

**USDOL
UKRAINE
MINE SAFETY PROJECT
FINAL EVALUATION**

Submitted to:
**U.S. DEPARTMENT
OF LABOR
ILAB**

June 19, 2003

NORWEST CORPORATION

1212 Bath Avenue
6th Floor, Suite 1
Ashland, KY 41101
TEL (606) 920-9833
FAX (606) 920-9664
ashland@norwestcorp.com

136 East South Temple
12th Floor
Salt Lake City, UT 84111
TEL (801) 539-0044
FAX (801) 539-0055
USA (800) 266-6351
slc@norwestcorp.com

www.norwestcorp.com

NORWEST
CORPORATION

TABLE OF CONTENTS

| | | |
|-------------------|---|------------|
| | EXECUTIVE SUMMARY | E-1 |
| SECTION 1 | PROJECT DESCRIPTION | 1-1 |
| SECTION 2 | PURPOSE OF EVALUATION | 2-1 |
| SECTION 3 | EVALUATION METHODOLOGY | 3-1 |
| SECTION 4 | FINDINGS..... | 4-1 |
| | INTERVIEWS | 4-1 |
| | DOL ILAB and MSHA..... | 4-1 |
| | Mines..... | 4-2 |
| | Regional Offices | 4-3 |
| | National Offices | 4-3 |
| | MINE VISITS | 4-4 |
| | Water Filters..... | 4-4 |
| | Rock Dusters..... | 4-5 |
| SECTION 5 | CONCLUSIONS..... | 5-1 |
| | PROJECT ORGANIZATION | 5-1 |
| | WATER FILTERS..... | 5-3 |
| | Training..... | 5-4 |
| | Installation and Operation..... | 5-4 |
| | Replacement Filters and Parts..... | 5-4 |
| | ROCK DUSTERS..... | 5-5 |
| | Training..... | 5-5 |
| | Installation and Operation..... | 5-5 |
| | Replacement Parts and Rock Dust Supply..... | 5-6 |
| | SUSTAINABILITY OF PROJECT..... | 5-6 |
| SECTION 6 | RECOMMENDATIONS..... | 6-1 |
| | Water Filters..... | 6-1 |
| | Rock Dusters..... | 6-2 |
| APPENDIX A | | |
| APPENDIX B | | |

EXECUTIVE SUMMARY

Norwest Corporation (Norwest) was retained by the U.S. Department of Labor (DOL) International Labor Affairs Bureau (ILAB) to conduct a final evaluation of the Mine Safety Project in Ukraine (Project). The Project was initiated in May 2000 in response to a need recognized by senior officials in the governments of both Ukraine and The United States of America (U.S.), to transfer mine safety technology from the U.S to Ukraine. Specifically, the goal was to reduce the levels of combustible coal dust that could be a source for the initiation or propagation of mine explosions. This evaluation is the final assessment of the Project.

The Project entailed a team comprised of U.S. and Ukrainian participants working to identify U.S. methods for enhancing mine safety, which could be effectively implemented in Ukraine's coal mines. DOL ILAB and the U.S. Mine Safety and Health Administration (MSHA) represented the U.S. Ukrainian participation was primarily through the Ministry of Labor, Department of Labor Safety and the Ministry of Fuel and Energy, Department of Coal, but also included managers and miners from 31 Ukrainian coal mines. DOL ILAB selected as project manager, the Partnership for Energy and Environmental Reform (PEER), a U.S. non-profit corporation with principle offices in Ukraine.

Water filtration and compressed air powered rock dusting machines (rock dusters) were chosen as the methods to be used. Ukrainian manufactured filters and U.S. manufactured rock dusters were selected, training was provided to representatives of the Ministries and mines, and the equipment was delivered, installed and operated. As of the date of this report, filters and rock dusters have been in use at some mines for nearly two years.

From Project inception in May 2000 to completion in April 2003, the U.S and Ukrainian participants worked very cooperatively. There was thorough communication and mutual respect shown by all. The consistent, cooperative effort of the participants was the critical element in the Project's success. Not only was the technology successfully transferred; but also a dialogue was developed between the individual participants, which will have lasting benefits for the safety of coal miners in both nations.

Norwest's assignment was to review and opine on all facets of the Project. Norwest's responses to specific questions posed by DOL ILAB are contained in this report, a summary of which is presented immediately below. Opinions presented in this report are based solely on Norwest's review of reports and materials provided by DOL ILAB and PEER, interviews with people identified in the appendices to this report and observations made at the six mines visited by Norwest.

- Mine personnel were effectively and thoroughly trained in the purpose and use of the water filters and rock dusters. Training of additional miners is ongoing.
- The water filters and rock dusters were, with minimal exceptions, properly operated and maintained.
- A spare parts inventory and distribution system was established, but additional communication of how the mines should use this system is warranted.
- The Project was adequately managed and supported by all participants. The personal commitment of people assigned to the Project and the respect they demonstrated to each other were the most important factors in the Project's success.
- The Project has enhanced the safety of the mines. Though cogent measurements are not available, it is certain the Project has reduced the explosion risk created by coal dust.
- It is probable the 31 mines will continue to benefit from the Project, though the use of water filters and rock dusters is not being expanded at these mines. It is uncertain when and if other Ukrainian mines will apply the two coal dust control methods.

