements, we began by asking potential users what services (data or analysis) were desired. Next, we asked the more critical questions: "What decision processes would these services support?" and, "What should be the function of the services in these processes?" User needs, determined in this way, provided the basis for the entire design of HSAC's organization, operations, and outputs.

SUMMARY OF RECOMMENDATIONS

Most of this report is devoted to our recommendations for HSAC. These recommendations concern all aspects of HSAC's role, organization, and activities. They vary in generality from the objectives and policies presented in Chapter 5 to the details of the report formats contained in the appendices.

To aid the reader in understanding our recommendations as they are developed throughout the report, we present below a partial summary of our recommendations for the new organization.

Organization Structure

The recommended structure consists of the Chief, HSAC, and four branches. These branches and their roles are:

Branch	Staff Size	Role
Accident Information	28	Gather, process and publish statistics.
Special Studies	11	Analyze data and conduct field studies.
Systems Evaluation	4	Formulate recommendations
Program Assurance	6	Coordinate work of other branches

With six additional staff members in the HSAC Administration group, the recommended staff total is 55.

Outputs

HSAC should fulfill the accident information needs of its users through four kinds of outputs:

1. Special Studies—major research efforts reporting on causes, circumstances, and potential improvements relating to specific accident categories.

2. Responses to Special Requests—reporting of specific accident information on a one-time basis.

3. Limited-Distribution Publications—two quarterly reports (one for coal, one for metal and nonmetal), and one monthly fatality report (covering all mining). All three reports should be distributed only within the USBM (or state agencies).

4. Broad-Distribution Publications—two quarterly reports (one for coal, one for metal and nonmetal), distributed to all interested parties.

Essential Operational Requirements

For HSAC to fulfill its role, it must provide current, relevant outputs in each of its four output categories. For this to be accomplished, HSAC must:

1. As rapidly as possible, establish its role within the Bureau and obtain recognition of that role at all management levels. This will enable users to take best advantage of the services HSAC offers.

2. Streamline its data collection and publication processes.

3. Maintain continuous contact with users of HSAC outputs to ensure the relevancy of those outputs.

CHAPTER 2

AN AUDIT OF OBJECTIVES, POLICIES, AND ORGANIZATIONAL ROLES OF THE OAA

Chapters 2 and 3 are the results of Tasks 1, 2, and 3 of the Safety Analysis Systems Study under Modification 1B of USBM Contract S0122023. These chapters are essentially a duplication of the Interim Report: Organizational Audit of the Office of Accident Analysis submitted April 1, 1972, as part of that contract.

Tasks 1, 2, and 3 of the study are, as the title of the interim report indicates, an organizational audit of the Office of Accident Analysis (OAA). An organizational audit is a descriptive report to management of how an organization functions—its objectives, policies, roles, and day-in-day-out activities. The audit is a summary picture of what currently exists, providing the signposts and insights for future changes and improvements.

In addition, the audit serves as a benchmark against which future changes may be measured.

It is worth repeating that an audit is essentially descriptive and not normative —it tells what is happening rather than what should be happening. The remaining chapters of this report will constitute the "should be" portion of our findings. However, it is difficult to separate description and analysis completely, and some evaluations are contained in this audit. Similarly, the reader will find himself making judgments about how this or that should work as he reads how it does work. If the reader reacts in this manner, then the audit is performing its function—highlighting areas of potential improvement and increased effectiveness.

While Theodore Barry and Associates was conducting this audit, the Office of Accident Analysis and the entire Bureau of Mines was experiencing substantial reductions in manpower and organizational redesign. Recognizing this environmental change, the Assistant Director of Health and Safety for Technical Support determined that the audit should focus upon the functions and operations of the Office of Accident Analysis as it existed prior to interim modifications. This provides a measure against which both interim and final changes (resulting from this study) may be compared.

This chapter, Chapter 2, is an audit of the objectives, policies, and roles of the Office of Accident Analysis. Chapter 3 is an audit of the OAA's activities.

APPROACH

Nearly every formal organization has a set of official objectives designed to explain the organization's reason for existence and to identify its roles, responsibilities, and functions.

In contrast to formal objectives, every organization tends to develop informal objectives, roles, and functions. These may differ somewhat from formal objectives for two reasons:

1. Formal objectives are static. But organizations tend to change, shifting attention and emphasis as new problems and situations arise and old ones dissolve.

2. Organizations and the relations among organizations are social relationships, affected by the character, personality, and intelligence of the people involved. This human side of organization is difficult to capture in formal objectives and policies.

The Office of Accident Analysis (OAA), like most organizations, had developed a series of informal objectives, policies, and roles which supplemented—and in some cases, conflicted with—its formally defined functions.

In cases of conflict, further analysis may show that either formal or informal guidelines—or both—are in need of revision. In any case, this section describes only what Theodore Barry and Associates has found to have been existing organizational guidelines, both formal and informal. Our recommendations of how these should be revised to improve the accident analysis function of the new Health and Safety Analysis Center (HSAC) will be discussed later in this report.

The various formal and informal organizational guidelines adopted by the OAA are summarized in the matrix below, and are discussed in the following pages.

OFFICE OF ACCIDENT ANALYSIS: SUMMARY OF ORGANIZATIONAL GUIDELINES

	Formal	Informal	Formal/Informal Conflict
Objectives	X	X	Moderate
Policies		X	None
Roles	X	X	Significant

OBJECTIVES

Formal

Part of 115.4.1 of the Departmental Manual (dated June 21, 1971) outlined the formal organizational objectives of the Office of Accident Analysis. In summary, these were:

- to analyze the cause, frequency, and manner of accidents;
- to analyze events and practices that contribute to accidents;
- to analyze the principal hazards associated with accidents;
- to publish information concerning the analysis of accident data.

As is evident, these formal objectives were stated in broad, general terms, leaving considerable room for management interpretation. They emphasized two primary functions—analysis of accidents and publication of accident information.

Informal

Informal objectives within OAA emphasized three functions. In order of significance, these were:

- to maintain a complete and accurate historical data base of accident statistics;
- to respond to external queries for accident information quickly and accurately;
- to maintain the regular, periodic production of established reports.

These informal objectives are explained below.

- Maintenance of a Complete and Accurate Data Base. Almost all OAA activities emphasized importance of developing and maintaining as complete and accurate an accident data base as possible for use in future reference and research. Incoming manhour and production figures were cross-checked with other sources external to OAA; all incoming reports from thousands of mines were individually checked to insure correct reporting procedures. In each case where incoming data from an individual mine was incomplete, an attempt was made to "work backwards" from commodity figures to arrive at production estimates, etc; ADP error lists were manually checked by reviewing each entry and cross-checking it with the corresponding entry on the total transaction list.

  These examples indicate the emphasis placed upon the development and maintenance of data files. The very significant amount of time and manpower devoted to these tasks is outlined in the Report Production Audit described later in Chapter 3. In summary, the emphasis was on the collection, storage, and maintenance of accident data, rather than upon the manipulation and analysis of that data.

- Responsiveness to External Queries. The Office of Accident Analysis viewed the prompt response to requests for accident information as one of its most important functions. Such requests originated from both within the Bureau, and from outside sources, such as Congressmen, commercial mining publications, state mining bureaus, students engaged in independent research, etc. As the Report Production Audit in the next chapter indicates, a significant amount of time and manpower was devoted to researching accident data files in order to respond to external queries.

- Maintenance of Production of Established Reports. The format and content of most OAA publications have changed very little from year to year. OAA assumed that, in the absence of criticism or recommendations for change from recipients of a publications, major modifications were not appropriate. Over the years, OAA had received very few criticisms or recommended changes from its customers. Consequently, the organization's attention and interest were devoted almost solely toward ensuring the continued production of established publications. OAA management time and energy were focused almost entirely upon overcoming recurring report production and publication problems, with little attention given to the reexamination of the continuing relevance, effectiveness, and usefulness of current products.

Conflicts Between Formal and Informal Objectives

The major formal-informal objectives' conflict lies in the formal emphasis upon analysis and the informal emphasis upon the collection, storage, and production of accident statistics, with no emphasis upon the analysis function —i.e., accident analysis versus accident statistics. The informal emphasis on report production, however, did coincide with the publications' function outlined in formal objectives.

POLICIES

Formal

No formal policies existed to guide the Office of Accident Analysis in the day-to-day conduct of its activities.

Informal

In the absence of formal policies, a set of informal policies evolved within OAA to supplement broad objectives and to serve as management guidelines in fulfilling the organization's responsibilities. Some of these were explicit policies consciously recognized by OAA management, while some were implicit in the way OAA functioned on a daily basis. OAA informal operating policies were:

- An OAA publication will be general and broad enough to meet the information needs of a wide variety of using groups, both inside and outside the Bureau of Mines.
- Industry is the primary user of OAA publications; consequently, empahsis will be placed upon satisfying external user needs.
- It is important to develop a complete and accurate data base for historical purposes; ensuring the completeness of accident data is more important than timeliness in publishing data.
- Written publications are the most effective means of conveying accident information to most users.
- OAA publications will be provided to users external to USBM only by request. Initiating a request for an OAA publication gives some indication that the recipient finds the information important and useful.
- The Office of Accident Analysis' main job is to publish accident statistics. OAA resources are organized and managed primarily to ensure the successful fulfillment of this responsibility—i.e., the regular production and publication of established reports.
- All special requests for information are given high-priority in the allocation of manpower.

Conflicts Between Formal and Informal Policies

Informal policies within OAA evolved in the absence of formal policies. Consequently, no formal-informal conflict existed. However, the lack of policy emphasis upon data analysis conflicted with the emphasis on analysis outlined in formal objectives.

ROLES

Formal

Part 115.4.1 of the Departmental Manual stated that the role of the Office of Accident Analysis was that of providing assistance and support to the Deputy Director, Health and Safety in the performance of his assigned functions, which are:

- to formulate and revise mandatory operation and equipment standards;
- to make recommendations to the Secretary on new Health and Safety standards;
- to ensure industry compliance with Federal regulations;
- to provide education, training, and technical assistance to improve health and safety conditions and practices.

Although Part 115.4.1 was published before the reorganization which assigned OAA to the Assistant Director, Technical Support, the new organizational arrangement does not necessarily affect OAA's (HSAC's) formal role of providing support to the Deputy Director.

Informal

Informally, the Office of Accident Analysis saw its primary role as that of a Public Information Office for Accident Statistics. The emphasis upon general information publications designed primarily for users external to the U.S. Bureau of Mines was evidence of this perceived role.

Conflict Between Formal and Informal Roles

The conflict in this case was significant. The formal role of providing support to the Deputy Director, Health and Safety in fulfilling his regulatory, enforcement, and education/training responsibilities implies a significantly different approach to the development of accident data than does the informal role of providing accident information to the industry and public at large. The difference in these roles is illustrated in the following diagrams.

FIGURE 1

OFFICE OF ACCIDENT ANALYSIS: FORMAL ROLE

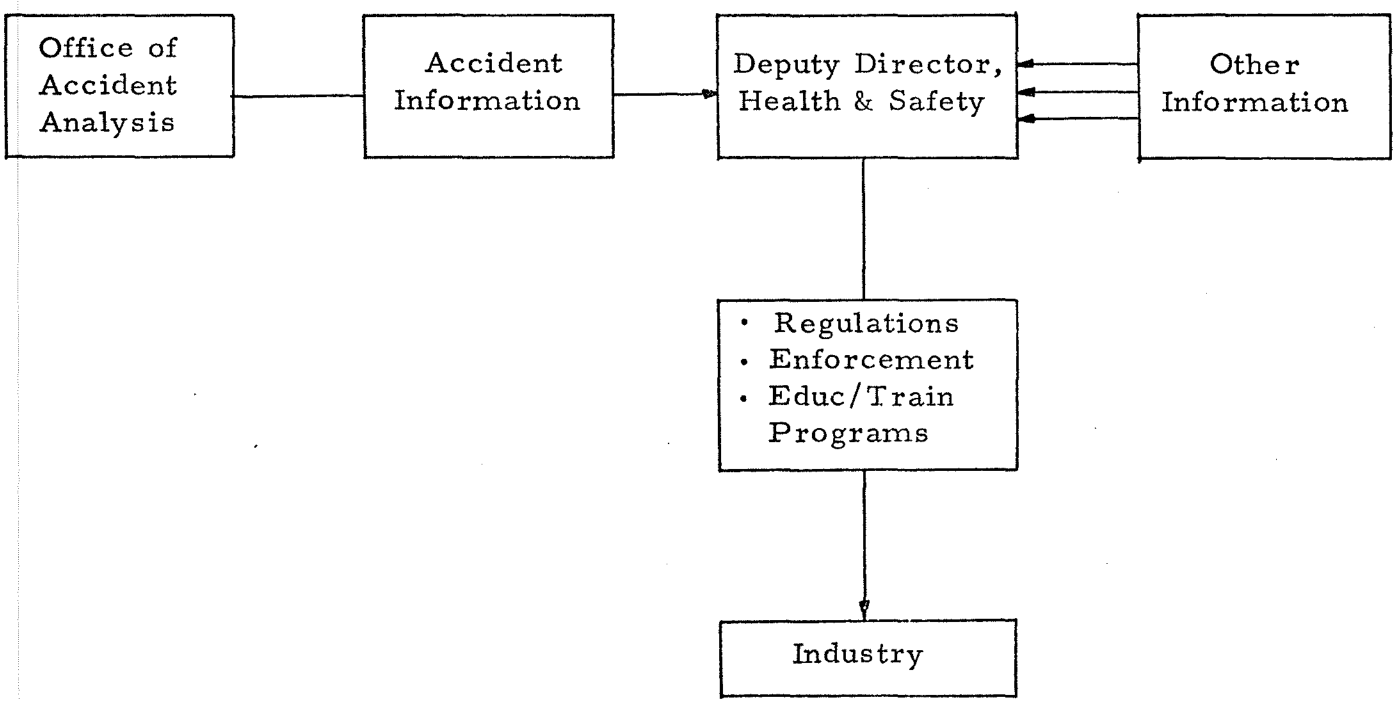
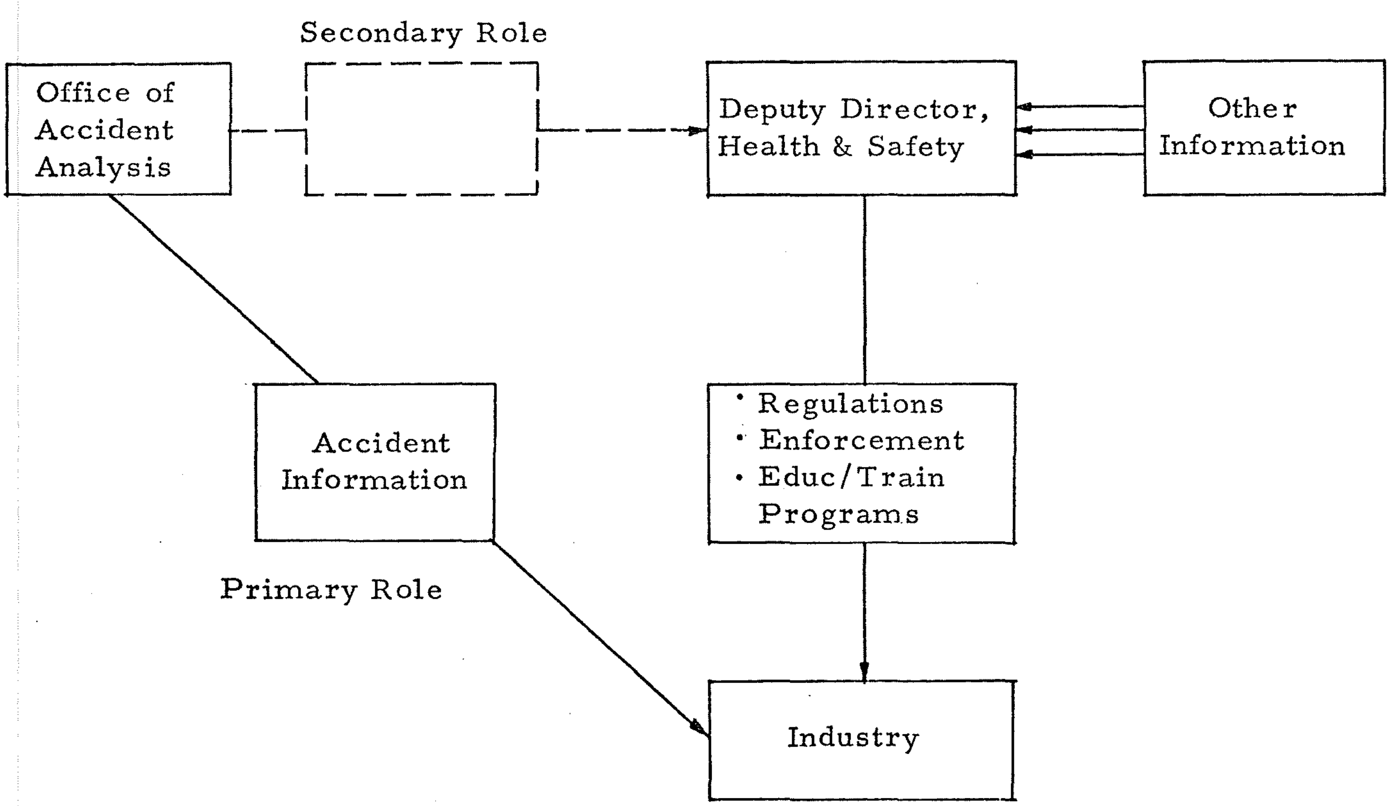


FIGURE 2

OFFICE OF ACCIDENT ANALYSIS: INFORMAL ROLE



As Figure 1 indicates, the Office of Accident Analysis, according to its formal role, provided an input into the Deputy Director's decision process. However, in its informal role OAA information was not a significant input into the Deputy Director's decisions on health and safety issues.

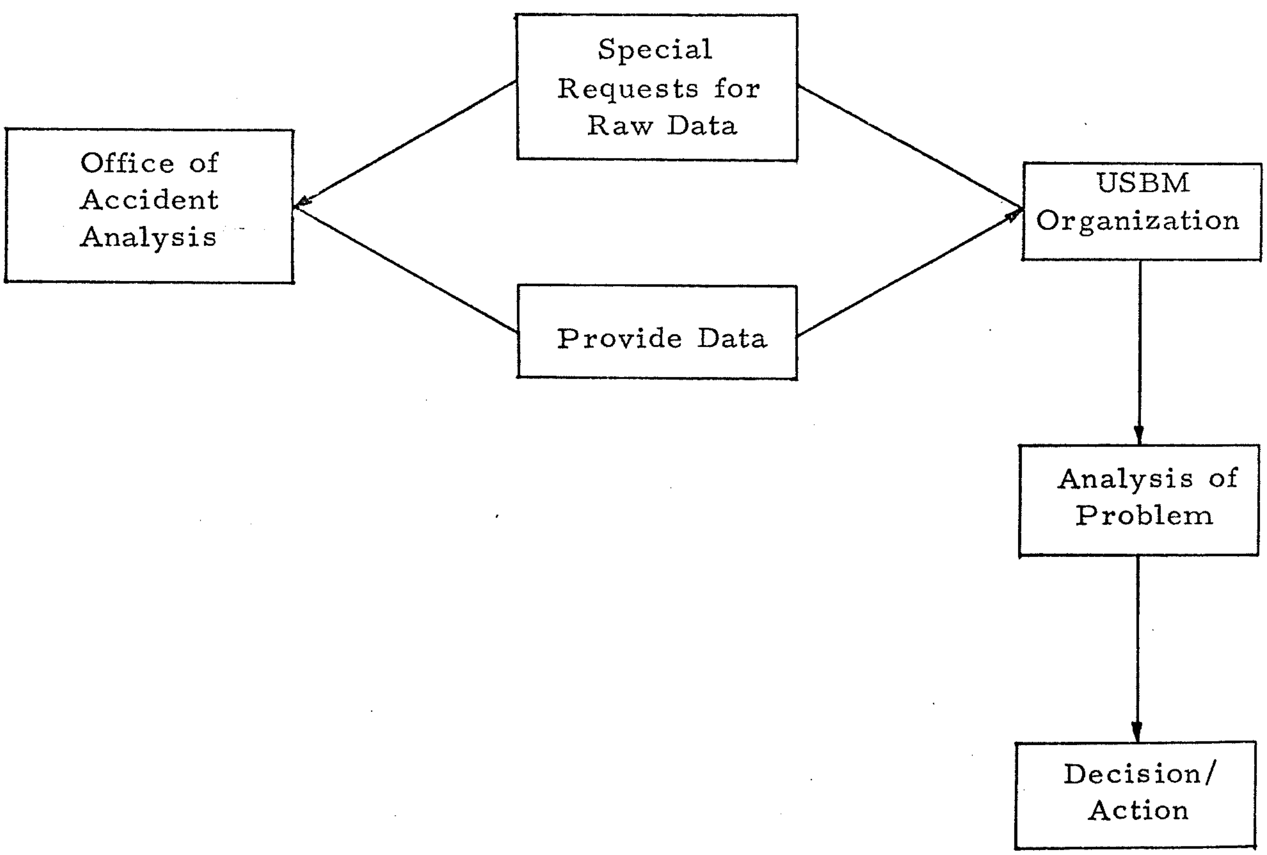
In the absence of such an input from OAA, one might expect decision-makers within Health and Safety to have developed other sources of accident analysis in order to make informal judgments on certain health and safety problems. This is, in fact, what actually has happened. Theodore Barry and Associates has found that instead of the formal system outlined in Figure 1, accident analysis is performed within Health and Safety and within the Bureau of Mines as a whole in several different ways.

Data Analysis Performed By Other USBM Organizations

The organization interested in performing the analysis used OAA in its function as an historical data bank by requesting relevant statistics, and then using these raw statistical data to perform its own analysis:

FIGURE 3

DATA ANALYSIS PERFORMED BY OTHER USBM ORGANIZATIONS



- Example. The Staff Associate to the Director was concerned about the increased likelihood of coal-dust explosions during the fall-winter dry season. He knew that experienced miners had a general feel for the period in which explosions occurred, but he wanted to determine whether it was possible to fix the period more precisely in terms of a certain number of days or weeks. His office requested dates from OAA concerning the number of injury-causing explosions occurring over a twenty-year period, and performed its own analysis.

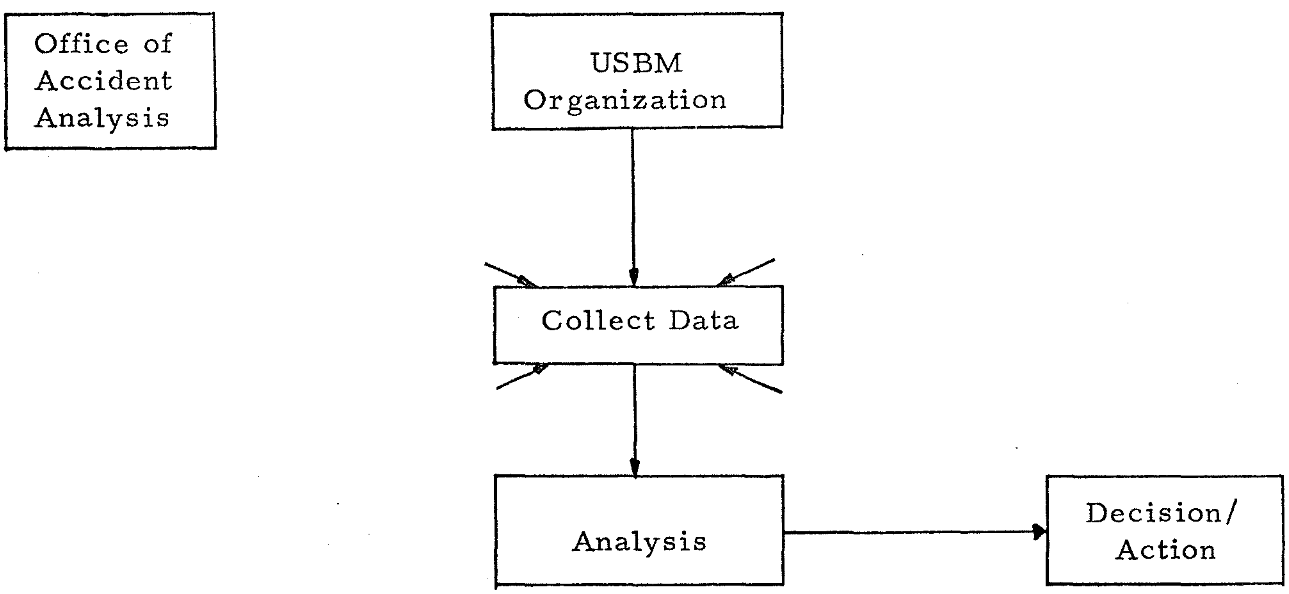
  It is significant that most USBM users of accident data which fit the above description did not use the data they received in regular OAA publications to perform their analyses, but relied instead upon special requests.

Data Collection and Analysis Performed by USBM Organization

The organization both collected data and performed analysis using its own internal resources:

FIGURE 4

DATA COLLECTION AND ANALYSIS PERFORMED BY USBM ORGANIZATION



- Example. Metal and nonmetal inspectors reported on recent fatalities in their districts at monthly inspector meetings and an assessment was made of current problems and trends.

Data Collection/Analysis Performed by Contractor

The organization retained an outside contractor to collect required data, or to perform the analysis of data maintained by OAA, or both:

FIGURE 5A

DATA COLLECTION PERFORMED BY CONTRACTOR

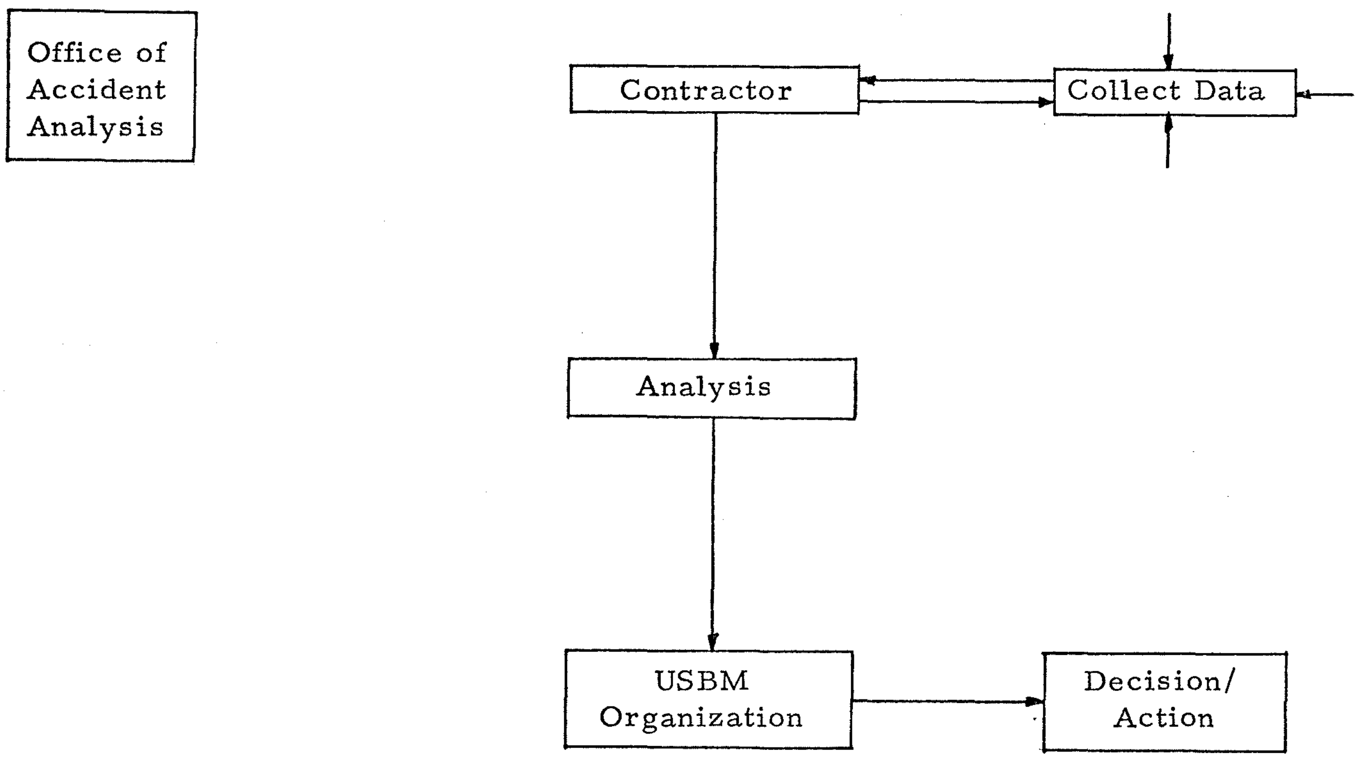
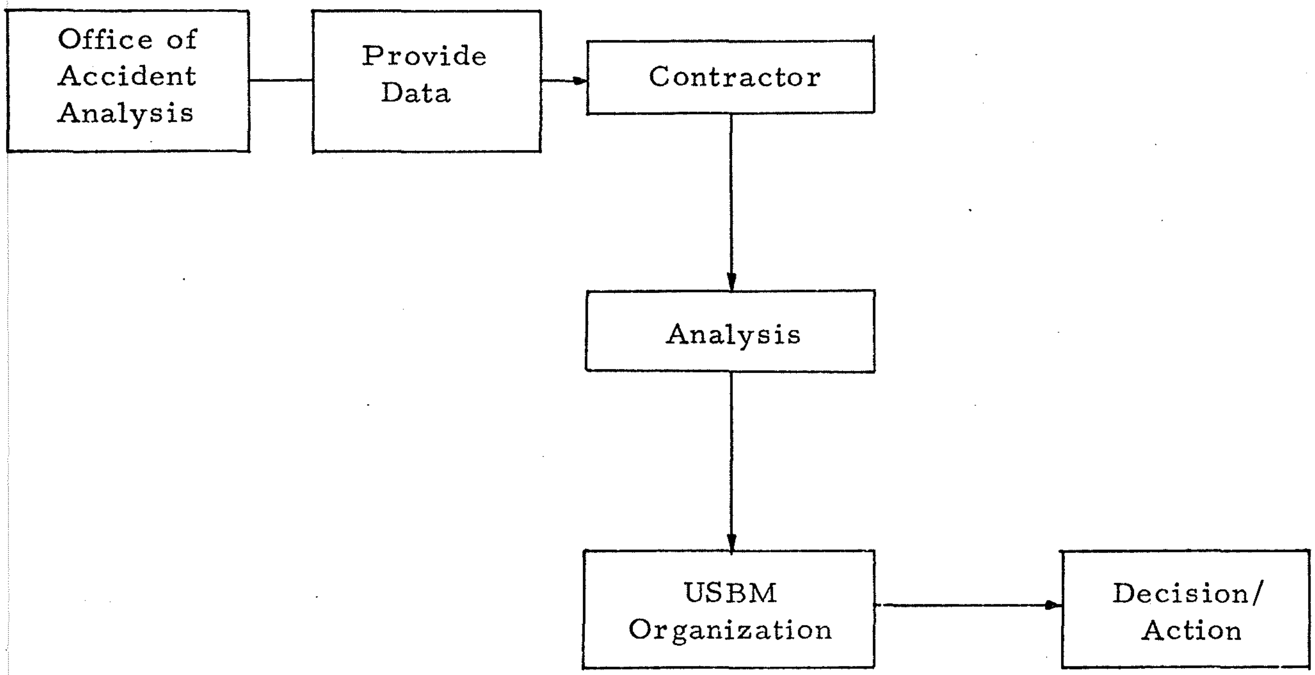


FIGURE 5B

DATA COLLECTION/ANALYSIS PERFORMED BY CONTRACTOR



- Example. Mining Research contracted Theodore Barry and Associates to perform an analysis of relevant variables associated with five years of fatal accidents, 1966-1970

SUMMARY AND CONCLUSIONS

Our audit of Office of Accident Analysis operations has led us to define three key management issues which affected the organization's objectives, roles, and policies and determine how it functioned in relation to other USBM organizations:

1. production of statistics rather than analysis of statistics;
2. service to industry rather than service to USBM;
3. completeness of data rather than currency of data.

Each of these issues involved a trade-off of some sort. In no case has the Office of Accident Analysis completely embraced one side of an issue to the total exclusion of the other side. It is, instead, a question of emphasis, and in each case we believe the emphasis to have been rather strong.

In each case, the decision to emphasize one direction to the de-emphasis of the other (e.g., external service rather than internal service) appeared to have been the result of a process of historical development rather than a conscious judgment at a single point in time.

While these decisions may have served USBM well in the past, we do not believe they can continue to fulfill the Bureau's accident information requirements in view of its anticipated needs. The survey of user needs which Theodore Barry and Associates has conducted indicates that in the case of each of the three issues outlined above, positive action should be taken to reverse the OAA emphasis. In other words, on the basis of what we have learned about user needs, we believe the emphasis should be as follows:

1. analysis of statistics rather than production of statistics;
2. service to USBM rather than service to industry;
3. currency of data rather than completeness of data.

