



**STUDY OF METAL/NONMETAL MINING
ENFORCEMENT AND COMPLIANCE
ASSISTANCE ACTIVITIES, 1983-2000**

MINE SAFETY AND HEALTH ADMINISTRATION

REPORT NO.: 2E-06-620-0003

DATE ISSUED: SEPTEMBER 26, 2001

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ACRONYMS AND GLOSSARY

ACRONYMS

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| BNA | - | Bureau of National Affairs |
| DOL | - | Department of Labor |
| GAO | - | General Accounting Office |
| GPRA | - | Government Performance and Results Act |
| M/NM | - | Metal/Nonmetal |
| MSHA | - | Mine Safety and Health Administration |
| NFDL | - | Non-Fatal Days Lost |
| OIG | - | Office of Inspector General |

GLOSSARY

Factor Analysis - Statistical procedure for uncovering a (usually) smaller number of unobserved variables by studying the covariation among a set of observed variables.

Kernel Density Diagram - A graph that shows the ordered items from the data plotted on their "density of occurrence." This technique allows for a visual inspection of the distribution of a variable.

Locally Weighted Scatterplot Smoothing - Technique that allows a researcher to fit a smooth curve to the data without specifying the shape of the curve beforehand; permits identification of trends based on data rather than assumptions.

Partial Regression Plot - A graph of the independent effect (holding all other variables constant) of an independent variable on a dependent variable in a multiple regression equation.

Pearson's Correlation Coefficient - Statistic that measures the strength and direction of the linear correlation between two variables.

Principal Components Analysis - A method for summarizing and simplifying the correlation structure in multivariate data through mathematic models and production of composite variables.

Regression Analysis - Calculation of a number of statistics that examine the relationship between two or more variables; allows the development of a linear model for predicting the dependent variable from one or more independent variables, and allows measurement of the accuracy of predictions made using the model.

Reliability Analysis - Method of assessing whether a summated rating scale will produce the same results in repeat applications; measures the proportion of total variability accounted for by the trait we are trying to measure.

Scatter Plot - Graphing technique in which the coordinates of two variables are plotted for each case in a distribution to permit visual representation of the relationship between the variables.

Summated Rating Scale - A data reduction method that is created by collapsing across columns of a data matrix and taking a measure of central tendency in each row, producing a summary score for each observation.

EXECUTIVE SUMMARY

The Mine Safety and Health Administration (MSHA), in partnership with the American mining community, works to eliminate fatalities, reduce the frequency and severity of accidents, and minimize health hazards associated with the mining industry in accordance with the Federal Mine Safety and Health Act of 1977 (the Mine Act).

As part of a prior evaluation,¹ MSHA M/NM provided the Office of Inspector General (OIG) with data on the performance of enforcement activities. Specifically, MSHA M/NM provided information that indicated declining completion levels of regular inspections. In addition, GAO performed three evaluations between 1985-1987 that specifically addressed regular inspection shortfalls. The combination of current shortfalls and prior GAO evaluations prompted the OIG to reevaluate MSHA M/NM's enforcement activities.

RESULTS OF STUDY

Analysis of the information and data we reviewed demonstrates that MSHA M/NM enforcement and compliance assistance activity is more complex than generally perceived. M/NM inspectors are responsible for performing over twenty-five types of enforcement/compliance assistance activities. This significant breadth of responsibility, combined with rapid growth in mine operations, reductions in the size of the inspectorate, and shifts in public policy orientation inhibits full performance of statutory duties. However, based on the number and scope of M/NM enforcement and compliance assistance activities, we identified three areas where MSHA M/NM can strengthen its ability to enhance miner safety. Those areas are identified below.

FINDING A – Enforcement and Compliance Assistance Activities Require Greater Coordination and Planning

MSHA M/NM engages in more than twenty-five enforcement and compliance assistance activities, both statutory and non-statutory. We found that M/NM programs require greater integration and coordination in order to fulfill MSHA's overall "safety mission." MSHA M/NM should improve guidance to district offices regarding program implementation and operation to enhance consistency in program performance and management. In addition, the passage of GPRA changed the way agencies are required to report program achievements. While MSHA M/NM easily adapted to these reporting requirements, the measurement of outcome performance with regard to enforcement and compliance assistance activities requires modification to call for significant reductions in fatalities and injuries.

¹ OIG report no. 2E-06-620-0002, issued March 22, 2001.

FINDING B – Proactive Approaches to Enforcement and Compliance Assistance Activities Help Prevent Injuries/Fatalities

An unavoidable feature of enforcement/compliance assistance activities performed by MSHA M/NM is their retrospective nature. When accidents or fatalities occur, M/NM inspectors are required to engage in a number of activities related to these specific incidents. The OIG realizes the necessity of reacting to developing situations. However, our analysis suggests that MSHA M/NM should identify successful features of current programs and revise enforcement and compliance assistance activities to enhance proactive approaches for preventing injuries and fatalities.

FINDING C – Characteristics of Enforcement and Compliance Assistance Activities Create Substantial Tradeoffs Among Inspectors' Duties

Programs and initiatives developed to improve the safety and health of miners require inspectors to engage in an increasing number of activities. The amount of time required to perform these duties creates a series of tradeoffs among the various activities. In addition, we found evidence of disparities in the inspector resources available per mine on a district basis. While this considers only one factor that contributes to the distribution and allocation of resources, additional factors reinforce the conclusion that more careful examination of resource allocation and utilization is needed to determine the most effective "enforcement and compliance assistance agenda."

RECOMMENDATIONS

We recommend that MSHA M/NM take the following actions to improve the effectiveness of enforcement activities designed to improve the safety and health of miners:

1. Further integrate enforcement and compliance assistance activities by improving direction/guidance to district management regarding the implementation and operation of programmatic activities in order to promote consistency in program performance and management across M/NM districts.
2. Modify current outcome performance goals, raising them to levels where substantive changes in the number of fatalities and NFDL injuries are required to meet the performance goal.
3. Study available data to identify trends in injuries and fatalities and identify possible problem areas that can be addressed in a proactive manner.

4. Carefully study features of current M/NM programs in order to identify program elements that are most successful in reducing injuries and fatalities, and utilize these elements to revise other enforcement and compliance assistance activities to produce a stronger proactive effect.
5. Study the allocation and distribution of enforcement and compliance assistance resources in order to determine what combination of activities will produce the greatest effect on mine safety, given that there are inherent tradeoffs among these activities.

MSHA RESPONSE AND OIG CONCLUSION

In response to the OIG's official draft report, MSHA agreed with the findings and believed that our recommendations would enhance MSHA's ongoing accident reduction efforts. As a result of corrective actions planned by MSHA, we consider all five recommendations to be resolved. The recommendations will be closed after these corrective actions are completed. In addition, MSHA recommended several wording changes that the Agency felt would enhance the accuracy and readability of the report. These changes are incorporated in the final report. The Agency's complete response is found in Appendix C.

BACKGROUND

The Mine Safety and Health Administration (MSHA), in partnership with the American mining community, works to eliminate fatalities, reduce the frequency and severity of accidents, and minimize health hazards associated with the mining industry in accordance with the Federal Mine Safety and Health Act of 1977 (the Mine Act).

As part of a prior evaluation,² MSHA Metal/Nonmetal provided the Office of Inspector General (OIG) with data on the performance of enforcement activities. Specifically, MSHA M/NM provided information that indicated declining completion levels of regular inspections. Because personal sampling is an integral part of the inspection process, we noted that sampling levels have experienced decreases in proportion to those observed in regular inspections.

The number of regular inspections to be completed is statutorily mandated in the Mine Act. For M/NM mines, surface mines must be inspected twice yearly; four yearly inspections are required for underground mines. MSHA M/NM officials attributed the observed decline in completed regular inspections to resources; specifically, fewer numbers of inspectors prevented full performance with regard to regular inspections.

Failure to meet statutory obligations with regard to inspections has been a source of prior Congressional concern. Three General Accounting Office (GAO) reports from 1985 to 1987 concluded that the shortfall in regular inspections resulted from a number of factors including: substantial reduction in the number of inspectors; the extent to which inspectors devote time to other types of inspections or activities; imbalances in the geographic location of inspectors; and limited emphasis given to conducting required regular inspections.

² OIG report no. 2E-06-620-0002, issued March 22, 2001.

PURPOSE, SCOPE AND METHODOLOGY

PURPOSE

We conducted a study of the Mine Safety and Health Administration's enforcement and compliance assistance activities. This study covered the period from 1983 through 2000 and was designed to study trends in Metal/Nonmetal mine enforcement and compliance assistance activities in order to identify possible areas for improvement.

SCOPE

The scope of this study covered a number of activities as well as a number of years. The period of time we examined included data from 1983 through 2000. For most of the statistical analyses, however, we utilized data from the period 1986-2000. This limitation was necessitated by: (1) Constraints associated with the analysis of time series data; and, (2) Deletion of cases due to missing data.