Though broader realization of the safety gains achieved by the Project may not currently be assured, Ukraine clearly has the capability to widely apply water filtration and compressed air powered rock dusting. All Project goals, which were to have been realized by April 2003, were achieved. This accomplishment was the result of the cooperative commitment of the Ukrainian and U.S. participants. As the technology has been effectively transferred, and the Ukrainian participants who have been involved since Project inception remain committed, it is likely they can overcome the challenges facing them in the future.

PROJECT DESCRIPTION

The Project was initiated in May 2000 in response to the 11 March 2000 explosion at the Barakov Mine in eastern Ukraine. The devastation caused by this disaster, which claimed the lives of 81 coal miners, was apparently amplified by the detonation of combustible coal dust. The initial source of the explosion may have been the ignition of methane, but the most intense and destructive forces were very likely due to the ignition of coal dust.

In addition to the formal expression of condolences by the U.S. to Ukraine, DOL offered its assistance to implement measures that could prevent a recurrence. The two nations believed a joint effort could lead to improved safety practices in Ukraine's coal mines. An agreement between DOL ILAB and the Ukrainian Minister of Labor, executed in May 2000, formalized this cooperative relationship. DOL ILAB also contracted with PEER to provide managerial, administrative and technical support for the Project.

A team of Federal mine safety experts from MSHA was assigned the task of identifying alternative means by which U.S. technology could be effectively transferred to Ukraine, applied at the Ukrainian mines and thereby reduce the likelihood of future disasters similar to Barakov. While the Ukrainian mining industry had a high level of technical expertise, it did not apply some practices used in U.S. coal mines, which have been found to minimize the risks of coal dust explosions. Additionally, the Ukrainian coal industry had been undergoing a restructuring that has limited the investment that can be made in new equipment. While the most effective methods for controlling the hazards created by coal dust were known in Ukraine, some of the more successful U.S. processes were not being implemented.

The U.S. team suggested the most effective and reasonably transferable technology would consist of two elements. These were water filters and rock dusters. Filtered water was considered to be a more effective method for allaying coal dust at its point of generation than the use of unfiltered water, which had been commonly used in Ukrainian mines. Additionally, the team believed water filters could become readily available from Ukrainian manufacturers and could be provided to the mines at a minimal cost. The team also decided rock dusters would allow more effective application of rock dust, the internationally

accepted means of inerting explosive coal dust. While such rock dusters were more complex and expensive than water filters, it was expected that Ukraine's strong technological and industrial base would allow U.S. style rock dusting machines to be replicated and domestically produced.

Extensive discussions between DOL ILAB, MSHA, PEER and Ukrainian representatives of the Ministry of Labor, Department of Labor Safety and the Ministry of Fuel and Energy, Department of Coal were conducted to review recommendations of the U.S. team. The parties agreed water filtration and rock dusting appeared to be methods that could be implemented in the Ukrainian mines, and have a positive impact on mine safety. Mutually, the parties to the Project stated its goals to be:

- Introduction of water filtration and compressed air powered rock dusting
- Training of mine personnel in the purpose and use of water filters and rock dusters
- Installation of water filters and rock dusters
- Establishment of a spare parts inventory and distribution system.

A prototype water filter and rock dusters, manufactured by the A.L. Lee Corporation, were selected. Though the water filter was capable of performing effectively, it became apparent a modified design, manufactured in Ukraine was preferable. Rock dusters were ordered from the A.L. Lee Corporation. After a pilot project to assess the probable effectiveness of the water filters and rock dusters, 31 mines were selected to participate in the Project. One U.S. manufactured rock duster, and a minimum of four Ukrainian manufactured water filters, each with multiple replacement filter elements, were then delivered to each of these mines.

Prior to delivery of the filters and rock dusters, meetings and training sessions were held at the mines to introduce managers to the equipment, required maintenance and proper operating procedures. These forums allowed for thorough discussions of not just the filters and rock dusters, but they also permitted the Ukrainian and U.S. participants to explore many areas of mutual interests relating to mine safety.

Upon completion of the training and installation of the filters and rocks dusters at the 31 mines, PEER representatives made regular visits to provide additional training and observe the mines'

application of the new technology. Much less frequently, due to the need to travel from the U.S., MSHA representatives visited the mines to provide additional assistance. Both PEER and MSHA provided continuing support to the people at the 31 mines.

By early-2003, all 31 mines had installed the water filters and rock dusters. Some had nearly two years experience with the new technology. The Project concluded at the end of April 2003.

PURPOSE OF EVALUATION

After completion of the Project, it was necessary to have an independent evaluation performed. This evaluation was conducted to determine if the Project achieved its goals and if safety advances made at the 31 mines could be sustained and expanded to other mines in Ukraine. Significant investments have been made by the U.S. and Ukraine to implement the Project. In addition to the financial contribution for the rock dusters and filters, time and travel expenses for many workers have been committed to the Project. Ministries of Ukraine, their officials and members, regional officials, mine managers, engineers and workers have dedicated themselves to the success of the Project. U.S. personnel from DOL ILAB and MSHA have worked both in the U.S. and in Ukraine to assure the success of the Project. The staff of PEER continually supported the efforts of all participants and provided training and technical assistance as well as performing its monitoring function.

A final evaluation is necessary to independently establish the following:

- Have mine personnel been properly trained in the purpose and use of the water filters and rock dusters?
- Are the water filters and rock dusters being properly operated and maintained?
- Has a spare parts inventory and distribution system been effectively established?
- Has the Project been adequately managed and supported by all the participants?
- Has the Project enhanced the safety of the mines?
- Will the benefits of the Project be sustained at the 31 mines and be extended to other Ukrainian mines?