The description of user needs which Theodore Barry and Associates has developed as the result of Task 4 (Chapter 4) of the current contract documents the need for these changes in emphasis. In addition, these changes necessitate revising organizational objectives, policies, and roles—which are discussed in Chapter 5.

CHAPTER 3

AN AUDIT OF PRODUCTION ACTIVITIES OF THE OAA

To satisfy the requirements for Tasks 2 and 3 of the Safety Analysis Systems Study, Theodore Barry and Associates performed a production audit of all reports and statistics generated by the Office of Accident Analysis. To conduct this audit, we interviewed all key OAA personnel both in Washington and Denver to determine how and why the reports were actually produced.

Our questions were concerned with the following:

- history of the report, the significance of the content of the report;
- the steps involved in producing the report;
- the time and manpower required to complete each production step of the report;
- the procedure for resolving the problem of late incoming data;
- the method of estimating injury, production, and employment figures when gaps occur in actual data;
- OAA's estimate of the primary users of the report.

GENERAL

The Office of Accident Analysis internally prepared sixteen different publications. Additionally, the OAA contributed injury statistics to six annual publications produced by other organizations, and maintained three standing special requests for injury data.

Of the twenty-five regular reports and requests in which OAA generated data appeared, approximately ninety percent of the data gathering and report preparation time was spent on three types of publications: (1) the monthly Coal Mine Fatalities; (2) the monthly Coal Mine Injuries and Worktime; and (3) the yearly Information Circulars. The data for the other reports was primarily offshoots of the basic data gathered for these main reports, and required a minimum effort by the OAA staff to prepare.

The majority of the data generated for the above publications and requests came from the various Injury and Employment forms that were distributed by the Bureau to the mining industry, which the companies were required to fill out and submit annually. Coal operations with more than twenty employees were an exception to this annual reporting, and were required to submit the forms every month.

Supplementing the data from the Injuries and Employment forms was data gathered from state surveys and reports, mine inspection reports, and USBM's Mineral Supply-Commodity Division. How and why these various data sources were used will be explained later when the individual reports are reviewed.

The majority of our effort on the production audit was analyzing the reports which occupied the bulk of the OAA's time. The three time consuming reports—the monthly Coal Mine Fatalities, the monthly Coal Mine Injuries and Worktime, and the yearly Information Circulars will be outlined in detail, while the other reports will be covered more briefly.

SCHEDULING

Internal schedules for timely publication of OAA reports were almost non-existent. The only two publication deadlines that the OAA tried to maintain were for the Coal Mine Fatalities (CMF), monthly (ten days after the reporting month), and Coal Mine Injuries and Worktime (CMI), monthly (sixty days after the reporting month). The completion dates for tables of data that the OAA developed for outside publications were not dictated by the internal organization, but by the various agencies and departments requesting the information. All other reports had secondary completion priorities which followed the CMF, CMI, and the requirement to respond to special requests.

The publications that bore the brunt of this schedule slippage were the yearly Information Circulars. Besides the inherent difficulties in getting the Information Circulars published, other delays and slippages compounded the lateness of these annual reports. These delays will be discussed when the Information Circulars are analyzed later in this chapter.

COAL MINE FATALITIES (CMF)

The CMF was published monthly by the Office of Accident Analysis. It was one of two monthly reports (the other being Coal Mine Injuries and Worktime) that had top priority for completion. The CMF was published approximately on the tenth day after the end of the reporting month.

Of the three reports that take ninety percent of the OAA's report preparation time, the CMF required the least amount of time. Unlike the other two reports, the CMF only showed data on fatalities and did not include injuries. By having to show only current fatality data, the inordinately long collection, editing, and coding steps needed to record injury data were eliminated.

Collect Data

- Process. The two pieces of raw data needed to publish the CMF were fatalities and monthly production fugures. The fatality data was current, as a coal operator is required to notify the Bureau immediately each time there is a fatality at his mine. Therefore, all the fatality-related data —cause, state, and location—that is needed for the publication was ready immediately at the end of the month. The production data was supplied to OAA by the Bureau's Division of Fossil Fuels. It was an estimate of the month's production and not a final published figure.

- Time. The time to collect the data for the CMF was difficult to determine, since it was a continual process throughout the month. Based upon our observations, a good estimate of the total time and manpower would be one GS5-9 working approximately two days.

- Delays. Because of the simplicity and currency of the CMF data, there were no delays in the collection of these data.

Develop Tables

- Process. Six tables appear in the CMF. The tables were basically a listing of the raw data in different forms. In addition to the raw data, only simple calculations of fatality rate and estimated manhour figures were needed to complete the tables. The data was transferred from the raw form to worksheets before being finalized on the tables that appeared in the CMF. The tables were then checked and typed.

- Time. The time to transfer the data from the raw form to the final tables normally took two GS6-9's one to three days. Again, due to the simplicity of the report, this process time was short. Once the tables were in final form, they took one GS 5 about two days to type.

- Delays. No appreciable delays were encountered in developing the tables.

Write Text and Publish

- Process. The text was written immediately after the tables were completed, and was essentially a written summary of some of the main points or highlights of the tables. The text was typed upon completion of writing, edited, and sent to Pittsburgh for printing along with finalized tables.

- Time. The text took one GS 9 only one day to write, since the format was reasonably standard. The typing of the text took one GS 5 about one-half day. The process of mailing the finished report to Pittsburgh for printing and distribution took approximately seven days.

- Delays. No delays were normally encountered in this part of the production process.

Content

The CMF displayed data in tables on fatalities, fatality rates in terms of million manhours and million tons of production, and fatality cause, location, and state.

The text of the report summarized various points in the tables; it covered some comparative data, but there was no analysis.

Summary and Comment

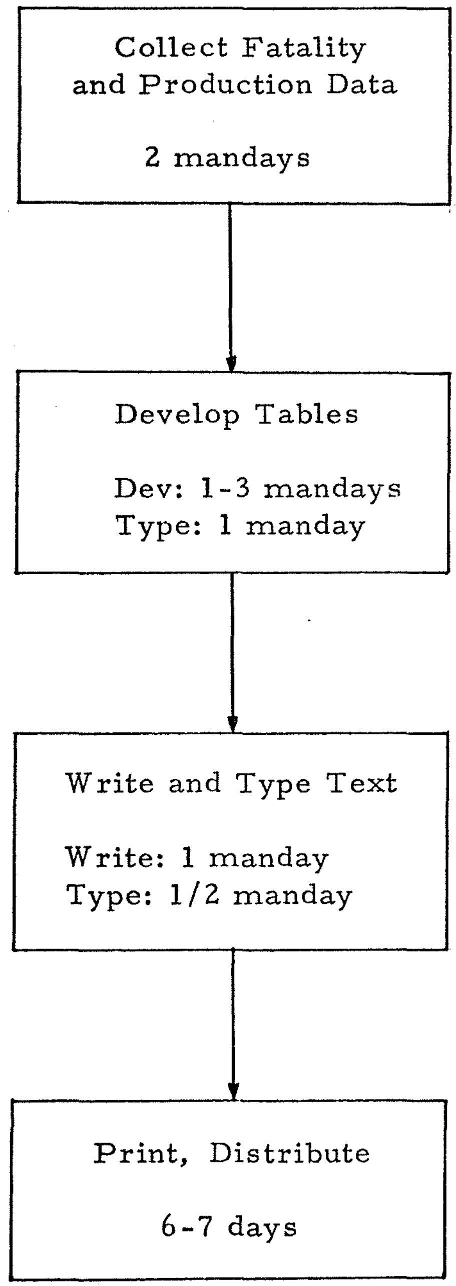
The CMF was the OAA's most effective publication in terms of displaying current data. Even so, there were questions that arose about the frequency of publication and the contents.

First, fatality frequency on a monthly basis is so low that it is questionable whether any meaningful analysis or trend identification could be performed because of statistical insignificance. For example, the frequency rates tended to deviate widely from month to month, making trend assessment virtually meaningless. Analysis of fatality data in a quarterly (or even semi-annual) publication would have far more meaning.

Second, the salient contents were essentially duplicated in the text. Therefore, consideration should have been given to eliminating the textual part of the report, or replacing it with some type of narrative analysis.

EXHIBIT 3-1

FLOW CHART: COAL MINE FATALITIES (CMF)



COAL MINE INJURIES AND WORKTIME (CMI)

The second monthly publication that the OAA turned out was the CMI. The CMI was published approximately two months after the end of the reporting period. The long delay between the end of the reporting period and the actual publication was due to the problems and process of gathering the raw data, and the process of developing the tables.

It was difficult to separate the production activities involved in preparing the CMI and the yearly Coal Information Circulars (IC). The injury and employment data was gathered for both publications at the same time and from the same source. The two main differences between the publications were that one came out monthly and had seven data tables (CMI), while the other publication came out yearly and had fifty-three data tables (IC).

Collect Data

- Process. The data collection process of CMI's started by sending out monthly Injuries and Employment forms to all anthracite, bituminous coal, and lignite mines that employed "twenty men or more on any day during the calendar year". The mine operators filled out the Injuries and Employment form, as well as one Employer's Report of Coal Mine Injury form for each nonfatal injury, and returned the forms to the Bureau by the fifteenth day of the following month.

  Two problems arose that tended to lengthen this data collection process.

  First, many of the reports that came in were not completely and/or correctly filled out. As a result, OAA personnel completely edited all forms before coding the injuries. The production and employment figures were checked by calculator to determine if they were reasonable. If any discrepancies were found, the company was usually notified so that the problem could be resolved in the future.

  The second problem was that many companies did not report by the required date (the fifteenth day of the month). In such cases, OAA contacted the company by mail or phone to remind them of their delinquent report.

  To remain on schedule, the latest that the last batch of edited and coded reports should have been sent to keypunch in Denver was about the thirty-fifth day after the end of the reporting month—or a full twenty days after the Bureau requests all reports to be in. The date which this last batch was mailed to Denver depended on the percentage of total reports received and the rate at which they were being received.

All computer printouts were returned by Denver to OAA, checked for errors, and all errors returned to Denver in the next batch of reports. Any reports received after the last batch was sent to keypunch would be included in the next month's CMI.

- Time. There were approximately 900 companies that had to report injuries and employment on a monthly basis. Theodore Barry and Associates estimates that it took .4 hours to edit and code an average Injuries and Employment form and all accompanying injuries. This .4 hours did not include any extra time needed to contact companies for second requests or other related work.

  So, to expand the .4 hours to a more realistic figure, we estimated that about eight people out of a staff of twelve spent ninety to ninety-five percent of their total time editing, coding, and performing related work on Injuries and Employment forms—or sixty to sixty-three percent of total staff time (90 to 95% x 8 ÷ 12). This included both the monthly and yearly reporting. The turnaround time for data processing of these reports in Denver was about ten days.

- Delays. Significant delays were inherent in this system. Many forms were not properly filled out when they were returned to OAA; many operators did not report within the required period of time. OAA's desire for almost 100 percent coverage of all reports was a significant delay in the timeliness of the report.

Develop Data Tables

- Process. Four worksheets were used to transfer the raw injury and employment data to the final tables. The last computer printout from data processing was the "matched run" of all mines reporting the current month matched against all the same mines reporting the previous month. The matched run report served as a basis for estimating the employment data. The percentage differences in matched employment figures from the previous month to the current month were used to estimate the change in the industry's total men worked, and total mandays/manhours.

  Injury data estimates were projected in a similar fashion as employment estimates. The injury data included projections of injuries that would be reported in future months but would be charged back to the current month.

- Time. To get from the computer printouts to the final seven tables took one or two GS 6-7's two to four days. Once the tables were completed in rough form, it took one GS 5 about two days to final type and edit.

- Delays. There were no significant delays in this part of the process, since it had first priority over all other reports and special requests.

Write Text and Publish

- Process. Table 1 of the CMF was used as the basis of the text. The text was a standard format, therefore the writing consisted primarily of changing numerical values presented in each sentence. After the text was written, edited and typed, it was sent to Pittsburgh for printing.

- Time. The writing and editing was performed by one GS 9 in one day. Final typing took one GS 5 one or two days. The printing process was the same as that for the CMF, and took about seven days.

- Delays. Again, there were no delays in this part of the production process.

Content

The CMI displayed data on injuries and employment, injury rates in terms of million manhours and million tons of production. The tables took this basic information and displayed it in different forms—by states, by month, and year-to-date.

The text was a summary of the salient figures in Table 1, and did not include any data from the other tables. About one-half of the text was a section entitled "Source and Definition of Data" which gave a detailed explanation of what data was gathered and how. As with the CMF, the CMI was a summary of data. There was no data analysis in the report.

Summary and Comment

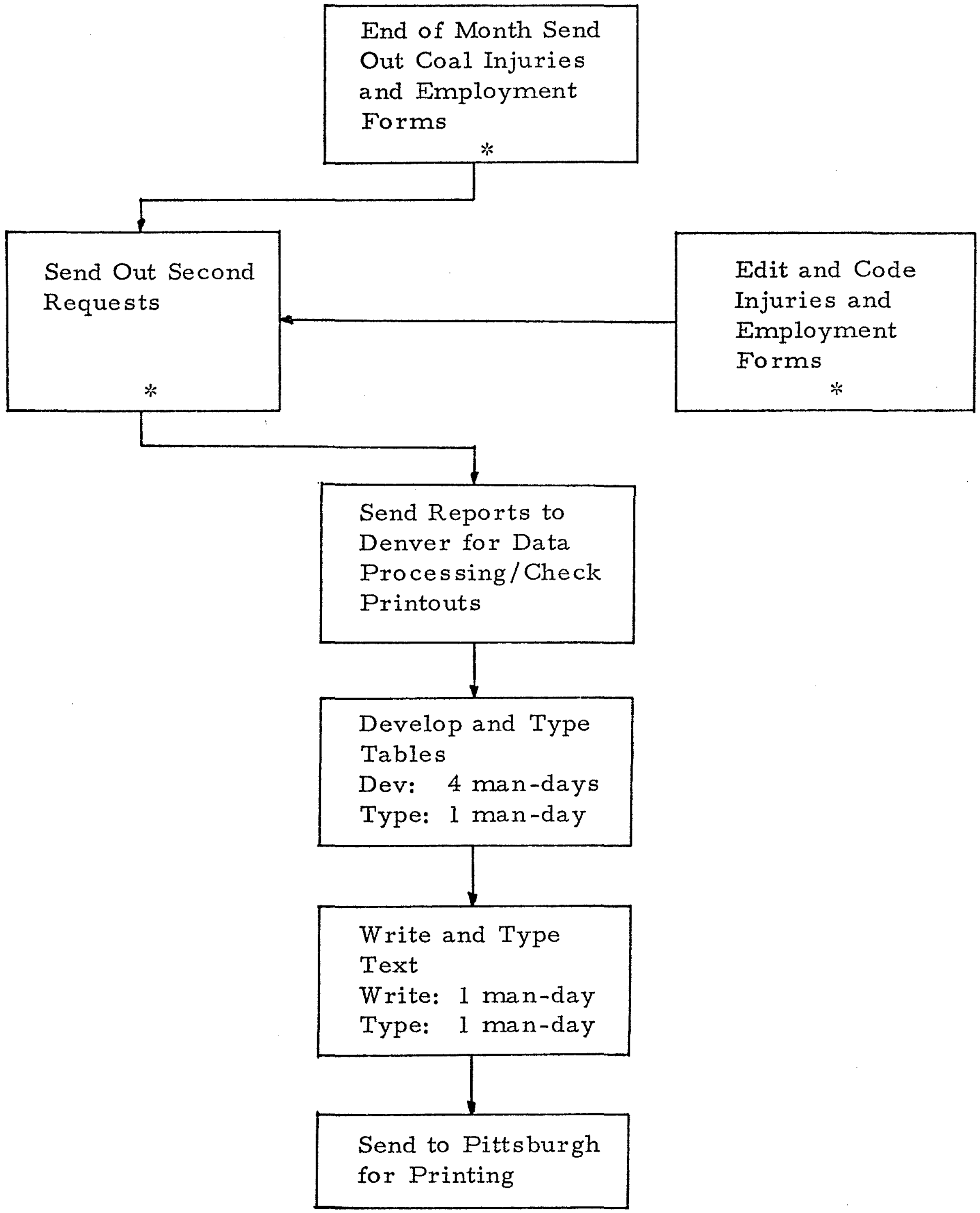
The OAA expended great effort to achieve completeness in their injury and employment data. However, even though the data might have been complete in terms of the percentage of total responses received, it remained suspect in terms of degree of accuracy. An example can be used to illustrate this point. On one worksheet that estimated injuries by states, all the calculations were carefully made to arrive at the various injury figures. Despite this, approximately one-half of the final injury figures were crossed out and replaced by another number. This second figure was arrived at based upon state reports and/or "a feeling for what it should be". In some cases, the difference in the two figures was greater than twenty percent.

The above example raises many questions about the data collection and recording for the CMI. Should OAA have tried for 100 percent response in their data collection when the final answers were likely to be changed anyway? Why was there sometimes a large discrepancy between injuries reported to the Bureau and the various states? Was it necessary to take the time to multiply estimated figures by percentages that are sometimes carried out to three decimal places, when the final figures were rounded to the nearest whole number?

In summary, it does not appear that the emphasis upon achieving complete data for the CMI had a corresponding payoff in data accuracy and reliability.

EXHIBIT 3-2

FLOW CHART: COAL MINE INJURIES AND EMPLOYMENT (CMI)



* These combined steps take approximately 60% of the time.

INFORMATION CIRCULARS (IC)

The IC's were yearly publications that showed annual injury experience in the various mining industries and "analysis of mine safety factors, related employment, and production data". The IC's were published for the following industries: Coal Mining, Metal Mining, Nonmetal Mining, and Stone Quarrying. (The OAA also published a Mineral Industry Survey on injury experience in the Sand and Gravel industry. The data was collected in a similar fashion to that collected for the IC's, and therefore is included in this section.)

Generally speaking, the IC's went through the same publication process as the CMI. The information displayed in the IC's originated from the same raw data source as the CMI—the Injuries and Employment forms; and the IC data tables were basically a detailed extension (with a few additional variables) of the CMI tables.

Collect Data

- Process. The majority of the raw data was gathered from the various Injuries and Employment forms that were distributed to the different mining industries. Except for those coal companies which reported monthly, all these Injuries and Employment forms were sent out annually.

  The collection problems (incomplete forms and non-reporting) that existed with the CMI existed for the IC's as well, but were greatly magnified as the number of forms mailed out for the IC's approached 20,000 versus only 900 of the monthly forms.

  Unlike the CMI, there was no strict scheduling of a cut-off date for completion of editing and coding, or accomplishment of the final "record run" of all reports. Instead, the data processing proof lists were continually checked and updated until someone deemed it time to have a final "record run".

- Time. As previously mentioned in the CMI section, the time to edit and code the Injuries and Employment forms for both the CMI and Coal IC was sixty to sixty-three percent of the staff's total report preparation time.

  In metal and nonmetal the time estimate was similar to that for coal, since the yearly total of reports that had to be edited and coded was approximately the same.

- Delays. Besides the two inherent delays of editing improperly filled out forms, and of tracking down companies that had not reported, there were two other important delays that were not encountered with the CMI.

The first problem that generated significant delays was the lack of any production schedule which prescribed a definite time for final submission of data and development of tables. Without such a completion schedule, the injury and employment data received low completion priority, and were left in incomplete form for an unnecessarily long period of time.

The second problem concerned the most recent coal IC record run. Seven runs were needed to get the final, corrected run. This was due to program changes which allowed mistakes to go uncorrected. This problem was new and could be considered temporary.

Develop Tables

- Process. All the IC's, except coal, projected and developed the tables for the report in the same manner as the CMI. That is, since none of these yearly surveys covered 100 percent of the various mining industries, OAA matched the previous year's return with the current year's return to get a basis for projecting the whole industry. Like the CMI, the percentage differences between the two surveys was calculated, and the industry's total injuries and employment were projected based on these percentage changes.

  The coal survey IC represented 100 percent of possible data, and therefore did not need yearly percentage changes from matched runs in order to project estimates of injuries and employment. There were about twenty injury and employment tabulations generated to facilitate the transfer of the raw data into the tables. The worksheets were drawn up by OAA, and the data manually transferred from the tabulations to the more than fifty tables.

  After the rough tables were completed, they were typed and sent to another section to have the text written.

- Time. The work involved in developing the tables was much more easily measured than the data collection process, and, therefore, the performance was more precisely defined.

  Developing the worksheets for one IC took approximately five man-weeks. Compiling tables took about six man-months. Typing the tables required $1\frac{1}{2}$ to $2\frac{1}{2}$ man-months. All these times assumed the people would be working a specific activity without any interruptions.

- Delays. Again, the lack of scheduled completion dates caused significant delays in this part of the process—the low priority given to the IC's resulted in constant interruptions for higher priority work. The lack of completion schedules and the unscheduled interruptions led to conditions in which the rough tables had been completed up to six months before the typing of the tables had been started.

Write Text and Publish

- Process. The finished tables were used as a basis for the text. After the text was completed, the IC was sent to the editorial staff for review. From editing, the IC was sent out for printing and distribution.

- Time. The manpower required to develop the text was one GS 9-14 one man-month. Editing often required as long as three calendar months, as various persons commented upon and made suggested changes to the first draft.

- Delays. Many of the major delays occurred during the text-writing process. The first delay was encountered after the tables were completed and were passed on for text development. Somewhere in the transfer, the finished tables might have been delayed for months before the text writing was begun. Then, after the text was rough finished, it might have been delayed for many more months before it was finalized and sent to editing. The 1967 Coal IC had been in the rough finished state for over two years.

Content

The IC's presented a great variety of fatality, injury, employment, and production data, displayed in over fifty tables and then re-emphasized in the text.

As with the other OAA reports, the IC's concerned themselves with the presentation of statistical data; the analysis of the data was left up to the user.

Summary and Comment

The IC's were very complex and time-consuming publications to develop and publish. However, their value, either to USBM or to the industry, did not appear to be proportional to the time and manpower expended in their production. Two facts supported this judgment:

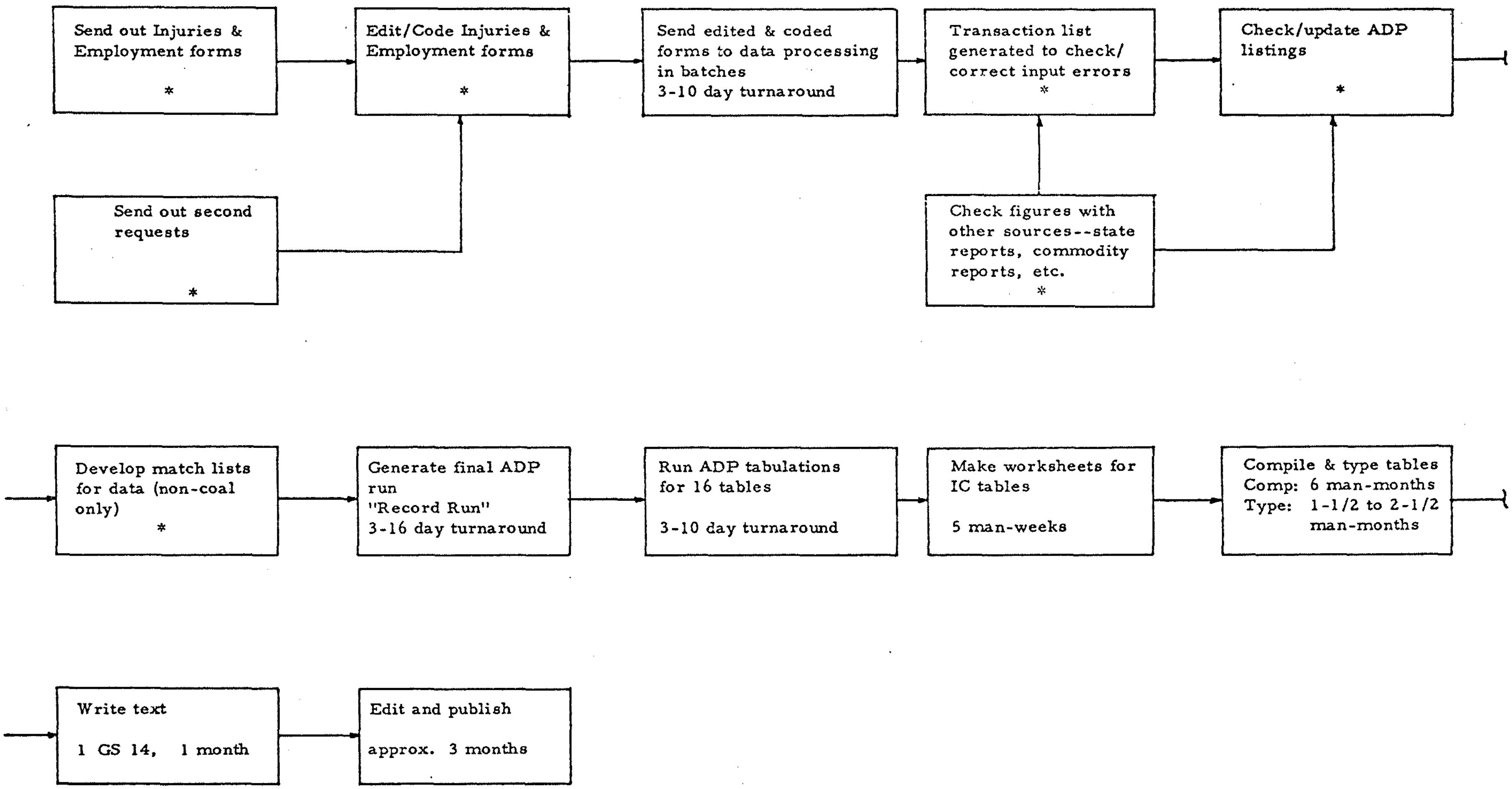
1. The publication date of most IC's lagged the data cut-off date by five to ten years. This suggested that, although an IC may have some value as a data base for historical research, it did not provide a useful information input into health and safety decisions, either for the Bureau or for industry.

2. Well over fifty percent of the special requests for information received and handled by OAA (Special Requests are covered in the following section of this report) concerned information which might be found in an existing or future IC. This indicated that most accident data users see special requests as their primary sources of management information, not regular publications such as IC's.

As with the CMI, much of the data for non-coal IC's was based on estimates and projections. Again, it is worth asking whether significant time should have been spent in detailed manipulation of <u>estimated</u> data.

EXHIBIT 3-3

FLOW CHART: INFORMATION CIRCULARS (IC)



* These combined steps take approximately 60% of the time.

SPECIAL REQUESTS

One of the major functions of the OAA was to answer special requests on injury and employment statistics. Besides the CMI and CMF reports, the special requests had the highest priority for completion.

OAA received approximately thirteen major special requests and 120 minor special requests (minor requests are here defined as phone requests requiring fifteen minutes or less to answer) for coal mine accident information each month. The monthly rate of requests for non-coal accident data was three major requests and twenty minor requests. About eighty-five percent of all special requests concerned coal mine information, while fifteen percent concerned non-coal data.

Approximately eighty-five percent of all special requests originated from within the Bureau of Mines, with fifteen percent coming from various outside sources—newspapers, Congressional offices, union and industry groups, etc.

- Process. Special requests were phoned or mailed to OAA. As soon as the requests were received, OAA started to work on the reply. OAA kept a file of the replies that would be used for recurring requests for the same information.

- Time. There was no standard time to reply to a special request. Some could be answered over the phone, while others could take almost the entire OAA staff a week to develop a response.

- Delay. There were no delays in special requests due to their priority.

Content of Requests

We estimate that seventy to eighty percent of the special requests asked for fatality, injury, or employment data which could be researched from available OAA publications. Less than thirty percent of the requests asked for data which could not be retrieved from OAA publications.

About sixty percent of all major special requests for coal mine data concerned fatality information only; about thirty percent asked for both fatal and nonfatal data. Ten percent concerned non-accident information on production, employment, number of mines, etc.

Nearly eighty percent of all major non-coal requests were for non-accident data, such as address lists, employment data, etc.

Summary and Comment

Responding to special requests was a necessary function of OAA, but there were two conflicts between the priority given special requests and OAA's most important perceived function—publishing reports.

One, many of the special requestors received OAA publications which would give them the answers they were seeking.

Two, much of the data that was requested had been compiled in the OAA but, due to schedule slippages, had not been published, e.g., the 1967 to 1970 data that would appear in a current IC could be used in responding to special requests.

OTHER REPORTS

The CMF, CMI, and CI's took ninety percent of OAA's staff time devoted to report production.

The other reports and data generated by the OAA took the remaining ten percent of staff time. This ten percent did not include the time required to edit and code injuries and employment forms—a function which can be prorated over all the reports that use information from these forms as the primary input.

The matrix on the following pages lists the reports and briefly outlines the important production factors of each report.

EXHIBIT 3-4

REPORTS MATRIX
OFFICE OF ACCIDENT ANALYSIS

PUBLICATION	FREQUENCY OF PUBLICATION	SOURCE OF DATA	TIME TO PREPARE	TIME TO WRITE	COMMENTS
Fatality and injury data for Annual Report to Congress on Coal Mines Health and Safety	Annual	Injuries and Employment Forms	GS 5-9 2 weeks	No Text	15 tables were compiled but only one table used in report
Fatality and injury data for Annual Report to Congress on Metal and Non-metal Mine Health and Safety	Annual	Injuries and Employment Forms	GS 5-9 1 week	No Text	
Injury frequency and severity rates of mineral industries to Accident Facts, National Safety Council	Annual	Safety Competition Injury & Employment Forms	GS 5-9	No Text	
Injuries and injury rates in mineral industries to Bureau of Labor Statistics, U. S. Department of Labor	Annual	Injuries and Employment Forms	GS 5-9 1/2 day	No Text	Rates taken from "Annual Safety In Mineral Industries"
Injuries, injury rates in mineral industries to International Labor Organization	Annual	Injuries and Employment Forms	GS 5-9 1/2 day	No Text	Rates taken from "Annual Safety In Mineral Industries"
<u>STANDING SPECIAL REQUESTS FOR INJURY DATA</u>					
Daily, weekly, and monthly reports of coal mine fatalities on fiscal and calendar year-to-date basis to Coal Mine Health and Safety	Daily, Weekly, Monthly	Fatality Notifications By Telephone	Total time for all reports GS 5-9 2 days	No Text	
Weekly and monthly reports of metal and non-metal mine fatalities on fiscal and calendar years-to-date basis to Metal and Non-Metal Mine Health and Safety	Daily, Weekly, Monthly	Fatality Notifications By Telephone	Total time for all reports GS 5-9 2 days	No Text	
Monthly report of fatalities and fatality frequency rates in metal and non-metal mines by Districts, States, and industry groups to Metal and Non-Metal Mine Health and Safety	Daily, Weekly Monthly	Fatality Notifications By Telephone	Total time for all reports GS 5-9 2 days	No Text	

PUBLICATION	FREQUENCY OF PUBLICATION	SOURCE OF DATA	TIME TO PREPARE	TIME TO WRITE	COMMENTS
Alpha Radiation Exposure Levels in Underground Uranium Mines	Semi-Annual	Inspection Reports from Uranium Mines	GS 5-9 3-4 days	GS-9 1 day	
Injury Experience in the Mineral Industries (Minerals Yearbook Chapter)	Annual	Injuries and Employment Forms--preliminary IC Data	GS 5-9 2 weeks	GS-14 2 days	
Injury Experience in the Mineral Industries, by States (Minerals Yearbook Chapter)	Annual	Injuries and Employment Forms--preliminary IC Data	GS 5-9 2 weeks	GS-14 2 days	
Injury Experience in the Mineral Industries	Annual	Injuries and Employment Forms--preliminary IC Data	GS 5-9 2 weeks	GS-14 2 days	
Falls of Roof, Face, and Rib; the number one killer in Bituminous Coal Mines	Annual	Formal Fatality Investigation Report	Information extracted as report received 15 min./report	GS 9-14 1 week	Begun in 1912
Apparent Consumption of Industrial Explosives and Blasting Agents	Annual	Voluntary Data from Manufacturers of Explosives	GS 5 1 week	GS-14 2 days	
Injury Experience in the Oil and Gas Industries	Annual	Injuries and Employment Forms	GS 5 2 weeks	GS 9-13 3 days	
Awards in the National Lime Association Safety Competition	Annual	Quarterly Injuries and Employment Forms (Voluntary)	GS 5 5 days	GS-13 3 days	
Awards in the National Limestone Institute Safety Competition	Annual	Quarterly Injuries and Employment Forms (Voluntary)	GS 5 5 days	GS-13 3 days	
Awards in the Bureau of Mines Safety Competition for Sand and Gravel operations	Annual	Quarterly Injuries and Employment Forms (Voluntary)	GS 5 5 days	GS-13 3 days	

GENERAL SUMMARY AND CONCLUSIONS

The way an organization spends its time provides a good indication of how it sees its role and how it views its priorities.