The activities covered in this study were drawn from the universe of enforcement and compliance assistance activities conducted by MSHA M/NM. They included: regular inspections; "non-regular" inspections; special emphasis programs; Part 50 audits; program in accident reduction; conference litigation representative initiative; compliance assistance visits; haulage activities; sampling activities; safety program evaluation and assistance; and at-mine training. While this does not cover all activities categorized as "enforcement activities," we believe the scope of activities analyzed in this study is broad enough to effectively characterize MSHA M/NM's efforts. A list and description of all enforcement and compliance assistance activities performed by MSHA M/NM are presented in Appendix A.

METHODOLOGY

To complete the study's objectives, we used a variety of quantitative and qualitative analytical methods as well as a review of available documents.

Quantitative Methods

MSHA M/NM provided data regarding enforcement activity for the period of interest. We did not independently verify the validity of the data provided by the agency; however, M/NM officials internally checked the data for accuracy and provided the requested information according to calendar year and MSHA M/NM district. We analyzed all data that was necessary and sufficient to characterize M/NM enforcement activities and assess their performance.

The techniques utilized to uncover these relationships varied according to purpose. To establish the existence of significant relationships between variables, we employed Pearson's Correlation Coefficient. This statistic indicates the existence of a relationship between two variables, as well as the direction and intensity of that relationship.

For the purpose of data reduction, we utilized techniques that enable the construction of multi-variable scales that summarize the information from several related variables into a single measure. These techniques included reliability analysis, summated rating scale construction, principal components analysis and factor analysis.

To analyze trends in the data, we used a variety of graphical methods, including scatter plots, kernel density diagrams, partial regression plots, and locally weighted scatterplot smoothers. Graphical analysis of trends is advantageous because these techniques rarely rely on the onerous assumptions of some statistical modeling techniques. Simply put, graphical analyses allow the data to speak for themselves.

Finally, we developed interactive models of the data based on regression analysis. These models provide information regarding the linear association between items of interest. Specifically, regression models provide information regarding the intensity of the relationship and measures of the model's explanatory power. Please see Appendix B for more detailed Technical/Methodological concerns.

Qualitative Methods

We utilized formal and informal discussions with officials from MSHA M/NM headquarters. These discussions were conducted in person, over the telephone, and through electronic mail. Additionally, we conducted telephone interviews with MSHA Metal/Nonmetal district managers.

Document Review

We examined a wide range of documents relating to activities undertaken by MSHA M/NM. The statutory requirements regarding regular inspections are established in the text of the Mine Act and its amendments. We examined press releases related to various initiatives. We also referred to three GAO reports (from 1985-1987) that focused on M/NM inspection activity. Additionally, we examined MSHA's annual performance plans and budget justifications.

We conducted this study in accordance with the *Quality Standards for Inspections* published by the President's Council on Integrity and Efficiency.

FINDINGS AND RECOMMENDATIONS

FINDING A - Enforcement and Compliance Assistance Activities Require Greater Coordination and Planning

Due to statutory requirements set forth in the Federal Mine Safety and Health Act of 1977, hereafter referred to as "The Mine Act", regular inspections are a central focus of MSHA M/NM's enforcement activity. However, M/NM engages in more than twenty-five other enforcement and compliance assistance activities, both statutory and non-statutory. We found that MSHA M/NM programs require greater integration and coordination in order to fulfill MSHA's overall "safety mission." MSHA M/NM should improve guidance to district offices regarding program implementation and operation to enhance consistency in program performance and management. In addition, the passage of GPRA changed the way agencies are required to report program achievements. While MSHA M/NM easily adapted to these reporting requirements, the measurement of outcome performance with regard to enforcement and compliance assistance activities requires modification to call for significant reductions in fatalities and injuries.

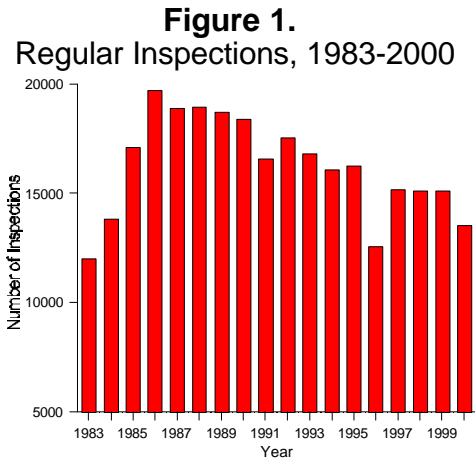
(1) Inspection Activity is Dependent On Several Factors

Our study of MSHA M/NM activities initially focused on the completion of regular inspections in both surface and underground mines; three factors contributed to this initial focus. First, GAO issued three reports in the mid-1980s that specifically note shortfalls in completing regular inspections. Second, information provided by MSHA M/NM during a previous evaluation indicated declining regular inspection rates from 1994 to 2000. Third, the Mine Act requires regular inspections. Surface mines are to be inspected twice yearly; underground mines are to be inspected four times yearly.

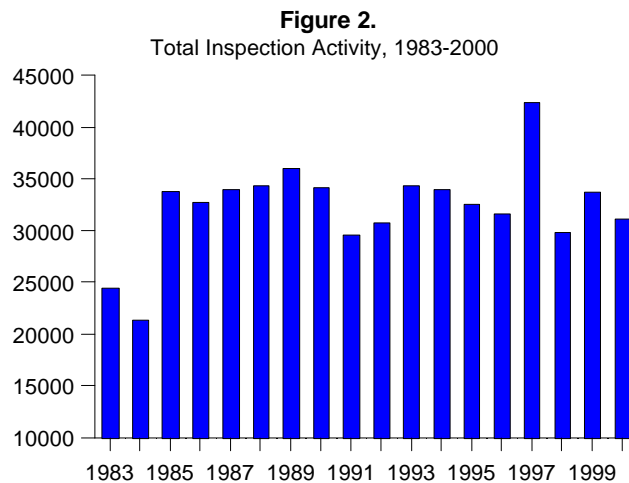
Congress first expressed interest in completion rates for regular inspections in 1985. In a review of DOL management, GAO noted that MSHA M/NM completed roughly sixty percent of its mandated regular inspections. This shortfall was attributed to: (1) a substantial reduction in the number of inspectors; (2) the extent to which inspectors devote time to other activities; (3) imbalances in the geographic distribution of inspectors; (4) limited emphasis given to conducting required regular inspections by MSHA M/NM; and (5) the lack of a reporting system comparing the required, planned, and actual number of inspections.

Follow-up reports in 1986 and 1987 found that MSHA M/NM had implemented GAO recommendations and improved its completion rate for regular inspections. This improvement was largely the result of: (1) better use of existing inspector resources; (2) improvements in MSHA M/NM's management information system to reflect an accurate mine inventory; and (3) policy changes prioritizing inspection activities. In addition, GAO added the recommendation that additional inspectors were needed in four MSHA M/NM districts to prevent inspection shortfalls. As of March 1987, inspectors had completed one hundred percent of the required mine inspections.

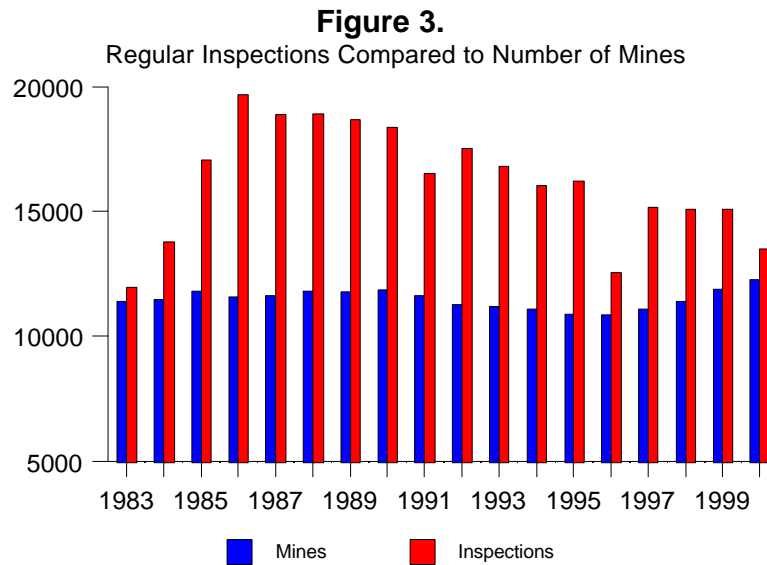
The number of regular inspections performed yearly are summarized in Figure 1. During the period of time that GAO was evaluating regular inspection activity, regular inspections were increasing each year. However, regular inspections peaked in 1986 and have declined slowly but consistently since then. Declining numbers of regular inspections do not, however, adequately or completely represent several important trends in inspection activity.



First, despite declines in *regular* inspections, MSHA M/NM is increasing total inspection activity (all inspections, including follow-ups, special inspections, investigations, etc.). Total inspection activity has increased from 24,450 "inspection events" in 1983 to 31,156 in 2000, an increase of 21.5%. In addition, the average amount of total inspection activity from 1983 to 2000 is 32,500 events. This is demonstrated graphically in Figure 2. Simply put, MSHA M/NM inspectors are currently completing (on average) more inspection activity than they were fifteen years ago.