This report presents Norwest's findings and conclusions in response to these questions. In addition, recommendations are offered which may assist in assuring the future success and expansion of water filtration and rock dusting in the Ukrainian mines.

EVALUATION METHODOLOGY

Norwest began its evaluation by conducting a review of materials developed by DOL ILAB, MSHA and PEER. The DOL ILAB materials included Project objectives and periodic technical, status and performance monitoring reports. Reports developed by MSHA included both narrative summaries of mine visits and analyses of rock dust samples taken at various Ukrainian mines. PEER's materials included reports on the status and progress of the Project.

Several telephone interviews were conducted with DOL ILAB and MSHA personnel prior to the visit to Ukraine. A list of all those interviewed by Norwest is contained in Appendix B of this report.

One Norwest Vice President visited Ukraine from 12 April through 26 April 2003. During this time, PEER's staff assisted in travel plans, meeting and mine visit arrangements and acted as interpreters.

Six of the 31 coal mines participating in the Project were visited. At each mine, an opening session with senior managers was conducted in which Norwest was provided a description of the mine and the status of the filters and rock dusters. Managers were questioned regarding the status of the equipment, its utilization, and their overall opinions of the Project and its current and future impact on their mines. Underground visits followed. During these visits both filters and rock dusters were inspected. The process of operating the rock dusters was demonstrated at most mines. Managers and workers assigned to perform rock dusting were questioned as to their training, the reason the rock dusters were being used and their opinions regarding the benefits of the machines.

Rock dusters were visited at all six mines, but filters were visited at only half the mines, due to the lengthy travel times often required. At the conclusion of each mine visit, a session was held to discuss Norwest's observations and acquire additional data or information.

In Lugansk and Donetsk, the Regional Labor Safety Directors were interviewed. Both interviews primarily focused on expectations for future use of filters and rock dusters. The purpose of these interviews was to determine the level of support that could be expected. These interviews also focused on the Directors' opinions regarding the organization and management of the Project.

After mine and Regional office visits, final interviews were conducted in Kyiv with senior representatives of the Ministry of Fuel and Energy and The State Committee on Labor Safety. As at the Regional offices, these sessions concentrated on expectations for future use of water filters and rock dusters. They also provided the opportunity to determine specific plans for the expanded use of filters and rock dusters. These senior representatives gave Norwest all the time needed to review the history of the Project, delve into details of the management of the Project and discuss all relevant issues relating to both the Project and other aspects of mine safety.

A few telephone interviews were conducted with Project participants based in the U.S., after Norwest returned from Ukraine. Detailed notes of all visits and interviews were transcribed. A literature search, discussions with safety experts and a review within Norwest were conducted regarding statements made and practices observed during the visits and interviews performed in Ukraine. Finally, a review of selected factual data gathered during the trip to Ukraine was requested of PEER, to assure translations and notes were fully accurate.

Norwest considered a statistical review of the Project's results, but the data available was generally insufficient. The primary goal of the Project was to reduce accidents and major mine disasters. At the 31 mines, there have been no incidents where the water filters or rock dust can be specifically identified as having prevented or reduced the impact of a fire or explosion. Data of this sort can only be developed over time as the records of the Project mines are compared to others. It is reasonable to accept the safety impact of the filters and the rock dusters based upon performance in other countries. Based on the concept of measuring performance rather than effect, there are currently no valid statistical measures by which the Project can be assessed.

FINDINGS

INTERVIEWS

The interviewees were, in all cases, candid and descriptive regarding activities relating to the Project. The Ukrainian and U.S. participants voiced both satisfaction and pride in the implementation of the project. This section summarizes the statements, comments and opinions voiced by the interviewees. Nearly all the DOL ILAB interviews were conducted by telephone; for the Ukrainians, all interviews were conducted in-person. Interviewing of the PEER staff was an ongoing process. Their comments are not specifically included in this section, but they are consistent with what was related by the others.

DOL ILAB and MSHA

The most consistent opinions expressed by these U.S. participants were satisfaction in the technological transfer and a sense that all parties to the Project had contributed and benefited. In regard to the specific goals, they felt all had been achieved in an effective manner at minimal expense. There were no exceptions identified.

Voiced most clearly were their opinions regarding the other participants. All Ukrainians, both at the mines and Ministries, were felt to be knowledgeable and personally committed to the goals of the Project. MSHA was felt to be a valued source of technical expertise and was particularly recognized for its ability to maintain a diplomatic and cooperative relationship with its Ukrainian counterparts.

Having PEER as the primary contractor for the Project was considered to be a critical element in the Project's success, largely due to two factors. First, PEER's knowledge of Ukraine and established personal relationships with key individuals at the mines and Ministries assured a favorable reception for the DOL ILAB and MSHA personnel. Additionally, the PEER staff possessed significant technical and administrative skills, which were critical to the efficient management of the project.

Generally, the DOL ILAB and MSHA interviewees stated the Project was one of the most successful technology transfers they had experienced. Both welcomed opportunities to work on similar mine safety projects in Ukraine.

Mines

Two categories of people were interviewed at the mines: managers and engineers, all of whom were technically trained; and underground workers. Managers and engineers were interviewed on the surface. These individuals appeared to be very knowledgeable and supportive of the goals and activities of the Project. They spoke highly of the contributions of DOL ILAB, MSHA and PEER.