The Office of Accident Analysis spent the overwhelming majority of its total staff time performing four functions:

- editing and coding raw data;
- producing monthly CMF's and CMI's;
- responding to special requests;
- developing IC's.

We estimate that seventy-five percent of total staff time was devoted to report production, including editing and coding. As much as ninety percent of this total report production time was spent on CMF's, CMI's, and IC's.

The remaining twenty-five percent of total staff time was spent responding to special requests.

This division of effort—seventy-five percent report production and twenty-five percent special requests—indicates that industry was the primary "user" or "beneficiary" of OAA activities. Why? —because OAA management indicated that industry was the primary user of OAA publications, and the distribution of these publications supports this contention (e.g., about eighty percent of monthly CMF's and CMI's are distributed to industry).

On the other hand, the "special request" function was primarily a response to internal Bureau needs for accident information.

CHAPTER 4

USER NEEDS SURVEY

HSAC's role—to provide services which will improve the decision-making processes of health and safety decision-makers—requires that its character and direction be determined by the needs of the users of its services. Each activity and output should be directed toward these needs. Because of the overall importance of user needs in shaping our recommendations for HSAC, we present, in this chapter, a summary of the facts, impressions, etc., that we derived from our many interviews with potential users of HSAC services. No recommendations are offered in this chapter. Its purpose is to present the users' view of the accident analysis function of the Bureau of Mines.

In interviewing potential users, we followed the approach described in Chapter 1. That is, we discussed the users' health and safety decision processes and the effect HSAC's services might have on them. When a particular service or item of information was requested, we tried to determine what the user might do differently if it were provided. There were two minor difficulties in conducting these interviews. First, although most users were very willing to discuss their needs, they were, for the most part, somewhat doubtful that the Bureau could or would provide information and analysis that would really help them. Second, many users could not clearly define their specific needs or their uses of the service they needed. In the past, these users had not been given services of the kind HSAC can provide. Therefore, the users need to experiment with different forms of HSAC data and analysis to find out what will be most effective in their health and safety activities.

GENERAL USES OF HSAC SERVICES

Our survey of potential users indicated that HSAC's outputs will be used for many purposes. In most cases, the users will affect mining health and safety in some reasonably direct way. A few users will not. They will be residual beneficiaries of the publications designed for health and safety decision-makers.

For purposes of analyzing HSAC's services, it is convenient to categorize users according to their probable application of HSAC's data and analyses.

Category 1: <u>Mine Level Decision-Makers</u> translate HSAC's output into direct action at mines. Among this class are:

- USBM Inspection Force
- USBM Education and Training
- USBM Technical Support
- State Inspectors
- Mine Operators
- Unions
- Individual Miners

Category 2: Other Decision-Makers utilize HSAC's output to plan their activities. In some cases these activities lead to health and safety decision-making. Among those who generally are health and safety decision-makers are:

- USBM Director
- Mining Research
- Mining Trade Associations
- Equipment Manufacturers

Those who utilize HSAC outputs for decisions which generally do not affect mining health and safety include:

- Insurance Companies
- Other Government Agencies

Category 3: Non-Decision-Makers will utilize HSAC's outputs primarily as reference data. This group consists of:

- Academicians
- Newspapers
- Other Publications

SPECIFIC NEEDS

Analysis of the functions of each of these potential users indicates that, for the purpose of designing HSAC's outputs, eight health and safety decision-makers must be considered. They are:

USBM—

1. Director (including the offices of the Secretary of the Interior and of legislators who seek information through the Director)
2. Mining Research
3. Coal Safety
4. Metal and Nonmetal Safety
5. Technical Support
6. Educational Training

NON-USBM—

7. State Agencies
8. Industry (including mining companies, unions, individual miners, and mining trade associations)

Each of these users has needs of its own which must be satisfied by HSAC.

1. Director

The offices of the Director, the Secretary of the Interior, and various legislators utilize accident data for a variety of legal, administrative, and planning purposes. In the past, they have obtained their data primarily through special requests to the OAA. Most of these requests have been for fatality data.

To satisfy the Director's needs for accident information, HSAC must provide quick access to an up-to-date data base, and the capability to efficiently summarize and communicate data. In addition, detailed analytical studies are sometimes needed for purposes of legislation, regulation, or policy setting.

2. Mining Research

Mining research personnel need accident information to help them in allocating their resources. They need to identify the best opportunities for safety improvement through research. For this purpose they need to know the relationships between accident rates, accident severity, and the variables which contribute to accidents. Another mining research use for accident data is to test the hypotheses they develop. They also need to evaluate the effects of safety standards. Finally, they need information to assist them in advising the mining industry of potential safety improvements.

These needs extend far beyond traditional data collection and compilation. The detail and depth of analysis required can be satisfied only through major accident analysis projects involving analysis of data, equipment, and mining processes.

3. Coal Safety

The needs of coal safety are quite broad. Accident information can be helpful to inspectors, district managers, and all levels of Health and Safety administration.

- Inspectors. Inspectors can use mine-by-mine accident data to prepare them for inspection of any given mine. They also need summaries by district and for the entire United States to put safety problems in proper perspective. In addition, the results of analytical studies can assist inspectors in evaluating mine safety and in advising mine operators.

- District Managers. In addition to the needs of inspectors, district managers need detailed analyses and compilations of data for their particular districts to assist them in dealing with local problems. They also need mine-by-mine data in order to concentrate on mines whose accident histories indicate the most potential for improvement.

- Administration. Health and Safety administration can utilize HSAC's services for two purposes. First, reports of accident histories of each district (or subdistrict) can assist in the evaluation of programs and personnel. Second, in-depth analytical studies can provide valuable inputs to the process of formulating regulations, policies and plans. In the past, coal safety personnel have obtained accident data largely through special requests. Even with revised publications, it must be anticipated that these requests will continue.

4. Metal and Nonmetal Safety

The needs of Metal and Nonmetal Safety are similar to those of Coal Safety, but there are three complications. First, there are approximately 20,000 metal and nonmetal mines, and fewer than 200 inspectors. Consequently, the problem of managing inspectors' time is very actue and there is a serious need for HSAC's services in identifying potential problem areas. Second, enforcement responsibility is shared with state inspectors in "state plan" states. Data is needed to help evaluate these state plans. Finally, there is a wide variety of metal and nonmetal mines and processes. Industry-wide technical problems are not as well known as in coal. There is a need for more basic analysis.

5. Technical Support

Technical support personnel can utilize HSAC's services to identify technical problems that need study, to identify particular mines or categories of mines which need assistance, and to advise the Bureau and industry about technical problems.

HSAC can support the identification of technical problems through special industry-wide or regional studies. Mines in need of assistance can be identified through specific requests for data—that is, one-time compilations of selected accident, employment, and production statistics. Technical support's advisory function can be supported by special studies of causal relationships.

6. Education and Training

HSAC's services can be very helpful in the processes by which Education and Training personnel: (a) ranks various education and training programs, (b) select particular mines for training programs, and (c) decide which training programs are needed at a particular mine. For these purposes, Education and Training needs data and analysis explaining safety trends, up-to-date data on the accident histories and profiles of specific mines, and the ability to receive specific data compilation and analysis on request.

As a secondary function, HSAC can technically support Education and Training through accident data.

7. State Agencies

The needs of state agencies are essentially the same as those of Coal Safety and Metal and Nonmetal Safety. Needs for metal and nonmetal information are somewhat more acute in "state plan" states.

State agencies need recurring reports from HSAC to make them aware of accident problems and to provide them with performance "yardsticks". HSAC's specialized studies can provide them with the same kind of assistance. State inspection forces also need mine-by-mine data.

8. Industry

Industry has two needs which can be satisfied by HSAC's services. One is for data summaries which provide performance "yardsticks". The other is for increased understanding of the causes and circumstances affecting accidents and of the precautions that can be taken to prevent them.

HSAC can contribute in both of these areas by publishing reports of the findings and recommendations of their accident analysis projects and by distributing regular publications of summary accident data.

ROLE OF SPECIAL STUDIES

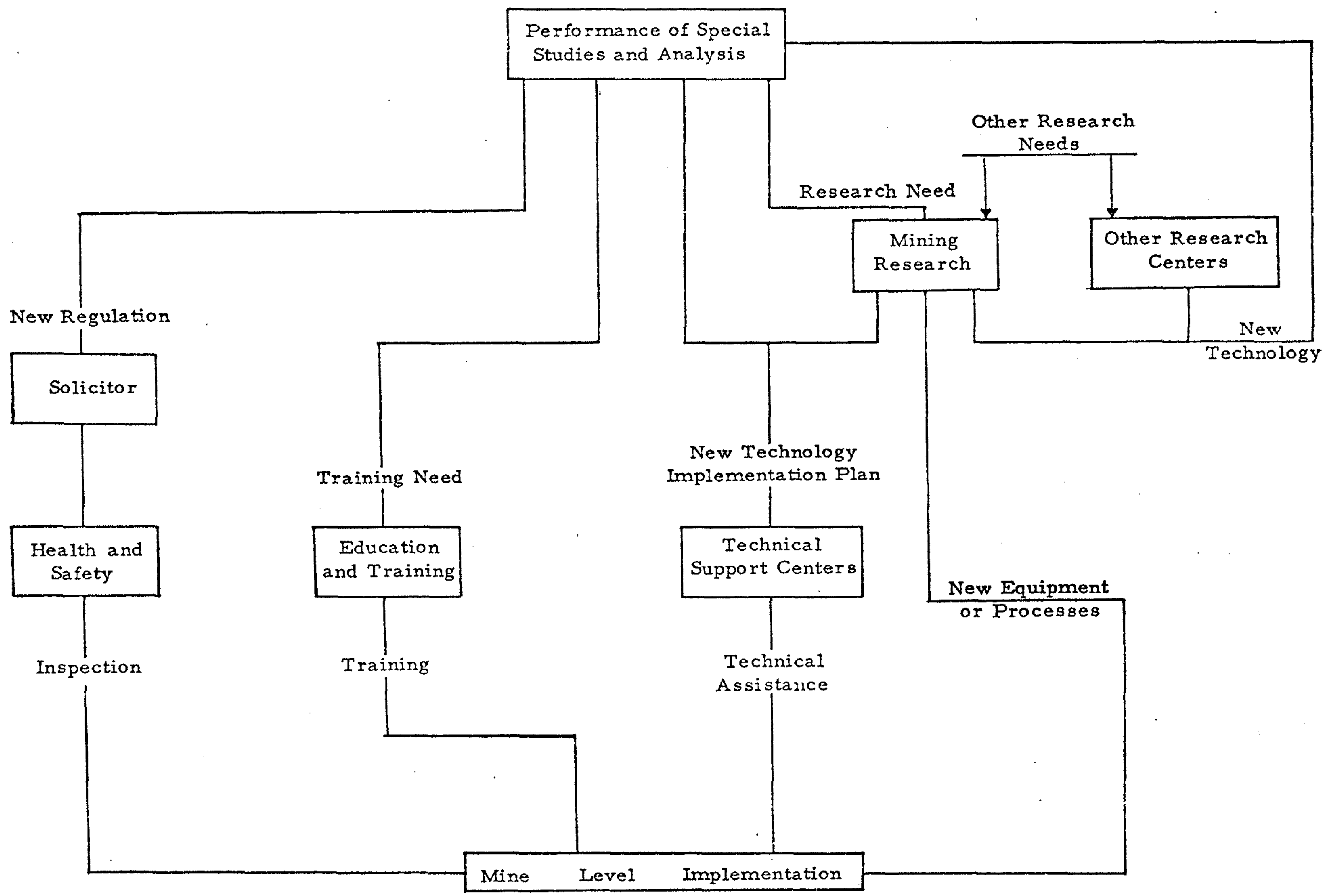
Our user needs survey revealed a substantial need for major accident analysis projects which would be performed on a one-time basis. These projects involve specialized data collection, analysis, development of recommendations for actions, and publication of results. In this report we refer to such projects as "special studies".

From our discussions with users, we concluded that, for HSAC to be effective, the outputs of special studies would have to extend far beyond the compilation and analysis of accident information. Special study outputs must be in such a form that the users can directly apply them. (For example, if a regulation is needed, a draft of the regulation should be part of the study's output.)

Exhibit 4-1 demonstrates some of the potential uses of special studies.

EXHIBIT 4-1

ROLE OF SPECIAL STUDIES



CHAPTER 5

HEALTH AND SAFETY ANALYSIS CENTER: OBJECTIVES AND POLICIES

Chapters 2 and 3 identified problems and weaknesses in the operating charter of the old Office of Accident Analysis (OAA).

This chapter addresses those problems by recommending a new series of HSAC organizational objectives and policies.

BACKGROUND

The Health and Safety Analysis Center will be a service organization dedicated to providing decision-makers with the information they need about safety and accidents to make sound, well-informed decisions.

Who are these "decision-makers" who need safety and accident information? A more precise way of asking this question is: Who makes or should make decisions as a result of significant information about safety and accidents? As a part of this study, Theodore Barry and Associates has conducted a survey of internal (USBM) and external users of accident data, (see Chapter 4) and believes the following list broadly defines all major users:

USBM—
- Director
- Coal Safety
- Metal and Nonmetal Safety
- Educational Training
- Technical Support
- Research

Non-USBM—
- State Agencies
- Industry

What kind of decisions hinge upon important safety and accident information? Again, our survey has suggested four broadly defined categories of use for HSAC-generated information:

- <u>To assign priorities for resource allocation</u>.

- <u>To identify new ways of improving safety within the limits of existing technology and training</u>. We might call this the <u>direct</u> application of Accident Science, since we are talking about improvements in safety which do not require breakthroughs in either the performance of equipment or the behavior of people.

- To guide the day-to-day management of Health and Safety functions. To Coal and Metal and Nonmetal Safety, this function equates with one objective—to help enforce the law, e.g., a report to identify mines with high nonfatal haulage accident rates. To Education and Training and Technical Support, this function means providing reports which help them administer their specific responsibilities, e.g., periodic report of comparative accident rates by job title will help Education and Training in scheduling training courses.

- To evaluate industry-wide performance. USBM and the Industry need a yardstick to measure the aggregate effectiveness of all factors and decisions which impact upon safety. HSAC should provide this yardstick.

Finally, what instruments should HSAC employ to provide important information to key users? In other words, what will HSAC physically produce; what are its "products"?

As a result of our user needs survey, we feel that there are four kinds of reports, or products, which should carry HSAC information to its ultimate users:

- Broad-distribution reports—general reports distributed USBM- and industry-wide;

- Limited-distribution reports—special reports designed to satisfy the information needs of specific users; distributed to those users only;

- Responses to special requests—similar in scope and purpose to limited-distribution reports, except they are generated on a one-time basis, as a result of direct requests by users.

- Special studies and analyses—major research efforts reporting on the causes, circumstances, and potential improvements relating to certain accident categories.

In summary, we have asked three questions of the new HSAC:

- Who will benefit from your services?
- Why do they need you?
- What will you give them?

The answers to these questions are crucial in defining the scope of authority and responsibility for the new Health and Safety Analysis Center. Exhibit 5-1 summarizes what we feel are the right answers to these questions. This scope of activities is significantly broader than that of the OAA, which concentrated its efforts on broad-distribution reports that were useful only for evaluation of industry-wide performance and on responses to special requests which did not involve analysis.

HEALTH AND SAFETY ANALYSIS CENTER SERVICES

WHY?

WHAT?

	Assignment of Priorities for Resource Allocation	Direct Application of Accident Science	Management of Day-To-Day Health and Safety Functions	Evaluation of Industry-wide Performance
Broad Distribution Report		• Coal Safety • M/NM Safety • Educ/Training • Non-USBM		• Coal Safety • M/NM Safety • Non-USBM
Limited Distribution Report			• Coal Safety • M/NM Safety • Educ/Training • States	
Response to Special Requests	• Research • Educ/Training		• Director • Coal Safety • M/NM Safety • Educ/Training • Technical Support	
Special Studies and Analysis	• Research • Technical Support • Educ/Training	• Director • Coal Safety • M/NM Safety • Research • Technical Support • Educ/Training • Non-USBM		• Non-USBM

EXHIBIT 5-1

HSAC OBJECTIVES

The analysis of HSAC potential services in the preceding section provides the reasoning for the following proposed HSAC organizational objectives.

1. Support the Director of USBM by providing accident information to assist key USBM agencies in making informed decisions to:
   a. improve the Health and Safety enforcement program;
   b. improve the allocation of limited resources for research, technical support, and education/training.

2. Assist in improving mine safety by providing public information on significant accident problems and trends.

Three words in Objective 1 are underlined to emphasize their importance:

"Director"—The current OAA objectives as outlined in Part 115.4.1 of the Departmental Manual direct the OAA to support the Deputy Director, Health and Safety. This definition of responsibility is not broad enough, since the new HSAC will provide information directly to the Director and to Mining Research, under the Deputy Director, Minerals.

"Information"—The new HSAC will provide much more than the simple recording and summarization of raw accident data. It will analyze that data as a basis for providing an organized, systematic approach to a particular safety problem. HSAC's output is, therefore, information rather than statistics.

"Decisions"—The information which HSAC supplies to internal USBM users is not "nice-to-know" or "background" information. It is intended as a major input into USBM management decisions about safety. Close adherence to the spirit of this objective will prevent the HSAC collection and production systems from being clogged with the development of duplicative and extraneous reports.

Objective 2 affirms USBM's responsibility as a public agency to provide information to the citizenry.

HSAC POLICIES

The following HSAC proposed operating policies are designed to: (1) implement the previously recommended objectives, and (2) address the problems of currency and relevancy of published data which were discussed in Chapters 2 and 3, the Organizational Audit.

1. The primary emphasis of HSAC activities will be on service to accident information users within the Bureau.

2. HSAC will provide its services through three vehicles. In order of emphasis they are:

   a. special studies;
   b. responses to requests for information;
   c. recurring publications.

3. The basic service of HSAC will be analysis. It will provide public information as a secondary function.

4. HSAC will emphasize timely accident information, and will strive for as much data completeness and accuracy as an emphasis on timeliness of publication allows.

5. HSAC will be responsible for the types of accident data collected, and for the data collection and coding processes as well as for analysis and presentation.

6. In performing special studies, HSAC responsibilities extend beyond the written publication of findings. When appropriate, HSAC personnel will develop oral briefings, seminars, field meetings etc., designed to communicate the substance of significant findings.

7. HSAC will maintain close communication with users of HSAC services in determining what data should be collected and what analyses should be performed.

CHAPTER 6

ORGANIZATION PLAN

ORGANIZATIONAL REQUIREMENTS

Consistent with the objectives and policies of Chapter 5, HSAC should be organized to facilitate its two major roles:

1. To perform significant health and safety projects based upon accident and illness information.

2. To produce accurate and timely recurring reports.

To adequately fulfill these roles, HSAC's organization must, at a minimum, perform the following functions:

1. Timely collection and coding of incoming accident and employment reports;

2. Maintenance of an accident data base for use in storing and retrieving data for both recurring publications, special requests and special study projects;

3. Timely production and distribution of recurring reports;

4. Definition and development of special study projects and assignment of priorities;

5. *Ad hoc* data collection;

6. In-depth analysis of accident data and development of alternative actions;

7. Economic, social, and behavioral analysis of alternatives;

8. Formulation of recommendations;

9. Communicating special study findings and recommendations to users.

ORGANIZATIONAL STRUCTURE

Exhibit 6-1 demonstrates the structure we recommend to enable HSAC to satisfy its organizational requirements. This structure provides for the performance and coordination of each of the nine functions described in "Organizational Requirements". These functions, in turn, will allow HSAC to efficiently and effectively produce the following four outputs as were described in Chapter 5.

- Broad Distribution Reports
- Limited Distribution Reports
- Responses to Special Requests
- Special Studies and Analysis

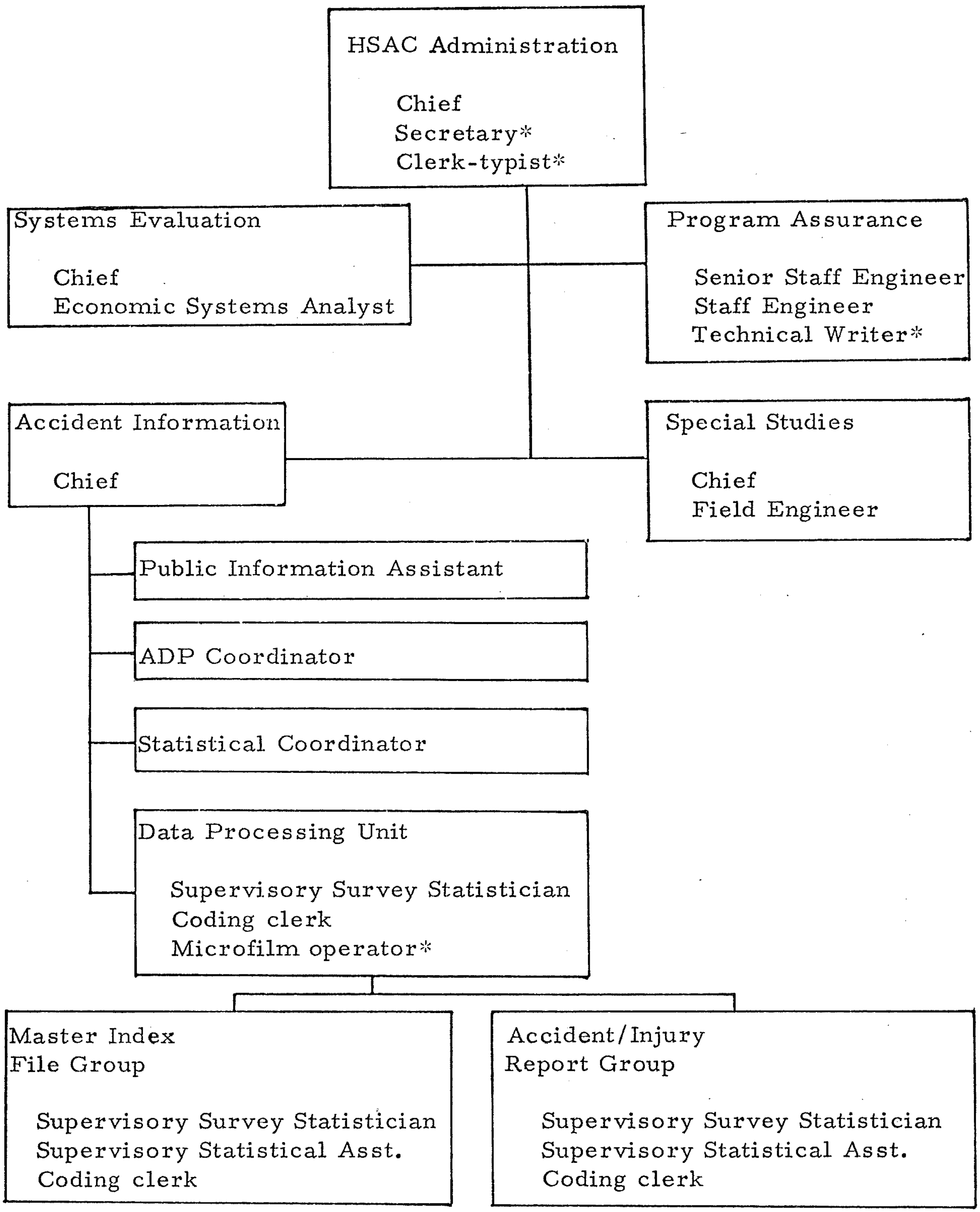
In general, the first three outputs listed above are similar in nature to outputs generated by the old Safety Analysis Center. Because of the general repetitive nature of these types of outputs, the organizational structure to accomplish these tasks can continue to be of a functional type where the general line authority and responsibilities are present.

But, for the efficient completion of special studies projects, it is necessary to introduce a matrix organization (both functional and project responsibilities). This matrix organization is built around specific projects (in our case, special studies). A project manager is given the authority, responsibility and accountability for completion of the project within its particular parameters. The project manager is assigned personnel from the functional departments and when the project is completed these personnel return to their functional groups for reassignment.

From Exhibit 6-1, it is seen that four branches of HSAC are recommended. They are as follows:

- Branch of Accident Information. This branch will be primarily responsible for collection and coding of incoming accident and employment reports, maintenance of the accident data base, and the production and distribution of the recurring reports (with the exception of text-writing). Additionally, this branch will answer all special requests for accident data, with the exception of any special data collection or accident analysis that is outside the scope of routinely submitted reports and forms.

EXHIBIT 6-1



* Position descriptions not written for these positions.

- Branch of Special Studies. The analysis of accident and employment data will be the primary function of this group. This analysis can be performed for four major end uses: (1) answering special requests that are beyond the scope of the Branch of Accident Information; (2) writing all narratives for recurring reports; all narratives will be based upon some phase of accident analysis and will supplement the accident tables; (3) developing alternative actions (based only on accident data) as part of special studies; (4) determining areas of study in the mining Health and Safety field. This work could include field observations, ad hoc data collection and causal factor analysis.

- Branch of Systems Evaluation. The Systems Evaluation Branch should be utilized for economic, social, and behavioral analysis, and the formulation of recommendations. As part of the special studies project team, the System Evaluation group will participate in program planning and analysis to ensure that the work performed will provide a useful basis for formulating recommendations. Additionally, this group may be called upon to do economic, social, and behavioral analysis for other health and safety projects outside of HSAC.

- Branch of Program Assurance. The general responsibility of this group is to act as project management for the special studies. This responsibility should include identifying and defining the special studies; coordinating with the branch chiefs to plan the objectives, scope, approach, and nature of final product; controlling special studies as they are performed, and communicating findings and recommendations to users.

Exhibit 6-2 illustrates the matrix organization needed to effectively conduct the special study projects.

Exhibit 6-3 lists the responsibilities each HSAC branch has both in the functional organization and in the project (special studies) organization.

EXHIBIT 6-2

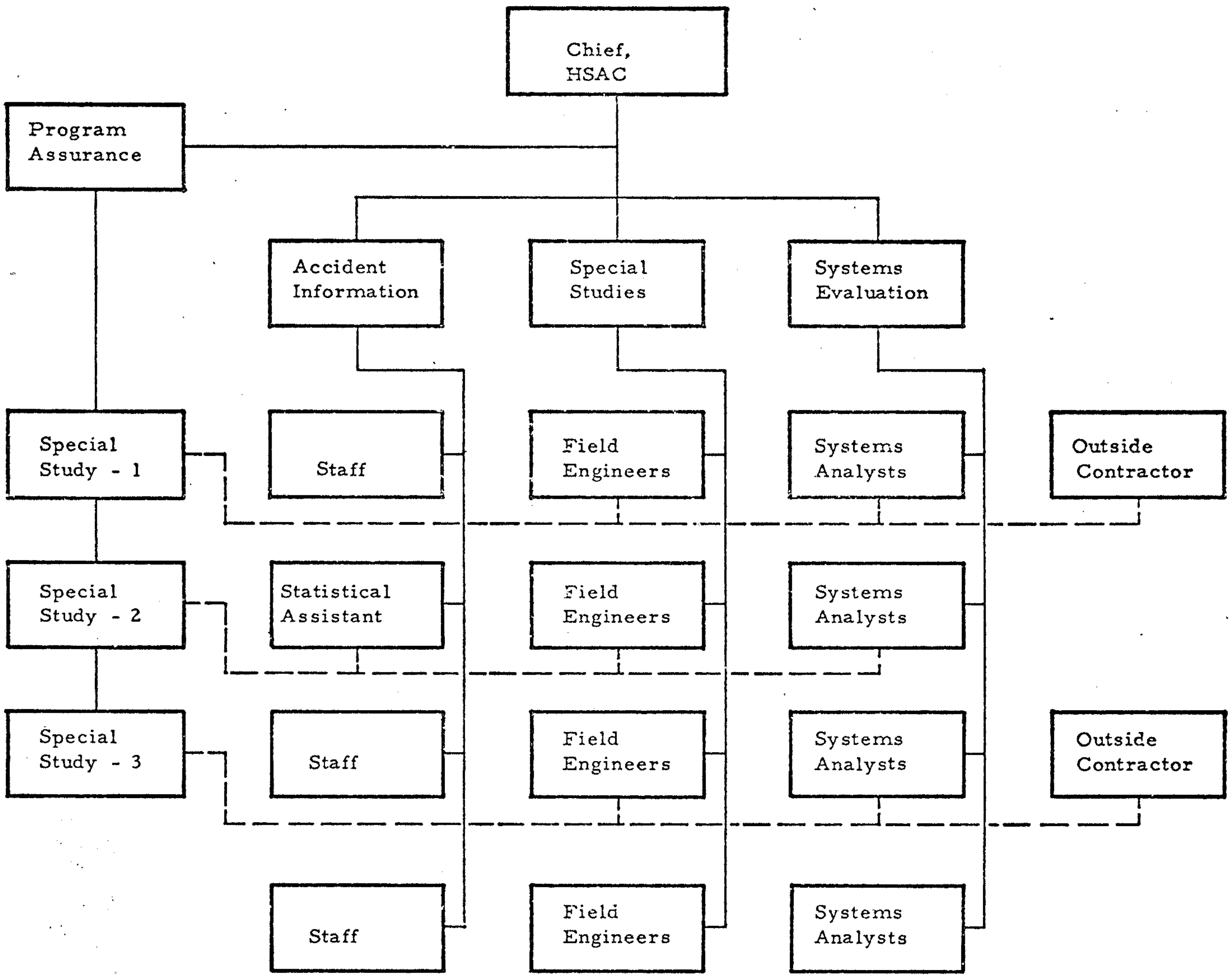

Chief, HSAC
Program Assurance
Accident Information
Special Studies
Systems Evaluation
Special Study - 1
Staff
Field Engineers
Systems Analysts
Outside Contractor
Special Study - 2
Statistical Assistant
Field Engineers
Systems Analysts
Special Study - 3
Staff
Field Engineers
Systems Analysts
Outside Contractor
Staff
Field Engineers
Systems Analysts

EXHIBIT 6-3

MATRIX RESPONSIBILITIES

	FUNCTIONAL	PROJECT (SPECIAL STUDIES)
Accident Information	• Collect and code accident and injury reports • Maintain data base • Answer majority of special requests	• Provide data from computerized data base as needed
Special Studies	• Answer special requests that involve analysis or special data collection • Write narrative for recurring reports • Accident analysis to determine areas of study in mining health and safety • Field study and ad hoc data collection	• Field study and ad hoc data collection • Develop alternative actions based upon accident analysis; to be supplied to System Evaluation for final recommendations
Systems Evaluation	• Economic, social, and behavioral analysis of health and safety problems within the U. S. B. M.	• Formulate recommendations for Special Studies based upon alternative actions supplied by Special Studies and economic, social/behavioral factors
Program Assurance		• Project Management for Special Studies

STAFFING

Three parameters will have major significance in determining HSAC's staffing needs. They are:

1. hardware available to process incoming data;
2. special study workload;
3. utilization of contractor assistance in conducting special studies.

Available hardware will affect the number of coding clerks and supervisory statistical assistants needed. Special study workload will determine the need for staff engineers and economic system analysis. The required number of field engineers will depend upon the extent of contractor assistance.

In formulating staffing recommendations for HSAC, we assume (and recommend) the following conditions with respect to the parameters listed above.

1. Hardware consisting of:
   a. Dataflow model 3402, Optical Reading System, or equivalent;
   b. Wang 720 Calculator, or equivalent;
   c. Rapid Print numbering machine, or equivalent.
2. A relatively stable workload of three on-going special studies.
3. Very little contractor assistance—work to be performed in-house to the extent feasible.

Under these assumptions, we recommend for HSAC the staffing levels shown in Exhibit 6-4. These levels are appropriate for HSAC's operation on a continuing basis only. Transitional staffing problems and recommendations are discussed in Chapter 9.

POSITION DESCRIPTIONS

Position descriptions for the HSAC staff are included in Chapter 12. These descriptions follow the format of, but are not intended to replace, formal position descriptions submitted to the Personnel Department of the Bureau.

EXHIBIT 6-4

RECOMMENDED STAFFING LEVELS

HSAC Administration	
Chief	1
Secretary	4
Clerk-typist	1
	6
Program Assurance Branch	
Senior Staff Engineer	1
Staff Engineer	4
Technical Writer	1
	6
Systems Evaluation Branch	
Chief	1
Systems Analyst	3
	4
Special Studies Branch	
Chief	1
Field Engineer	10
	11
Accident Information Branch	
Chief	1
Public Information Assistant	1
ADP Coordinator	1
ADP Assistant	1
Statistical Coordinator	1
DPU Supervisory Survey Statistician	1
Coding Clerk	1
Microfilm Operator	1
MIF Supervisory Survey Statistician	1
Supervisory Statistical Assistant	1
Coding Clerk	4
Accident/Injury Report Supervisory Survey Statistician	1
Supervisory Statistical Assistant	2
Coding Clerk	11
	28

TOTAL HSAC --- 55

CHAPTER 7

OPERATING PLANS

INTRODUCTION

Chapter 6 presented a recommended plan for the organization of HSAC. Four functional groups were identified and their responsibilities defined. Organizational and personnel requirements were specified. In Chapter 7 we recommend a series of plans for the major operations HSAC must perform. These plans consist of specific procedures for the processing, analysis, dissemination and publication of data as well as for interfaces between functional groups within HSAC, and between HSAC and other organizations.