Additionally, the number of regular inspections completed is partially dependent on the number of mines that must be inspected. Figure 3 demonstrates, however, that no clear pattern or trend exists for the entire time frame considered. From 1992 to 1995, both the number of regular inspections and the number of mines decrease. Beginning in 1997, regular inspections have fallen somewhat while the number of mine operations have increased.³



Interviews with MSHA M/NM district managers reinforce the statistical analysis. A number of managers reported that increases in the number of mine operations have a significant impact on the regular inspection completion rate. For some districts, weather prevents the completion of regular inspections on a year-round basis; since inspections can only be conducted during specific times of year, increases in the number of mines severely taxes inspector time.

Additionally, district managers feel that the number of small mine operations has been rising in large part due to the TEA-21 transportation legislation.⁴ These small mine operations are often portable in nature, making it difficult to conduct regular inspections; this difficulty is increased with larger numbers of operations. One district manager reported that the increase in mine

³ The decline in the number of regular inspections is difficult to determine in Figure 3, due to the overall scale. In 1997, the number of completed regular inspections was 15,141; in 1998, 15,075; in 1999, 15,067; and in 2000, 13,516.

⁴ TEA-21 stands for the Transportation Equity Act for the 21st Century (P.L. 105-178). The Surface Transportation Program portion of this legislation authorizes (from FY1998-FY2003) over six billion dollars for road and highway construction projects nationwide. The number of road construction projects made possible by TEA-21 has significantly increased the demand for crushed stone and gravel, thereby increasing the number of mine operations, particularly small operations (under 20 employees).

operations requires roughly two additional inspectors per year, just to keep pace. From this, we can conclude that part of the decline in the regular inspection completion rate is due to growth in the number of mine operations.

A final comparison appropriate to the completion of regular inspections is the relationship between the number of inspectors and the number of inspections. The data analysis demonstrates that the number of completed regular inspections depends partially on the size of the inspectorate. Holding other factors constant (such as the number of mines, the MSHA M/NM district, amount of time spent on other compliance assistance activities) each additional inspector added corresponds to an additional 19.288 completed regular inspections yearly.

While there is a positive association between regular inspections and the size of the inspectorate, over the past fifteen years the number of inspectors has declined over 20%, from a high of 365 in 1988, to 285 in 2000. The effect of this trend is exhibited in the data. For example, in 1989 the size of the inspectorate was 360 and 18,681 regular inspections were conducted; in 2000, the size of the inspectorate was 285 and 13,516 regular inspections were conducted.

Overall, conclusions regarding regular inspection activity must account for a number of other influential factors. Analyzing regular inspections in isolation from trends in the number of inspectors and mine operations could lead to misleading conclusions regarding inspection activities. While a drop off in regular inspections exists in recent years, we should not overestimate the impact of this drop, especially when accounting for growth in the number of mine operations and the reduction in the size of the inspectorate. In addition to regular inspections, MSHA M/NM performs a number of other activities that are classified as enforcement and compliance assistance activities.

(2) Other Activities Broaden MSHA M/NM's Range of Responsibilities

While regular inspections are the most recognized enforcement activity performed by MSHA M/NM, over twenty classes of activity are categorized as enforcement (versus support) activities. These classes include: other, non-regular inspections such as compliance follow-ups, hazard complaint inspections, discrimination investigations, lost-time injury audits, and special initiatives. A full list of all enforcement and compliance assistance activities and their definitions is included in Appendix A.

Our analysis confirmed that these additional activities, while not as recognized as regular inspections, do consume significant amounts of time. Our study finds that inspection activities (especially regular inspections) cannot be analyzed in isolation from other types of activities performed by MSHA M/NM inspectors. Inspectors have available a finite number of hours during which to accomplish their enforcement/compliance assistance objectives.

Documentation provided by MSHA M/NM indicates that a number of these other activities and initiatives arose in response to increases in specific types of injuries and fatalities at Metal and Nonmetal mines (e.g., the *Stay Out - Stay Alive* safety campaign precipitated by accidents related to children and adults venturing onto active and abandoned mine property). This is especially true for safety-related activities and haulage training. Inspectors have increasingly spent time performing duties related to safety and haulage training since 1985. For example, the amount of time spent on compliance assistance visits has increased 38.3% in the period from 1986-2000. In contrast, regular inspections decreased by 31.3% during this period.

Other enforcement and compliance assistance activities have tapered off with regard to the amount of time spent by inspectors in performing them. *Safety program evaluation and assistance* and the *program in accident reduction* have fallen 95.1% and 66.9%, respectively. Nevertheless, the other enforcement activities contribute to the diversity of M/NM enforcement/compliance assistance efforts. In addition, these other enforcement activities cover a broad range of health and safety issues and are targeted to prevent injuries and fatalities. As such, these activities should not be underestimated with respect to their importance to the overall safety mission of MSHA.

(3) Integration and Coordination of Program Activities Require Significant Improvement

Part of the diversity evident in MSHA M/NM's enforcement and compliance assistance activities results from the nature of the programs; many activities were developed specifically to address particular problems in the M/NM mining industry. Other programmatic activities are required by statute. However, all enforcement and compliance assistance activities should work toward achieving the overall "safety mission" of MSHA M/NM. Simply put, an *integrated and coordinated program* of enforcement and compliance activities plays a positive role in fulfilling this "safety mission."

To examine the integration and coordination of enforcement and compliance assistance activities, our analysis tested *how much* these activities have in common. For this study, we were particularly interested in examining macro-level connections between programs. As a result, we analyzed aggregate data on enforcement and compliance assistance activities. While this approach to the analysis may obscure features such as program integration within individual MSHA M/NM districts, we can effectively study broad patterns that apply to all M/NM districts.

Using a technique known as factor analysis, we are able to determine the pattern of structural relationships among a set of enforcement and compliance assistance activities. This type of analysis groups together activities based on the amount they have in common. The fewer groups that define the relationships between enforcement and compliance activities, the greater their integration. The data are best explained by four groups (see Appendix B). These results indicate that structural relationships do exist among some program elements. However, the number of groups that define these relationships indicate room for improvement in integrating program activities.

The integration of programmatic activities was also addressed in interviews with MSHA M/NM district managers. MSHA M/NM district managers feel there are problems in moving from "program intent" to practical implementation. Current enforcement and compliance assistance activities are not viewed (by M/NM district managers) as highly integrated. That is, current guidance does not promote continuity among the entire set of enforcement and compliance assistance activities. In general, district managers believed that improved direction and guidance would enhance the quality of programs and produce consistent results across MSHA M/NM districts.

(4) Measures of Outcome Program Performance Do Not Require Significant Reductions In Injuries and Fatalities

The passage of the Government Performance and Results Act (GPRA) in 1994 fundamentally changed the reporting requirements of enforcement and compliance assistance activities. Effectively, changes brought about by GPRA have meant that performance measurement of MSHA M/NM enforcement and compliance assistance activities must focus on *what the programs can accomplish* in terms of miner safety and health. However, current performance measures do not require significant reductions in injuries or fatalities in order to achieve or exceed program goals.

Provisions of GPRA require outcome-based performance measures, as opposed to output-based performance measures. The nature of MSHA's activities required the agency to address program outcomes (i.e., miner safety and health) from its inception; as a result, MSHA M/NM was able to easily alter its performance reporting. Compliance with GPRA performance standards required MSHA M/NM to report performance in terms of the health and safety of miners, rather than regular inspection completion ratios. As demonstrated by The Budget of the United States (President's request, FY 1997 – FY 2002), the program statistics reported to Congress changed in 1995 from the number of Metal/Nonmetal mine inspections to fatality and non-fatal days lost injury rates in Metal/Nonmetal mines.

Further evidence appears in MSHA M/NM budget requests. For FY 1995, the request stated that "major emphasis will be placed on required regular inspections." By FY 1997, the request emphasized that "...the enforcement strategy of M/NM will be an integrated approach...this includes not only enforcement activities but also education and training and compliance assistance." This orientation in budget justification clearly indicates MSHA M/NM's commitment to outcome performance.

In addition, M/NM district managers believe that a substantial effort has been made to shift program emphasis toward compliance assistance activities. Several district managers believe that M/NM policies and senior officials have encouraged such a shift over the past five or six years. The average amount of time inspectors now spend on activities *other than* regular inspections is close to 60%, based on comments from district managers. Data provided by

M/NM officials indicate that *overall*, 57% of inspector time is spent on activities other than regular inspections (including administrative duties, leave, and training). The data also shows that, of the time devoted to enforcement and compliance assistance activities, activities other than regular inspections comprise only 36% of an inspector's time.