In regard to the filters, they were generally unable to define specific measures of the safety benefits. However, they expressed their subjective opinion that filtered water was a more effective means of allaying airborne dust than methods which were commonly used. They did state that the lives of water-cooled motors and pumps had been extended, an unintended but valued benefit. This extended life of the water-cooled motors is likely a function of the lack of deposits that would be common with unfiltered water. These same deposits tend to plug water sprays making dust suppression less effective. One possible measure would be to get a statistical sample on a regular basis from both Project and non-Project mines to determine if water sprays are operating properly a higher percentage of the time with filtered water. This would still not quantify the safety benefits but would quantify the operating efficiency of the safety systems.

More specific comments were made about the rock dusters. All those interviewed were pleased with the machines, as well as the training and support provided by Project participants. The practice of periodically locating the rock dusters to the areas most in need of dusting was explained, including the rationale for this practice. Visual observations and occasional rock dust sampling indicate areas where the rock dusters can have the greatest benefit. As these areas are identified, the machines are relocated. At a few of the mines, comments were made that the cost of rock dust was a factor which troubled the managers, though the cost was not identified as a reason for limiting its use.

Underground, both supervisors and workers were interviewed at the rock dusters. At all but one mine these people were anxious to explain the purpose of the machines and operating procedures. Clearly, there was a sense of ownership by the rock dusting crews of the rock dusters and their contribution to the safety of the mines. Nearly everyone interviewed demonstrated a full understanding of the benefit of inerting coal dust and the proper use and care of the rock dusters. Even employees recently assigned to the rock dusting

crews were able to explain the salient issues involved with rock dusting and the machines.

Regional Offices

Both Regional Directors were familiar with the details of the Project. Though the Regional Directors have duties, which encompass large geographic areas and many industries, both Directors appeared to be active participants in the water filtration and rock dusting programs. They were very complementary toward DOL ILAB, MSHA and PEER. They were very satisfied with the water filters, particularly the fact they were now manufactured in Ukraine.

Their comments relating to the rock dusters were very positive, but both Directors raised the issue of the cost of rock dust. While adequate dust is presently available, they felt lower cost rock dust could allow for more to be used at the mines. It is unknown whether or not the efforts being made to lower the cost of rock dust will increase its usage. Bagging of rock dust, which would keep the dust cleaner and minimize absorption of moisture, both significant issues, was described as being in its initial stages. It is a means of packaging that both Regions would like to see expanded, however a timetable for this expansion is not known at this time.

The Directors also discussed the potential for rock dusters to be manufactured in Ukraine. Neither provided a specific program for making domestic machines available, but both indicated it was an issue of concern. It was during one of these interviews where the issue of the patent for the A.L. Lee rock dusters was mentioned. It was stated Ukraine is sensitive to patent rights covering the machines delivered and will endeavor to not infringe on those rights.

National Offices

Two sessions were conducted at Ministry offices in Kyiv. The first was for questioning senior officials of the Ministry of Fuel and Energy and The State Committee on Labor Safety. The second, conducted the following day, was a presentation of the preliminary, summary findings of this evaluation.

Both Ministries were familiar with the Project's goals and the activities of the past three years. They stated that both the technology and methodology provided by the Project were of value. At both meetings, it was emphasized a significant benefit of the Project was that it had created a dialogue between miners and engineers of the two nations which would provide lasting benefits. DOL ILAB, MSHA and PEER were all complemented on their

efforts and the respect they showed to the people at the Ministries and mines.

Both Ministries recognized that the water filters have provided safety, cost and production advantages. The water filters are perceived to be working very effectively. A Ukrainian manufacturer is supplying the filters as requested by the mines. Filters are keeping sprays clean, and they are also improving the reliability of water-cooled motors.

Attention is being given to increasing the availability of rock dust to all mines. Bagging of rock dust has begun, but only a small portion is delivered bagged, and that is normally supplied only to the more profitable mines. It was unclear when Ukraine will begin manufacturing rock dusters. As yet, there did not appear to be agreement between the two Ministries as to what designs would be used or how the cost of design and manufacture would be allocated. Though repair parts have not been needed for the rock dusters, there was minor concern expressed that communication of the process for providing such parts to the mines should, again, be emphasized.

Both Ministries clearly stated, in their opinion, the key elements of the Project, selection of the mines, delivery of the filters and rock dusters, training of the people and ongoing use and maintenance of the equipment, had all been achieved.

MINE VISITS

Underground visits were conducted at six mines. Participants on each visit included Norwest's Vice President, a representative of PEER and mine managers and engineers. While the general itineraries and underground travel routes were established by the mines, all areas and activities which needed to be observed were made fully available. The visits therefore included representative portions of the mines as well as the filters and rock dusters.

Water Filters

Filters were observed at three mines. As filters are a new concept at the mines, the precise methods of installation varied. One mine had a single filter in the main water supply line leading underground. Another had four filters in parallel.

Most filter elements were cleaned by closing the inlet water line and removing a cover plate, but one had a separate valve solely used to flush the element, which greatly expedited the cleaning

process. The frequency of cleaning the elements varied considerably, depending upon the condition of the unfiltered water. Reportedly the interval between cleanings varied from weekly to semi-annually.