PLAN 1: Processing of Incoming Data

As pointed out in TB&A's interim report, the largest single time consuming job in the old Office of Accident Analysis was, and will continue to be, in the new Safety Analysis Center, the coding and editing of incoming Accident, Injury, and Illness Reports and Employment Reports. Under the existing system, it is estimated that 18 coders for coal injury reports and 10 metal and nonmetal injury coders will be needed. Although the coal coders are now located in the District Offices and not under HSAC's jurisdiction, the large manpower requirements are still present and should not be ignored.

In addition to the large cost of coding and editing, present data processing methods involve major expenditures for keypunching. Depending on the volume of incoming reports, keypunching costs could amount to several hundred thousand dollars per year.

TB&A believes that significant reductions can be made in the total cost of editing, coding and keypunching. Calculations of costs and potential improvements are not presently possible because the metal and nonmetal forms are not yet in use. Nevertheless, it is our opinion that the most promising opportunity for savings is in eliminating the keypunching step. Consequently, we recommend that HSAC utilize the hardware recommended in Chapter 6 to process incoming data in the manner shown in Exhibit 7-1.

The important features of the recommended system are:

- Accident/Injury Forms

    1. Coders receive injury forms from operators and ensure that all responses are coded.

    2. Coders type codes in format readable by Optical Page Reader.

    3. Optical Page Reader reads sheets and transfers data to magnetic tape.

- Employment Forms

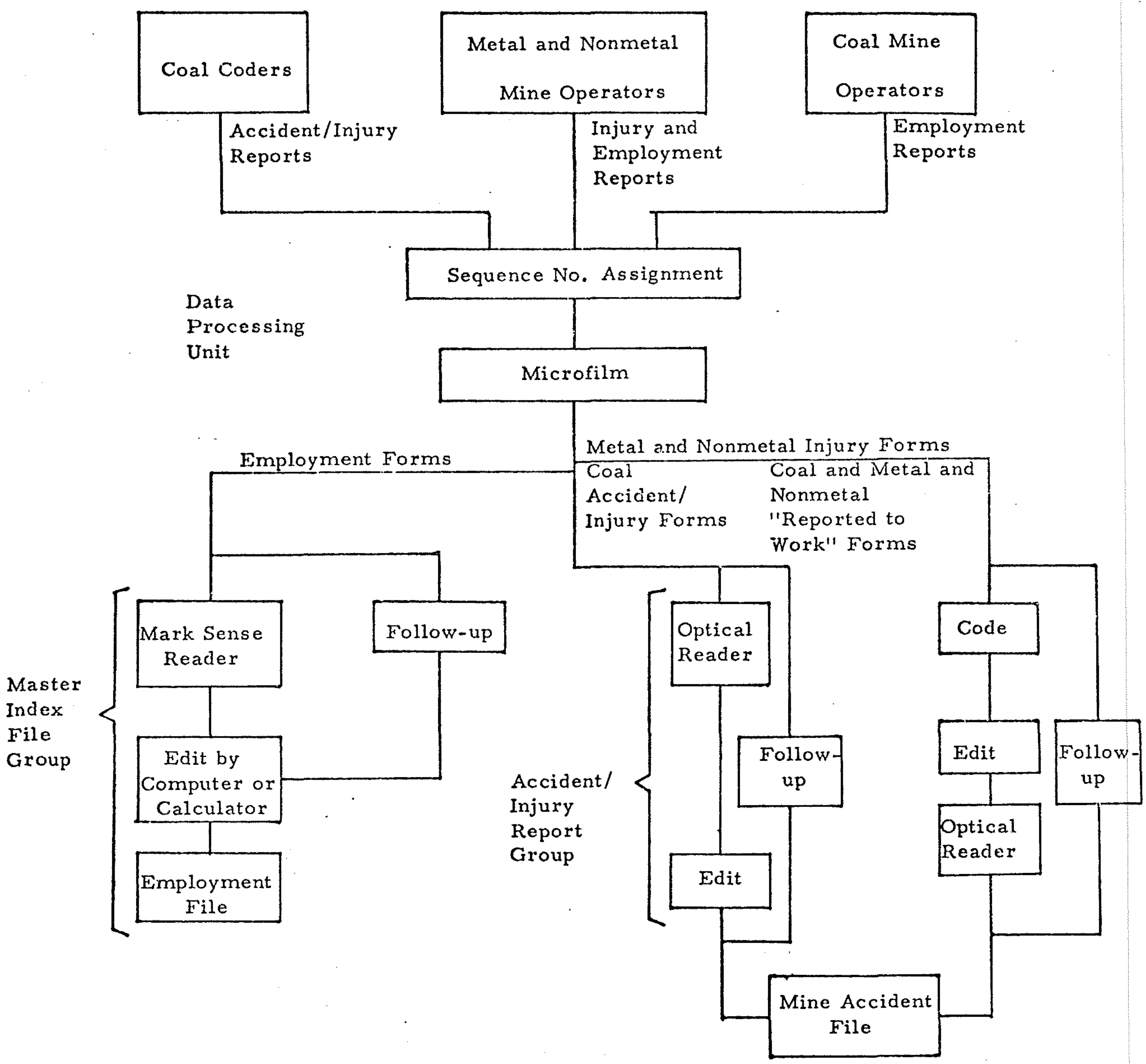
    1. Employment forms are designed for mark sense reading.

    2. Mark sense reader replaces keypunchers.

    3. Data is edited by calculator.

EXHIBIT 7-1

EDITING AND CODING OF ACCIDENT/INJURY AND EMPLOYMENT FORMS



We recognize that the recommended editing and coding system has not been tested and that there is a possibility that it may not prove to be feasible. Consequently, we propose an alternative cost-saving procedure. Under this procedure, HSAC would have a voluntary sample of reporting companies code all their accident data in the field. The accident reports would go directly from the field to keypunch, and, thereby, pass all HSAC coding and editing processes. HSAC would monitor all sample reports to determine the coding error rate. This error rate would be the basis of decision on whether or not this approach is a feasible alternative to existing or other proposed coding methods.

PLAN 2: Production of Recurring Reports

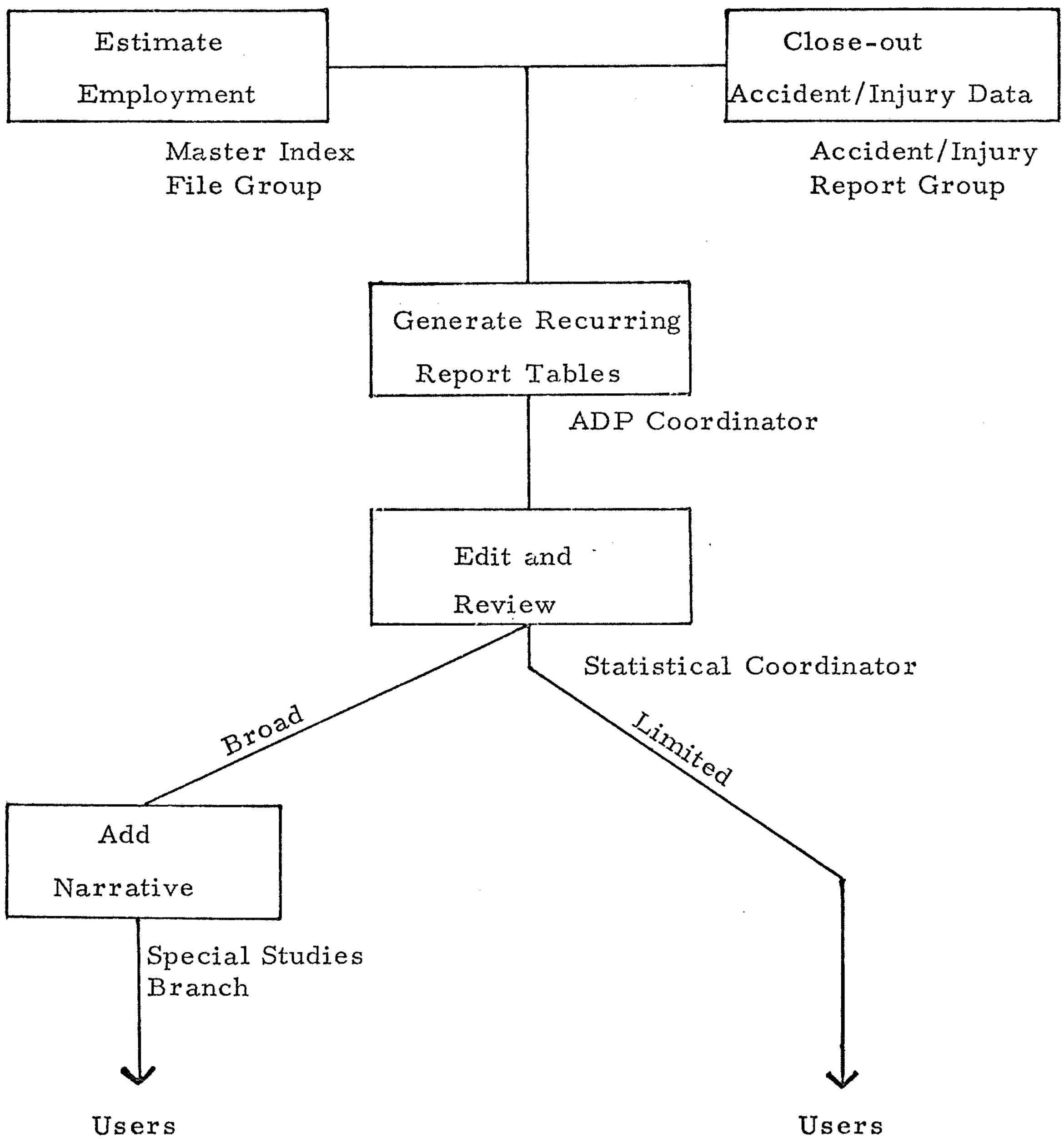
Recurring reports should be timely, simple, and produced with as little labor input as possible. We recommend the process shown in Exhibit 7-2 as a quick, efficient method of producing reports. This process should enable reports to be published approximately six weeks after the end of the period covered.

The five recommended procedures require explanation:

Procedure	Function
Estimate Employment	Improve comparability of data by including educated estimates of employment for non-responders (see Chapter 10).
Close-out Accident/Injury Data	Provide the best estimate of frequency and severity where follow-up procedures are incomplete or the victim has not returned to work.
Generate Recurring Report Tables	Print out stored data (by computer).
Edit and Review	Ensure consistency of reports from one period to the next. This function can be accomplished with the aid of a computer, using a "matched run" comparison.
Add Narrative	Comment on some aspect of special studies work as a report to the industry—generally, this narrative should deal with statistical cause-effect relationships.

EXHIBIT 7-2

PRODUCTION OF RECURRING
BROAD AND LIMITED DISTRIBUTION REPORTS



PLAN 3: Special Studies Formulation

Special studies will be the most important product of the new HSAC and within this special study process the project formulation will be the most important step. To effectively support bureau and industry health and safety efforts, HSAC must be able to perform relevant accident analysis on a specialized basis. HSAC can accomplish this goal. But to do so, key HSAC personnel must develop and maintain strong lines of communication to individuals and organizations who can use this special study support. In essence, HSAC must actively assist possible special study requestors in formulating projects for HSAC to undertake.

HSAC should be cognizant that special study ideas may flow from many sources. They can originate at numerous technical and research centers throughout government and industry. A continuous screening of journals and technical reports plus personal meetings will uncover these ideas. Within the Bureau, a close working relationship with potential users is essential if HSAC is to fulfill its role. The HSAC Chief must make a major effort to establish a pattern of regular communications with each health and safety decision-maker in order to cooperate in formulating special study needs and to get the programs underway.

HSAC should not be strictly limited to special study ideas generated by users. In many cases, projects will originate from within the organization. The constant analysis of accident data allows HSAC to continually monitor trends in accident data and identify health and safety problem areas. Then, with the help of interested Bureau groups, special study projects investigating these problem areas can be formulated.

HSAC will usually be faced with a wide range of study topics proposed by the many users discussed in Chapter 4. The selection of appropirate topics and the definition of study scopes should be undertaken with two criteria in mind:

1. potential for speedy production of usable results;

2. immediate, positive impact of results on the health and safety problem being studied.

PLAN 4: Special Studies

- Organization. Special studies will generally require significant inputs from each of HSAC's four branches. Because of this requirement we recommend that special study responsibilities be assigned on a project management basis rather than through traditional organizational lines. Under this arrangement, a project manager should be assigned from Program Assurance for each special study and it should be his responsibility to plan the project, including people required, time commitment for each person, and services and equipment needed. He should then arrange with each branch chief to make available the people and other resources needed for the study. The project manager should have supervisory responsibility and authority over the time horizon for which each person is assigned to the project.

- Procedure. Exhibit 7-3 outlines a general framework which is applicable to most of the special studies which HSAC is likely to perform. Some studies will require significant effort is all phases shown in the framework. Others will be more heavily or lightly concentrated at specific phases. For example, a study to compile data on coal mine roof control plans should be primarily a normalizing study, while little or no normalizing would be required in a study to determine the probable benefits of a device enabling miners to scale from under supported roof.

  Generally, Special Studies will involve the publication of final reports. In most cases these reports should be distributed to any requestor, but the HSAC Chief should review each report before release, so that he can restrict dissemination of confidential information.

  In Exhibit 7-3 we have assigned specific responsibilities for each phase. However, we do not recommend a strict segregation of activities. There should be some participation by each branch at all phases of a study. For example, the Branch of Special Studies should participate in every activity involving data collection or analysis; Systems Evaluation should be aware of all aspects of any study as to insure their understanding of all alternatives that contribute to the final recommendations; and the HSAC Chief should receive regular briefings as to the direction, progress, and findings of all studies.

EXHIBIT 7-3

FRAMEWORK FOR CONDUCTING SPECIAL STUDIES

	Responsibility
I. Study Design	
Identify and define study	Program Assurance working with users
Appoint project manager (usually from Program Assurance)	Senior Staff Engineer
Plan objectives, scope, approach, nature of final product	Project manager working with chiefs Program Assurance, Systems Evaluation, and Special Studies.
Determine requirements for personnel, equipment, contractors and make provisions for their availability	Project manager working with branch chiefs, approval by HSAC Chief
II. Causal Factor Analysis	
Selection of study parameters and associated measures of safety	Entire project team
Definition and quantification of problems through fatality analysis and/or nonfatal accident analysis	Special Studies
Collection and normalization of data	Special Studies
Field investigation to develop equipment and/or procedural alternatives and to test hypotheses	Special Studies
III. Formulation of Recommendations	
Field research to collect data on probable effects of each alternative in terms of productivity, investment costs, transition problems, etc.	Systems Evaluation
Consulting with groups who might ameliorate problem: equipment producers on designs, USBM Education and Training on appropriate instruction, inspectors on necessary procedures	Systems Evaluation
Analysis of alternatives and identification of costs and probable payoffs	Systems Evaluation
Formulation of recommendations	HSAC Chief, project manager
IV. Implementation	
Design plan for communication or implementation of findings and recommendations	Program Assurance
Specify measures of performance for evaluation of implementation actions	Systems Evaluation, Special Studies

PLAN 5: Dissemination of Results and Implementation of Recommendations

The primary measure of HSAC's success will be the extent to which its work is utilized to improve mining health and safety conditions. This means that HSAC's responsibilities include not only performing special studies and formulating recommendations, but also communicating the fruits of the studies to potential users and assisting in the implementation of recommendations. We recommend that HSAC accomplish this through the following approaches:

1. Utilize the formal and informal patterns of communication discussed in Plan 4 to keep users up to date on the progress and limitations of special studies.

2. Conduct presentations at various mining centers in the United States at the end of each special study.

3. Periodically follow-up each special study by checking with users as to their application of the project results and by providing additional analysis when necessary.

4. Measure and evaluate subsequent changes in health and safety in terms of the measures of performance specified as part of Plan 4.

PLAN 6: Responses to Special Requests

This plan deals with the sensitive public information role of the Center. Because the special request users of mine accident and injury data are concentrated in the Washington area, it is recommended that this function be conducted in Washington by the Public Information Assistant of the Accident Information Branch.

The following procedure is recommended for expeditious processing of special requests made to the HSAC:

1. Call or letter is received from requestor to Public Information Assistant.

2. Assistant responds to requestor with time required to retrieve information and form of response.

3. Assistant searches for information and makes response or passes request to HSAC via mail or phone.

4. If quick response is not practical, special requests are referred from the Public Information Assistant to the Chief, Branch of Accident Information. Chief assigns priority and passes the request to the ADP Coordinator.

5. The ADP Coordinator retrieves data requested from computer files and logs the request.

6. Mail copy to Washington, D. C. Office and mail or phone to requestor from Denver.

Personnel Required:	1 person full-time working for HSAC in the Washington, D. C. Office
Supervisor:	Chief, Branch of Accident Information
Information Requirements:	Have basic fatality and injury data recorded in various forms (i.e., fatal data by company, staff, etc.) as well as library of publications.

CHAPTER 8

DATA, FILE AND SOFTWARE REQUIREMENTS

MAJOR DATA FILES

Many existing Bureau files contain data that HSAC will need. The most necessary of these files are the employment and injury files and the employee history file.

The employment and injury file has recently been adapted to accept data collected through the new coal accident, injury and illness report. Similarly, provisions are being made to store data collected through the new forms for metal and nonmetal mines. Our recommentations as to changes in the new forms and in the corresponding input processes are contained in Chapters 7 and 11 of this report.

The employee history file is the largest file needed by HSAC. It contains the dust sample records, training records, certification records and work history records of all underground coal miners. It will be expanded to include all surface coal mine workers. Individual workers may have many entry records, especially dust sample records, and each record contains a number of variables. Thus, with over 100,000 workers, this file is currently large and is now expanding rapidly.

We make no recommendation as to the specifications of the files in which these types of data are stored. The data processing system must respond to the needs of many users within the Bureau, and it is not necessary that these files be structured specially for HSAC. HSAC's only requirements are to be able to continue to access these files for recurring reports and to strip them of the information necessary for the analytical purposes of special studies.

CROSS-REFERENCING CAPABILITIES

In many cases, HSAC's analyses will require data from more than one file. Such analyses are possible since individual employee data can be referenced by social security number and individual mine data can be traced by mine identification number. The size of the employee history file imposes a prohibitive cost on a direct cross-reference of files. We recommend that, in general, if data from more than one file should be included in an analysis, HSAC should strip the appropriate files of the necessary data and construct a new file to be used for the analysis.

SOFTWARE REQUIREMENTS

HSAC will need adequate software for accepting and analyzing data collected as part of special studies, for sophisticated manipulation of data files, and for a wide range of statistical analyses. Specifically, data management software with the following capabilities should be available to:

1. accept all modes of raw data, whether they be integer, decimal, coded data, alpha numeric or pure alpha data and accept all common data separaters, such as commas, periods, blanks, etc.;
2. transform or recode variables or to sample the variable string;
3. perform any kind of selection or weighting of specified cases or special kinds of screening of certain types of variables;
4. add to raw data strings already existing in files;
5. alter the files or any piece of data within a raw data file;
6. perform any sort of specialized selection, sorting classification and retrieval on the raw data files.

In addition to these kinds of data handling characteristics, the software should provide capabilities for various kinds of manipulation and testing. If possible, the software should be able to:

1. tabulate frequency distributions;
2. tabulate frequency distributions for desired interval scales;
3. develop simple and complex cross-tabulations of variables;
4. calculate simple descriptive statistics, i.e., mean, variance, standard deviation;
5. develop simple statistical correlations on ordinal data and interval data;
6. perform partial correlations;
7. perform multiple correlations;
8. perform factor analysis;

9. perform Gutman's scaling;

10. perform a variety of clustering statistical calculations.

Finally, HSAC needs statistical and software packages which have all these capabilities available in a string of specialized programs that can be used in sequence so that the user needs only to submit one run with a set of very simple instructions in order to have a series of operations performed automatically. Quite a number of software packages that have all these capabilities are available and it should be a very high priority that HSAC acquires this kind of software capability for their personnel.

SPECIALIZED DATA NEEDS

One of the fundamental tools HSAC will use for special studies will be fatality analysis. For this function, it is essential for HSAC to utilize the fatality data base developed for the Bureau by Theodore Barry and Associates under Contract S0110601. For this data base, as well as for other small data files, (generally, those consisting of only a few thousand cases and 100 to 300 variables), HSAC will need a system to store and manipulate data simply and quickly.

It was our experience in working with the fatality data base, that successful, efficient analysis required a direct access system with a very short response time. In a typical analysis,

1. as many as a dozen cross-tabulations would be run at one sitting;

2. the coordinates and limiters of a given cross-tabulation would be determined by the analyst after observing the results of previous cross-tabulations;

3. it was seldom possible for an analyst to know in advance all the data inquiries he would make at a given sitting.

Consequently, we recommend that HSAC utilize an on-line or timesharing system with a terminal located in HSAC's Denver offices. A detailed description of the fatality data base and software system is presented in Chapters 1 through 4 of Volume III of our Industrial Engineering Study of Hazards Associated with Underground Coal Mine Production (Contract S0110601). At a minimum, HSAC needs this system to satisfy its specialized data needs.

CHAPTER 9

HSAC IN TRANSITION

Chapter 6 presented our recommendations for HSAC's organization and staffing levels on a continuing basis. The recommendations were based on some implicit assumptions concerning the capabilities and performance of HSAC personnel and on explicit assumptions of available hardware, special study workload, and utilization of contractor assistance. This chapter addresses the problem of changing HSAC from its present status to that recommended in Chapter 6. The transition should be carried out in two phases.

PHASE I: Achieve Full, Efficient Output

During the first year of operation HSAC should attempt to reach the following goals:

1. Low error rates for inputing incoming data;
2. Timely publication of all recurring reports;
3. Adequate expertise among personnel;
4. Development of ability to perform ongoing special studies with contractor assistance who have experience in the performance of special study type projects.

Four critical steps are involved in reaching these goals.

1. Close management of the coding function;
2. Installation of an optical reading system for the editing and coding process presented in Chapter 7;
3. Development of staff skills required to perform special studies;
4. Timing of staff additions.

- Close Management of The Coding Function. Coal mine accident, injury and illness reports submitted by coders at district offices contain many errors. The percentage of forms requiring correction is well over 50%. From some offices the rate is over 90%.

  There are several reasons why HSAC is experiencing a high rate of error on coal reports. Operators and coders are unfamiliar with the forms and responses. There are ambiguities and omissions in the coding instructions. Because coal coders are dispersed, communication and coordination among coders, which would reduce errors, is difficult. Finally, ambiguous questions in the form make it difficult to formulate coherent answers.

The following measures are recommended to cope with these problems.

1. Coordination and communication should be increased by field trips to coal district offices.

2. Memoranda and letters to coders should increase their awareness of problem areas and clarify ambiguities and omissions in coding instructions.

3. Clarification of the terms should improve the operators' response to questions which are difficult to interpret.

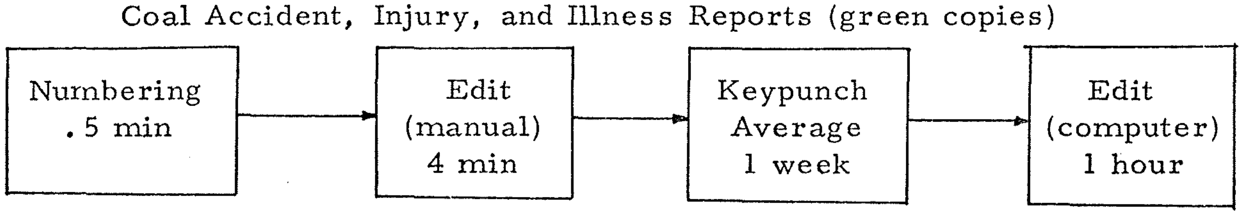
The first two recommendations are self-explanatory. Memoranda have already been issued to coders by HSAC in Denver. These memoranda should be supplemented by field visits to the district offices. Initially these trips should be biweekly with the frequency decreasing as the error rate declines.

Clarification of the form will reduce coding errors because operator responses should improve. Exhibits 11-1 and 11-2 present recommended formats for both Coal and Metal and Nonmetal Injury and Illness Reports. On these forms sample responses are provided to guide the operator in completing the report. These sample responses are placed next to those questions which had high rate of coding error on April-May, 1972, reports.

- <u>Installation of An Optical Reading System for The Editing and Coding Process Presented in Exhibit 8-1</u>. The production process now in effect severely limits HSAC's flexibility in meeting data processing deadlines. The key problem to be overcome in achieving flexibility is the need to operate within constraints imposed by a keypunch process which may require from two days to two weeks to process data.

Because reports are now keypunched, the processing time for data is essentially that required to process the report through keypunch. The following diagram illustrates:

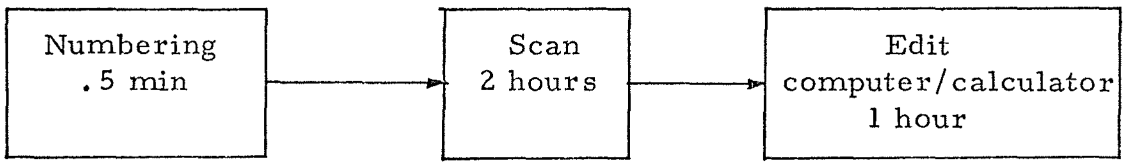
Processing of
Coal Accident, Injury, and Illness Reports (green copies)



Often the final edit on computer cannot be accomplished because of the late return of reports from keypunch. HSAC will probably have to operate with an oversized staff of data handling clerks if it does not improve the flexibility of its data handling process. More clerks will be needed since uncertainty and delays in keypunching will necessitate more staff members to handle work peaks and to perform manual editing.

Purchase of scanning equipment will increase flexibility by reducing keypunch time. The work process thus becomes:

Processing of
Coal Accident, Injury, and Illness Reports (green copies)



Manual editing at the initial stage is eliminated since computer or calculator editing can identify reports requiring follow-up faster and less expensively than manual editing.

Implementation of scanning techniques will have a beneficial effect on personnel requirements, reducing the requirements for coding clerks. Exhibit 9-1 is a projection of clerk needs without implementation of the scanning system. Exhibit 9-2 is a similar projection if a scanning system is used.

EXHIBIT 9-1

REQUIREMENTS FOR CODING PERSONNEL—WITHOUT SCANNING SYSTEM

Task	Aug.	Sept.	Oct.[2]	Nov.	Dec.	Jan.
Produce Monthly Coal Safety Report[1]	1	1	1	1	1	1
Produce 70-71 Metal and Nonmetal Reports	3	2	1	1	1	0
Produce 70-71 Sand/Gravel and Stone Reports	3	2	1	1	1	0
Edit Coal Employment Reports	1	1	1	1	1	1
Edit Coal Accident/Injury and Illness Reports	5	5	5	5	5	5
Edit Metal and Nonmetal Employment Reports	0	3	3	3	3	5
Code Metal and Nonmetal Injury and Illness Reports	0	0	0	10	10	10
Training[3]	0	12	11	0	0	0
Special Studies[1]	1	1	1	1	1	1
TOTAL	14	27	24	23	23	23

[1]Part-time by statistical assistants

[2]New reporting system initiated for metal and nonmetal

[3]Includes instructor

EXHIBIT 9-2

REQUIREMENTS FOR CODING PERSONNEL—WITH SCANNING SYSTEM

Task	Aug.	Sept.	Oct.[2]	Nov.	Dec.	Jan.
Produce Monthly Coal Safety Report[1]	1	1	1	1	1	1
Produce 70-71 Metal and Nonmetal Reports	3	2	1	1	1	0
Produce 70-71 Sand/Gravel and Stone Reports	3	2	1	1	1	0
Edit Coal Employment Reports	1	1	1	1	1	1
Edit Coal Accident/Injury and Illness Reports	5	5	3	3	3	3
Edit Metal and Nonmetal Employment Reports	0	3	3	3	3	3
Edit Metal and Nonmetal Injury and Illness Reports	0	0	0	8	8	8
Training[3]	0	10	9	0	0	0
Special Studies[1]	1	1	1	1	1	1
TOTAL	14	25	20	19	19	17

[1] Part-time by statistical assistants

[2] Scanning system and new reporting system for metal and nonmetal

[3] Includes instructor

Exhibit 9-3 below explains the changes in personnel requirements.

EXHIBIT 9-3

Task	Difference in Projected Jan. Level	Reason for Difference
Edit Coal Accident/Injury and Illness Reports	2	• Error-free coded reports will be separated by computer or calculator.
Edit Metal and Nonmetal Employment Reports	2	• Error-free reports will be separated by computer or calculator
Code Metal and Nonmetal Injury and Illness Reports	2	• Typing is faster than hand printing codes. There is no need to check all forms for consistency, just completeness, at the coding stage.

In summary, a scanning system has been recommended in Chapters 6 and 7.

This system is justified by three considerations:

1. Keypunch cost savings discussed in Chapter 7;
2. Flexibility in report production;
3. Lower data handling personnel requirements.

- Development of Staff Skills Required to Perform Special Studies. We recommend that HSAC undertake an extensive staff development program to ensure a high level of performance of special studies. This program should have three objectives: (a) a high level of technical expertise among HSAC personnel; (b) a broad base of understanding of mining safety problems; and (c) a reasonable degree of consistency in the manner in which HSAC personnel approach accident analysis problems. To achieve this objective, the program should include (for every branch chief, engineer, and analyst):

    1. Intensive exposure to fatality reports and accident analysis studies;
    2. Firsthand experience with HSAC's data base and software;
    3. Training in statistical applications for mining safety;
    4. A series of underground observations;
    5. Group discussions of specific accident analysis problems (including program design).

- Timing of Staff Additions. During this phase of HSAC's development, staffing should be gradually increased to the level shown in Exhibit 9-4. This level will support an ongoing workload of three special studies if contractor assistance is used for most of the work of two of them. We recommend a relatively slow rate of staff build-up because of the management and staff development problems of faster growth and because the nature of special studies requires that output quality take precedence over quantity. HSAC should start with one special study and a staff large enough to perform it. As management and staff development circumstances permit, additional special studies should be undertaken and the staff increased. We emphasize, however, that there is a substantial risk involved in accelerating HSAC's growth, and top priority should be given to ensuring successful operation at a given level before attempting to expand further.

EXHIBIT 9-4

INTERMEDIATE STAFFING LEVELS

HSAC Administration	
Chief	1
Secretary	3
Clerk-typist	1
	5
Program Assurance Branch	
Senior Staff Engineer	1
Staff Engineer	2
	3
Systems Evaluation Branch	
Chief	1
Systems Analyst	1
	2
Special Studies Branch	
Chief	1
Field Engineer	4
	5
Accident Information Branch	
Chief	1
Public Information Assistant	1
ADP Coordinator	1
Statistical Coordinator	1
DPU Supervisory Survey Statistician	1
Coding Clerk	1
Microfilm Operator	1
MIF Supervisory Survey Statistician	1
Supervisory Statistical Assistant	1
Coding Clerk	4
Accident/Injury Report Supervisory Survey Statistician	1
Supervisory Statistical Assistant	1
Coding Clerk	11
	27

TOTAL HSAC --- 42

PHASE II: Eliminate Reliance on Contractor Assistance

As recommended in Chapter 6, HSAC should eventually operate with a minimum of contractor assistance. Such assistance should be necessary only in cases of extreme emergency or necessity of specialized expertise, or where HSAC's nature as a government agency would significantly impede the performance of a study. Consequently, we recommend that HSAC gradually reduce contractor participation in special studies while increasing its staff size to the level recommended in Chapter 6. We estimate that this reduction should occur over a one to two year period depending upon the special studies undertaken and the degree to which HSAC is committed to a staff development program such as that described in this chapter.

CHAPTER 10

RECURRING REPORTS

As a result of our user needs survey (see Chapter 4), we have concluded that recurring reports published by HSAC should be simplified, consolidated, and user-oriented.

We recommend that all current regular accident reports (about sixteen different reports) be replaced by one brief monthly fatality report and four quarterly publications—two for coal and two for metal and nonmetal. Two of these quarterly reports (one coal, one metal and nonmetal) should provide important statistical indices for the industry which operators and managers can use to measure their individual progress and problems with regard to safety against the performance of the industry as a whole. The two remaining quarterly reports (again, one for coal, one for metal and nonmetal) should be internal Bureau management tools designed primarily for use by district and subdistrict managers to assist them in inspection planning and alert them to particular safety problems. These internal reports should describe accident occurrence on mine-by-mine, subdistrict-by-subdistrict, travel area-by-travel area, district-by-district, etc., basis.

For the two broadly-distributed reports, the final quarterly report each calendar year should contain additional summaries on accident/injury occurrence in various categories for the entire year.

We recommend that statistical tabulation for the four quarterly reports be computer generated, with very little editing of the output. Text writing should be kept to a minimum. We anticipate that reports can be published within six weeks of the end of each quarter.