The development and implementation of new MSHA M/NM programs reinforce this orientation toward outcome performance. The former Assistant Secretary of Labor for Mine Safety and Health oversaw the implementation of initiatives geared toward improving safety for miners. For example, in response to a rise in fatal accidents in 1997, MSHA M/NM engaged in activities such as special safety meetings, technical surveys and other activities focused on accident prevention in metal and non-metal mines.

The emphasis on programs specifically targeted to reduce fatalities and non-fatal injuries is particularly evident in the data on enforcement and compliance assistance activity. Inspection of these trends demonstrates that existing programs experienced peak levels (in terms of inspector time spent performing the activity) in the years immediately following GPRA implementation. *Haulage training* and the *program in accident reduction* both experienced peak levels from 1995-1997 and the *Program in Accident Reduction* experienced a peak in 1994. In addition, a number of new initiatives were enacted during this period. The *conference litigation representative* initiative, which allows MSHA M/NM mediators to act in place of solicitors and streamline the appeals process for mine citations, is an exemplar of this type of program development.

In addition to the former Assistant Secretary's commitment to miner safety and health, the current Assistant Secretary has expressed a similar commitment, acknowledging that MSHA will likely focus more energy on assisting and educating employers. Enforcement would remain a fundamentally important role, but the Assistant Secretary indicated a lack of satisfaction with some regulatory requirements. In remarks in the Bureau of National Affairs (BNA) Daily Labor Report, Mr. Lauriski stated that new regulations would not be promulgated just for the sake of issuing regulations. There must be a demonstrated need for new regulations. Clearly, the statements of the new Assistant Secretary as well as the number of health and safety programs established or revitalized by the former Assistant Secretary indicate the commitment of MSHA M/NM management to the public policy orientation brought about by the implementation of the Government Performance and Results Act.

Despite the success in shifting policy orientation, MSHA M/NM must do more regarding the measurement of program outcomes. The annual performance plan for the Department of Labor defines the outcome goal for MSHA M/NM as a reduction in fatalities below the average of the previous five years. While this is an acceptable outcome goal, after reviewing the data provided by MSHA M/NM, we feel that a more challenging outcome goal should be put in place. Using a "five-year" rolling average as a baseline for improvement produces a situation where a reduction by one death will meet the goal. A reduction of this magnitude (while important) is not statistically significant. MSHA M/NM officials informed us that efforts are currently under way to revise the performance measures for injury/fatality reduction.

Conclusion

While MSHA M/NM enforcement activities have been successful in improving the safety and health of miners, characteristics of enforcement and compliance assistance activities contribute to several problems. Currently, a lack of program integration hinders the ability of M/NM to effectively fulfill the "safety mission" of MSHA. Further, consistency in program implementation and management is hampered by shortcomings in the guidance provided to district management. Finally, while MSHA M/NM easily adapted to GPRA reporting requirements, the measures of outcome performance themselves do not require significant reductions in injuries and fatalities.

RECOMMENDATIONS

We recommend that MSHA M/NM:

- 1. Further integrate enforcement and compliance assistance activities by improving direction/guidance to district management regarding the implementation and operation of programmatic activities in order to promote consistency in program performance and management across M/NM districts.**
- 2. Modify current outcome performance goals, raising them to levels where significant changes in the number of fatalities and NFDL injuries are required to meet the performance goal.**

MSHA's Response to Finding A (4)

- *Suggested change: "The average amount of time inspectors now spend on activities other than regular inspections is close to 60%, based on comments from district managers. Data provided by M/NM officials indicate that overall, 57% of inspector time is spent on activities other than regular inspections (including administrative duties, leave, and training). The data also shows that, of the time devoted to enforcement and compliance assistance activities, activities other than regular inspections comprise only 36% of an inspector's time."*
- *Suggested change: "...GPRA implementation. Haulage training and the Program in Accident Reduction both experienced peak levels from 1995-1997 and the Program in Accident Reduction experienced a peak in 1994. In addition..."*
- *Suggested change: "...but the Assistant Secretary indicated a lack of satisfaction with some regulatory requirements."*
- *Suggested change: "Mr. Lauriski stated that new regulations would not be promulgated just for the sake of issuing regulations. There must be a demonstrated need for new regulations."*

OIG's Conclusion

We agree that the recommended changes enhance the accuracy and readability of the report. All changes have been incorporated in the body of the final report.

MSHA's Response to Recommendation 1

“In June (2001), M/NM requested input from its district managers regarding their ideas on improving consistency. When we finish our review of those ideas, a plan will be developed and implemented nationwide.”

OIG's Conclusion

We concur with the proposed corrective actions and consider this recommendation resolved. The recommendation will be closed after a detailed action plan and timetable for implementation is submitted to this office.

MSHA's Response to Recommendation 2

“In May (2001), I directed MSHA to develop new performance goals with more meaningful outcomes regarding injuries and fatalities. MSHA finalized those goals into its Strategic Plan on September 6. These new goals are now effective and require the Agency to assist the mining community in:

- a. Reducing mining fatalities 15% per year below the projected baseline; and*
- b. Reducing the nonfatal incidence rate 50% over a four-year period (FY 2001 - FY 2004).”*

OIG's Conclusion

We consider this recommendation resolved and will be closed pending receipt of the updated Strategic Plan (dated September 6, 2001).

**Finding B - Proactive Approaches to Enforcement and Compliance Assistance
Activities Help Prevent Injuries/Fatalities**

An unavoidable feature of many activities performed by MSHA M/NM is their retrospective nature. When accidents or fatalities occur, MSHA M/NM inspectors are required to engage in a number of activities related to these specific incidents. The OIG realizes the necessity of reacting to developing situations. However, analysis suggests that MSHA M/NM should identify successful features of current programs and revise enforcement and compliance assistance activities to enhance proactive approaches for preventing injuries and fatalities.

Analysis of the data provided by MSHA M/NM demonstrates that a majority of enforcement and compliance assistance activities are reactive in nature. That is, increases in the number of injuries and fatalities change the amount of time devoted to these programmatic activities. The enforcement activities which exhibit the greatest sensitivity to injuries/fatalities are: *Safety Program Evaluation and Assistance*, *Part 50 Audits*, *Personal Sampling*, and *Haulage activities*. With the exception of Part 50 Audits, each of these activities decreases (in amount of time spent) as injuries and/or fatalities increase.

Interviews with M/NM district managers corroborate the finding that a significant percentage of MSHA M/NM activity is reactive rather than proactive. A number of remedies were suggested by managers, ranging from more careful identification of trends in data to greater emphasis on regular inspections. However, each manager felt that more emphasis should be given to proactive solutions.

This data analysis does not address related issues such as *why* particular programs are performed. For example, MSHA M/NM officials indicated that the selection criteria for certain programs are explicitly reactive in that they are based on a mine's injury experience. Additionally, statutes dictate *when* some programmatic activities must be performed. As a result, these statutory requirements often contribute to the reactive nature of enforcement and compliance assistance activities and inhibit MSHA M/NM's ability to implement programs with flexibility. Further, due to the limited number of years of data available for study, we can make no assessment of the long-term effects of enforcement and compliance assistance activities. Nevertheless, we believe the findings from the data analysis indicate that MSHA M/NM should study current enforcement and compliance assistance programs in order to identify elements that are most successful in preventing injuries and fatalities, rather than reacting to them.

RECOMMENDATIONS

We recommend that MSHA M/NM:

- 3. Study available data to identify trends in injuries and fatalities and identify possible problem areas that can be addressed in a proactive manner.**
- 4. Carefully study features of current M/NM programs in order to identify program elements that are most successful in reducing injuries and fatalities, and utilize these elements to revise other enforcement and compliance assistance activities to produce a stronger proactive effect.**

MSHA's Response to Recommendation 3

“Also in May (2001), I directed that a study be conducted to develop benchmarks and indicators to identify trends and problem areas. Once the study is completed, MSHA inspectors will be able to provide proactively safety and health information as part of their regulat inspections to miners and mine operators. This information will assist the mining community in preventing future accidents, injuries, and illnesses. The study is being conducted with the assistance of MSHA's Program Evaluation and Information Resources office.”

OIG's Conclusion

We concur with the proposed corrective actions and consider this recommendation resolved. The recommendation will be closed upon receipt of findings from MSHA's benchmarks and indicators study.

MSHA's Response to Recommendation 4

“In June (2001), MSHA, in partnership with its stakeholders, began a series of nation-wide meetings seeking input regarding best practices that had been shown to reduce accidents, injuries, and illnesses. As part of this process, M/NM also established a team to identify ways to enhance its past efforts to reduce these occurrences. After the meetings have been completed, MSHA and the mining community will review these ideas, then develop and implement a plan which will allow inspectors to provide more up-front, proactive assistance to the mining community so that they can assist operators and miners in reducing accidents, injuries, and illnesses.”

OIG's Conclusion

We concur with the proposed corrective actions and consider this recommendation resolved. The recommendation will be closed upon receipt of a final list of best practices and MSHA's plan to provide more proactive assistance to the mining community. In that regard, please submit to

this office information regarding progress of the MSHA team in identifying ways to enhance past efforts, a detailed action plan and a timeline for implementation of the plan.