Generally, the filters were properly installed and all were easily accessible for cleaning and maintenance. The installation where the four parallel filters were in use was truly a world-class installation. Though continuing measurements of particulates in the water before and after filtration were not routinely made, the measurements that were taken, observations of underground water sprays and comments by managers at the mines, indicated that the water filters are effectively reducing particulates in the water supply.

Rock Dusters

At all six mines, the rock dusters were examined and in most mines their operation was observed. Each mine has but one rock duster, so the machine is periodically relocated to an area where its contribution will be maximized. The six rock dusters were observed in the following locations.

- Longwall tailgate returns
- Main belt conveyor entries
- Intake aircourses.

All machines had been installed on track-mounted rail cars. Frames constructed of 4-inch steel pipe were used to protect the machines, and most had heavy wire mesh cages fastened to the frames and rail cars. Protection provided was at least adequate and typically excellent. Every rock duster was operable. Their general condition was very good. The only deficiencies were a few gauges and fittings that had been removed or were inoperable. Automatic pressure relief valves were usually not functioning, but the low pressure provided by the mines' compressed air lines typically did not create a hazard. Similarly, unreadable or inoperative pressure gauges did not limit the effectiveness or safety of the machines under current conditions. Generally, the six rock dusters inspected by Norwest were as, if not more effectively maintained than similar machines in the U.S.

Rock dust hose had been supplied by a Ukrainian manufacturer, for all but one of the machines. This domestically manufactured hose was well suited for the application, due to its resistance to kinking and minimal cost. In one case an improper hose was

observed being used with a rock duster. When mine managers became aware it was not the appropriate hose, it was immediately removed from service.

Workers using the rock dusters performed their tasks very efficiently. Rock dust, which is transported underground in small rail-mounted cars, was properly screened before it was loaded into the machines. Extraneous material was very rarely co-mingled with the dust. Normally the dust was dry and uncaked. In only one instance was encrusted dust found in the pod of the rock duster.

Rock dust, during the observations, was usually applied with a proper sweeping motion of the hose. The roof and ribs were suitably dusted. In the conveyor belt entries, loose coal had usually been shoveled onto the belt, so significant quantities of float coal dust were not found beneath the coating of rock dust. However, in some cases, substantial quantities of minimally inerted coal dust were observed beneath the rock-dusted surface.

CONCLUSIONS

PROJECT ORGANIZATION

All participants agreed the assistance of the U.S., particularly the involvement of DOL ILAB, MSHA and PEER, and the commitment of the Ministries and miners of Ukraine was outstanding. Communication and cooperation between these parties was the critical element in the Project's success. Decisions regarding the selection of the 31 participating mines, training, delivery and installation of the filters and rock dusters, mine visits and periodic assessments of the Project were made jointly and effectively. All parties made a concerted effort to make the Project a cooperative endeavor.

Ongoing participation by DOL ILAB, though the individuals involved may have changed, provided continuity. MSHA's role as the source of expertise regarding the application of water filtration and rock dusting was very important. If MSHA had not been available, an alternative technical authority would have been needed, at greater cost and possibly less expertise. People assigned to the Project by DOL ILAB and MSHA were ideal. They were consistently recognized as being respectful and sensitive to the Ukrainians, including both senior level managers and the miners. Based upon the level of attention given to this issue in the interviews, it appears this respect and sensitivity was viewed as a critical factor in the acceptance of input from the U.S participants and ultimately in the success of the Project.

PEER provided the link between DOL ILAB and MSHA and the Ukrainian participants. PEER's unique assets included its Ukrainian members, its U.S. leader, an extensive knowledge of the Ukrainian participants and, perhaps most importantly, the ability to translate not only words but mine safety concepts. The absence of an organization such as PEER would have made management of the Project extremely difficult. It appears DOL ILAB utilized a process to review and issue the contract to PEER which allowed full consideration of PEER's subjective qualifications. With the technical support of MSHA readily available, and the continuing backing of the U.S. embassy staff in Kyiv, a team with all the skills needed to assure effective Project implementation was formed.

One weakness relating to the management and control of the Project was the lack of consistent measurement of detailed project results and the reporting of such measurements. Many reports were

generated during the Project. These included PEER's reports and notes of mine visits, many of which were not translated into English and therefore not reviewed by Norwest. It is unlikely these non-translated reports, which may have contained measurements of water quality and the results of rock dusting, were reviewed by technically trained representatives of DOL ILAB or MSHA, as these individuals apparently do not read or speak Russian.

DOL ILAB developed periodic Status Reports and compiled updates to its Performance Monitoring Plan. While these reports were valuable, they did not specifically provide meaningful, frequent and representative measurements of the quality of the filtered water or the extent to which rock dust had been used and how effectively it had inerted coal dust. As an example, of all reports provided Norwest, only one included specific measurements of particulates contained in mine water. That report contained results of particulate analysis for only five mines, and only one analysis before filter installation and one after installation were included. Such minimal data does not provide a useful metric by which to determine the effect of the water filters.

Rock dust analyses were included in several of the reports. However, there were a limited number of samples and analyses included in the reports, particularly given the large number of mines and length of time the rock dusters had been in operation. There was also some doubt as to the method of rock dust sampling that had been applied in gathering some of the samples. Ukrainian sampling standards are significantly different from U.S. standards, in that only the very thin top layer is sampled while the U.S. standard is to sample material on the mine floor to a depth of one inch. Norwest gathered samples during mine visits, applying the U.S. sampling protocol, but after the samples had been transferred to MSHA, they were lost. Therefore, Norwest is unable to provide measurements of the effectiveness of rock dusting to compare to analyses contained in the reports generated by DOL ILAB, MSHA or PEER.