ROLE OF COMMENTARY

The two broadly distributed reports should not be limited to presentation of statistics. They are also a convenient vehicle for publishing analyses of specific safety problems. The subjects of these analyses can come from two sources:

1. Analysis of statistics in the report, including special problems reflected by the statistics, supplemented by field data from inspectors or instructors.

2. Reports on special studies being conducted or having been completed by HSAC. These reports could stimulate suggestions for additional special studies.

The importance of commentary in the quarterly safety reports is equal to that of the statistical tables. This importance arises from the fact that the commentary aids readers in interpreting statistics and increases their awareness of specific safety problems. It is recommended that the commentary be written by the Special Studies Branch.

COAL REPORTS

Two quarterly reports should be addressed to coal safety. The Coal Safety Report should be broadly distributed and should be aimed at the information needs of the mining community as a whole. Specifically these needs are:

1. A series of yardsticks presenting the levels and trends of accidents in coal mining.

2. Insights into specific safety problems.

Each quarter the Coal Safety Report should consist of three tables of statistics and one brief commentary addressing an accident analysis topic. For the final quarter of each year, the report should be expanded to include seven tables. The additional tables in this "annual edition" should present statistical summaries for the entire year. Details and explanations of each of the tables are presented in Appendix A. The Coal Safety Report should be sent to every coal mining company and to any other user upon request.

In addition to the Coal Safety Report, HSAC should publish a USBM Coal Report. This publication should be produced quarterly and distributed exclusively within the Bureau. It should consist of five tables which present accident data by district, subdistrict, and individual mine. Its primary role should be as a management planning and operating tool for the inspection and education and training functions. Details and explanations of the tables recommended for the USBM Coal Report are presented in Appendix B.

METAL AND NONMETAL REPORTS

In our user need survey we encountered a substantial need for mine information about metal and nonmetal accidents. To fulfill this need, we recommend two quarterly publications—one broadly-distributed (the Metal and Nonmetal Safety Report) and one for distribution within the Bureau only (the USBM Metal and Nonmetal Report). The recommended report formats parallel those for coal. They should consist primarily of computer generated tables (see Appendices C and D for details and explanations), with a brief commentary added to the broadly-distributed report.

In formulating these recommendations, the following industry characteristics were considered the most important:

1. Mines vary widely in characteristics, size, and past safety performance.

2. In some states, inspection responsibilities are shared by the Bureau with "state plan" state inspectors.

3. Because of a thinly spread USBM inspector force, many mines must rely on "self-help" to improve their safety records.

4. Commodity groups with individual interests exist within the industry.

5. Current injury statistics for metal and nonmetal mines have been lacking in the past.

The presence of these industry traits determined the following report characteristics:

1. Frequency of reports
2. Mine categories used
3. Geographic reporting regions employed
4. Type of commodity report

These characteristics will now be discussed in detail.

1. Frequency. It is recommended that the safety reports be produced each quarter. Because there are many small operations in metal and nonmetal mining which are operated seasonally, quarterly reports are necessary to reflect differences in safety due to seasonal variations. Also, many different inspector groups (including state and USBM inspectors) are involved. Each group has different needs for information currency. Quarterly reports should be frequent enough to satisfy these needs. Frequent reporting will also increase the reader's reliance on and confidence in the new report. Yearly summaries are used for sparse or difficult to compute data such as occupational illness and severity statistics.

2. Mine Categories. Mines and mills are divided by number of employees as follows:

   Underground
   small (1-49)
   medium (50-149)
   large (150+)

Surface
small (1-34)
medium (35-99)
large (100+)

Mills

These seven categories best account for differences in physical characteristics of mines. The separation can best focus attention on the most unsafe types of operation. On a yearly basis, commodity breakdowns are presented in the annual edition of the broadly-distributed publication. This will enable easy cross-reference to traditional separations (e.g., metal, nonmetal, stone, sand and gravel).

3. Geographic Regions. Breakdown by state is recommended as the best way to ensure maximum helpfulness to state inspection agencies and state plan evaluators in the Bureau. District and subdistrict performance can also be easily evaluated since these jurisdictional areas are divided along state lines.

4. Commodity Reports. A yearly summary of frequency rates for each commodity is recommended for broad distribution. This information will give those mines producing common commodities and having strong commercial ties information regarding their industry. Also, mines producing common commodities may have similar problems. The commodity summary will indicate the presence of such common problems.

GENERAL FATALITY REPORT

A monthly in-house publication that will highlight all pertinent data covering fatalities is also recommended. This publication should not be distributed externally, but the information can be available to any interested party. If the requests for this current fatality data are frequent, an analysis should be made to determine if this publication should be generally distributed outside the USBM.

The purpose of this report is to keep Bureau personnel up to date on recent fatalities. It should consist of two pages. Page one should list summary information for each fatality (in coal or metal and nonmetal) occurring during the month. Page two should summarize fatality experiences for each of the previous twelve months. Suggested formats are presented in Appendix E. The General Fatality Report should be prepared manually by the Public Information Assistant of the Accident Information Branch.

USES OF RECURRING PUBLICATIONS

The recommended package of recurring publications is directed at the needs for recurring information presented in Chapters 4 and 5. These vary from general performance yardsticks to aids for Bureau personnel in managing their activities. In addition, it is anticipated that the information included in the tables will provide opportunities for Bureau, industry and labor personnel to participate in coordinated safety efforts.

For example, it is recommended that each annual edition of the two safety reports list the ten tasks where the most injuries occur. This presentation is shown in Table 6 for coal and Table 7 for metal and nonmetal.

Presentation of the Top Ten Tasks in the safety reports could be supplemented by other USBM efforts to publicize the dangers inherent in the tasks. These publicity efforts could include:

1. Reiteration by inspectors during mine visits
2. Reiteration by safety instructors during course presentations
3. An illustrated education and training bulletin discussing the Top Ten Tasks and their dangers
4. News releases announcing new Top Ten Tasks lists and improvements/degradations in the Top Ten accident record

REPORTING ERRORS

The validity of recurring reports produced by the center will be limited to the response from the industries involved. There are three sources of error introduced into the data by weaknesses in the reporting system. These errors are:

Case 1 — Errors arising because mines are omitted completely from the reporting system because the mines are "unknown" to USBM.

Case 2 — Errors in accident data from inaccurate reporting or absence of reporting by operators.

Case 3 — Errors in employment data from inaccurate reporting or absence of reporting by operators.

The Branch of Accident Information must continuously work to reduce these errors. The following recommendations are broad guidelines to be followed in minimizing the three types of error.

<u>Case 1 Errors</u> "Unknown" mines should be "discovered" and placed into the reporting system. Safety inspectors provide contact with the industry and should be the primary source of information on new mines. Within the Branch of Accident Information, the survey statistician in charge of the Master Index File should coordinate the effort to bring previously "undiscovered" mines into the reporting system. It is recommended that HSAC make no attempt to project employment and accident history to the non-reporting segment of an industry. Statistically, the characteristics of the non-reporting segment are unknown and, therefore, biases are introduced in the estimating process. Furthermore, the estimates are proportional projections of the known data so the comparative frequency ratios will not change with the addition of the estimated data.

<u>Case 2 Errors</u> Some operators, through unfamiliarity with the new system or through negligence, will report accident and injury data incorrectly or not at all. Errors from failures to report should be corrected by inspectors at the mine. Minor errors in the way accidents are reported can be corrected by phone or mail feedback to the operator. If errors are very minor, no follow-up should be made. The statistical assistant can determine what omissions can be tolerated. Identification of errors can be made during the processes of coding and editing of accident reports.

It is recommended that HSAC make no attempt to estimate the number of unreported accidents or injuries. For accidents that are reported erroneously or where the victim has not returned to work by the close-out time for report production, the following estimation procedure is recommended:

Situation	Recommendation
Date returned to work unknown	Record 1 temporary total injury. Estimate day charge.
Nature of injury unclear.	Record 1 temporary total injury. Estimate lost time from report description.

Case 3 Errors

Employment data, like accident data, is likely to be incomplete. Failures to report or reporting inaccuracies can be brought to the operator's attention by inspectors or mail follow-up.

Employment data can be estimated if the number of workers at the mine is known or if employment has been reported previously. This estimate should be made only for mines reporting accidents or injuries. A computer program can select the appropriate figure on the close-out date. The following priority for selection of manhours worked is recommended:

Coal:	1. Previous month 2. Last month reported 3. Number of men working x (Average # working hours per month.)
Metal and Nonmetal:	1. Same quarter previous year 2. Previous quarter 3. Number of men working x (Average # working hours per quarter.)

The process of estimating should be part of the report preparation process. These estimates can be computer generated on a mine-by-mine basis on the report close-out date.

CHAPTER 11

DATA INPUT

This chapter presents our recommendations for changes in the standard forms used to report accident, injury, illness, and employment data. A recommended form for reporting injuries and illnesses associated with coal mining is presented in Exhibit 11-1. A comparable metal and nonmetal form is presented in Exhibit 11-2. Employment and production forms are not exhibited.

Four types of changes are recommended:

1. A change in the scope of reporting;

2. Changes resulting from our recommendation of an optical reading system;

3. Changes in the content of the forms;

4. Changes in format.

CHANGE IN SCOPE

We recommend that coal companies should not be required to notify the USBM of non-injury accidents. Based on early returns, not many of the mines are reporting this type of accident so the deletion of this reporting would help reduce the burden on the "honest" mines. We do not anticipate a significant use for the sparse, nonrepresentative data now reported.

CHANGES RESULTING FROM THE OPTICAL READING SYSTEM

In order to streamline the clerical operations involved in report processing, HSAC should invest in new scanning equipment. This equipment can reduce the time and expense of processing reports by eliminating the keypunch step.

We recommend Datatype Model 3402, Optical Reading System, or its equivalent. If this equipment is purchased, the following changes should be instituted:

1. Employment data should be recorded on mark sense forms by operators. The forms could then be directly processed by the machine.

2. Coal injury and illness forms should be coded by typing codes in the space provided at the bottom of the forms. These typed codes can be read directly by the machine.

EXHIBIT 11-1

BUREAU OF MINES ID NUMBER ____________

COMPANY NAME ____________

MINE NAME ____________

MAILING ADDRESS ____________

Date of injury or illness (for illness, date diagnosed) ____________
month day year

Do not write in this box

Time of injury--------- ☐ AM ☐ PM (1) ☐ Production (2) ☐ Maintenance

Time shift started------ ☐ AM ☐ PM (3) ☐ Other

A. LOCATION OF INJURY OR ILLNESS (Circle the applicable code.)

(1) Underground Mine

On Section (1) ☐ Section ID Number ____________ Operator Section Number ____________ Seam Height ____________

Off Section (2) ☐ Operator location number or name ____________

Mining Method -- On Section, circle code for applicable method. Off Section, circle code for principal method used.

01 Continuous 02 Conventional 03 Hand 04 Longwall 05 Continuous Auger

Location -- Whether On Section or Off Section, circle location codes describing accident.

01 Shaft 02 Slope 03 Drift 04 Entry 05 Room 06 Face Area or Intersection

Status -- On Section, circle applicable status. Off Section, circle principal status. 01 Development 02 Retreat

(2) Surface Mine 03 Strip 04 Auger 05 Culm Bank 06 Dredge

(3) Surface Operation

01 Tipple
02 Mechanical Cleaning Plant
03 Preparation plant or breaker
04 Tramline or railroad
05 Central Shops
00 Office at mine
06 Other surface operations: Specify ____________

B. OCCUPATIONAL ILLNESS (Complete this section only if reporting an illness.)

☐ 21 Occupational skin diseases ☐ 23 Respiratory diseases (toxic agents) ☐ 25 Disorders (physical agents) ☐ 29 All other Illnesses

☐ 22 Dust diseases of the lung ☐ 24 Poisoning (toxic materials) ☐ 26 Disorders (repeated trauma)

C. INFORMATION CONCERNING INJURY OR ILLNESS

1. What brought about the injury or illness reported? (For example: "Roof fell" or "Employee tripped and struck electric cable".) ____________

2. What was the unsafe physical or mechanical condition(s) contributing to the injury or illness? (For example: "Improperly assembled equipment" or "Premature detonation of explosives".) ____________

3. Name the equipment, material, or tool involved. (For machinery, include manufacturers name.) ____________ Model Number (If applicable) ____________

4. Describe any unsafe acts contributing to the injury or illness (For example: "Working under unsupported roof".) ____________

5. How many employees were injured or became ill as a result of this occurrence? ____________ (A separate Injury and Illness Report must be submitted for each employee who was injured or became ill.)

D. INFORMATION CONCERNING INJURED OR ILL PERSON ☐ Fatal ☐ Non-Fatal

1. Regarding injury or illness: What was the agent, object, or tool inflicting injury? (For example: If employee tripped and fell on a nail, write "nail".) ____________

What was the nature of the injury or illness? (For example: Dislocation, burn, silicosis) ____________

Part of body injured? ____________ Amputation? (1) ☐ Yes (2) ☐ No If Yes, part of body lost ____________

2. Regarding injured or ill person: Full Name ____________ Social Security No. ____________

Sex: ______ Age: ______ Regular Job Title: ____________ Experience at regular job: ______ Years ______ Months

Experience at this mine: ______ Years ______ Months Total Mining Experience: ______ Years ______ Months What was the employee doing when injured? (For example: "Drilling roof" or "Operating shuttle car".) ____________

Was that activity part of the employee's regular job? (1) ☐ Yes (2) ☐ No If "No", what was the job title of the job being performed by the employee? ____________ Experience at that job: ______ Years ______ Months

3. Regarding employee's return to work: Did employee return to regular job the next regular shift? (1) ☐ Yes (2) ☐ No If Yes, at full capacity? (1) ☐ Yes (2) ☐ No Did employee return to another job the next regular shift? (1) ☐ Yes (2) ☐ No Was the employee transferred to another job or terminated? (1) ☐ Yes (2) ☐ No If Yes, (1) ☐ after lost work days, or (2) ☐ because of injury or illness, but without lost work days.

Total number of lost work days ______. Number lost from regular job ______. Date returned to work ____________.

PERSON TO BE CONTACTED REGARDING THIS REPORT: Name & Title ____________ Phone ____________ (Include area code)

Retain this original (White) copy at the mine for five years.

EXHIBIT 11-2

BUREAU OF MINES ID NUMBER ____________

COMPANY NAME ____________

MINE NAME ____________

MAILING ADDRESS ____________

____

Date of injury or illness (for illness, date diagnosed) ____________ month day year

Do not write in this box

Time of injury--------- ☐ AM ☐ PM (1) ☐ Production (2) ☐ Maintenance

Time shift started------ ☐ AM ☐ PM (3) ☐ Other

A. LOCATION OF INJURY OR ILLNESS (Circle the applicable code.)

(1) Underground Mine

Injury or illness occurred at production point? (1) ☐ Yes (2) ☐ No

Mining Method--If at production point, circle applicable method. If not at production point circle principal mining method used.

01 Cut and fill
02 Shrinkage
03 Room and pillar
04 Open stopes, naturally supported
05 Open stopes, artificially supported
06 Block caving
07 Sub-level caving
08 Other, specify ____________

Location--Circle applicable area indicating where accident and injury occurred.

09 Shaft or winze
10 Inclined haulageway
11 Other haulageway, adit, or drift
12 Raise
13 Stope
14 Other, specify ____________

(2) Surface Mine
01 Open pit or quarry
02 Dredge
03 Other, specify ____________

(3) Operations, Sub-Unit
01 Exploration
02 Sawing and finishing of dimension stone associated with mining operation
03 Crushing and sizing
04 Kiln products: Calcining, sintering
05 Milling: Grinding and concentrating
06 Tramline or railroads
07 Loading docks
08 Warehousing
09 Shops and yards
10 Other, specify ____________

B. OCCUPATIONAL ILLNESS (Complete this section only if reporting an illness.)

☐ 21 Occupational skin diseases
☐ 22 Dust diseases of the lung
☐ 23 Respiratory diseases (toxic agents)
☐ 24 Poisoning (toxic materials)
☐ 25 Disorders (physical agents)
☐ 26 Disorders (repeated trauma)
☐ 29 All other Illnesses

C. INFORMATION CONCERNING INJURY OR ILLNESS

1. What brought about the injury or illness reported? (For example: "Roof fell") ____________

2. What was the unsafe physical or mechanical condition(s) contributing to the injury or illness? (For example: "Improperly assembled equipment" or "Premature detonation of explosives".) ____________

3. Name the equipment, material, or tool involved. (For machinery, include manufacturers name.) ____________ Model Number (If applicable) ____________

4. Describe any unsafe acts contributing to the injury or illness (For example: "Working under unsupported roof".) ____________

5. How many employees were injured or became ill as a result of this occurrence? ____________ (A separate Injury and Illness Report must be submitted for each employee who was injured or became ill.)

D. INFORMATION CONCERNING INJURED OR ILL PERSON ☐ Fatal ☐ Non-Fatal

1. Regarding injury or illness: What was the agent, object, or tool inflicting injury? (For example: If employee tripped and fell on a nail, write "nail".) ____________

What was the nature of the injury or illness? (For example: Dislocation, burn, silicosis) ____________

Part of body injured? ____________ Amputation? (1) ☐ Yes (2) ☐ No If Yes, part of body lost ____________

2. Regarding injured or ill person: Full Name ____________ Social Security No. ____________

Sex: ______ Age: ______ Regular Job Title: ____________ Experience at regular job: ______ Years ______ Months

Experience at this mine: ______ Years ______ Months Total Mining Experience: ______ Years ______ Months

What was the employee doing when injured? (For example: "Drilling roof" or "Operating shuttle car".) ____________

Was that activity part of the employee's regular job? (1) ☐ Yes (2) ☐ No If "No", what was the job title of the job being performed by the employee? ____________ Experience at that job: ______ Years ______ Months

3. Regarding employee's return to work: Did employee return to regular job the next regular shift? (1) ☐ Yes (2) ☐ No If "Yes", at full capacity? (1) ☐ Yes (2) ☐ No Did employee return to another job the next regular shift? (1) ☐ Yes (2) ☐ No Was the employee transferred to another job or terminated? (1) ☐ Yes (2) ☐ No If "Yes", (1) ☐ after lost work days, or (2) ☐ because of injury or illness, but without lost work days.

Total number of lost work days ______. Number lost from regular job ______. Date returned to work ____________

PERSON TO BE CONTACTED REGARDING THIS REPORT: Name & Title ____________ Phone ____________ (Include area code)

Retain this original (White) copy at the mine for five years.

3. Metal and nonmetal injury and illness coding should be typed on separate sheets of paper. This is feasible since the coding will be handled by HSAC personnel in Denver where control over coding is reasonably close.

These changes are designed to eliminate keypunching and to reduce report processing time and expense. The cost of Datatype Model 3402 is approximately $20,000 plus about $2,000 in accessories.

It is likely that within two years, the ADP Division will purchase an optical scanning device with much greater capabilities. Such a machine would provide opportunities for further economies in report processing, since alphanumeric figures could be read directly from forms.

CHANGES IN CONTENT

- Coal Injury and Illness Report. We recommend five changes from the current accident/injury and illness forms.

  1. Seam Height. It is widely believed that one of the most important variables in accident analysis is the seam height in which the underground accident occurred. Much of our accident analysis has tended to confirm this. Certain types of accidents are more prevalent in low seams than they are in higher seams. (One example would be injuries due to the operator hitting the roof while tramming a haulage or supply vehicle.) For this reason we feel that it is important to again require seam height to be recorded for each accident.

  2. Principal Method of Mining Used. Under this category we feel that a box for auger-type continuous mining should be included. In the past, this form of underground mining has caused more than its proportion of injuries compared to other mining methods. For this reason, we feel that closer attention should be given to the continuous auger mining style. The first step for this closer scrutiny would be to identify this type of mining on the accident forms.

  3. Experience. All of the questions that ask for experience should have spaces for the number of months and years. Besides clarifying this for the operator, the answers will be more accurate for all injuries that occur to miners with less than one year of experience.

  4. Explanations. The questions which have been causing the most problems for both operators and coders have been those which require the operator to explain the answer in writing. We propose that these written explanations no longer be required. Instead,

the operator should be given the option of filling in the specific codes. This can be done by supplying each operator with a list of the appropriate codes. A list of commonly used codes should be assembled from the earlier report returns. There would be three main advantages to this system:

a. The coding would be more accurate as there would be no need for interpretation of the written answers by the coders.

b. It would eliminate many of the steps now performed by the coders.

c. It would relieve part of the reporting burden on the operators.

5. Type of Accident. Section B, "Type of Accident", should be deleted. This will eliminate the need to make many corrections to the reports as they are submitted by operators. The same information provided by Section B can be obtained from the section for "Accident Occurrence Data" which includes the question, "What brought about the accident or illness reported?" If this change is made, the coding instructions would have to be amplified in order to cover all types of accidents in mines.

- Coal Employment and Production Report. As in the case of the Coal Injury, and Illness Report, seam height should be added to the Coal Employment Report when reporting employment for underground mines. As previously explained, seam height can be an important variable in analyzing underground accidents. It must be reported on the employment report so HSAC will have a seam height record for the mines that did not report any accidents over the past quarter.

- Metal and Nonmetal Injury and Illness Report and Employment Report. No content change beyond those recommended for the coal reports are recommended for the metal and nonmetal reports.

CHANGES IN FORMAT

Two major format changes are recommended for both the coal and the metal and nonmetal injury and illness reports. One is that examples of responses are presented on the form for questions which have caused problems in the past. These examples should be very helpful for operators who do not choose to fill in the specific codes. The second change is in the space provided for coding. The recommended coal forms provide space at the bottom so that coders can type in appropriate codes while reading the responses. No coding space is provided on the recommended metal and nonmetal form since it is anticipated that codes will be typed on a separate sheet.

CHAPTER 12

POSITION DESCRIPTIONS

In order to clarify our recommendations as to HSAC's functions and the roles and interactions of HSAC's personnel, we have included, in this chapter, a set of recommended summary position descriptions. Descriptions are included for the major functional positions under the Chief, Health and Safety Analysis Center. Although these position descriptions are in the format of formal position descriptions written for Personnel, they are not intended to be a substitute for them.

SENIOR STAFF ENGINEER

Introduction

This position is established as the Senior Staff Engineer, Chief of the Program Assurance Branch of the Health and Safety Analysis Center located in Denver, Colorado. The Program Assurance Branch will be responsible, within HSAC for: (1) identifying topics for special studies in the field of mine health and safety; (2) coordinating the conduct of health and safety special studies; (3) reviewing the results of special studies for fulfillment of the requirements of the study; and (4) assisting the Chief, Health and Safety Analysis Center, in executing an implementation program for recommendations of health and safety special studies.

Duties and Responsibilities

As Chief, Program Assurance Branch, the Senior Staff Engineer must identify opportunities for improved health and safety in domestic mines through improvements in conventional technology. Sources of improvement may be in the mining technologies of other countries, the technology of other industries, improvements originated by domestic mining corporations, improvements generated by other USBM divisions and offices in Health and Safety and Mineral Resources, and in the HSAC itself.

Once an area for study is identified, the Senior Staff Engineer will be responsible for coordinating the initiation and conduct of the study. He will decide the extent of contractor participation, specify the timetable to be followed in completing the study, and assign specific responsibilities to other HSAC branches in connection with the study. The Senior Staff Engineer will consult with the Chief, HSAC in appointing a Project Manager from Program Assurance to coordinate the activities of the branches and/or contractors. The Project Manager will be responsible to the Senior Staff Engineer for fulfillment of the study's requirements within the specified time frame.

Specific duties and responsibilities of the Senior Staff Engineer are represented, but not limited, by the following:

1. Is responsible for the continual development of new topics for special study within the scope of mine health and safety.

2. Is responsible for the supervision and completion of special studies undertaken by the Health and Safety Analysis Center.

3. Is responsible for guiding the implementation of the results of all HSAC special studies and measuring the effectiveness of that implementation.

4. Is responsible for conducting liaison and negotiations with contractors performing special studies for the HSAC.

5. Is responsible for working closely with the Chief, HSAC, in increasing awareness in the Bureau and in industry of the services provided by the Center.

6. Is responsible for developing and directing an inter-disciplinary group to discharge these assigned responsibilities.

Supervision Received

The position is under the general administrative supervision of the Chief, Health and Safety Analysis Center. The Senior Staff Engineer has complete responsibility for monitoring the day-to-day conduct of HSAC's special studies program and is expected to exercise sound judgment in ensuring coordination of the other HSAC branches and contractors in performing these studies. Performance is evaluated in terms of ability to make decisions and use initiative to ensure that special studies are completed and that the effort expended in their performance will advance the technology of mine health and safety.

Qualifications

The Senior Staff Engineer must have a high degree of training, experience, and knowledge of mine systems analysis and engineering. He must be eager to seek new ideas involving changes of current mining technology and must be aggressive in the implementation of the products of HSAC projects.

STAFF ENGINEER

Introduction

This position is established as a Staff Engineer assigned to the Program Assurance Branch of the Health and Safety Analysis Center in Denver, Colorado. A Staff Engineer will be Project Manager on special studies, with the responsibility for overseeing the formulation, execution, and implementation of special studies to which he is assigned.

Duties and Responsibilities

The primary duties and responsibilities of this position will be to:

1. Review technological advances in mining and other industries for opportunities to advance the state of health and safety in the nation's mines.

2. Examine cause-effect relationships resulting from analysis of data for opportunities to stimulate new technology.

3. Where new technology or an identified cause-effect relationship warrants further investigation, formulate the task, time and manpower requirements to complete a special study of the new technology's applicability to mining.

4. Coordinate the execution of the special study with other HSAC branches or with contractors.

5. Supervise the implementation of special study recommendations as made by the Systems Evaluation Branch.

6. Design parameters for measuring the effectiveness of implementation and formulate whatever plans are necessary for measuring those parameters.

Supervision Received

This position reports to the Senior Staff Engineer. Performance will be measured by the ability to complete the transfer of new technology to the nation's mines, bringing about improved health and safety for the miner.

Qualifications

Master of Science degree in one of the following disciplines:

Mining Engineering
Other engineering
Business Management

Bachelor of Science degree in one of the following disciplines:

Mining Engineering
Other engineering

The Staff Engineer must be able to direct and coordinate the efforts of others in effectively completing special studies.

CHIEF, SYSTEMS EVALUATION BRANCH

Introduction

This postion is established as the Chief, Systems Evaluation Branch of the Health and Safety Analysis Center in Denver, Colorado. The Systems Evaluation Branch will be responsible, within HSAC, for: (1) participating in the formulation and scheduling of special studies to be undertaken by the Center; (2) reviewing the progress of special studies whether they are performed by the Center or by contractor; (3) evaluating the economic impact of alternative solutions to health and safety problems, both as part of special studies and independently; and (4) selecting the most economically sound solution to health and safety problems from the proposed alternatives.

Duties and Responsibilities

The primary duty of the Chief, Systems Evaluation Branch, will be to participate in the conduct of HSAC special studies. His role in these special studies will be selection of the most economically sound solution to the health and safety problem considered by the special study. Therefore, he must be familiar with all phases of the study including the data collection and analysis performed by other HSAC branches. Because of this need, his participation in a study begins at the study's start; that is, when the Project Manager specifies a timetable and a desired product. The process of economic evaluation and selection of a final recommendation begins after the Branch of Safety Analysis has identified causal relationships and has specified alternative solutions to the technological problem.

Specific duties and responsibilities of the Chief, Systems Evaluation Branch, are represented, but not limited, by the following:

1. Is responsible for submission to the Chief, HSAC, the final recommendations representing the products of special studies, including the impact of the recommendation in terms of improved health and safety (benefits) and the impact in terms of costs to the government and to industry (costs).

2. Is responsible for coordinating with the Senior Staff Engineer the effort to specify the type of data collection and analysis necessary to complete a special study, once a decision has been made to conduct a particular study.

3. Is responsible for monitoring the activities of the Accident Information and Special Studies Branches during the course

CHIEF, SPECIAL STUDIES BRANCH

Introduction

This position is established as Chief, Special Studies Branch, of the Health and Safety Analysis Center in Denver, Colorado. The Special Studies Branch will be responsible, within, HSAC, for: (1) determining cause and effect relationships from accident, injury, and employment data leading to identification of causes of accidents and injuries, both independently and as part of special studies; (2) making field visits to mines to collect accident and employment data not regularly reported to U.S.B.M.; (3) assisting the Accident Information Branch by collecting and/or analyzing accident and employment information in response to special requests; (4) writing narratives, based upon some aspect of accident analysis, for recurring broad distribution publications; (5) participating in the formulation and scheduling of special studies to be undertaken by HSAC; (6) providing the Systems Evaluation Branch at HSAC alternative solutions to health and safety problems as part of special studies.

Duties and Responsibilities

The primary duty of the Chief, Special Studies Branch, will be to use data gathered by the Accident Information Branch to determine cause and effect relationships in mine accidents which in turn lead to the identification of mine safety problems. He will apply these relationships to new technology in mine health and safety in order to delineate alternative solutions to the mine safety problem identified by data analysis.

The Chief, Special Studies Branch, will not limit his investigations of data to analyses associated with special studies and special requests. He is expected to seek, on his own initiative, accident causes through a program of continuous monitoring of accident and injury reports.

Specific duties and responsibilities of the Chief, Special Studies Branch, are represented, but not limited, by the following:

1. Is responsible for performing analysis of accident data, facilitated by direct liaison with Accident Information Branch personnel including the ADP Coordinator and the Statistical Coordinator.

2. Is responsible for submitting to the Chief, Systems Evaluation Branch, alternative solutions to safety and health problems under consideration as part of HSAC special studies.

3. Is responsible for determining the need for, scheduling, and, finally, conducting field trips to mines and mills in connection with special studies.

4. Is responsible for conducting independent study of potential problems, the purpose of which is to identify new special studies, research projects, or topics for publication.

5. Is responsible for writing narratives for recurring broad-distribution publications.

6. Is responsible for coordinating with the Senior Staff Engineer, or Project Manager, the scheduling of Special Studies Branch personnel participation in special studies.

7. Is responsible for developing and directing an inter-disciplinary group to discharge these assigned responsibilities.

Supervision Received

The position is under the general administrative supervision of the Chief, Health and Safety Analysis Center. Performance is evaluated in terms of ability to analyze and identify solutions to safety problems, to exercise originality in identifying factors for independent analysis, and to efficiently coordinate and administer his branch.

Qualifications

The Chief, Special Studies Branch, must possess a high degree of training in the disciplines of statistics, mine engineering, and personnel administration. He must evaluate recommendations based on statistical relationships and engineering disciplines. He must also be an effective administrator, able to coordinate the activities of personnel in his Branch within the constraints imposed by project scheduling.

of the study to the extent necessary to ensure that he possesses all knowledge of the problem necessary to make a sound decision when the analysis is complete and the alternatives are presented.

4. Is responsible for proposing steps necessary to implement his recommendations within the mining industry and estimating the time required and costs involved in that implementation.

5. Is responsible for developing and directing an inter-disciplinary group to discharge these assigned responsibilities.

Supervision Received

The position is under the general administrative supervision of the Chief, Health and Safety Analysis Center. Beyond the requirement that he meet completion timetables for special studies, there is no supervision or technical review of his work. All recommendations are made to and reviewed by the Chief, Health and Safety Analysis Center.

Performance is evaluated in terms of the ability to evaluate technological alternatives to mine health and safety problems and to formulate economically sound programs to implement technological change in the mining industry.

Qualifications

The Chief, Systems Evaluation Branch, must possess a high degree of training in the disciplines of mine systems engineering, engineering economy, and economics. He must also have extensive experience and a reputation in the field of mine engineering.

ECONOMIC SYSTEMS ANALYST

Introduction

This position is established as an Economic Systems Analyst assigned to the Systems Evaluation Branch of the Health and Safety Analysis Center in Denver, Colorado. An Economic Systems Analyst will be responsible for analyzing the economic and social impact of various solutions to health and safety problems, as proposed by the Special Studies Branch or contractor, and then selecting the most economically sound alternative.

Duties and Responsibilities

The primary duties and responsibilities of this position will be to:

1. Measure the economic and social costs and benefits of each proposed alternative made by the Special Studies Branch.

2. Select the best alternative and propose a method for implementation including the personnel or agency involved, costs involved, and time required.

3. Maintain liaison with other HSAC branches or contractors throughout the course of special studies to the extent necessary to make a thorough analysis of alternative solutions to health and safety problems.

Supervision Received

This position will be under the supervision of the Chief, Systems Evaluation Branch. Performance will be measured in terms of the ability to identify all benefits and costs of proposals and develop a program for implementation of solutions to health and safety problems.