Finding C - Characteristics of Enforcement and Compliance Assistance Activities Create Substantial Tradeoffs Among Inspectors' Duties

Programs and initiatives developed to improve the safety and health of miners require inspectors to engage in an increasing number of activities. The amount of time required to perform these duties creates a series of tradeoffs among the various activities. In addition, we found evidence of disparities in the inspector resources available per mine on a district basis. While this considers only one factor that contributes to the distribution and allocation of resources, additional factors reinforce the conclusion that more careful examination of resource allocation and utilization is needed to determine the most effective "enforcement agenda."

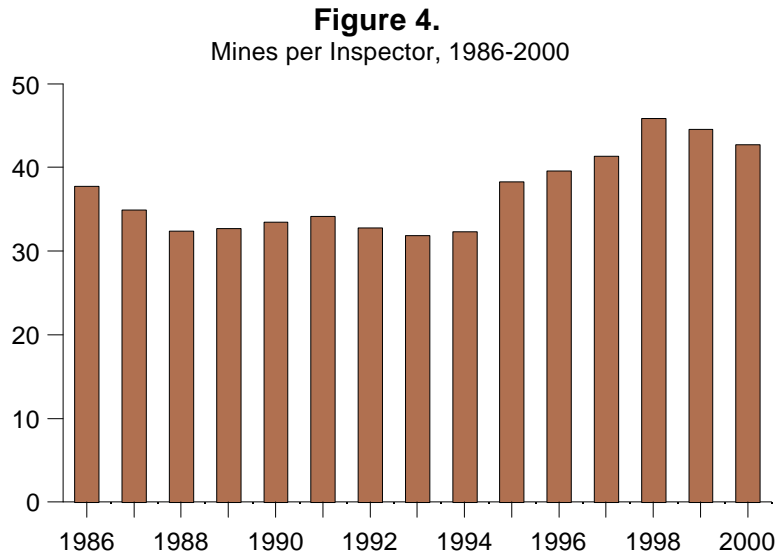
The passage of GPRA created a climate that encourages reducing threats to miner health and safety. Based on these changes, each inspector must engage in an increasing number of activities. Since each inspector is available to work only a certain number of hours per year, inspectors are by definition a finite resource. As such, each inspector can only undertake a certain number of activities.

MSHA M/NM inspectors currently engage in twenty-six different types of enforcement and compliance assistance activities, including regular mine inspections. Data provided by MSHA M/NM indicates that these activities are in a constant state of flux. Where haulage training may be stressed in a particular district, compliance assistance visits may be stressed in another. Further, these activities vary from year to year. Analysis of data on enforcement and compliance assistance activities demonstrates that relationships between various types of enforcement and compliance activity are relatively complex. In addition, our analysis found evidence that among enforcement and compliance assistance activities, significant tradeoffs exist with respect to the amount of time devoted to various programs. In other words, performance of certain activities tends to correspond with decreases in the amount of time spent on other activities.

This complexity was also evident from conversations with MSHA M/NM district managers. Among the district managers, no consensus exists regarding the most and least effective activities. Some felt compliance-oriented activities such as compliance assistance visits were very effective; others believe that regular inspections are the most effective. No district manager felt that there was a "least effective" program. Rather, they believe all enforcement and compliance assistance activities have merit; the difficulty lies in allocating time for the activities to be completed.

Given that tradeoffs exist among the various activities and inspectors have a finite amount of time to complete their required duties, MSHA M/NM must engage in careful planning to assure effective utilization of inspector time. The data analysis indicates that time cannot be devoted to all activities equally. Therefore, MSHA M/NM must strive to implement an "enforcement and compliance assistance agenda" (as discussed in Finding A, Recommendation 1) that provides the greatest benefit in the limited time available.

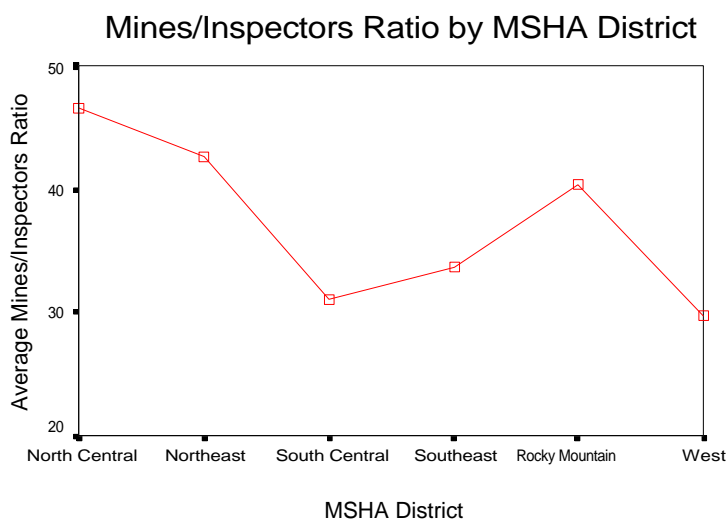
In addition to the direct relationships involved in these enforcement and compliance assistance activities, a number of other factors affect the amount of time that can be spent performing these activities. One factor is the growth in the number of mine operations; another is the steady decrease in the size of the inspectorate. Figure 4 presents this material in a slightly different manner. This graphic charts the number of mines per inspector from 1986 through 2000. Over the past fifteen years, the number of mines per inspector has increased significantly, from an average of 37.72 in 1986 to 45.82 in 1998, an increase of 17.68%.



One effect produced by the increasing number of mines and decreasing number of inspectors is a reduction in the overall inspection resources available per mine. In addition, the distribution of resources may be significantly different in the various MSHA M/NM districts. The most reasonable method to test for this possibility is to examine the ratio of mines to inspectors in each of the districts, and note any statistically significant differences. Figure 5 demonstrates the average number of mines per inspector in each of the districts from 1986 to 2000.

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Figure 5.



The most notable feature of this graph is the higher ratio that exists for the North Central and Northeast districts. The North Central and Northeast districts differs significantly from the South Central, Southeastern and Western districts. Based on this line of reasoning, the growth of mines and/or decreases in the size of the inspectorate produced a higher ratio in these two districts. However, this analysis presents only one aspect of the distribution of inspector resources. In order to address concerns related to distribution of inspectors, MSHA M/NM implemented the Volunteer Transfer Program in 1999. This program allows for the movement of inspectors from an overstaffed office to an understaffed one.

MSHA M/NM officials informed the OIG that a number of other factors (such as mine size, geographic clustering, and travel times) must be considered with respect to allocation and distribution of available resources. These comments reinforce the observation regarding the complexity of resource allocation. The differences in resource availability among the MSHA M/NM districts and the tradeoffs among various enforcement and compliance assistance activities we observed suggest that a careful examination of resource allocation and utilization is needed to determine the most effective "enforcement and compliance assistance agenda."

RECOMMENDATION

We recommend that MSHA M/NM:

- 5. Study the allocation and distribution of enforcement and compliance assistance resources in order to determine what combination of activities will produce the greatest effect on mine safety, given that there are inherent tradeoffs among these activities.**

MSHA's Response to Recommendation 5

“MSHA is in the process of reviewing appropriate data to determine how its resources should be used to achieve maximum safety and health benefits. Violation rates, incident rates, and other appropriate data are being considered to identify problem mines where the agency should focus its resources to reduce fatalities, injuries, and illnesses.”

OIG's Conclusion

We concur with the proposed corrective actions and consider this recommendation resolved. The recommendation will be closed upon receipt of the results of MSHA's review of resource data.

Appendix A
Enforcement and Compliance Assistance Activity
Codes and Descriptions

Appendix A
Enforcement and Compliance Assistance
Activity Codes and Descriptions

| <u>CODE</u> | <u>ACRONYM</u> | <u>ACTIVITY</u> | <u>DEFINITION</u> |
|-------------|----------------|--|--|
| 01 | REG | Regular Inspection | The complete health and safety inspection in its entirety (Section 103(a)). |
| 02 | CFI | Compliance Follow-Up | An inspection conducted for the purpose of ascertaining the abatement status of previously cited violations. |
| 05 | OAI | Operating Area Inspection | An inspection of a mine that is not in full production capacity, e.g., a mine with a skeleton crew performing only maintenance operations |
| 07 | DOE | Attempted Inspection (Denial of Entry) | A mine visit specifically for the purpose of conducting an enforcement activity, but the activity could not be accomplished because of direct or indirect denial of entry. |
| 09 | HAZ-V | Verbal Hazard Complaint | An inspection or investigation resulting from a hazard complaint received in an MSHA M/NM office (in person or via telephone) and not reduced to writing, including imminent danger, violation of safety and health standards, or non-compliance with the Mine Act. |
| 10 | ATT | Attempted Inspection | A mine visit specifically for the purpose of conducting an enforcement activity, but the activity could not be accomplished because the mine was not operating or for other reasons. |
| 11 | WVI | Willful Violation Investigation | The actual conduct of an investigation of a claim that an operator either knowingly or willfully violated a mandatory health and safety standard or knowingly and/or willfully violated, failed or refused to comply with any order issued under Section 104, Section 107, or any order incorporated in a decision under the Mine Act. |
| 12 | GAS | Gas Inspection | An inspection conducted pursuant to Section 103(i). |