The existing reports do show that water filters and rock dusters were delivered, installed and operated, but they do not provide a useful quantification of the effect these activities had on removing particulates from water or inerting coal dust.

Though the key Project results were achieved, a more detailed record of measurements made during mine visits and periodic measurements made by the mines should have been maintained.

Periodic and frequent measurements, and reporting of the results, should have included the following:

- Water quality before and after filtration
- Quantity of rock dust consumed by the machines
- Rock dust samples taken by Ukrainian Mine Rescue teams
- Hours of machine operation each month.

Consideration should have also have been given to comparing Project and non-Project mines with regard to more peripheral issues such as:

- Effect on life of water cooled motors
- Occurrence of plugged water sprays
- Length of time between rock dusting areas.

MSHA and DOL ILAB formally reported the results of their visits, which were relatively infrequent. DOE ILAB produced several status reports, which identified project achievements. One mechanism for verifying the achievements was DOE ILAB's Performance Monitoring Plan. The Performance Monitoring Plan called for MSHA/PEER to sample and measure inert dust, as a percentage of the samples, on three to four month intervals. Norwest requested all reports that had been created during the Project, but the versions provided in English did not include rock dust samples taken at the three to four month intervals.

PEER's numerous mine visits were reported and the reports have been maintained in PEER's offices, though most of these reports were not translated into English. The lack of statistical reports is not a significant deficiency, as the records of all critical metrics were apparently maintained at the mines. However, more comprehensive measurement and reporting would have provided more effective management of the Project and allowed a more objective evaluation, particularly by the DOL ILAB and MSHA participants who did not read or speak Russian. Also, objective measurement of factors that are important to all mines would help as these methodologies are expanded to others operations. Performance measurement is an indispensable means of assuring actions and results are supporting the safety goals of the mines.

WATER FILTERS

It appears the transfer of water filter technology was as effective and complete as possible. Ukrainian engineers and miners had been aware of the advantages of using water to allay coal dust. At

the start of the Project they were applying some dust control methods that relied on water, such as sprays on longwall shearers and adding surfactants to spray water. However, the principle of water filtration had not been commonly applied. The Project provided an opportunity to add water filtration to the Ukrainians' suite of dust control processes, and it appears the Ukrainian mines have accepted and are effectively employing this added tool.

Training

Training in the use of the filters was clearly successful. Filters are generally installed where they will have the maximum benefit and periodic cleaning can be made uncomplicated. For this new technology to be so skillfully applied indicates water filtration, its purpose and filter maintenance must have been thoroughly presented to and fully understood by the responsible people at the mines. All those interviewed fully explained the application of water filtration and had only positive comments concerning the training. The training was effective.

Installation and Operation

As mentioned above, a new technology such as water filtration presents opportunities for the mines to try different procedures. Among these alternatives are variations in the mesh size of the filter elements, specific location of the filters and the method and frequency of cleaning. Though varying procedures are being applied at the mines, all appear to be effective. Communication between the mines has promoted the transfer of experiences, and it is likely the best practices are being identified and consistently applied. The water filters are performing effectively.

Replacement Filters and Parts

Ukraine is fully capable of supplying the mines with additional filters and replacement parts. A privately owned firm, Globus, Ltd., located in Donetsk, is manufacturing both filter casings and elements. The current design uses cast iron casings with stainless steel elements. Mesh openings for the elements have been varied from approximately 0.3mm to 1.0mm. Consideration is being given to using a stainless steel casing, but it appears there is no compelling need to change the current design. Globus, Ltd. appears fully capable of supplying the filter needs of all Ukrainian mines.

ROCK DUSTERS

As with the water filters, the rock dusters, their purpose, use and maintenance were fully presented to the Ukrainian participants. Reportedly, the 31 rock dusters are all in operation. Based upon the

six mine visits, it appears personnel responsible for the machines are trained and applying generally proper procedures in the use and maintenance of the machines. The concept of mechanical rock dusting is well understood by mine managers and workers, and the machines are achieving the intended purpose.

Training

A clear indication of the effectiveness of the training is that everyone interviewed fully explained the principle of rock dusting and the function of the machines. Significantly, even the newest workers assigned to rock dusting were obviously trained, based on their responses to Norwest's questions. Training of these new crew members is the responsibility of the crew leaders. At most mines, it appears many workers are being qualified in the use of the machines. The high literacy rate among the miners has led to the workers readily grasping the concepts of rock dusting and the proper operation of the rock dusters.

At the senior mine management level and at the Ministries, there is a thorough understanding of rock dusting and the A.L. Lee machines. DOL ILAB, MSHA and PEER clearly were able to communicate the goals of the Project and the specific tasks needed to assure its success.

Installation and Operation

All machines examined were in good condition, indicating effective installation and maintenance. Mounting the rock dusters on rail cars has allowed the machines to be relocated in response to the needs of the mines. The frames and wire mesh protection are generally effective. Most machines observed had some inoperative or missing parts. In almost all cases these items were the gauges, which are not critical due to the low air pressure available in the mines. The cleanliness of the machines is indicative of the care and attention being shown by the miners. The exception to this consistent concern was at one mine where it was stated that an automatic pressure relief valve had been stolen, however, this appeared to be an isolated case.