Qualifications

Master of Science degree in one of the following disciplines:

- Economics
- Business Administration
- Psychology
- Industrial Engineering

Bachelor of Science degree in one of the following disciplines:

- Mining Engineering
- Industrial Engineering
- Psychology
- Metallurgy
- Statistics

CHIEF, SPECIAL STUDIES BRANCH

Introduction

This position is established as Chief, Special Studies Branch, of the Health and Safety Analysis Center in Denver, Colorado. The Special Studies Branch will be responsible, within HSAC, for : (1) determining cause and effect relationships from accident, injury, and employment data leading to identification of causes of accidents and injuries, both independently and as part of special studies; (2) making field visits to mines to verify causal relationships and the applicability of new technology; (3) providing the Systems Evaluation Branch at the Safety Analysis Center alternative solutions to health and safety problems as part of special studies; and (4) writing narratives for recurring broad-distribution publications.

Duties and Responsibilities

The primary duty of the Chief, Special Studies Branch, will be to use data gathered by the Accident Information Branch to determine cause and effect relationships in mine accidents which in turn lead to the identification of mine safety problems. He will apply these relationships to new technology in mine health and safety in order to delineate alternative solutions to the mine safety problem identified by data analysis. These alternative solutions will be submitted to the Systems Evaluation Branch for economic evaluation.

The Chief, Special Studies Branch, will not limit his investigations of data to analyses associated with special studies. He is expected to seek, on his own initiative, accident causes through a program of continuous monitoring of accident and injury reports.

Specific duties and responsibilities of the Chief, Special Studies Branch, are represented, but not limited, by the following:

1. Is responsible for submitting to the Chief, Systems Evaluation Branch, alternative solutions to safety and health problems under consideration as part of HSAC special studies.

2. Is responsible for coordinating with the Senior Staff Engineer the scheduling of Special Studies Branch personnel participation in special studies.

3. Is responsible for performing analysis of accident data, facilitated by direct liaison with Accident Information Branch personnel including the ADP Coordinator and the Statistical Coordinator.

4. Is responsible for determining the need for, scheduling, and, finally, conducting field trips to mines and mills in connection with special studies.

5. Is responsible for conducting independent study of potential problems, the purpose of which is to identify new special studies, research projects, or topics for publication.

6. Is responsible for selection of the Top Ten Tasks for annual publication.

7. Is responsible for writing narratives for recurring broad-distribution publications.

8. Is responsible for developing and directing an inter-disciplinary group to discharge these assigned responsibilities.

Supervision Received

The position is under the general administrative supervision of the Chief, Health and Safety Analysis Center. He is responsible to the Senior Staff Engineer for completion of special project analysis by dates specified in the scheduling of the project. Performance is evaluated in terms of ability to analyze and identify solutions to safety problems, to exercise originality in identifying factors for independent analysis, and to efficiently coordinate and administer his branch.

Qualifications

The Chief, Special Studies Branch, must possess a high degree of training in the disciplines of statistics, mine engineering, and personnel administration. He must evaluate recommendations based on statistical relationships and engineering disciplines. He must also be an effective administrator, able to coordinate the activities of personnel in his Branch within the constraints imposed by project scheduling.

FIELD ENGINEER

Introduction

This position is established as Field Engineer assigned to the Special Studies Branch of the Health and Safety Analysis Center in Denver, Colorado. A Field Engineer will be responsible for analyzing accident, injury, and employment data for cause-effect relationships and verifying these relationships by visits to mines and mills in the United States. The Field Engineer must also relate new technology in mining to the solution of problems identified by establishing these cause-effect relationships.

Duties and Responsibilities

The primary duties and responsibilities of this position will be to:

1. Analyze accident, injury, and employment data for cause-effect relationships both independently, and as part of special studies.

2. Apply new technology to the solution of problems identified by establishing cause-effect relationships.

3. Conduct field trips to mines to gather special data or verify cause-effect relationships.

4. Conduct liaison with contractors working on special studies as directed by the Chief, Special Studies Branch.

5. Write narrative material for broad-distribution publications.

Supervision Received

This position will be under the supervision of the Chief, Special Studies Branch. Performance will be measured in terms of knowledge, judgment, and originality demonstrated in analysis of safety problems.

Qualifications

Master of Science degree in one of the following disciplines:

Operations Research	Industrial Engineering
Mining Engineering	Geology
	Metallurgy

Bachelor of Science degree in one of the following disciplines:

Mining Engineering	Metallurgy
Industrial Engineering	Statistics

CHIEF, ACCIDENT INFORMATION BRANCH

Introduction

This position is established as the Chief, Accident Information Branch, of the Health and Safety Analysis Center in Denver, Colorado. The Accident Information Branch will be responsible, within HSAC, for: (1) dissemination of accident, injury, and employment data to private and government users in accordance with their needs for information; (2) collection of accident, injury, and employment data from all mines on a recurring basis; (3) collection of data as assigned by the Program Assurance Branch for special studies.

Duties and Responsibilities

The primary duty of the Chief, Accident Information Branch, will be the collection and dissemination of accident, injury, and employment data within specified time constraints. He will accomplish this function by means of four outputs:

1. Statistical tables in recurring broad-distribution publications.

2. Statistical tables in recurring limited-distribution publications.

3. Responses to telephone and mail inquiries.

4. Response to special studies requirements.

To ensure that these outputs are available in time to meet the needs of their users, he will develop and administer a staff comprising the following four groups:

- Data Processing Unit
- Statistical Coordinator
- ADP Coordinator
- Public Information Assistant

The functions of each of these groups is explained in the following paragraphs.

1. Data Processing Unit. This group will edit and code for computer input recurring and special study mining data dealing with mine accidents and injuries and employment.

2. Statistical Coordinator. This individual will assist all HSAC branches and contractors in developing their specific requirements for accident, injury, and employment statistics. The Statistical Coordinator will also write proposals for clearance by the Office of Management and Budget when necessary to gather data for special studies.

3. ADP Coordinator. This individual will assist all HSAC branches and contractors by ensuring that all steps necessary to retrieve previously specified data from computer files is accomplished by specified deadlines. The ADP Coordinator will provide all computer generated data for recurring reports.

4. Public Information Assistant. This individual will screen incoming telephone and mail requests attempting to answer as many as possible. Those which cannot be answered will be referred to the Chief, Accident Information Branch. All incoming fatality data will be processed by the Public Information Assistant who will manually prepare all recurring report tables dealing exclusively with fatalities.

The Chief, Accident Information Branch, will administer these four groups. His specific duties and responsibilities are represented, but not limited, by the following:

1. Must ensure the prompt publication of statistical tables in broad- and limited-distribution publications.

2. Must satisfy the requirements of all HSAC branches for ADP and statistical assistance.

3. Must coordinate the data gathering efforts of the Center, including the design and OMB approval of such efforts.

4. Is responsible for filling the non-recurring data requirements imposed by private and government users of such data.

5. Is responsible for assembling data necessary to make safety awards, as required.

6. Must establish and operate a mechanism for maintaining a current list of operating mines in the United States with data applicable to their individual operations.

7. Is responsible for coordinating with the Senior Staff Engineer the scheduling of Accident Information Branch personnel in special studies.

8. Must ensure that data generated on a recurring and non-recurring basis meets the needs of data users.

9. Is responsible for developing and directing an inter-disciplinary group to discharge these assigned responsibilities.

Supervision Received

The position is under the general administrative supervision of the Chief, Health and Safety Analysis Center. He is responsible to the Senior Staff Engineer for completion of data collecting activities associated with special studies by dates specified in the scheduling of the project.

Performance is measured in terms of ability to satisfy the needs of the many users of accident, injury, and employment data and to efficiently administer the personnel in his branch.

Qualifications

The Chief, Accident Information Branch, must possess knowledge and experience in statistics, electronic data processing, and personnel administration. He must be able to exercise judgment in assigning priorities to the day-to-day assignments of his staff, evaluating continuously the importance of demands made on his staff by data users and coordinating his staff's efforts to meet these demands.

PUBLIC INFORMATION ASSISTANT

Introduction

This position is established as the Public Information Assistant to the Chief, Accident Information Branch, of the Health and Safety Analysis Center in Denver, Colorado. The Public Information Assistant will locate in the Washington, D. C. area and conduct liaison between the Center and users of accident, injury, and employment statistics in the Washington area.

Duties and Responsibilities

The primary duties and responsibilities of this position are to:

1. Record data on fatalities reported from the field.

2. Disseminate fatality data to Bureau personnel as required.

3. Create tables of fatality information for recurring reports.

4. Screen incoming phone and mail inquiries for accident, injury, and employment data. Answer all requests for readily available information; pass other requests to the Chief, Accident Information Branch.

Supervision Received

This position is under the supervision of the Chief, Accident Information Branch. Performance is measured in terms of the ability to meet user demands for accident, injury, and employment data.

Qualifications

Typing ability.

STATISTICAL COORDINATOR

Introduction

This position is established as the Statistical Coordinator of the Accident Information Branch of the Health and Safety Analysis Center in Denver, Colorado. The Statistical Coordinator will monitor all statistical activities in the Center for statistical validity and will coordinate all efforts to collect data regarding mine health and safety.

Duties and Responsibilities

The primary duties and responsibilities of this position are to:

1. Review procedures for collecting and disseminating data for recurring reports.

2. Define specific data gathering methods to be used as part of special studies.

3. Where necessary, gain OMB clearance for data gathering efforts on a recurring or special study basis.

4. Monitor incoming data for statistical bias and attempt to identify characteristics of non-responders.

5. Review, for statistical validity, the cause-effect relationships identified by the Safety Analysis Branch or by contractors in connection with special studies.

Supervision Received

This position is under the supervision of the Chief, Accident Information Branch. Performance is measured in terms of ability to fulfill the Center's needs for assistance in the field of statistics.

Qualifications

Master of Science degree in Statistics.

ADP COORDINATOR

Introduction

This position is established as the ADP Coordinator under the Chief, Accident Information Branch, of the Health and Safety Analysis Center in Denver, Colorado. The ADP Coordinator provides liaison between the Division of Automatic Data Processing and the Center and fulfills, to the extent possible, the programming needs of the Center.

Duties and Responsibilities

The primary duties and responsibilities of the position are to:

1. Provide communications between the Center and the ADP Division concerning the data processing needs of the Center.

2. Write programs to extract data from computer files for use by HSAC branches.

3. Generate tables for use by the Data Processing Unit in preparing broad-distribution publications.

4. Generate limited-distribution publications.

5. Conduct liaison with limited-distribution publications users concerning their needs for recurring and special data.

6. Extract non-recurring data as required in response to special requests.

7. Program calculators used internal to HSAC.

8. Design forms and write programs for use with scanning devices when they are available.

Supervision Received

This position is under the supervision of the Chief, Accident Information Branch. Performance is measured in terms of ability to meet user demands and to program computers and calculators.

Qualifications

Programming ability with computers, calculators, and scanners.

SUPERVISORY SURVEY STATISTICIAN
DATA PROCESSING UNIT

Introduction

This position is established as supervisor of the Data Processing Unit of the Accident Information Branch of the Health and Safety Analysis Center in Denver, Colorado. This group will collect and code information on accidents and injuries and employment in the coal mining industry of the United States and information on injuries and employment in the metal and nonmetal industry of the United States.

Duties and Responsibilities

The primary duties and responsibilities of this position will be to:

1. Collect and code injury and employment data from metal and non-metal mines on a recurring basis and for special studies.

2. Process accident/injury and employment data from coal mines which is received from district coal coders and from mine operators on a recurring basis and as part of special studies.

3. Prepare computer generated statistical tables for publication.

4. Fulfill microfilming and storage requirements for all accident injury, and employment forms.

5. Maintain a system of retrieval for all accident/injury and employment reports.

6. Coordinate the exchange of clerical personnel between the Master Index File Group, and the Accident/Injury Report Group.

7. Provide assistance to the branch chief and ADP Coordinator in answering special requests as required.

8. Supervise the activities of personnel temporarily and permanently assigned to the Data Processing Unit.

Supervision Received

This position will be under the supervision of the Chief, Accident Information Branch. Performance will be measured in terms of the ability to provide complete and timely accident and injury statistics concerning mine health and safety on a recurring and non-recurring basis.

SUPERVISORY SURVEY STATISTICIAN
MASTER INDEX FILE GROUP

Introduction

This position is established as supervisor of the Master Index File Group of the Data Processing Unit in the Accident Information Branch of the Health and Safety Analysis Center in Denver, Colorado. This group will maintain a current list of mines in the United States, including name and address of the mine, commodity mined, and other pertinent data as directed by the Chief, Accident Information Branch and will also collect and code employment statistics on the mining industry in the United States.

Duties and Responsibilities

The primary duties and responsibilities of this position will be to:

1. Maintain the Master Index File.
2. Circulate Accident and Injury and Employment Reports forms to coal and metal and nonmetal mines.
3. Collect and code coal and metal and nonmetal employment data.
4. Maintain a system for other Bureau divisions to report the existence of new mines and the closing of old mines.
5. Provide, as needed, supervisors and personnel to answer special requests.
6. Supervise the activities of personnel temporarily and permanently assigned to the Master Index File Group.

Supervision Received

This position will be under the supervision of the Supervisory Survey Statistician, Data Processing Unit. Performance will be measured in terms of ability to provide complete and accurate employment and mine data at times specified by the Chief, Accident Information Branch.

Qualifications

Some computer programming experience.

Experience at processing statistical data.

SUPERVISORY SURVEY STATISTICIAN
ACCIDENT/INJURY REPORT GROUP

Introduction

This position is established as supervisor of the Accident/Injury Report Group of the Data Processing Unit in the Accident Information Branch of the Health and Safety Analysis Center in Denver, Colorado. This group will code all injury reports for metal and nonmetal mines and edit coded reports submitted by coal coders.

Duties and Responsibilities

The primary duties and responsibilities of this position will be to:

1. Translate data received on metal and nonmetal injury reports to a form suitable for data processing (i.e., code metal and nonmetal injury data).

2. Edit coal accident and injury data submitted by coal coders and monitor the performance of individual coal coders.

3. Prepare computer generated tables for publication in distribution publications.

4. Maintain a system for correcting erroneous information and collecting missing information on coal and metal and nonmetal accident and injury reports submitted to the Center.

5. Provide, as necessary, personnel to answer special requests.

6. Supervise the activities of personnel temporarily and permanently assigned to the Accident/Injury Report Group.

Supervision Received

This position will be under the supervision of the Supervisory Survey Statistician of the Data Processing Unit. Performance will be measured in terms of ability to provide complete and accurate accident and injury data at times specified by the Chief, Accident Information Branch.

Qualifications

Some computer programming experience.

Experience at processing statistical data.

SUPERVISORY STATISTICAL ASSISTANT

Introduction

This position is established within the Data Processing Unit of the Accident Information Branch of the Health and Safety Analysis Center in Denver, Colorado. Supervisory Statistical Assistants will be employed in the Master Index File and Accident/Injury Report Groups where they will assist the supervisors of these groups in the conduct of their group's day-to-day activities.

Duties and Responsibilities

The primary duties and responsibilities of this position will be to:

1. Assist group supervisors in planning the work of the group.

2. Supervise the work of statistical clerks assigned to the respective groups.

3. Instruct statistical clerks concerning their duties.

4. Prepare computer generated tables for publication of broad-distribution publications.

5. Perform duties of statistical clerks when necessary.

Supervision Received

This position will be under the direction of the Supervisory Survey Statistician supervising the Master Index File Group or the Accident/Injury Report Group. Performance will be measured in terms of effectiveness in planning the work of statistical clerks, instructing statistical clerks regarding their duties, and ability to complete assigned tasks on time.

Qualifications

Typing ability.

CODING CLERK

Introduction

This position is established within the Data Processing Unit of the Accident Information Branch of the Health and Safety Analysis Center in Denver, Colorado. Coding clerks will be employed to process accident, injury, and employment data within the Master Index File Group and the Accident/Injury Report Group.

Duties and Responsibilities

The primary duties and responsibilities of this position will be to:

1. Edit and code metal and nonmetal injury reports.

2. Edit coal accident and injury reports.

3. Edit and code, as necessary, coal and metal and nonmetal employment forms.

4. Process incoming reports as part of the retrieval system.

5. Assist Supervisory Statistical Assistants as directed in the performance of their assigned duties and responsibilities.

Supervision Received

This position will be under the direction of Supervisory Statistical Assistants or Supervisory Survey Statisticians as directed. Performance will be measured by the ability to complete assigned tasks as directed.

CHAPTER 13

TECHNICAL ASPECTS OF SAFETY ANALYSIS

In Chapters 5 through 12 we have presented our recommendations as to

- —what HSAC's role should be
- —what it should produce
- —how it should be organized
- —how it should operate

In this final chapter we will address some of the technical considerations which impact upon the analyses HSAC will perform.

The chapter is presented in seven parts. In Part 1 we explain the difference between the analysis HSAC should perform and the data manipulation and presentation function performed by OAA.

Part 2 describes the results of our investigation of the accident analysis activities of other agencies. The remaining five parts address specific analysis issues. The positions we have taken on these issues have been developed primarily as a result of previous accident analysis work by Theodore Barry and Associates.

PART 1: Definition of Analysis

As pointed out in Chapter 2 of this report, the formal objectives of the old Office of Accident Analysis were to analyze the cause, frequency, and manner of accidents; to analyze events and practices that contribute to accidents; to analyze the principle hazards associated with accidents; and, finally, to publish this accident information data. We have stated that although the OAA attempted to maintain a complete and accurate historical data base of accident data, they did not perform analysis.

In the future, HSAC should utilize the accident data base to fulfill their primary function of analysis. To make sure there is no misunderstanding of that function, we have extracted a formal definition of the word "analysis" from the dictionary. It reads as follows:

> "The separation of an intellectual or substantial whole into constituents for individual study."

The Office of Accident Analysis only fulfilled half of this definition. They would separate "the whole into constituents", but would stop the process at that point. We want to emphasize that HSAC should not stop at this point, but should take the constituents and look at them "for individual study". In other words, breaking down accidents into categories is not enough. The circumstances and events which yield accident statistics must be explained in operational terms. Only then do data and statistical manipulations become useful tools rather than end products.

PART 2: Evaluation of Other Than USBM Accident Analysis Procedures and Institutional Programs

In the course of accident analysis work performed in the past by Theodore Barry and Associates for the USBM, we have frequently investigated the accident analysis activities of other agencies, both public and private. The Safety Analysis System Study required us to go through this process again—to review and update our past research and to seek out additional procedures and programs which might be adapted for HSAC's use. This investigation was performed immediately after our user needs survey. At that time we had ascertained the needs of HSAC's users for accident information, and we were then looking for additional approaches which could be applied to satisfy these needs. More specifically, we sought analytical approaches, statistical techniques, and formats for publications and presentations which would help make health and safety decision-makers more effective.

In our investigation we examined the safety programs of mining companies, the United Mine Workers, mining trade organizations, state mining agencies, and other federal agencies. We performed a search of safety publications, conducted a series of telephone inquiries and, where appropriate, followed up with personal interviews.

Findings

The agencies surveyed performed two functions which can be categorized as accident analysis: causal analysis and display of accident data.

- Causal Analysis. Outside the mining industry there are some elaborate programs to determine the causes of accidents and near accidents. For the most part, these programs involve major efforts to trace the specific events which led to breakdowns in highly technical systems. This type of investigation is of limited usefulness for HSAC for the following reasons.

    1. The technical nature of the mining industry is not conducive to such analysis. Most accidents involve many human and physical factors which cannot be determined in retrospect.

2. Eyewitness descriptions of the events leading to mining accidents do not usually offer the kind of detail and certainty that would justify further analysis.

3. The cost per accident of elaborate causal determination programs would limit their application to mining.

It is our opinion that the general level of investigation of accidents in mining is at approximately the right level. Our data collection recommendations (Chapter 11 of this report and Volume III of our "Industrial Engineering Study of Hazards Associated with Underground Coal Mine Production") have been addressed primarily to the details and form of reporting. We do, however, recommend two aspects of detailed causal analysis programs for HSAC's use.

1. Data Recording Devices—It would be appropriate for HSAC to utilize data recording devices which would be attached to mining machinery. Although such devices are not likely to contribute to a detailed understanding of all the events leading up to an accident, they could provide some useful data. We do not recommend a particular device as part of this study.

2. Selected Detailed Investigations—While we do not recommend across-the-board usage of significantly more detailed accident investigations, we do foresee some substantial benefits of more intensive study on a sampling basis. For example, a detailed study of the recent personal history of injured miners might be of considerable use even if the sample were limited to the employees of one mining company.

- Display of Accident Data

Health and safety organizations in all fields have utilized accident data for two purposes:

1. to provide safety performance yardsticks (e.g., accident rates);

2. to display decision-oriented causal information(e.g., traffic accident pin maps used by police departments).

All agencies use the same basic approach to data presentation. They tabulate and cross-tabulate accidents by the variables which appear to contribute to their occurrence. Most agencies face the same data collection problems as the Bureau, and most data bases include fewer events and/or fewer variables. For the most part, data base weakness precludes sophisticated statistical analysis. We found no new approaches to displaying accident data which would be useful for HSAC.

Conclusion

Our investigation of accident analysis activities external to USBM did not produce procedures or programs which can radically improve accident analysis in the Bureau. While HSAC should continually contact other safety agencies and review their literature, we do not anticipate that analytical techniques developed for other industries will solve the basic human, engineering, and data collection problems in mining.

PART 2: Frequency Rates—Injuries/Million Manhours

In TB&A's proposed publications, there are two types of injury frequency per million manhours of exposure. The first type of frequency will be the same as reported in the past, and is in compliance with the American Standard Method of Recording and Measuring Work Injury Experience. This measure is the number of disabling work injuries per million employee-hours of exposure.

This old type of injury frequency should be used on all publications that will be distributed to the general public so comparisons to previous years' data can be made without any manipulations or confusion of data. This frequency rate will also be in compliance with similar figures reported by other industries. The new injury frequency rate which will be appearing on the limited-distribution reports is derived from the new federal regulations requiring mine operators to report all injury accidents. This new frequency rate includes all work injuries (disabling and no lost time) per million employee-hours of exposure. This frequency is developed mainly for the inspector force. It will allow them to have a more complete picture of the accident history of an individual company or district.

PART 4: Frequency Rates—By Employment or By Production

Traditionally, two ratios have been used to summarize mining injury experience: injuries per million manhours and injuries per million tons. It is the contention of Theodore Barry and Associates that the employment ratio is the more useful figure for most purposes, but that sometimes the production ratio is appropriate.

Generally, users of injury frequency rates are asking questions such as, "Are mines (or a given mine) doing a good job of protecting miners from injury?" or "How dangerous are the nation's mines?" The answers to these questions should naturally be in terms of the miners facing the danger. They should explain the risks that miners are facing. Frequencies presented in terms of employment measure the risk to which a miner is subjected over time. Frequencies presented in terms of production can distort the extent of this risk. The following facts clarify this problem.

- The tonnage injury frequency rates are usually based upon cleaned coal, not the mined coal. Depending upon the conditions of the mine, the tonnage of prepared coal could differ quite drastically from the tonnage actually mined. This difference would put a bias into many of the tonnage frequency figures and thereby reduce their reliability for use in analysis.

- The tonnage frequency rates depend upon the type of mining method being used and the physical conditions of the mine, i. e., a high seam mine using the continuous mining method will generally have a lower tonnage injury frequency rate than a low seam mine using the conventional mining method.

Other figures can also be used to support this point. In coal mining injury frequency rates per million tons have decreased continuously over the past 11 years from 28.11 to 17.92. But over the same period of time, the injury frequency rate per million manhours has remained relatively constant at around 42.

This comparison shows that productivity in coal mines has increased significantly over the past decade, but it has not become safer in terms of manhours of exposure. This means that the average miner is still facing the same risk he faced 11 years ago.

There is one instance in which Theodore Barry and Associates favors using the tonnage frequency. That is the case where the user is asking value questions about mining or about miners. For example, in deciding whether a particular mine, or mining style, or piece of equipment is "too dangerous" or in assessing the "true cost" of coal production, it is important to determine exactly how many lives are lost or how many men are injured to produce a given amount of coal. A tonnage frequency is a direct measure of this burden.

PART 5: Severity and Severity Rate

Two statistics which are widely used in measuring the "level" of safety in any industry are average severity and severity rate. These terms are defined as follow:

- Average Severity—The average number of days lost or charged per disabling injury. It is the total number of days lost or charged divided by the total number of disabling injuries.

- Severity Rate—The number of days lost or charged from disabling work injuries per million manhours of exposure. This is calculated by multiplying the total number of days lost or charged by one million and dividing the product by the total manhours of worktime.

Average severity indicates the number of days expected to be lost from disabling accidents (including fatalities and permanent total disabling injuries). Severity rate is intended to relate lost work days due to exposure, in terms of manhours, to mining hazards. Both statistics have the same numerator. This numerator is the sum of:

1. reported days lost for temporary total injuries;

2. estimated days lost for temporary total injuries where the injured person has not returned to work;

3. day charges for fatal, permanent total and permanent partial injuries. (All fatalities and permanent total disabilities have a standard time-loss charge of 6,000 days. Permanent partial disabilities are assigned standard time-loss charges.)

Severity statistics are of limited usefulness because of the way in which charges are arbitrarily assigned. With a standard 6,000 day charge for fatalities, severity statistics tend to reflect fatality trends only.

Examination of data for underground coal mines between 1960 and 1966 reveals the extent to which fatalities affect severity.

	Total days Charged	Days Charged to:			
		Fatalities	Permanent Total	Permanent Partial	Temporary Total
Total days lost	12,601,158	9,186,000	540,000	827,214	2,047,944
Percent	100%	72.9%	4.3%	6.6%	16.3%

This data shows that the preponderance of lost days assigned are for fatalities, at a rate of 6,000 days per fatality.

As the sample population gets smaller, the inclusion of fatalities, causes wide swings in severity measures. For example, in underground coal mining, in a typical year between 1960 and 1966 the total number of day charges are about 1,800,000. If the population to which a severity rate is applied consists of less than 5% of national employment (such as in a single state) the expected day charge total would be less than 100,000. For this size population, even one or two incidents could have a significant impact on the severity rate, and could thereby distort the overall safety picture. Obviously, as the sample becomes even smaller the problem gets more serious. For an individual mine, extreme fluctuations of the severity rate can be caused by untypical, isolated incidents—often by one serious nonfatal accident.

A second problem in the use of severity rates arises because not all injured miners will be back on the job at the end of a reporting period. Thus, the work days lost due to some temporary total injuries must be estimated. For shorter reporting periods, such as quarters, more lost days of work must be estimated. For example, if the distribution of days lost in underground coal mining accidents in 1966 is typical, and if estimates must be made for all accidents in which the injured man has not returned to work within 15 days after a period ends, then 13% of all nonfatal days lost must be estimated for annual reports and 36% must be estimated for quarterly reports.

Recommendations

1. A "severity rate" as currently defined should not be used for accident analysis. It provides no more information than does a fatality frequency rate.

2. For limited purposes a "nonfatal severity rate" might be useful. Such a rate would be calculated in the same manner as the severity rate, but would not include day charges for fatalities.

3. Use of severity data should be restricted to relatively large population samples.

4. Severity data should not be published for current use unless the time period used is at least one year.

PART 6: Frequency Rate, Severity Rate

Two statistics attempt to measure, in a single number, the accident experience of a group of mines. These are frequency rate and severity rate. They are defined as follow:

- Frequency Rate--The number of disabling work injuries per million manhours of exposure.

- Severity Rate—The number of days lost or charged from disabling work injuries per million manhours of exposure.

The difference between these rates is that a frequency rate reasures occurrences without regard to the "seriousness" of the occurrences while severity fails to measure the number of occurrences but accounts for "seriousness" of the occurrences.

The recommendations of this study emphasize frequency rate as the better measure of mine safety. Two reasons, discussed in Part 5 of this chapter, are the difficulty of calculating severity on a quarterly basis and fluctuations in severity rate. Another reason is that the number of lost work days due to accidents tends to be random. The amount of injury in terms of lost time inflicted by comparable accidents in two different situations can vary with a number of random variables. These variables include age and health of the victim, time of day, shift working, location of the victim in the accident area, medical care available and the ability of the employer to provide another job for a partially disabled employee. Slight changes in these variables can cause vastly different severity rates but will not affect frequency rates.

In formulating our recommendations for recurring reports, we have recognized that, for some purposes, the seriousness of reported injuries is worth considering. However, for the reasons presented in this chapter we see little value in a single number representation of severity. Our recommended publications present injuries in five categories of severity:

—fatality
—permanent total disability
—permanent partial disability
—temporary total disability
—non-disabling injury

These correspond to the "injuries by degree" categories in current use. The advantages of this breakdown are:

1. Heavy concentrations of serious injuries can easily by identified.

2. The totals cannot be distorted by one or two particularly serious injuries.

3. The problem of poor reporting of relatively minor injuries (a big problem in using frequency rates) is mitigated since the omission of minor injuries will not significantly affect the accident profile, and since an unusual distribution of reported injuries can be interpreted as a sign of probable reporting deficiencies.

PART 7: <u>Moving Averages</u>

One of the concepts that Theodore Barry and Associates has introduced in the reports recommended in this study is that of moving averages. The primary purpose of the moving average in our reports is to improve the presentation of trend information.

In the past, accident reports offered many different figures for comparison of past history with current accident information. The two most widely used comparisons were current month's data versus the same month in the previous year and the current year-to-date data versus the previous year-to-date. The major problem in making comparisons with data for a given month is that the month used for comparison might not be "typical". Year-to-date comparisons suffer from the same weakness early in the calendar year because insufficient time has elapsed to establish a trend. We recommend the use of moving averages as a more consistent comparison than those currently employed.

Moving averages are calculated as follow: the data is averaged for a predetermined number of periods—just as for any mean. As the data is developed for a new period it is included in the average and the oldest period of data is dropped. This allows the average to remain completely current at all times, and at the same time, keep the total number of periods in the calculation constant.

The determination of the number of periods to be used in a moving average requires an understanding of the source of the data to be analyzed and of the use of the comparisons to be made. Generally, the time horizon included in the average should be short enough so that the data is current, but long enough to extablish a trend—that is, long enough so that one unusual period will not significantly distort the average.

Our recommended reports utilize an 8 quarter moving average for coal statistics and a 4 quarter moving average for metal and nonmetal data. The shorter time frame was selected for metal and nonmetal data because high turnover of metal and nonmetal mines and frequent significant changes in the types and levels of their operation can often cause year-old data to be obsolete for purposes of comparison.

An example of the use of a moving average will demonstrate why we have recommended its inclusion in recurring reports. Table 1 displays a hypothetical fatality history for a given coal mine (or district, state, etc.).

TABLE 1

FATALITIES BY QUARTER

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Totals
Year 0	4	4	4	4	16
Year 1	5	3	3	5	16
Year 2	7	8	6	5	26
Year 3	6	6	6	4	22

Table 2 presents the year-to-date figures corresponding to the hypothetical fatality history.

TABLE 2

YEAR-TO-DATE

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Year 0	4	8	12	16
Year 1	5	8	11	16
Year 2	7	15	21	26
Year 3	6	12	18	22

The appropriate 8 quarter moving averages are shown in Table 3.

TABLE 3

MOVING AVERAGE (FATALITIES/QUARTER)

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Year 0				
Year 1				4.00
Year 2	4.38	4.88	5.13	5.25
Year 3	5.38	5.75	6.13	6.00

The first two quarters of Year 3 demonstrate the advantage of using a moving average. For these quarters, comparison with the same quarter in Year 2 or with year-to-date totals for Year 2 would indicate that safety performance was improving.

However, closer examination reveals that the extraordinarily high totals for the first 2 quarters of Year 2 have distorted the picture. The total of 6 fatalities for Quarter 1 of Year 3 is actually greater than the 5.38 average of the most recent 8 quarters. Similarly, the total of 6 for Quarter 2 of Year 3 is no better than the 2-year average of 5.75.

APPENDIX A

COAL SAFETY REPORT

COAL SAFETY REPORT

TABLE 1 Frequency: Quarterly

SALIENT STATISTICS

Injury experience and worktime at bituminous and anthracite coal mines in the United States.

Principal Users—All three groups of users: mine level decision-makers, other decision-makers, non-decision-making groups.

Purpose and Role—Provide current data on pertinent statistics in the coal mining industry. Historical data is also given to allow the reader to compare current performance with past performances.

Data Sources—Coal accident, injury, and illness report; coal production and worktime report.

Special Considerations—

a. If the data is not available for the calculation of the eight quarter moving average, a fewer number of quarters may by used. As the data becomes available, the average can be increased up to eight quarters.

b. All injury frequency rates are calculated by the standard definition—that is,

$$\frac{\text{\# of lost time injuries}}{\text{\# of manhours}} \times 1{,}000{,}000$$

c. Severity figures will be reported only in the annual edition of the Coal Safety Report. This severity figure is reported only to help other agencies, e. g., National Safety Council, that use these figures in their publications for comparative purposes.