| | | | |
|----|-------|---|---|
| 13 | HAZ-W | Hazard Complaint Inspection | An inspection or investigation conducted under Section 103(g)(1) and 103(g)(2) as the result of a written complaint of the existence of a violation of the Mine Act or a mandatory health or safety standard or existence of imminent danger. |
| 14 | DIS | Discrimination Complaint Investigation | The actual conduct of an investigation emanating from a complaint filed by a miner or applicant for employment, or representative of miners who believes he/she has been discharged, discriminated against or interfered with in the exercise of statutory rights under the Mine Act. |
| 15 | SEP | Special Emphasis Programs | Code reserved for future enforcement action(s). |
| 16 | AUDIT | Part 50 Audit | A special audit of mine records conducted to determine accuracy of records and compliance with Part 50 reporting requirements (injury reporting). |
| 17 | OCAA | Other Compliance Assistance Activities | An activity whose primary purpose is not the citation of observed violations of standards. This activity encompasses a wide variety of mine visits, including but not restricted to: technical assistance activities; special conferences or meetings with mine management/labor to discuss or resolve health or safety problems; PAR-type activities at mines not officially under the Program in Accident Reduction. Activity must be at the mine property in order to use this code. |
| 18 | PAR | Program in Accident Reduction | A metal and nonmetal program aimed at injury reduction in selected mines with high accident and injury levels. This activity includes accident reduction surveys conducted by teams. |
| 19 | MOD | Petition for Modification Investigation | Investigation at a mine for the purpose of evaluating a petition for modification of a mandatory safety standard, Section 101(c). |
| 20 | ACR | Alternate Case Resolution | Activities involving Alternative Case Resolution Initiative (renamed the <i>Conference Litigation Representative</i> (CLR) initiative). |
| 21 | RESCU | Mine Rescue - Recovery | A trip to a mine to engage in a mine rescue or recovery operation. No citation or order should be issued against this type of activity. |

| | | | |
|----|-------|-------------------------------|--|
| 30 | ACCID | Accident Investigation | A mine visit to investigate accidents, with or without injuries |
| 33 | SEA | Special Enforcement Activity | An enforcement activity for a specialized purpose that may be unique for each district. An example of this activity is Coal mine inspections by Metal and Nonmetal inspectors in the Western District. |
| 35 | LIT | Litigation | All activities related to and connected with legal proceedings including preparation, travel and court time. |
| 37 | MISC | Miscellaneous Inspection | Enforcement activities not specifically covered by other codes where the issuance of citations/orders might be involved. Examples of such activities are: special inspections which, by definition, cannot be reported as regular inspections, such as electrical, radiation, shaft, hoist or tailings pond inspections; a special investigation to determine if there was actually a violation after a citation/order was issued; a special investigation to determine if a condition or practice is or is not a violation; and, a special visit to investigate the failure of an operator to file a legal identity report. |
| 40 | SE 1 | Special Enforcement 1 | An enforcement activity for a specialized purpose that may be unique for each district |
| 41 | CAV | Compliance Assistance Visit | A visit to a new mine not yet producing to point out potential violations without monetary civil penalties being proposed. |
| 42 | SE 2 | Special Enforcement 2 | An enforcement activity for a specialized purpose that may be unique for each district |
| 43 | HAUL | Haulage Inspection | Code reserved for future compliance assistance activity(s). |
| 44 | SE 3 | Special Enforcement 3 | An enforcement activity for a specialized purpose that may be unique for each district. |
| 45 | MHAUL | Haulage Training at Mine Site | Code reserved for future compliance assistance activity(s). |
| 46 | SE 4 | Special Enforcement 4 | An enforcement activity for a specialized purpose that may be unique for each district. |

| | | | |
|----|-------|--|---|
| 47 | FRP | Fatality Reduction Program | Fatality emphasis activity(s). |
| 48 | SE 5 | Special Enforcement 5 | An enforcement activity for a specialized purpose that may be unique for each district. |
| 81 | EVAL | Safety Program Evaluation & Assistance | Advising a specific mine operator on developing or improving a safety program, including training plans, evaluating the effectiveness of an existing safety program, and assisting with accident reduction programs. Includes work done at PAR mines, if not directly related to PAR. |
| 82 | MTRNG | At Mine Training Activities | Instructor training and monitoring instructors and conducting training at a mine site. |

Enforcement codes specifically mandated by the Mine Act - 01, 05, 09, 11, 12, 13, 14, 19, 21, 30

Enforcement codes falling under the umbrella of the Mine Act or ones used as the result of an activity specifically mandated by the Mine Act - 02, 07, 10, 15, 16, 17, 33, 37

Compliance assistance codes falling under the umbrella of the Mine Act - 18, 40, 41, 42, 43, 44, 45, 46, 47, 48, 81, 82

Other codes used as the result of an activity taken/which might be taken by the Agency under the Mine Act - 20, 35

Appendix B
Technical/Methodological Issues

Appendix B

Technical and Methodological Issues

1. Linear regression models were utilized in order to determine the nature of any linear associations between the number of completed regular inspections and a series of independent variables. The independent variables we used in our analysis included: number of inspectors; number of fatalities; number of injuries; hours of at-mine training; hours of compliance assistance visits; hours of program in accident reduction; hours of special emphasis programs; hours of haulage training activities; number of personal samples drawn; MSHA M/NM district location of mine operations; hours of Part 50 Audit; hours of training; hours of alternate case resolution.

Based on the information available, we developed a series of nested regression models to assess the contribution of additional variables. This methodology provides a means for eliminating unnecessary variables from the analysis and avoiding specification error. Our analysis found the following model to be the best fitting linear model.

Coefficients

| Variable | Unstandardized | | Standardized | | t | Sig. |
|-------------------------------------|----------------|------------|--------------|--|--------|------|
| | Coefficients | | Coefficients | | | |
| | B | Std. Error | Beta | | | |
| (Constant) | 268.016 | 966.175 | | | .277 | .782 |
| # Inspectors | 19.288 | 6.058 | .293 | | 3.184 | .002 |
| Metal/Nonmetal Fatalities | 7.881 | 5.608 | .094 | | 1.405 | .164 |
| At-Mine Training | -8.845E-02 | .141 | -.038 | | -.626 | .533 |
| Compliance Assistance Visit | 8.441E-02 | .327 | .019 | | .258 | .797 |
| CLR | -4.673 | 2.871 | -.142 | | -1.628 | .108 |
| Program in Accident Reduction (PAR) | 4.804 | 1.699 | .183 | | 2.828 | .006 |
| Safety Program Evaluation | .905 | .981 | .076 | | .922 | .359 |
| Injuries | 1.838E-02 | .198 | .010 | | .093 | .926 |
| Mills | 9.593 | 4.595 | .488 | | 2.088 | .040 |
| Underground Mines | -1.537 | 3.392 | -.094 | | -.453 | .652 |
| Strip Mines | .253 | .363 | .153 | | .698 | .488 |
| Sampling | -1.508E-02 | .007 | -.182 | | -2.122 | .037 |
| Haulage | -9.162E-02 | .154 | -.039 | | -.597 | .553 |
| Northeast District | 308.054 | 162.895 | .209 | | 1.891 | .063 |
| South Central District | -136.747 | 339.003 | -.093 | | -.403 | .688 |
| Southeast District | -50.780 | 436.607 | -.035 | | -.116 | .908 |
| Rocky Mountain District | -91.695 | 269.297 | -.062 | | -.340 | .734 |
| Western District | -496.949 | 342.913 | -.338 | | -1.449 | .152 |

a Dependent Variable: Regular Inspections - North Central

ANOVA

| | <u>Sum of Squares</u> | <u>df</u> | <u>Mean Square</u> | <u>F</u> | <u>Sig.</u> |
|------------|-----------------------|-----------|--------------------|----------|-------------|
| Regression | 21726179.130 | 18 | 1207009.952 | 16.035 | .000 |
| Residual | 5344254.526 | 71 | 75271.191 | | |
| Total | 27070433.656 | 89 | | | |

Model Summary

| <u>R</u> | <u>R Squared</u> | <u>Adjusted R Squared</u> | <u>Std. Error of the Estimate</u> |
|----------|------------------|---------------------------|-----------------------------------|
| .896 | .803 | .753 | 274.35596 |

Other models which provided reported results dealt with fatalities and injuries. The results of these models are provided below.