Operating practices are usually very effective. Rock dust is typically being applied according to Ukrainian standards. Rock dust crew members are, with minor exceptions, complying with the procedures provided by A.L. Lee.

While the A.L. Lee machines were generally suited for use in the Ukrainian mines, there is a need to provide additional, alternative

machine designs for the mines. Machines are needed that will be mounted with dedicated air compressors, for use in areas where compressed air lines are not available. Smaller machines are needed for use in some locations where access is restricted. There also appears to be a need for rock dusters that can be regulated to consistently emit a small quantity of dust, in locations such as the return aircourse from the longwalls. Such machines are described as trickle-dusters in the U.S.

Replacement Parts and Rock Dust Supply

Although Norwest did not visit the Regional spare parts inventory sites, it was consistently stated that parts were available. At each mine visited, replacement parts had not been required. While the need for parts may increase as the machines age, there is presently no deficiency in parts availability. Ukrainian manufactured hose is fully adequate for all the applications required at the mines.

Rock dust is, according to consistent statements made at the mines and Ministries, available in sufficient quantities. However, it appears the mines would apply more dust if the price was reduced. To meet the current need, as determined by Ukrainian regulations, the supply is adequate. This issue is discussed further below.

SUSTAINABILITY OF PROJECT

It is extremely probable water filtration and mechanical rock dusting will continue to be practiced at the 31 mines and eventually expanded to other mines in Ukraine. The Ministry of Fuel and Energy and The State Committee on Labor Safety recognize the contributions of these two practices, both to safety and operating efficiency. There is also a consistent appreciation by all personnel at the mines, from Mine Directors to workers, of the benefits.

Water filtration is becoming commonly accepted as a low-cost means of improving the effectiveness of allaying coal dust while at the same time improving the operation of water-cooled motors and pumps. Filters are available at an acceptable cost. There is no impediment to expansion of this facet of the Project. The level and rate of expansion, however, are unclear. It does not appear many additional mines have installed filters, and at the 31 mines selected for the Project, all available filters are not in use. While filters are appreciated, there does not appear to be a strong motivation to place more into service. The reason for this contradiction between praise of results and reluctance to expand usage is not totally understood at this time. It may be the result of there not being

effective communication of the results achieved at the 31 to the other mines in Ukraine.

Mechanical rock dusting appears to be fully accepted at the six sampled mines, and reportedly at all 31 Project mines, but it is not being expanded at those mines or to additional mines. There are at least two reasons. First and foremost, additional rock dusters are not available. Various opinions were expressed by the interviewees as to when additional machines could be manufactured in Ukraine. One person stated they should be available when the 31 now in service are worn-out. The unavailability of a Ukrainian rock duster not only prevents expansion to other mines, but it limits broader application of the method at the 31 Project mines.

The second reason to be concerned regarding expansion of rock dusting is the cost and availability of dust. There is but one source of rock dust for all of Ukraine, and the price is a recognized deterrent to the use of more dust.

All those interviewed at the mines expressed these concerns regarding expansion of mechanical rock dusting. The State Committee on Labor Safety, at both the regional and national level, is exploring ways to minimize these restrictions. In summary, there is no specific plan or obvious process that will result in more dusters and more rock dust for the 31 mines involved in the Project or for other mines in Ukraine.

RECOMMENDATIONS

Norwest believes the organization and managerial matters relating to the Project were effectively administered and present little opportunity for improvement. The exception is the need for more frequent measuring and reporting of detailed results, such as water quality and rock dust samples. The critical elements, which led to this success, include the selection of the U.S. personnel assigned to the Project, the use of a Ukrainian based Project Manager and the continuing involvement of MSHA. Most important was the selection of the people. The U.S. representatives provided the Ukrainians with allies in their effort to improve safety in Ukrainian mines. They also became friends and counselors.

Maintenance of the gains made over the past three years, and expansion of water filtration and rock dusting to other mines, may be promoted by the lead individuals in DOL ILAB, MSHA and PEER continuing their personal dialogues with their counterparts in Ukraine. The personal support, which was provided by U.S. personnel, was recognized as a very positive motivator during the Project, and it can remain so even after the formal conclusion.

Water Filters

While progress is being made to develop standard installation, maintenance and operating practices for the filters, a directed effort by senior leaders in The Ministry of Fuel and Energy and The State Committee on Labor Safety would be beneficial. Both these Ministries have a vested interest in water filtration and could coordinate an assessment of the various current practices that would lead in the establishment of standards that should be applied at all Ukrainian coal mines.

One practice that should be more broadly applied is the use of several filters in parallel, as was observed at one mine visited by Norwest. By using the maximum surface area of the filter elements the effectiveness of filtration is improved. More filters provide more surface area. It should also be advantageous to use different size filters in series. A filter with a 1.0mm mesh filter element could be the primary unit, followed by successive reductions to near 0.2mm mesh. All filters should also be modified to include a separate by-pass valve, which will allow cleaning of the elements without disassembly of the casing, as has already been done at least one mine.

Rock Dusters

There are several opportunities to improve results with the rock dusters. Inlet air pressure gauges should be maintained operational to assure adequate pressure is available before a rock duster pod is loaded. All protective cages for the machines should include wire mesh, and access to the rock dusters should be restricted by the use of locks. Every time the machines are used the pods should be completely emptied, even if this must be done manually. Only properly suited, Ukrainian approved and manufactured hose should be used, and it should be replaced regularly as it wears. The one hose supplied by A.L. Lee is worn to the point where it should be removed from service.