TABLE 1 — SALIENT STATISTICS: INJURY EXPERIENCE AND WORKTIME AT BITUMINOUS AND ANTHRACITE COAL MINES IN THE UNITED STATES

Frequency: Quarterly

GROUPINGS

Bituminous Coal
Anthracite
All Coal

Spaces	Item	Heading	Source
1-29	The listing of all data to be presented	As shown in example report	—
30-59	Comparative current quarter data	CURRENT QUARTER	Accident and employment reports; commodity report
30-44	Current quarter	1972 (current year)	
45-59	Same quarter last year	1971 (previous year)	
60-89	Comparative year to date data	YEAR TO DATE	Accident and employment reports; commodity report
60-74	Current year to date	1972 (current year)	
75-89	Previous year to date	1971 (previous year)	
90-104	8 quarter moving average of all data	8 QUARTER MOVING AVERAGE	Accident and employment reports; commodity report

Table 1 - Coal Safety Report

Salient Statistics: Injury Experience and Worktime at Bituminous and Anthracite Coal Mines in the United States during 1972

	Current Quarter		Year to Date		8 Quarter Moving Ave.
	1972	1971	1972	1971	
Bituminous Coal					
Number of Injuries: Fatal Non-fatal Total					
Injury Rates: (Per Mil Man-Hrs) Fatal Non-fatal Total					
*Severity Rate Men Working Manhours Worked Production, Short Tons					
Anthracite					
Number of Injuries: Fatal Non-fatal Total					
Injury Rates: (Per Mil Man-Hrs) Fatal Non-fatal Total					
*Severity Rate Men Working Manhours Worked Production, Short Tons					
All Coal					
Number of Injuries: Fatal Non-fatal Total					
Injury Rates: (Per Mil Man-Hrs) Fatal Non-fatal Total					
*Severity Rate Men Working Manhours Worked Production, Short Tons					

*On Annual Report only

TABLE 2 | Frequency: Quarterly

FATAL AND NONFATAL INJURIES AND INJURY FREQUENCY RATES PER MILLION MANHOURS AT BITUMINOUS COAL AND ANTHRACITE MINES BY STATE IN THE UNITED STATES

Principal Users—Mine level decision-makers, other decision-makers.

Purpose and Role—Primarily to allow decision groups to analyze the injuries of individual states and to compare the injuries to the past trend.

Data Sources—Coal accident, injury and illness report
Coal production and worktime report

Special Considerations—Frequency rates—see explanation under Special Considerations, part b for Table 1, Quarterly Coal Report.

TABLE 2 FATAL AND NONFATAL INJURIES AND INJURY FREQUENCY RATES PER MILLION MANHOURS AT BITUMINOUS COAL AND NATHRACITE MINES BY STATE IN THE U.S.

Frequency: Quarterly

GROUPINGS: States by alphabetical listing

Spaces	Item	Heading	Source
1-29	State listings, totals		—
30-67	Current quarter data	CURRENT QUARTER	—
30-48	Number of injuries in current quarter by state	NO. OF INJURIES	Accident reports
30-34	Current quarter fatal injuries	FATAL	Accident reports
35-41	Current quarter nonfatal injuries	NON-FATAL	Accident reports
42-48	Total quarter fatal and nonfatal injuries	TOTALS	Accident reports
49-67	Current quarter frequency rates per million manhours by state	FREQUENCY RATES PER MIL MANHRS	Accident and Employment reports
49-53	Current quarter fatal frequency rate	FATAL	Accident and Employment reports
54-60	Current quarter nonfatal frequency rate	NON-FATAL	Accident and Employment reports
61-67	Current quarter total frequency rate	TOTAL	Accident and Employment reports
68-105	8 quarter moving average data	8 QUARTER MOVING AVERAGE	—
68-86	8 quarter average of numbers of injuries by state	NO. OF INJURIES	Accident and Employment reports
68-72	8 quarter average of fatal injuries	FATAL	Accident and Employment reports
73-79	8 quarter average of nonfatal injuries	NON-FATAL	Accident and Employment reports
80-86	8 quarter average of total injuries	TOTAL	Accident and Employment reports

TABLE 2 continued

87-105	8 quarter average of the injury frequency rates per million manhours	FREQUENCY RATES PER MIL MANHRS	—
87-91	8 quarter average, fatal frequency rate	FATAL	Accident and Employment reports
92-98	8 quarter average, nonfatal frequency rate	NON-FATAL	Accident and Employment reports
99-105	8 quarter average, total frequency rate	TOTAL	
99-105	8 quarter average, total frequency rate	TOTAL	Accident and Employment reports

Table 2 - Coal Safety Report

Fatal and Nonfatal Injuries and Injury Frequency Rates Per Million Manhours
at Bituminous Coal and Anthracite Mines by State in the United States

Alphabetical list of all states that have had injuries	Current Quarter						8-Quarter Moving Average					
	Number of Injuries			Frequency Rates/Mil Manhrs			Number of Injuries			Frequency Rates/Mil Manhrs		
	Fatal	Nonfatal	Total	Fatal	Nonfatal	Total	Fatal	Nonfatal	Total	Fatal	Nonfatal	Total
Bituminous Coal												
Alabama												
Alaska												
Arizona												
Arkansas												
California												
Colorado												
Georgia												
Illinois												
Indiana												
Iowa												
Kansas												
Kentucky												
Missouri												
Maryland												
Montana												
New Mexico												
North Dakota												
Ohio												
Oklahoma												
Oregon												
Pennsylvania												
South Dakota												
Tennessee												
Texas												
Utah												
Virginia												
Washington												
West Virginia												
Wyoming												
Total Bituminous Coal												
Total Anthracite Coal												
Total All Coal												

TABLE 3 Frequency: Quarterly

TYPES OF ACCIDENTS BY GENERAL WORK LOCATION

Principal Users—Mine level decision-makers, other decision-makers.

Purpose and Role—To provide a general survey of the distribution and frequency of the various types of injury accidents, and to compare the current data with the historical data.

Data Sources—Coal accident, injury and illness report
Coal production and worktime report

Special Considerations—Same as Table 1, Quarterly Coal Report, Parts a, b, c, and d.

TABLE 3 TYPES OF ACCIDENTS BY GENERAL WORK LOCATION

Frequency: Quarterly

GROUPINGS

General Work Locations

a. Underground
b. Surface (at underground mines)
c. Surface mines

Spaces	Item	Heading	Source
1-29	The listing of all data to be presented	(As shown in example report)	—
30-127	The listing of all types of accidents	TYPE OF ACCIDENT (INJURY ACCIDENT ONLY)	—
30-120	13 individual listings (7 spaces each)	• ELEC • EXPL & IGN • FALL OF ROOF RIB • HAND MATL • HAUL • MACH • FIRE • BUMP • FALL MATL • SLIP FALL • SUFF • OTHER	Accident report
121-128	The total of all data by general work location	TOTAL	

Table 3 - Coal Safety Report

Types of Accidents by General Work Location in Coal

	Type of Accident (Injury Accident Only)													
	Elec.	Expl. & Ign.	Fall Of Roof	Fall Of Face & Rib	Hand Matl	Haul	Mach	Fire	Bump	Fall Matl	Slip Fall	Suff	Other	Total
Bituminous Coal Underground Mine														
Underground No. of Injuries Freq/Mil Man-Hours Freq 8 Qtr. Mov. Ave.														
Surface No. of Injuries Freq/Mil Man-Hours Freq 8 Qtr. Mov. Ave.														
Surface Mine No. of Injuries Freq/Mil Man-Hours Freq 8 Qtr. Mov. Ave.														
Anthracite No. of Injuries Freq/Mil Man-Hours Freq 8 Qtr. Mov. Ave.														
All Coal No. of Injuries Freq/Mil Man-Hours Freq 8 Qtr. Mov. Ave.														

TABLE 4 Frequency: Annual

INJURY EXPERIENCE BY DEGREE, BY GENERAL WORK LOCATION

Principal Users — Mine level decision-makers, other decision-makers.

Purpose and Role — To provide users with a distribution of injuries by work location. This table is a substitute for severity. It allows the reader to determine which work location has the most accidents and the degree of these accidents.

Data Sources — Coal accident, injury, and illness report
Coal employment report

Special Considerations — This is the only table in the broad-distribution report that includes no lost time accidents. As explained previously, these accidents will not be included in the frequency calculations.

TABLE 4 INJURY EXPERIENCE BY DEGREE, BY GENERAL WORK LOCATION Frequency: Annual

GROUPINGS

General Work Locations

1. Bituminous
   a. Underground
   b. Surface (at underground mines)
   c. Strip
   d. Auger
2. Anthracite
   a. Underground
   b. Strip

Spaces	Item	Heading	Source
1-29	The listing of the work locations	(As shown in example report)	—
30-84	Number of injuries by degree during the year	NUMBER OF INJURIES	—
30-75		NONFATAL	—
30-34	Number of fatals for the year	FATAL	Accident reports
35-39	Number of permanent total injuries for the year	PERMANENT TOTAL	Accident reports
40-44	Number of permanent partial injuries for the year	PERMANENT PARTIAL	Accident reports
45-52	Number of temporary total injuries for the year	TEMP TOTAL	Accident reports
53-60	Total number of disabling injuries for the year	TOTAL	Accident reports
61-67	Number lost time accidents for the year	NOLOST TIME	Accident reports
68-75	The total nonfatal injuries for the year	TOTAL NONF	Accident reports
76-83	Total fatal and nonfatal injuries for the year	TOTAL	Accident reports

TABLE 4 continued

84-95	Total yearly manhours worked by work location	MANHOURS WORKED	Employment reports
96-103	Frequency per million manhours This is the standard definition of frequency. See Special Considerations, Table 1, Part b.	FREQ MIL MANHRS	—

Table 4 - Coal Safety Report, Annual Edition

Injury Experience by Degree Manhours Worked,
and Frequency, by Work General Location

	Number of Injuries								Manhrs Worked	Freq Mil Manhrs.
	Fatal	Non-Fatal								
		Permanent								
Work Location		Total	Partial	Temp Total	Total Disabling	No lost Time	Total Nonf	Total		
Bituminous										
Underground										
Underground										
Surface										
Strip										
Auger										
Total Bituminous										
Anthracite										
Underground										
Strip										
Total Anthracite										
Total All Coal										

TABLE 5 Frequency: Annual

NUMBER OF INJURIES, FREQUENCY RATES BY WORK LOCATION AND NUMBER OF EMPLOYEES

Principal Users—Mine level decision-makers.

Purpose and Role—Primarily to allow operators to determine how they compare, safety-wise, with other mines their size and type of mine. This table will also help indicate to inspectors which mines (based upon size and location) are generally the most dangerous.

Data Sources—Coal accident, injury, and illness report
Coal production and worktime report

TABLE 5 NUMBER OF INJURIES, FREQUENCY RATES BY WORK LOCATION AND NUMBER OF EMPLOYEES

Frequency: Annual

GROUPINGS

- Work Locations
  1. Bituminous
     a. Underground
     b. Surface (at underground mine)
     c. Strip
     d. Auger
  2. Anthracite
     a. Underground
     b. Surface (at underground mine)
     c. Strip
- Number of Employees

Spaces	Item	Heading	Source
1-29	Number of employees	(As shown in example report)	—
30-34	Total number of fatal injuries	FATAL	Accident reports
35-42	Total number of nonfatal disabling injuries	NON-FATAL	Accident reports
43-50	Total number of disabling injuries	TOTAL	Accident reports
51-57	Fatal frequency per million manhours	FATAL	Accident reports and employment reports
58-64	Nonfatal frequency per million manhours	NON-FATAL	Accident reports and employment reports
65-71	Total frequency per million manhours	TOTAL	Accident reports and employment reports

*The same spacings are to be followed for all other work location categories.

Table 5 - Coal Safety Report, Annual Edition
Number of Injuries, Frequency Rates by Work Location and Number of Employees

Bituminous	Underground Mine											
	Underground						Surface					
	Number of Injuries			Frequency Mil Manhours			Number of Injuries			Frequency Mil Manhours		
Number of Employees	Fatal	Nonfatal	Total	Fatal	Nonfatal	Total	Fatal	Nonfatal	Total	Fatal	Nonfatal	Total
0- 7												
8- 15												
16- 40												
41- 65												
66-100												
101-160												
161-260												
260												
Totals												

	Strip Mine						Auger Mine					
	Number of Injuries			Frequency Mil Manhours			Number of Injuries			Frequency Mil Manhours		
Number of Employees	Fatal	Nonfatal	Total	Fatal	Nonfatal	Total	Fatal	Nonfatal	Total	Fatal	Nonfatal	Total
0- 7												
8- 15												
16- 40												
41- 65												
66-100												
101-160												
161-260												
260												
Totals												

Table 5 - Coal Safety Report, Annual Edition
Number of Injuries, Frequency Rates by Work Location and Number of Employees

Anthracite

	Underground Mine											
	Underground						Surface					
	Number of Injuries			Frequency Mil Manhours			Number of Injuries			Frequency Mil Manhours		
Number of Employees	Fatal	Nonfatal	Total	Fatal	Nonfatal	Total	Fatal	Nonfatal	Total	Fatal	Nonfatal	Total
0- 7												
8- 15												
16- 40												
41- 65												
66-100												
101-160												
161-260												
260												
Totals												

	Strip Mine					
	Number of Injuries			Frequency Mil Manhours		
Number of Employees	Fatal	Nonfatal	Total	Fatal	Nonfatal	Total
0- 7						
8- 15						
16- 40						
41- 65						
66-100						
101-160						
161-260						
260						
Totals						

TABLE 6 Frequency: Annual

INJURY EXPERIENCE BY VICTIM'S JOB CLASSIFICATION, BY VICTIM'S TASK

Principal Users—Mine level decision-makers, other decision-makers.

Purpose and Role—To provide an overview of who is getting injured and at what tasks. This table also points out the most dangerous tasks in the coal mines. By knowing the most dangerous tasks, it is possible for the Bureau to channel their training and inspection efforts in the problem areas; it also allows the mine operators to become familiar with who is getting hurt and how.

Data Sources—Coal accident, injury, and illness report

Special Considerations—In order to make this table meaningful and manageable, we have condensed the current coding list of 79 activities into 25 tasks. These tasks are listed in Exhibit A-1, along with their assigned activity numbers.

TABLE 6 INJURY EXPERIENCE BY VICTIM'S JOB CLASSIFICATION, BY VICTIM'S TASK Frequency: Annual

GROUPINGS: Victim's Task

Spaces	Item	Heading	Source
1-20	Listing of all the victim's tasks	VICTIM'S TASK	Groups of like activities that are combined together into tasks.
21-122	Listing of all injuries by victim's job classification (6 spaces for each heading)	• CUT MACH OPR HLP • DRIL • SHOT • ROOF BOLT • MACH LOAD OPR HLP • HAND LOAD • CONT MINR OPR HLP • GENL LABR • SHUT • TRAK HAUL • REPR • FORE MAN • MINE SUPR • OTHR	Accident reports
123-130	Total number of injuries for each task	TOTAL	Accident reports

Table 6 - Coal Safety Report, Annual Edition

Number of Injuries by Victim's Job Classification by Victim's Task

	Injuries by Victim's Job Classification																	
	Cut Mach		Dril	Shot	Roof Bolt	Mach Load		Hand Load	Cont Minr		Genl Labr	Shut	Trak Haul	Repr	Fore Man	Mine Super	Other	Totals
Victim's Task	Opr	Hlp				Opr	Hlp		Opr	Hlp								
Totals																		

TABLE 6 INJURY EXPERIENCE BY VICTIM'S JOB CLASSIFICATION, BY VICTIM'S TASK Frequency: Annual

GROUPINGS: Victim's Task

Spaces	Item	Heading	Source
1-20	Listing of all the victim's tasks	VICTIM'S TASK	Groups of like activities that are combined together into tasks.
21-122	Listing of all injuries by victim's job classification (6 spaces for each heading)	· CUT MACH OPR HLP · DRIL · SHOT · ROOF BOLT · MACH LOAD OPR HLP · HAND LOAD · CONT MINR OPR HLP · GENL LABR · SHUT · TRAK HAUL · REPR · FORE MAN · MINE SUPR · OTHR	Accident reports
123-130	Total number of injuries for each task	TOTAL	Accident reports

TABLE 7 Frequency: Annual

ILLNESS EXPERIENCE BY WORK LOCATION

Principal Users—All groups

Purpose and Role—To provide a summary of illnesses reported during the year. This data is useful for historical purposes and for comparison of illness rates with the rates of other industries. It is not particularly useful for enforcement purposes or for evaluation of current health programs since illnesses are often the result of cumulative exposure over a number of years.

Data Sources—Coal accident, injury and illness report

EXHIBIT A-1

TASKS FROM ACTIVITIES' LIST

1. Clean-up—0, 1, 5, 6, 44
2. Roof Bolt—2, 3, 4, 9, 11, 12, 19, 48
3. Continuous Mining—7
4. Shuttle—8, 61, 62, 63
5. Drill Face—10
6. Conveyor—13, 80, 84
7. Electric—14
8. Other—15, 32, 33, 35, 68, 69, 70, 76, 81, 85
9. Hand Load—16, 60
10. Handle Material—17, 18, 27, 54, 79
11. Shot Firer—20, 39, 41, 42
12. Inspect—21, 22, 52
13. Loading—23
14. Set Support—24, 25, 26, 36, 37, 38
15. Survey—28, 31, 45
16. Maintenance—29, 30
17. Scale—34, 46
18. Ventilation—40
19. Remove Fall—43
20. Cutting—47, 48, 55, 56
21. Tram—50, 51
22. Test Roof—53
23. Jack Set—57, 58, 59
24. Mainline—64, 65, 66, 71, 72, 73, 74, 75, 77, 83
25. Supervise—67

Note: Numbers indicate the activity numbers

LIST OF ACTIVITIES

0) brush fl	-brush floor
1) brush rf	-brush roof
2) chang bt	-change bit
3) chang dr	-change drill
4) clean bt	-clean bit
5) clean rb	-clean rib
6) clean up	-clean up
7) cont min	-operate continuous miner
8) dmp shut	-dump shuttle car
9) drl xtnd	-extend drill
10) drl face	-drill face
11) drl roof	-drill roof
12) mty dbox	-empty dustbox
13) xtnd cnv	-extend conveyor
14) elecmain	-electrical maintenance
15) get redy	-get ready (for work element)
16) handload	-hand load
17) hangtube	-hang tubing
18) hookwire	-hookup wires
19) nsrtbolt	-insert bolt
20) nsrt chg	-insert charge
21) nspt eqp	-inspect equipment
22) nspt min	-inspect mine
23) loadshut	-load shuttle, op. loader
24) jack set	-set hydraulic jack
25) jack rel	-relocate hydraulic jack
26) jack rmv	-remove hydraulic jack
27) mv cable	-move cables
28) mrk hole	-mark hole
29) machmain	-machine maintenance
30) machsrvc	-service machine
31) mrk roof	-mark roof
32) meth tst	-methane test
33) pos eqpt	-position equipment
34) pry f/r	-pry face/rib
35) rockdust	-rock dust
36) prop set	-set props
37) prop rel	-relocate props
38) prop rmv	-remove props
39) rcv wire	-recover wire
40) set brat	-set brattice
41) shootcol	-shoot coal
42) shootflr	-shoot floor
43) cleanfal	-clean up fall
44) sweepflr	-sweep floor
45) survey l	-survey layout
46) scale rf	-scale roof
47) sweepunc	-sweep undercut
48) sump	-sump
49) testhole	-drill test hole
50) tram in	-tram in
51) tram out	-tram out
52) torque	-torque bolt
53) testroof	-test roof
54) transupl	-transport supplies
55) undercut	-operate undercutter
56) cut vert	-cut vertically
57) rjck set	-set rope (winch) jack
58) rjck rel	-release rope (winch) jack
59) rjck thg	-tighten rope (winch) jack
60) handpick	-use hand pick
61) shutl op	-operate shuttle car
62) jitny op	-operate jitney
63) trctr op	-operate tractor
64) mainln o	-operate mainline haulage equipment
65) mantrp o	-operate mantrip car
66) tracklay	-lay track
67) suprvise	-supervise
68) observe	-observe operations
69) idle	-idle (eat lunch, sit down, etc)
70) ride	-ride equipment
71) coup. unc	-couple/uncouple mine car
72) switchin	-switch tracks
73) sprag/bl	-sprag/block/chock mine car
74) crlod/ul	-load/unload minecar
75) rerailng	-rerail equipment
76) other	-other
77) —	- —
78) signalng	-mainline signaling
79) rcv mt/eq	-recover/retrieve matl/eqp
80) belt op	-operate conveyor belt
81) escaping	-escaping hazard
82) unknown	-unknown
83) rep pole	-replace trolley pole
84) crossover	-crossover (conveyor)
85) walking	-walking

TABLE 7 ILLNESS EXPERIENCE BY WORK LOCATION

Frequency: Annual

GROUPINGS

General Work Locations

1. Bituminous
   a. Underground
   b. Surface (at underground mine)
   c. Strip
   d. Auger
2. Anthracite
   a. Underground
   b. Surface (at underground mine)
   c. Strip

Spaces	Item	Heading	Source
1-25	Description of illness	ILLNESS	Accident, injury and illness report
26	Blank		
27-30	Number of illnesses reported in underground bituminous mines	NO.	Accident, injury and illness report
31	Blank		
32-35	Frequency of illness	FREQ	$\frac{\text{(Number of illness) x 1,000,000}}{\text{Manhours worked in underground bituminous mines}}$
36	Blank		
37-96	Repeat pattern for other work locations		
97-101	Total number of illnesses reported	NO.	
102	Blank		
103-107	Average frequency of illness	FREQ	
108-109	Blank		
110-120	Same as 97-107 for prior year		

Table 7 - Coal Safety Report, Annual Edition

Illness Experience by Work Location

	Bituminous								Anthracite					
	Underground		Surface at underground mine		Strip		Auger		Underground		Surface at underground mine		Strip	
Illness	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.
TOTALS														

APPENDIX B

USBM COAL REPORT

USBM COAL REPORT

TABLE 1 — Frequency: Quarterly

INDIVIDUAL MINE HISTORY

Principal Users—Mine level decision-makers

Purpose and Role—To provide Bureau personnel (inspectors and education and training) with individual mine history which will aid them in their inspection and education decisions. Mines with the worst records in terms of accident frequency and increase in frequency will be "flagged" to additionally aid Bureau personnel in determining the most severe problem areas.

Data Sources—Coal accident, injury and illness report
Coal production and worktime report
Coal mine file

Special Considerations—The flag system will decrease the time district and subdistrict managers have to spend searching for potential problem mines. The flags will point out the worst accident records in terms of highest frequency and largest increase in frequency.

The criteria for assigning a flag are as follows:

1. Top 20% increase in frequency over the previous quarter with at least 2 injuries during the quarter.

2. Top 20% in frequency for the quarter with at least 2 injuries during the quarter.

TABLE 1 INDIVIDUAL MINE HISTORY

Frequency: Quarterly

GROUPINGS: Individual Mines and Subdistricts

Spaces	Item	Heading	Source
1-32	Mine ID, name and address (4 lines)	MINE ID NAME ADDRESS	Mine file
33-39	Current quarter frequency rate	CURR QT FREQ RT	
40-46	8 quarter moving average frequency rate	8 QT FREQ RT	
47-53	The trend of the accident frequency rate—the trend will indicate whether the injury frequency is going up or down and by how much	TREND	$\% = \frac{\text{Current quarter trend}}{\text{Past quarter trend}}$ if current > past, the trend is up if current < past, the trend is down
54-77	The distribution of the number of injuries over the quarter	NUMBER OF INJURIES FA PT PP TT NL TOTAL	Injury reports
78-132	The number of injury accidents, by type, for the past quarter	· FALL OF ROOF FACE · HAND MATL · MACH · HAUL · EXPL &IGN · LIFT PULL · SLIP FALL	Injury reports

TABLE 1 continued

Spaces	Heading
78-132 (continued)	· ALL OTHER · ALL ILL · TOTL

Note: Under all items from lines 54 to 132 a second number will be displayed which will indicate the 8 quarter moving average for each of the items.
(A space should be left between the current quarter figures and the moving average figures. The moving average figures will be rounded to the nearest tenth.)

Special Flag Mines

1. Top 20% increase in frequency over the previous quarter with at least two injuries during the quarter.

2. Top 20% in frequency for the quarter with at least two injuries during the quarter.

Table 1 - USBM Coal Report, Quarterly

Individual Mine History

Mine ID, Name, Address	Curr Qt. Freq Rate	8 Qt. Ave. Freq Rate	Trend	Number of Injuries						Type of Accident or Illness (Injury Accidents Only)										
				Fa	Pt	PP	TT	NL	Total	Fall of Roof	Fall of Face	Hand Matl	Mach	Haul	Expl &Ign	Lift Pull	Slip Fall	All Other Inj.	All Ill	Total
	8 Qt. Mov. Ave. →																			

TABLE 2 Frequency: Quarterly

INJURY ACCIDENT FREQUENCY RATES BY TYPE OF ACCIDENT, BY DISTRICT

Principal Users—Mine level decision-makers

Purpose and Role—To primarily provide district and subdistrict managers with accident frequency data by type of accident. They can use this data to assess their district's performance versus the other districts' and the national average. They can also assess their performance against a historical 8 quarter moving average.

Data Sources—Coal accident, injury and illness report
Coal production and worktime report
Mine file

TABLE 2 INJURY ACCIDENT FREQUENCY RATES BY TYPE OF ACCIDENT, BY DISTRICT Frequency: Quarterly

GROUPINGS: District and National

Spaces	Item	Heading	Source
1-24	District listings	(As shown in example table)	—
25-114	Frequency rates by district of the injury accidents	• ELEC • EXPL &IGN • FALL OF ROOF FACE • HAND TOOL • HAND MATL • HAUL • LIFT PULL • MACH • FIRE • BUMP • FALL MATL • SLIP FALL • SUFF • OTHR	Injury reports
115-121	Total frequency rate in each district	• TOTL	Injury reports

Table 2 - USBM Coal Report
Injury Accident Frequency Rates by Type of Accident, by District

	Type of Accident (Injury Accident Only) - Frequency Rate															
	Elec.	Expl. &	Fall Of Roof	Fall Of Face	Hand Tool	Hand Matl	Haul	Lift Pull	Mach	Fire	Bump	Fall Matl	Slip Fall	Suff	Other	Total
National Average																
District 1 Average																
District 2 Average																
District 3 Average																
District 4 Average																
District 5 Average																
District 6 Average																
District 7 Average																
District 8 Average																
District 9 Average																

TABLES 3, 4 and 5 Frequency: Quarterly

NUMBER OF INJURIES BY TYPE OF ACCIDENT, BY JOB CLASSIFICATION FOR EACH SUBDISTRICT

NUMBER OF INJURIES BY TYPE OF ACCIDENT, BY VICTIM'S TASK FOR EACH SUBDISTRICT

NUMBER OF INJURIES BY VICTIM'S TASK, BY VICTIM'S JOB CLASSIFICATION FOR EACH SUBDISTRICT

Purpose and Role—These three tables are cross-tabulations of three variables—job classification, type of accident, and task—are developed to assist the Bureau personnel in determining who is getting hurt (job classification), how (accident type), and when (task). With this information, the Bureau can allocate their resources to alleviate any acute problems which are evident in any of the above categories.

Data Sources—Coal accident, injury and illness report

Special Considerations—Victim's task is defined as in Exhibit A-1.

TABLE 3 NUMBER OF INJURIES BY TYPE OF ACCIDENT, BY JOB CLASSIFICATION FOR EACH SUBDISTRICT

Frequency: Quarterly

GROUPINGS: Job Classification

Spaces	Item	Heading	Source
1-24	Job classifications	(As shown on example table)	—
25-114	Frequency rates by district of the injury accidents (6 spaces each)	• ELEC • EXPL &IGN • FALL OF ROOF FACE • HAND TOOL • HAND MATL • HAUL • LIFT PULL • MACH • FIRE • BUMP • FALL MATL • SLIP FALL • SUFF • OTHR	Injury reports
115-121	Total frequency rate in each district	• TOTL	Injury reports

Table 3 - USBM Coal Report
Number of Injuries by Type of Accident, by Job Classification for each Sub-District

	Type of Accident (Injury Accident Only)															
Job Classification	Elec.	Expl. &	Fall Of Roof	Fall Of Face	Hand Tool	Hand Matl	Haul	Lift Pull	Mach	Fire	Bump	Fall Matl	Slip Fall	Suff	Other	Total
Cutting Machine																
Operator																
Helper																
Drilling																
Shot Firer																
Roof Bolter																
Machine Load.																
Operator																
Helper																
Hand Load																
Cont. Mining																
Operator																
Helper																
Gen. Labor																
Shuttle Operator																
Track Haul																
Repair																
Foreman																
Mine Super																
Other																
TOTALS																

TABLE 4 — NUMBER OF INJURIES BY TYPE OF ACCIDENT, BY JOB CLASSIFICATION FOR EACH SUBDISTRICT — Frequency: Quarterly

GROUPINGS: Victim's Task

Spaces	Item	Heading	Source
1-24	Job classifications	(As shown on example table)	—
25-114	Frequency rates by district of the injury accidents (6 spaces each)	• ELEC • EXPL &IGN • FALL OF ROOF FACE • HAND TOOL • HAND MATL • HAUL • LIFT PULL • MACH • FIRE • BUMP • FALL MATL • SLIP FALL • SUFF • OTHR	Injury reports
115-121	Total frequency rate in each district	• TOTL	Injury reports

Table 4 - USBM Coal Report
Number of Injuries by Type of Accident, by Victim's Task, for each Sub District

Victim's Task	Type of Accident (Injury Accident Only)															Total
	Elec.	Expl. &	Fall Of Roof	Fall Of Face	Hand Tool	Hand Matl	Haul	Lift Pull	Mach	Fire	Bump	Fall Matl	Slip Fall	Suff	Other	
031																
032																
033																
↓																

TABLE 5 NUMBER OF INJURIES BY VICTIM'S TASK, BY VICTIM'S JOB CLASSIFICATION FOR EACH SUBDISTRICT

Frequency: Quarterly

GROUPING: Job Classifications

Spaces	Item	Heading	Source
1-24	Job classification	(As shown on example table)	—
25-124	Listing of the victim's task (4 spaces each)		

Table 5 - USBM Coal Report

Number of Injuries by Victim's Task and Victim's Job Classification for each Sub District

	Victim's Task			
Job Classification	031	032	033	→
Cutting Machine				
Operator				
Helper				
Drilling				
Shot Firer				
Roof Bolter				
Machine Load.				
Operator				
Helper				
Hand Load				
Cont. Mining				
Operator				
Helper				
Gen. Labor				
Shuttle Operator				
Track Haul				
Repair				
Foreman				
Mine Super				
Other				

APPENDIX C

METAL AND NONMETAL SAFETY REPORT

TABLE 1 Frequency: Annual

INJURY EXPERIENCE AND WORKTIME IN METAL AND NONMETAL MINES AND MILLS IN THE UNITED STATES

Principal Users—Other decision-makers.

Purpose and Role—This table will provide historical data reflecting trends in mine safety and the level of mining activity in metal and nonmetal mining.

Data Sources—Injury report
Employment report

Special Considerations—Data gathered prior to the new reporting system will not be comparable to new data. This discrepancy should be noted on the new form. The discrepancy arises because operators will be required, under the new regulations, to report injuries not involving lost time, as well as those involving lost time. To ease the transition, it is recommended that lost time frequency be stated as well as total injury frequency.

This report should be generated manually.

Metal and Nonmetal Broad Distribution Publications

#1 Salient Statistics: Injury Experience and Worktime in Metal and Nonmetal Mines and Mills in the United States

Frequency: Annual

Year	No. Injuries		Frequency Rate		Men Employed	Man Hours Worked (000)
	Fatal	Non-Fatal	Fatal	Non-Fatal		

Notes: Separate List for Mines and Mills

TABLE 2 Frequency: Quarterly

FATALITY EXPERIENCE BY MINE TYPE, BY STATE

Principal Users—Mine level decision-makers and other decision-makers.

Purpose and Role—This table will report fatality experience by state and reflect differences in the safety records of the various types of mines.

Data Sources—Manual tabulation as fatalities occur. (Public Information Assistant)

Special Considerations— In the quarterly report, only states where fatalities occur are listed. In the annual report, all states where mines exist are listed.

Metal and Nonmetal Broad Distribution Publications, Cont.

#2 Fatality Experience by Mine Type, by State

Frequency: Quarterly, Annual

Name of State	Underground			Surface			Mills	Total	Experience: Last Three Periods		
	Large	Med.	Small	Large	Med.	Small			(Period)	(Period)	(Period)
	No. Freq.	No. Freq.	No Freq.	No. Freq.	No. Freq.	No. Freq.	No. Freq.	No. Freq.	No. Freq.	No. Freq.	No. Freq.
(List States Where Fatals Occur)	(150+ Employees)	(50-149 Employees)	(1-49 Employees)	(100+ Employees)	(35-99 Employees)	(1-34 Employees)					
Total No.	-	-									
Ave. Freq.	-	-									
Ave. No. (Last 4	-	-									
Ave. Freq. Periods)	-	-									

TABLE 3 Frequency: Quarterly

NONFATAL INJURY EXPERIENCE BY MINE TYPE, BY STATE

Principal Users—Mine level decision-makers and other decision-makers.