Coefficients

| <u>Variable</u> | <u>Unstandardized</u> | | <u>Standardized</u> | | <u>t</u> | <u>Sig.</u> |
|---------------------------|-----------------------|-------------------|---------------------|--|----------|-------------|
| | <u>Coefficients</u> | | <u>Coefficients</u> | | | |
| | <u>B</u> | <u>Std. Error</u> | <u>Beta</u> | | | |
| (Constant) | -1483.868 | 343.517 | | | -4.320 | .000 |
| # Inspectors | -1.459 | 2.265 | -.071 | | -.644 | .521 |
| Training hours | -2.233E-03 | .004 | -.042 | | -.503 | .616 |
| Mills | -.786 | 1.816 | -.128 | | -.433 | .666 |
| Underground | -.294 | 1.356 | -.058 | | -.217 | .829 |
| Strip | .489 | .130 | .949 | | 3.761 | .000 |
| Northeast District | 217.113 | 58.830 | .473 | | 3.691 | .000 |
| South Central District | 440.103 | 129.100 | .958 | | 3.409 | .001 |
| Southeast District | 585.698 | 163.752 | 1.275 | | 3.577 | .001 |
| Rocky Mountain District | 112.614 | 96.805 | .245 | | 1.163 | .248 |
| Western District | 530.385 | 127.749 | 1.155 | | 4.152 | .000 |
| Sampling Scale | 9.178E-03 | .003 | .355 | | 3.368 | .001 |
| Haulage | 2.176E-02 | .061 | .029 | | .357 | .722 |
| Metal/Nonmetal Fatalities | -1.580 | 2.175 | -.060 | | -.727 | .470 |
| Injuries | .521 | .074 | .891 | | 7.063 | .000 |

a Dependent Variable: Part 50 Audits - NC

Coefficients

| Variable | Unstandardized | | Standardized | | t | Sig. |
|---------------------------|----------------|------------|--------------|------|--------|------|
| | Coefficients | | Coefficients | | | |
| | B | Std. Error | Beta | Beta | | |
| (Constant) | 344.474 | 725.090 | | | .475 | .636 |
| # Inspectors | -1.708 | 4.292 | -.061 | | -.398 | .692 |
| Training hours | -2.002E-02 | .008 | -.279 | | -2.477 | .016 |
| Mills | -.763 | 3.439 | -.092 | | -.222 | .825 |
| Underground | -2.400 | 2.551 | -.349 | | -.941 | .350 |
| Strip | .109 | .268 | .157 | | .407 | .685 |
| Northeast District | -142.914 | 119.840 | -.230 | | -1.193 | .237 |
| South Central District | -23.779 | 262.444 | -.038 | | -.091 | .928 |
| Southeast District | -2.989 | 335.149 | -.005 | | -.009 | .993 |
| Rocky Mountain District | 254.525 | 182.419 | .410 | | 1.395 | .167 |
| Western District | -69.339 | 267.879 | -.112 | | -.259 | .796 |
| Sampling Scale | -8.514E-03 | .005 | -.244 | | -1.564 | .122 |
| Part 50 Audits | 7.787E-02 | .218 | .058 | | .357 | .722 |
| Metal/Nonmetal Fatalities | 9.019 | 3.995 | .254 | | 2.258 | .027 |
| Injuries | -.278 | .177 | -.351 | | -1.566 | .122 |

a Dependent Variable: HAULAGE

Coefficients

| Variable | Unstandardized | | Standardized | | t | Sig. |
|---------------------------|----------------|------------|--------------|------|--------|------|
| | Coefficients | | Coefficients | | | |
| | B | Std. Error | Beta | Beta | | |
| (Constant) | 66490.494 | 12269.47 | | | 5.419 | .000 |
| # Inspectors | 388.616 | 85.162 | .489 | | 4.563 | .000 |
| Training hours | -.660 | .155 | -.321 | | -4.246 | .000 |
| Mills | 228.859 | 68.373 | .966 | | 3.347 | .001 |
| Underground | -165.890 | 47.649 | -.844 | | -3.481 | .001 |
| Strip | -19.188 | 4.868 | -.964 | | -3.942 | .000 |
| Northeast District | -7023.282 | 2299.750 | -.396 | | -3.054 | .003 |
| South Central District | -23471.334 | 4556.873 | -1.323 | | -5.151 | .000 |
| Southeast District | -27726.131 | 5902.013 | -1.562 | | -4.698 | .000 |
| Rocky Mountain District | -3418.335 | 3692.366 | -.193 | | -.926 | .358 |
| Western District | -19757.314 | 4926.236 | -1.113 | | -4.011 | .000 |
| Regular Inspections | -4.499 | 1.580 | -.373 | | -2.848 | .006 |
| Haulage | -4.732 | 2.295 | -.165 | | -2.061 | .043 |
| Part 50 Audits | 15.234 | 4.075 | .394 | | 3.739 | .000 |
| Metal/Nonmetal Fatalities | -216.419 | 79.540 | -.213 | | -2.721 | .008 |
| Injuries | -9.428 | 3.449 | -.417 | | -2.734 | .008 |

a Dependent Variable: Sampling Scale

Coefficients

| <u>Variable</u> | <u>Unstandardized</u> | | <u>Standardized</u> | | <u>t</u> | <u>Sig.</u> |
|---------------------------|-----------------------|-------------------|---------------------|--|----------|-------------|
| | <u>Coefficients</u> | | <u>Coefficients</u> | | | |
| | <u>B</u> | <u>Std. Error</u> | <u>Beta</u> | | | |
| (Constant) | 11.188 | 113.057 | | | .099 | .921 |
| # Inspectors | -.454 | .752 | -.082 | | -.604 | .548 |
| Training hours | -4.472E-04 | .001 | -.031 | | -.331 | .741 |
| Mills | -.122 | .572 | -.074 | | -.213 | .832 |
| Underground | 1.029 | .401 | .753 | | 2.567 | .012 |
| Strip | -8.413E-03 | .042 | -.061 | | -.202 | .841 |
| Northeast District | -20.054 | 19.026 | -.162 | | -1.054 | .295 |
| South Central District | -29.662 | 41.409 | -.240 | | -.716 | .476 |
| Southeast District | 43.150 | 52.429 | .350 | | .823 | .413 |
| Rocky Mountain District | -25.944 | 28.953 | -.210 | | -.896 | .373 |
| Western District | -26.565 | 42.376 | -.215 | | -.627 | .533 |
| Regular Inspections | 1.148E-02 | .013 | .137 | | .885 | .379 |
| Sampling Scale | 1.396E-03 | .001 | .201 | | 1.540 | .128 |
| HAULAGE | -1.011E-02 | .018 | -.051 | | -.550 | .584 |
| Part 50 Audits | 8.821E-02 | .035 | .328 | | 2.546 | .013 |
| Metal/Nonmetal Fatalities | .667 | .650 | .095 | | 1.026 | .308 |
| Injuries | -7.180E-02 | .028 | -.457 | | -2.545 | .013 |

a Dependent Variable: Safety Program Evaluation and Assistance

In none of the cases were significant interaction effects among independent variables discovered. Additionally, we found no significant negative consequences resulting from multicollinearity, abnormal distributional shape, or heteroskedasticity.

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2. For purposes of data reduction, we tested for the existence of a number of multi-item scales that could be used in further analysis. We found only two such scales; one related to personal samples, and another related to haulage training activities. We utilized a reliability analysis (test statistic: Cronbach's α) to make conclusions about the scalability of these items. The results are provided below.

R E L I A B I L I T Y A N A L Y S I S - S C A L E (A L P H A)

| <u>Statistics for Scale</u> | <u>Mean</u> | <u>Variance</u> | <u>Std Dev</u> | <u>N of Variables</u> |
|-----------------------------|-------------|-----------------|----------------|-----------------------|
| | 45847.2857 | 398746779 | 19968.6449 | 3 |

Item-total Statistics

| | Scale Mean if Item Deleted | Scale Variance if Item Deleted | Corrected Item- Total Correlation | Alpha if Item Deleted |
|--------|-------------------------------------|---|--|-----------------------------|
| SILICA | 37283.1905 | 279518391.1314 | .8925 | .9534 |
| NOISE | 31463.4286 | 178891392.5349 | .9550 | .7390 |
| OTHER | 22947.9524 | 99336279.9817 | .9998 | .8133 |

Analysis of Variance

| <u>Source of Variation</u> | <u>Sum of Sq.</u> | <u>DF</u> | <u>Mean Square</u> | <u>F</u> | <u>Prob.</u> |
|----------------------------|-------------------|-----------|--------------------|----------|--------------|
| Between People | 16614449144.57 | 125 | 132915593.157 | | |
| Within People | 16359505992.00 | 252 | 64918674.5714 | | |
| Between Measures | 13099044614.29 | 2 | 6549522307.14 | 502.1929 | .0000 |
| Residual | 3260461377.714 | 250 | 13041845.5109 | | |
| Total | 32973955136.57 | 377 | 87464071.9803 | | |
| Grand Mean | 15282.4286 | | | | |

Alpha = .9019 Standardized item alpha = **.9692**

R E L I A B I L I T Y A N A L Y S I S - S C A L E (A L P H A)

| <u>Statistics for Scale</u> | <u>Mean</u> | <u>Variance</u> | <u>Std Dev</u> | <u>N of Variables</u> |
|-----------------------------|-------------|-----------------|----------------|-----------------------|
| | 244.4907 | 418291.355 | 646.7545 | 3 |