Thirty-one rock dusters were provided through the Project, but there appears to be an opportunity for several hundred to be effectively used at the Ukrainian mines. In order to facilitate this expansion, domestically manufactured rock dusters must be made available in Ukraine, and this should be done in the very near future. The machines supplied from the U.S. are not ideal for many applications in the mines. There is also some possibility the complexity and cost of machines similar to those now in operation may make them unacceptably expensive for all mines. PEER has evidently provided alternative rock duster designs to the Ukrainian participants. Alternative designs should be reviewed and a few appropriate models selected, manufactured in Ukraine and supplied to the mines.

The supply of rock dust should be increased. While it is generally accepted the mines comply with current Ukrainian regulations, the application of more dust will increase the likelihood the Project's ultimate goal, minimizing the hazard of explosive coal dust, will be realized. Ideally, dust should be used in large enough quantities so areas where float coal dust is consistently generated may be dragged, mixing the top layer of coal dust with the thick lower layer of rock dust. For rock dust to be available in such quantities, its cost must be reduced. This could be achieved by allowing the mines and their holding companies to become rock dust producers. Other rock dust suppliers could be allowed to enter the market. Even if the current supplier only developed new quarries and plants, closer to the mines, the cost of rock dust could be reduced by lowering transportation expenses.

APPENDIX A

UKRAINIAN MINES AND OFFICES VISITED

| | |
|---------------|--|
| 15 April 2003 | 50 Years of the USSR Mine |
| 16 April 2003 | Barakov Mine |
| 17 April 2003 | Orekhovskaya Mine |
| 17 April 2003 | Lugansk Regional Labor Safety Office |
| 18 April 2003 | Donetsk Regional Labor Safety Office |
| 21 April 2003 | Karasnorameiskaya-Zapadnaya No. 1 Mine |
| 22 April 2003 | Alamazaya Mine |
| 23 April 2003 | Skochinsky Mine |
| 24 April 2003 | The State Committee on Supervision of Labor Safety |
| 25 April 2003 | The State Committee on Supervision of Labor Safety |

APPENDIX B

INTERVIEWS CONDUCTED

U.S. Department of Labor:

Steve Marler,
ILAB, Current Project Manager of Ukrainian Mine Project

Gary Russell,
ILAB, Director of Technical Cooperation

Anne Zollner,
ILAB, Former Project Manager of Ukrainian Mine Project

Sydney Smith,
ILAB, Former DOL SEED Coordinator & Deputy Director

Laura Buffo,
ILAB, Former Project Manager of Ukrainian Mine Project

Dave Lauriski,
MSHA, Assistant Secretary

Roslyn Fontaine,
MSHA, Contract Review

Joe Pavlovich,
MSHA, District 7, District Manager

U.S. Department of Energy:

Jacquelin McKisson,
DOE, Attache, U.S. Embassy Ukraine

Partnership for Energy and Environmental Reform (PEER):

Jerry R. Tripplet,
President

Valentine Chukhalov,
Assistant Director & Translator

Natasha Zolotareva,
Office Manager & Translator

50 Years of the USSR Mine:

Valentine Bukreyev,
Technical Director of the Holding Company

Victor Steblin,
Deputy Director Lugansk Division of Labor and Safety

Alexander Ankudinov,
Deputy Manager of the Holding Company

Valery Mirgorodsky,
Mine Manager

Alexander Stepovenko,
Mine Chief Engineer

Barakov Mine:
Sergi Ostapenko,
Mine Director

Guennady Matushkov,
Mine Chief Engineer

Orekhovskaya Mine:
Alexander Yushko,
Mine Director

Victor Verbyi,
Chief Engineer

Guennady Syvolobov,
Assistant Director of Production

Yuri Bougrov,
Assistant Director of Labor Safety

Lugansk Regional Labor Safety Office:
George Basakin,
Director of Region

Donetsk Regional Labor Safety Office:
Nikolai Malyeyev,
Director of Region

Karasnорameiskaya-Zapadnaya No. 1 Mine:

Anatoly Demchenko,
Chief Engineer

Alexander Arshinov,
Production Manager

Oleg Kayun,
Chief Mechanical Engineer

Alexander Strelnikov,
Section Chief

Pavel Kakovsky,
Transportation Section Chief

Viacheslav,
Safety Inspection Field Office Chief

Alamazaya Mine:

Sergi Ivanchishyn,
Director

Sergi Kuzmin,
Acting Chief Engineer

Sergi Budylsky,
Safety Manager

Levgeny Badasko,
Chief Technologist

Valery Petrovsky,
Section Chief

Yuri Volodin,
Mine Inspector

Skochinsky Mine:

Valery Miminoshvily,
Director

Sergey Lobodin,
Mine Safety Manager

Oleg Savonov,
Chief of the Labor Safety Field Office

A. Koval,
Mine Chief Engineer

The State Committee on Supervision of Labor Safety:

Dr. Sergey A. Storchak,
Chairman

Vichislov Pletnov,
Deputy Director – Special Projects

Valentine Golikov,
Deputy Director Technical Services

Ministry of Fuel and Energy:

Vladimir Fichov,
First Deputy – Department of Coal