Purpose and Role—This table, because it reports all nonfatal injuries, will provide a more complete picture of mine safety than Table 2, Fatality Experience. Mine operators, unions, state officials, and legislators will be able to evaluate safety performance in their area of concern.

Data Sources—Computer generation from Injury and Employment reports.

Special Considerations—All states where mines exist should be listed both quarterly and annually.

TABLE 3 NONFATAL INJURY EXPERIENCE BY MINE TYPE, BY STATE Frequency: Annual

NO GROUPINGS

Spaces	Item	Heading	Source
1-14	Name of state	STATE	Mine file
15-17	Number of nonfatal (excluding illnesses) in large underground mines in state.	NO.	Injury reports for mine # where injury occurred. Mine file for state where mine is located and type of mine
18	Blank		
19-22	Frequency of nonfatal injuries (excluding illnesses) in large underground mines (nearest 1/10).	FREQ	Injury report for record of injury. Employment report for manhours worked. Calculated as (# reports) x (1,000,000) ÷ (total manhours worked in large underground mines in the state)
23	Blank		
24-95	Repeat for other mine types.		
96	Blank		
97-100	Total number of nonfatal injuries	NO.	Sum of row
101	Blank		
102-105	Average frequency	FREQ	Calculated as (total nonfatal injuries) x (1,000,000) ÷ (total manhours worked in the state during period)
106	Blank		
107-132	Total number and average frequency for last 3 comparable periods (quarters or years)	NO.	Calculated for past periods

ROW TOTALS

Row 1

Spaces	Item	Heading	Source
1-14	Name of row	TOTAL NO.	Print
15-132	Print sum of nonfatal injuries columns for each mine type under the appropriate columns		

Row 2

Spaces	Item	Heading	Source
1-14	Name of row	AVE FREQ	Print
15-132	Print average frequencies for each mine type under the appropriate columns.		

TABLE 3 continued

Rows 3-4 Repeat rows 1 and 2 for average data for the last four periods.

$$\text{Average Number} = \frac{(\#\text{ this period}) + (\#\text{ each of last 3 periods})}{4}$$

$$\text{Average Frequency} = \frac{(\#\text{ this period}) + (\#\text{ each of last 3 periods}) \times 1{,}000{,}000}{(\text{Manhours this period}) + (\text{Manhours each last 3 periods})}$$

Metal and Nonmetal Broad Distribution Publications, Cont.

#3 Nonfatal Injury Experience by Mine Type, by State

Frequency: Quarterly, Annual

	Underground								Surface								Mills		Total		Experience: Last Three Periods					
State	Large		Med.		Small		Total UG		Large		Med.		Small		Total SFC						(Period)		(Period)		(Period)	
	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.
Total No.	-		-																							
Ave. Freq.		-		-																						
Ave. No.	-		-																							
Ave. Freq. (Last Four Periods)		-		-																						

TABLE 4 Frequency: Annual

NONFATAL INJURY SEVERITY BY MINE TYPE, BY STATE

Principal Users—Mine level decision-makers and other decision-makers.

Purpose and Role—This table will summarize reported days lost, from which severity rates are calculated. Decision-makers can use this data, along with frequency, to evaluate safety performance in their area of concern.

Data Sources—Computer generation from Injury and Employment reports.

Special Considerations—Because severity is more difficult to compute than frequency, it is recommended that this report be annual, rather than quarterly.

Nonfatal severity, rather than total severity (including fatalities), is a better measure of degree of injury in nonfatal accidents. Including day charges for fatalities distorts the figure and causes wide fluctuations in trends.

Day charges for permanent total and permanent partial injuries should be made by coding personnel on receipt of injury data. At the end of the year, estimates, based on past injury experience, should be made to cover injuries where the injured miner has not returned to his regular job.

TABLE 4 NONFATAL INJURY SEVERITY BY MINE TYPE, BY STATE Frequency: Annual

NO GROUPINGS

Spaces	Item	Heading	Source
1-5	State Abbreviation	STATE	Mine file
6-9	Lost work days	DAYS LOST	Injury reports
10	Blank		
11-15	Severity rate in large underground mines in state (nearest whole unit)	SEV RATE	Injury reports (augmented by day charges and estimate of future days lost due to injuries occurring during reporting period). Severity rate calculated as (reported days lost) + (day charges) + (estimated future days lost) x 1,000,000 ÷ (total manhours worked)
16	Blank		
17-103	Repeat for other mine types.		
104-105	Blank		
106-110	Total days lost	DAYS LOST	Sum of row
111	Blank		
112-116	Average severity rate (nearest whole unit)	SEV RATE	Severity rate calculated as (lost days assigned) x (1,000,000 for all mine types) ÷ (total manhours worked in all mine types)
117-118	Blank		
119-129	Same total data for previous year		

ROW TOTALS

Row 1

1-5	Name of row	TOT	Print
6-132	Print sums of days lost columns for each mine type under appropriate column		

Row 2

1-5	Average severity rate by mine type	AVE	Print
6-132	Print average severity rates for each mine type under appropriate column. Average severity is calculated by the same procedure employed for spaces 112-116.		

Rows 3-4 Repeat rows 1 and 2 for last year's data

Metal and Nonmetal Broad Distribution Publications, Cont.

#4 Nonfatal Injury Severity by Mine Type, by State

Frequency: Annual

State (ABB)	Underground								Surface								Mills		Total		(Year)	
	Large		Medium		Small		Total		Large		Medium		Small		Total							
	Days Lost	Severity	Days Lost	Severity	Days Lost	Severity	Days Lost	Severity	Days Lost	Severity	Days Lost	Severity	Days Lost	Severity	Days Lost	Severity	Days Lost	Severity	Days Lost	Severity	Days Lost	Severity
Total	-		-																			
Ave.		-		-																		
Total																						
Ave.																						
(Last year)																						

TABLE 5

Frequency: Annual and Quarterly

MANHOURS WORKED BY MINE TYPE, BY STATE

Principal Users—All groups.

Purpose and Role—Reporting manhours worked in different mine types by state will provide readers with a measure of the level of mining activity. The figures can also be used by individuals desiring normalizing data for their own statistical purposes.

Data Sources—Employment report

Special Considerations—The validity of the data reported will be especially dependent on obtaining complete returns from operators. Reconciliations of employment reports with commodity returns and state reports may have to be made, especially initially.

TABLE 5 MANHOURS WORKED BY MINE TYPE, BY STATE

Frequency: Annual and Quarterly

NO GROUPINGS

Spaces	Item	Heading	Source
1-5	State abbreviation	STATE	Mine file
6-12	Manhours worked in large underground mines	LARGE	Employment reports
13	Blank		
14-87	Repeat for other mine types. Allow one extra space for "underground total" and "surface total"		
88-90	Blank		
91-100	Total manhours worked	TOTAL	Sum of row
101-102	Blank		
103-132	Total manhours worked during the last 3 periods		Prior calculation

ROW TOTALS

Row 1

1-5	Name of row	TOT	Print
6-132	Print sums of manhours worked in each mine type under the appropriate column		Print

Row 2 Print the average number of days worked in each mine type for the last 4 periods, including the present reporting period.

Metal and Nonmetal Broad Distribution Publications, Cont.

#5 Man-Hours Worked by Mine Type, by State

Frequency: Quarterly, Annual

State (ABB)	Underground				Surface				Mills	Office	Total	Experience: Last Three Periods
	Large	Med.	Small	Total	Large	Med.	Small	Total				
Total Ave. (Last four Periods)												

TABLE 6 Frequency: Annual

INJURY EXPERIENCE BY MINE TYPE, BY COMMODITY

Principal Users—Mine level decision-makers.

Purpose and Role—This exhibit is aimed at operators who wish to compare their safety performance with the performance of their industry as a whole.

Data Sources—Injury report
Employment report
Mine file

Special Considerations—Grouping mines by commodity does not provide as complete information to users as grouping by mine type and state. For this reason, it is only done annually.

TABLE 6 INJURY EXPERIENCE BY MINE TYPE, BY COMMODITY Frequency: Annual

GROUPINGS

General Commodity Type

a. Metal: Copper, gold-silver, iron, lead-zinc, uranium, miscellaneous metals (all remaining metals)
b. Nonmetal: Clay, fluorspar, gypsum, phosphate rock, potash, salt, sulphur, miscellaneous nonmetals (all remaining nonmetals)
c. Stone: Granite, limestone, cement, miscellaneous stone
d. Sand and gravel

Spaces	Item	Heading	Source
1-10	Commodity name	COMMODITY	Mine file
11-14	Number of fatal and nonfatal injuries in the commodity in large underground mines	NO.	Injury reports
15	Blank		
16-19	Frequency of fatal and nonfatal injuries in the commodity in large underground mines	FREQ	Calculation: $\frac{\text{(\# fatal and nonfatal injuries) x 1,000,000}}{\text{Total manhours worked in the commodity}}$
20	Blank		
23-102	Repeat for all other mine types. Add one space for "underground total" and "surface total"		
103-105	Blank		
106-110	Total number of fatal and nonfatal injuries this year	TOTAL	Add fatal and nonfatal injuries for all mine types
111-112	Blank		
113-116	Average frequency of fatal and nonfatal injuries this year	FREQ	Calculation: $\frac{\text{Total injuries x 1,000,000}}{\text{Total manhours}}$
117-118	Blank		
119-129	Repeat 106-116 for last year's fatals and nonfatals		

TABLE 6 continued

ROW TOTALS

Row 1	Item	Heading	Source
1-10	Name of row	TOTAL NO.	Print
11-132	Print sum of fatal and nonfatal injuries for each mine type under the appropriate columns		
Row 2			
1-10	Name of row	AVE FREQ	Print
11-132	Print average frequencies for each mine type under the appropriate columns		
Rows 3-4	Repeat rows 1 and 2 for last year's data		

Metal and Nonmetal Broad Distribution Publications, Cont.

#6 Injury Experience by Mine Type, by Commodity

Frequency: Annual

Commodity	Underground								Surface								Mills		Total		(Year)	
	Large		Med.		Small		Total		Large		Med.		Small		Total							
	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.
Ave. Freq.		-	-																			
Total No.			-	-																		
Ave. Freq.		-	-																			
Total No. (Last year)			-	-																		

TABLE 7

Frequency: Annual and Quarterly

INJURY EXPERIENCE BY MINE TYPE, BY INJURY TYPE

Principal Users—Mine level decision-makers.

Purpose and Role—This table will help operators, unions, and USBM inspectors and training personnel to identify specific problem areas before serious injuries or fatalities occur.

Data Sources—Injury report

Special Considerations—Often a serious injury or fatality will be preceeded by numerous less serious injuries of the same type. Thus, detecting increasing frequency in a type of injury is important. Because normalizing data is absent, reporting of past experience will be important in detecting these increases in frequency.

TABLE 7 INJURY EXPERIENCE BY MINE TYPE, BY INJURY TYPE

Frequency: Annual and Quarterly

NO GROUPINGS

Spaces	Item	Heading	Source
1-19	Type of injury	TYPE OF INJURY	Injury reports, Question C-1 on recommended form.
20-21	Number of fatalities in large underground mines	FA	Injury reports
22	Blank		
23-26	Number of nonfatal injuries in large underground mines	NONF	Injury reports
27	Blank		
28-90	Repeat for other mine types		
91-92	Blank		
93-96	Total fatalities for the period	FAT	
97	Blank		
98-102	Total nonfatals for the period	NONFA	
103	Blank		
104-132	Total number of fatals and nonfatals for the last 3 comparable periods (quarters or years)		

ROW TOTALS

Row 1

Spaces	Item	Heading	Source
1-19	Name of row	TOTAL	Print
20-132	Print totals for appropriate columns		

Row 2 Print the average number for the last 4 periods (either quarters or years)

Metal and Nonmetal Broad Distribution Publications, Cont.

#7 Injury Experience by Mine Type, by Injury Type

Frequency:
Quarterly, Annual

Type of Injury	Underground				Surface				Mills	Total	Experience: Last Three		
	Large	Med.	Small	Total	Large	Med.	Small	Total			(Period)	(Period)	(Period)
	Fa Nonf	Fa Nonf	Fa Nonf	Fa Nonf	Fa Nonf	Fa Nonf	Fa Nonf	Fa Nonf	Fa Nonf	Fa Nonf	Fa Nonf	Fa Nonf	Fa Nonf
Total													
Ave. (Last four periods)													

TABLE 8 Frequency: Annual

INJURY EXPERIENCE BY DEGREE, BY MINE TYPE

Principal Users—All groups.

Purpose and Role—In this table, the distribution of injuries by degree illustrates how serious the injuries are that occur at various mine types.

Data Sources—Injury report, supplemented by coder interpretation of degree of injury. Assignment of injury category.

Special Considerations—The data in the exhibit is not normalized, so comparison cannot necessarily be made between types of mines, except on a percentage basis. Total frequency rates should be used to make total safety comparisons between mine types.

Upon receipt of the final injury report, the coder will assign the injury to a degree category.

TABLE 8 INJURY EXPERIENCE BY DEGREE, BY MINE TYPE Frequency: Annual

GROUPINGS

Mine Size

a. Underground—large, medium, small
b. Surface—large, medium, small
c. Mills

Spaces	Item	Heading	Source
1-25	Type of mine	TYPE OF MINE	Mine file
26-30	Number of fatal injuries for mine type	FATAL	Injury reports
31-32	Blank		
33-37	Number of permanent total injuries for mine type	TOTAL	Injury reports
38-39	Blank		
40-46	Number of permanent partial injuries for mine type	PARTIAL	Injury reports
47-48	Blank		
49-54	Number of temporary total injuries	TEMP TOTAL	Injury reports
55-56	Blank		
57-65	Total lost time injuries for mine type	TOTAL DISABLING	Add prior columns including fatalities, permanent, and temporary total injuries
66	Blank		
67-73	Total injuries without lost time for mine type	NO LOST TIME	Injury reports
74-75	Blank		
76-81	Total nonfatal injuries for mine type	TOTAL NONF	Injury reports
82-83	Blank		
84-90	Total number of injuries for mine type	TOTAL	Injury reports
91	Blank		
92-95	Fraction of injuries that were fatalities (nearest 1/1000)	FAT	$\frac{\text{Number fatalities}}{\text{Total number of injuries}}$
96	Blank		
97-100	Fraction of injuries that were permanent total	TOT	$\frac{\text{Number permanent total}}{\text{Total number of injuries}}$

TABLE 8 continued

Spaces	Item	Heading	Source
101	Blank		
102-105	Fraction of injuries that were permanent partial	PAR	Number permanent partial / Total number injuries
106	Blank		
107-110	Fraction of injuries that were temporary total	TEM TOT	Number temporary total / Total number injuries
111-112	Blank		
113-116	Fraction of injuries that were totally disabling	TOT DIS	Number of totally disabling / Total number injuries
117	Blank		
118-121	Fraction of injuries that involved no lost time	NO LT	Number of no lost time injuries / Total number injuries
122-123	Blank		
124-129	Fraction of injuries that were nonfatal	TOT NONF	Number of nonfatal injuries / Total number injuries

ROW TOTALS

Row 1

1-25	Name of row	TOTAL	Print
26-132	Print appropriate totals under columns then calculate fractions as above		

Row 2 Repeat row 1 for prior year

Metal and Nonmetal Broad Distribution Publications, Cont.

#8 Injury Experience by Degree, By Mine Type

Type of Mine	Number of Injuries: Fatal	Nonfatal: Permanent Total	Nonfatal: Permanent Partial	Nonfatal: Temp Total	Nonfatal: Total Lost Time	Nonfatal: No lost Time	Nonfatal: Total Nonf	Total	Frequency: Annual, Per cent of Injuries: Fat	Nonfatal: Perm Tot	Nonfatal: Perm Par	Nonfatal: Per Tot	Nonfatal: Tot Lt	Nonfatal: No Lt	Nonfatal: Tot Non	Tot
Total																
Ave. (Last Four Periods)																

TABLE 9 Frequency: Annual

DEGREE OF INJURY IN THE TOP TEN TASKS, BY TASK

Principal Users—Mine level decision-makers.

Purpose and Role—This table would delineate the most dangerous (in terms of total injuries) tasks, or duties, in metal and nonmetal mining. Once these tasks are identified, efforts by management, labor, and the Bureau can be made to make miners more aware of dangers inherent in the tasks. See Chapter 10.

Data Sources—Injury report

Special Considerations—The Top Ten Tasks are selected solely on the basis of number of incidents. Thus, the data is not normalized in terms of total exposure to the tasks.

HSAC should make a continuing effort to define appropriate tasks for use in determining the Top Ten Tasks in a manner similar to that used in defining tasks for coal mining (Exhibit A-1). The proposed Industrial Engineering Study of metal and nonmetal mining will provide a basis for formulating these tasks.

TABLE 9 DEGREE OF INJURY IN TOP TEN TASKS, BY TASK Frequency: Annual

NO GROUPINGS

Spaces	Item	Heading	Source
1-30	Task performed during occurrence of injuries	DESCRIPTION OF TASK	The tasks will be derived from the injury report. Report question: "What was the victim doing when injured?" Appropriate codes will come from the Industrial Engineering Study and injury reporting experience.
31-36	Number of fatalities while performing task	FATAL	Injury reports
37-40	Blank		
41-44	Number of permanent total injuries while performing task	PERM TOT	Injury reports
45-46	Blank		
47-50	Number of permanent partial injuries while performing task	PERM PART	Injury reports
51-52	Blank		
53-56	Number of temporary total injuries while performing task	TEMP TOT	Injury reports
57-58	Blank		
59-67	Total number of disabling injuries while performing task	TOTAL DISABLING	Injury reports
68-69	Blank		
70-76	Number of no lost time injuries while performing task	NO LOST TIME	Injury reports
77-78	Blank		
79-86	Number of nonfatal injuries while performing task	TOTAL NONFATAL	Add nonfatal injuries
87-90	Blank		
91-99	Total number of injuries while performing task	TOTAL	Add nonfatal and fatal injuries
100-104	Blank		
105-110	Total number of injuries in task for prior year	(YEAR)	Prior year's injury reports
111-112	Blank		
112-132	Repeat for two more years to illustrate trend		

Metal and Nonmetal Broad Distribution Publications, Cont.

#9 Degree of Injury in Top Ten Tasks, by Task

Frequency: Annual

Description of Task	Fatal	Nonfatal					Total	Past Experience		
		Perm Tot	Perm Part	Temp Tot	No Lost Time	Total Nonfatal		(Year)	(Year)	(Year)

TABLE 10 Frequency: Annual

ILLNESS EXPERIENCE BY MINE TYPE, BY COMMODITY

Principal Users—All groups.

Purpose and Role—This table will report the occurrence of illness for the year. Because some diseases are common to the commodity mined, the table is separated by commodity.

Data Sources—Injury and illness report

Special Considerations—Occupational illnesses differ in the time required for the illness to develop. Some require minutes; others require years. Realization that these differences exist is important when analyzing occurrence data for a single year.

TABLE 10 ILLNESS EXPERIENCE BY MINE TYPE, BY COMMODITY Frequency: Annual

GROUPINGS

General Commodity Type

a. Metal: Copper, gold-silver, iron, lead-zinc, uranium, miscellaneous metals (all remaining metals).
b. Nonmetal: Clay, fluospar, gypsum, phosphast rock, potash, salt, sulphur, miscellaneous nonmetals (all remaining nonmetals)
c. Stone: Granite, limestone, cement, miscellaneous stone
d. Sand and gravel

Spaces	Item	Heading	Source
1-25	Description of illness	ILLNESS	Injury and illness report, Part D on recommended form.
26-27	Number of reports of illness in large underground mines	NO.	Same
28	Blank		
29-32	Frequency of illness	FREQ	(Number of reports) x 1,000,000 ÷ (manhours worked in large underground mines in the commodity group)
33	Blank		
34-96	Repeat pattern for other mine types and mills		
97	Blank		
98-100	Total number of illness reported in the commodity group	NO.	Injury and illness reports, Part C
101	Blank		
102-105	Average frequency of illness	FREQ	(Total number of reports) x 1,000,000 ÷ (manhours worked in commodity group)
106-108	Blank		
109-127	Same as 98-105 for prior year		

ROW TOTALS

Row 1

1-25	Name of row	TOTAL NUMBER	Print
26-132	Print sums of number of illness column under appropriate columns		

TABLE 10 continued

Spaces	Item	Source
Row 2		
1-25	Name of row	Print
26-132	Print average frequency rates calculated as follow under appropriate columns: $\frac{\text{(Total illnesses reported for mine type) x 1,000,000}}{\text{Total manhours worked for mine type}}$	
Rows 3-4	Repeat above for prior year	

Metal and Nonmetal Broad Distribution Publications, Cont.

#10 Illness Experience by Mine Type, by Commodity

Frequency: Annual

Illness	Underground								Surface								Mills		Total		(Year)	
	Large		Med.		Small		Total		Large		Med.		Small		Total							
	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.
Commodity A																						
Illness 1																						
Illness 2																						
Commodity B																						
Illness 1																						
Total No.																						
Ave. Freq.																						
Total No.																						
Ave. Freq. (Last Year)																						

APPENDIX D

USBM METAL AND NONMETAL REPORT

TABLE 1 Frequency: Quarterly

INJURY EXPERIENCE BY INJURY TYPE, BY DISTRICT

Principal Users—Deputy Director, Health and Safety

- Assistant Director, Metal and Nonmetal Health and Safety
- Metal and Nonmetal District and Subdistrict Managers
- Assistant Director, Education and Training
- Assistant Director, Technical Support

Purpose and Role—This report to Bureau users will enable management to evaluate and compare safety performance in their districts. Also, subdistrict managers can identify changes in the frequency of various types of accidents. This will guide the inspection force during mine inspections.

Data Sources—Injury reports
Employment reports

Special Considerations—To assist in evaluating district safety performance, data for state plan states—where inspection responsibility is shared—is separated from data for states where the Bureau is solely responsible for inspections.

TABLE 1 **INJURY EXPERIENCE BY INJURY TYPE, BY DISTRICT** Frequency: Quarterly

GROUPINGS

1. Metal and nonmetal districts: Rocky Mountain, etc.
2. Metal and nonmetal subdistricts
3. Inspection jurisdiction:
   - USBM—inspected states
   - State plan states

Spaces	Item	Heading	Source
1-13	Jurisdiction within the district	DISTRICT	Mine file
14-16	Number of fatal and nonfatal injuries of specific type	NO.	Injury reports
17	Blank		
18-21	Frequency of injuries of specific type	FREQ	(Total number of injuries) x 1,000,000 ÷ Total manhours worked in district in jurisdictional category (USBM or state)
22	Blank		
23-101	Report for other types of injuries (see spacing chart)		
102-103	Blank		
104-107	Total number of fatal and nonfatal injuries of all types	NO.	Add previous row entries
108	Blank		
109-112	Average frequency of all types of injuries	AVE. FREQ	(Total number of injuries) x 1,000,000 ÷ Total manhours worked in jurisdictional category or, sum all row frequencies
113	Blank		
114-117	Total number for the current quarter	NO.	
118	Blank		
119-122	Average total frequency for the current quarter	AVE. FREQ	
123	Blank		
124-127	Average number for the last 4 quarters, including current quarter	NO.	Calculation: $\frac{\text{Injuries for 4 quarters}}{4}$
128	Blank		
129-132	Average frequency for the last 4 quarters, including current quarter	AVE. FREQ	Calculation: $\frac{\text{(Injuries for 4 quarters)} \times 1{,}000{,}000}{\text{(Manhours for 4 quarters)}}$

TABLE 1 continued

ROW TOTALS

		Heading	Source
Row 1			
1-13	Name of row	TOTAL NO.	Print
14-132	Print sum of columns for each injury type under the appropriate columns.		
Row 2			
1-13	Name of row	AVE. FREQ	
14-132	Print the average frequency for each injury type under the appropriate columns. Calculate as calculated for spaces 109-112.		
Rows 3-4	Print average total number and average frequency for the last four quarters, including the current reporting quarter. Calculate as calculated in spaces 124-132.		

Metal and Nonmetal Limited Publications

#1 Injury Experience by Injury Type, by District

District

	Fall Gnd Face Side Bnk		Fall of Objects		Fall of Person		Haulage		Machine		Handling Material		Explosive		Electric		Explosion Gas Dust		Fire		Other		Total		Ave. Last Four Qtr.	
	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Ave. Freq.	No.	Ave. Freq.
District																										
USBM (For States not under state plan. lumped together)																										
Underground																										
Surface																										
Sand/Gravel																										
Mill																										
State (for state plan states lumped together)																										
Underground																										
Surface																										
Sand/Gravel																										
Mill																										
Total No.	-	-																								
Ave. Freq.	-	-																								
Ave. No. Ave. Freq. (Last Four Quarters)																										

TABLE 2 Frequency: Quarterly

NONFATAL INJURY EXPERIENCE BY INJURY TYPE, BY MINE
(Separated by State, Travel Area, and Size. Data is listed for 4 quarters.)

Principal Users—Subdistrict Managers
Inspectors

Purpose and Role—This report will provide subdistrict managers and inspectors with a four quarter history of individual mine injuries and employment. A system of flagging individual mines with potential problems is employed to conserve the time required for reading the report and to direct attention to mines with potential safety problems.

Data Sources—Injury reports
Employment reports
Mine file

Special Considerations—The flag system will shorten the time a subdistrict manager will require to read the report. The number of flags in a travel area will also be recorded in Table 3. This number will be useful to the manager in determining which travel areas should be inspected.

The criteria for assigning a flag to an individual mine are listed here:

1. Large mines*: top 20% increase in frequency over the prior quarter.
2. Medium mines*: top 10% in frequency.
3. Small mines*: top 10% in frequency with 2 or more injuries.
4. Mills: top 5% increase in frequency with at least 2 injuries.
5. Sand and gravel: top 5% with 2 or more injuries.

*Underground mines and surface mines will be considered separately.

TABLE 2 **NONFATAL INJURY EXPERIENCE BY INJURY TYPE, BY MINE** Frequency: Quarterly

GROUPINGS

1. Subdistrict
2. State
3. Travel Area
4. Size and type of operation: large, medium, small, mill

Spaces	Item	Heading	Source
1-29	Mine name and address (4 lines)	MINE NAME AND ADDRESS	Mine file
30-45	Mine characteristic data (4 lines) (See spacing chart)	MINE DATA: 1. STATUS/TYPE OP/NO. OF EMPLOYEES 2. COMMODITY 3. NEW ID NO. 4. OLD ID NO.	
46-47	Blank		
48-56	Inspection summary: date of the last inspection, whether inspection was USBM, state, or joint, and number of notices pending against the mine.	DATE LAST INSPECTED TYPE INSP. NOT. PEND.	Mine file
57-58	Blank		
59-62	Period of data (quarter)	QTR.	Enter prior to program fun. Four quarters of data will be reported each time.
63-64	Blank		
65-71	Manhours worked during quarter	MANHOURS WORKED	Quarterly employment reports
72-73	Blank		
74-121	Number of injuries in each type category (See spacing chart)	(Appropriate number)	Injury reports
122	Blank		
123-125	Total nonfatal injuries for quarter at mine	TOT	Add injuries in row to obtain total
126	Blank		
127-130	Nonfatal frequency for quarter at mine (nearest whole number)	NONF FREQ	$\frac{\text{(Total nonfatal injuries)} \times 1{,}000{,}000}{\text{Total manhours worked}}$

TABLE 2 continued

Spaces	Item	Heading	Source
131	Blank		
132	Asterisk (flag) to denote mines with potential safety problems	F	Criteria for "flagging" mines: 1. Large mines*: top 20% increase in frequency over the previous quarter 2. Medium mines*: top 10% in frequency 3. Small mines*: top 10% in frequency and having at least 2 injuries during quarter 4. Mills: top 5% increase in frequency with at least 2 injuries during quarter 5. Sand and gravel: top 5% in frequency with at least 2 injuries during quarter

*Consider underground mines and surface mines separately.

Metal and Nonmetal Limited Publications, Cont.

#2 Nonfatal Injury Experience by Injury Type, by Mine (Separated by State, Travel Area and Size)
(Data listed for four quarters)

Mine Name and Address	1. Status/ Type of/No. Employees 2. Commodity 3. New ID No. 4. Old ID No.	Date Last Inspected / Type of Inspection*	Qtr.	Man-Hours Worked	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Nonfa Freq.	F
		*Joint, State or USBM																					

1. No. Perm Total
2. No. Perm Partial
3. No. Temp Total
4. No. No Lost Time
5. Fall Gnd Face Side Bank
6. Fall Objects
7. Fall of Person
8. Haulage
9. Machinery
10. Handling Materials
11. Explosives
12. Electricity
13. Explosions-Gas, Dust
14. Fire
15. Hand Tools
16. Other
17. Total, Nonfatal Injuries

F. Special Flag Mines
- Large--top 10% increase in freq.
- All --top 10% in freq. Mines in group
- (Sand/Gravel would be flagged separately)

TABLE 3 Frequency: Quarterly

ACCIDENT HISTORY BY MINE TYPE, BY TRAVEL AREA

(Separated by State. Data is listed for 4 quarters.)

Principal Users—Subdistrict Managers

Purpose and Role—By examining this report, the subdistrict manager can determine important safety trends in his travel areas. By noting the number of flags given to individual mines in each travel area, the manager will also have a mechanism for ranking travel areas in terms of safety. The ranking can be used as part of the regular scheduling process or scheduling of inspectors for spot inspections to investigate specific problems.

Data Sources—Injury reports
Employment reports
Mine file

Special Considerations—This report will provide the subdistrict manager an initial indication of the travel areas where he can most efficiently allocate inspectors.

After examination of this table, he can inspect Table 2 to determine if circumstances contributing to the assignment of the flag justify a mine inspection. For categories of mines inspected less frequently (such as small open pit mines), establishing the priority of inspection of these mines will be easier.

TABLE 3 ACCIDENT HISTORY BY MINE TYPE, BY TRAVEL AREA (Separate by State, Data is listed for four quarters) Frequency: Quarterly

GROUPINGS: Subdistrict and State

Spaces	Item	Heading	Source
1-5	Travel area	AREA	Mine file
6-9	Quarter	QTR	Enter prior to program run. Four quarters of data will be reported each time.
10-11	Blank		
12-13	Number of large underground mines in travel area	NO.	
14	Blank		
15-19	Average nonfatal frequency in large underground mines during quarter	FREQ.	(Total # of nonfatal injuries in mine type in travel area) x 1,000,000 ÷ Total manhours worked in mine type in travel area
20	Blank		
21-82	Repeat for other mine types		
83	Blank		
84-89	Manhours worked in all mines during quarter	MINES	Employment reports
90	Blank		
91-94	Manhours worked in all mills during quarter	MILLS	Employment reports
95	Blank		
96-98	Number of permanent total injuries	PER TOT	Injury reports
99	Blank		
100-102	Number of permanent partial injuries	PER PAR	Injury reports
103	Blank		
104-106	Number of temporary total injuries	TEM TOT	Injury reports
107	Blank		
108-110	Number of no lost time injuries	NO LT	Injury reports
111	Blank		

TABLE 3 continued

112-122	Identification of four leading types of injuries	1, 2, 3, 4	Injury report, Question C-1 of recommended form.
123-124	Blank		
125-129	Total number of nonfatals during quarter	TOTAL NONFA TALS	
130	Blank		
131-132	Number of flags assigned to mines in the travel area	NO FL AG	Table 2

Metal and Nonmetal Limited Publications, Cont.

#3 Accident History by Mine Type, by Travel Area (Separated by State)
(Data Listed for Four Quarters)

Area/ Qtr.	Underground						Surface						Mills		Total		Man-Hours Worked		No. of Nonfatals By Degree				Leading Types				Total Nonfatals	FLAG
	Large		Med.		Small		Large		Med.		Small																	
	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	Mines	Mills	Per Tot	Per Par	Tem Tot	No Lt	1	2	3	4		

APPENDIX E

GENERAL MONTHLY FATALITY REPORT

Page 2: Fatality Summary

Month	Bituminous	Anthracite	Total Coal	M & NM Underground	M & NM Surface	M & NM Mills	Total M & NM
Year to Date							
Same Period Last Year							

Page 2: Fatality Summary

Month	Bituminous	Anthracite	Total Coal	M & NM Underground	M & NM Surface	M & NM Mills	Total M & NM
Year to Date							
Same Period Last Year							

APPENDIX E

GENERAL MONTHLY FATALITY REPORT

General Monthly Fatality Report

Page 1: Fatality List

Mineral	Mining Company	State	Accident Type	Work Location

Page 2: Fatality Summary

Month	Bituminous	Anthracite	Total Coal	M & NM Underground	M & NM Surface	M & NM Mills	Total M & NM
Year to Date							
Same Period Last Year							

General Monthly Fatality Report

Page 1: Fatality List

Mineral	Mining Company	State	Accident Type	Work Location

Page 2: Fatality Summary

Month	Bituminous	Anthracite	Total Coal	M & NM Underground	M & NM Surface	M & NM Mills	Total M & NM
Year to Date							
Same Period Last Year							