Item-total Statistics

| | Scale Mean if Item Deleted | Scale Variance if Item Deleted | Corrected Item- Total Correlation | Alpha if Item Deleted |
|---------------|-------------------------------------|---|--|-----------------------------|
| Haulage Insp. | 233.8056 | 410457.4665 | .3706 | .7004 |
| Haulage Trng. | 158.6481 | 192990.6601 | .6769 | .0551 |
| Misc. Haulage | 96.5278 | 71550.4011 | .6879 | .0632 |

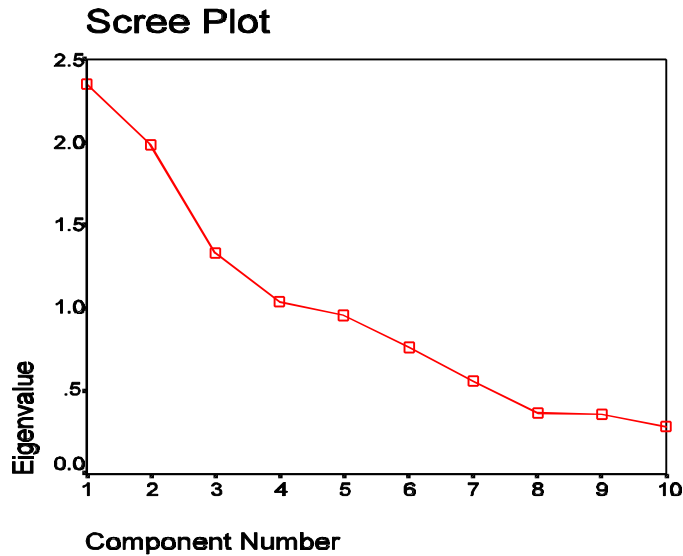
Analysis of Variance

| <u>Source of Variation</u> | <u>Sum of Sq.</u> | <u>DF</u> | <u>Mean Square</u> | <u>F</u> | <u>Prob.</u> |
|----------------------------|-------------------|-----------|--------------------|----------|--------------|
| Between People | 14919058.3302 | 107 | 139430.4517 | | |
| Within People | 13569308.6667 | 216 | 62820.8735 | | |
| Between Measures | 1020699.5247 | 2 | 510349.7623 | 8.7033 | .0002 |
| Residual | 12548609.1420 | 214 | 58638.3605 | | |
| Total | 28488366.9969 | 323 | 88199.2786 | | |
| Grand Mean | 81.4969 | | | | |

Alpha = .5794

Standardized item alpha = **.7054**

3. To assess the integration of M/NM enforcement and compliance assistance activities, we performed a factor analysis on the available enforcement and compliance assistance activity data. The results demonstrate that there is not a single underlying factor which explains all the common variance among these items. While this analysis does not dismiss the possibility that some integration exists (or that other factors mitigate against observing the underlying dimension), the results do corroborate our assertion that additional effort should be employed toward producing additional integration among program elements. All variables input into the factor analysis loaded significantly on at least one factor. As a result, the variables displayed in the rotated factor matrix were represent all variables considered in the analysis.



Rotated Component Matrix

| Variable | Component | | | |
|-------------------------------|-----------|-------|-------|------|
| | 1 | 2 | 3 | 4 |
| At Mine Training | | | -.677 | |
| Compliance Assistance Visit | .488 | | .412 | |
| CLR | -.521 | -.457 | | |
| Program in Accident Reduction | .846 | | | |
| Safety Program Evaluation | .685 | | | |
| Special Emphasis Programs | | | | .917 |
| Sampling | | .809 | | |
| Part 50 Audits | | .756 | | |
| Haulage | -.526 | -.547 | | |
| Regular Inspections | | | .772 | |

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.
 a. Rotation converged in 24 iterations.

Appendix C
Agency Reponse



SEP 21 2001

MEMORANDUM FOR WILLIAM H. PICKLE

Assistant Inspector General
Office of Communications, Inspections, and Evaluations

FROM:

A handwritten signature in black ink, appearing to read "D. Lauriski for".

DAVE D. LAURISKI
Assistant Secretary of Labor for
Mine Safety and Health

SUBJECT:

Response to OIG's Recommendations:
Study of Metal/Nonmetal Mining Enforcement
and Compliance Assistance Activities, 1983 - 2000,
Report No. 2E-06-620-0003

MSHA has reviewed the aforementioned report and agrees that the five recommendations contained therein will enhance the accident reduction efforts currently underway. Immediately after I assumed leadership at MSHA, I discussed my safety and health philosophy with all senior managers, and by now, most field managers, headquarters, and field employees. I stated that, to further reduce fatalities, injuries, and illnesses, MSHA inspectors needed to provide more up-front, proactive assistance to the mining community. This approach would involve balancing enforcement, education, training, compliance assistance, and technical services. In partnership with our mining community stakeholders, MSHA began an accident reduction initiative which will incorporate this new philosophy and address several of the recommendations in this report.

There are three places in the text where we believe changes would improve the readability of the report. These changes are detailed below.

Page 10 - 3rd paragraph - Suggested change is as follows:

The average amount of time inspectors now spend on activities other than regular inspections is close to 60%, based on comments from district managers. Data provided by M/NM officials indicate that, overall, 57% of all inspector time is spent on activities other than regular inspections (including administrative duties, leave, and training).

The data also shows that, of the time devoted to enforcement and compliance assistance activities, activities other than regular inspections comprise only 36% of an inspector's time.

Page 10 - 5th paragraph - comment

The statement that the Program in Accident Reduction (PAR) was one of the programs that "...experienced peak levels from 1995-1997..." PAR activities peaked in 1994 then were essentially discontinued due to lack of agency resources to complete mandatory inspections. We recommend the language below.

"...GPRA implementation. Haulage Training experienced peak levels from 1995-1997 and the Program in Accident Reduction experienced a peak in 1994. In addition..."

Page 11 - second word -

"statutory" should be changed to "regulatory"

"...but the Assistant Secretary indicated a lack of satisfaction with some regulatory requirements."

Page 11 - quote by Assistant Secretary Lauriski from an article in the Bureau of National Affairs (BNA) - for purposes of this report, it would be more appropriate to eliminate the quote and paraphrase the BNA article such as:

Mr. Lauriski stated that new regulations would not be promulgated just for the sake of issuing regulations. There must be a demonstrated need for new regulations.

The following addresses the recommendations specifically.

1. *Further integrate enforcement and compliance assistance activities by improving direction/guidance to district management regarding the implementation and operation of programmatic activities in order to promote consistency in program performance and management across M/NM districts.*

In June, M/NM requested input from its district managers regarding their ideas on improving consistency. When we finish our review of those ideas, a plan will be developed and implemented nationwide.

2. *Modify current outcome performance goals, raising them to levels where substantive changes in the number of fatalities and NFDL injuries are required to meet the performance goal.*

In May, I directed MSHA to develop new performance goals with more meaningful outcomes regarding injuries and fatalities. MSHA finalized those goals into its Strategic Plan on September 6. These new goals are now effective and require the Agency to assist the mining community in:

- a. Reducing mining fatalities 15% per year below the projected baseline; and
- b. Reducing the nonfatal incidence rate 50% over a four-year period (FY 2001-FY 2004).

3. *Study available data to identify trends in injuries and fatalities and identify possible problem areas that can be addressed in a proactive manner.*

Also in May, I directed that a study be conducted to develop benchmarks and indicators to identify trends and problem areas. Once the study is completed, MSHA inspectors will be able to provide proactively safety and health information as part of their regular inspections to miners and mine operators. This information will assist the mining community in preventing future accidents, injuries, and illnesses. The study is being conducted with the assistance of MSHA's Program Evaluation and Information Resources office.

4. *Carefully study features of current M/NM programs in order to identify program elements that are most successful in reducing injuries and fatalities, and utilize these elements to revise other enforcement and compliance assistance activities to produce a stronger proactive effort.*

In June, MSHA, in partnership with its stakeholders, began a series of nationwide meetings seeking input regarding best practices that had been shown to reduce accidents, injuries, and illnesses. As part of this process, M/NM also established a team to identify ways to enhance its past efforts to reduce these occurrences. After the meetings have been completed, MSHA and the mining community will review these ideas, then develop and implement a plan which will allow inspectors to provide more up-front, proactive assistance to the mining community so that they can assist operators and miners in reducing accidents, injuries, and illnesses.

5. *Study the allocation and distribution of enforcement and compliance assistance resources in order to determine what combination of activities will produce the greatest effect on mine safety, given that there are inherent tradeoffs among these activities.*

MSHA is in the process of reviewing appropriate data to determine how its resources should be used to achieve maximum safety and health benefits. Violation rates, incident rates, and other appropriate data are being considered to identify problem mines where the Agency should focus its resources to reduce fatalities, injuries, and illnesses.