FEDERAL MINE SAFETY AND HEALTH REVIEW COMMISSION

OFFICE OF ADMINISTRATIVE LAW JUDGES
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June 6, 1997

ASARCO, INC.,	:	CONTEST PROCEEDING
Contestant,	:	
v.	:	Docket No. SE 94-362-RM
	:	Citation No. 3052272; 3/16/94
SECRETARY OF LABOR,	:	
MINE SAFETY AND HEALTH	:	Young Mine
ADMINISTRATION (MSHA)	:	Mine ID No. 40-00168
Respondent,	:	
and	:	
INTERNATIONAL CHEMICAL	:	
WORKERS= UNION,	:	
Intervenor	:	

DECISION

Appearances: Henry Chajet, Esq., and David Farber, Esq., Patton Boggs, L.L.P. Washington, D.C., for Contestant;
Stephen D. Turow, Esq., Office of the Solicitor, U.S. Department of Labor, Arlington, Virginia, for Respondent;
Randall Vehar, Esq., and Mr. Michael L. Sprinker, Akron, Ohio, for Intervenor.

Before: Judge Maurer

STATEMENT OF THE CASE

This proceeding concerns a Notice of Contest filed by the Contestant (Asarco) against the Respondent (MSHA) challenging the validity of AS&S@ Citation No. 3052272, which was issued pursuant to section 104(a) of the Federal Mine Safety and Health Act of 1977, 30 U.S.C. ' 814(a). The citation charges Asarco with a violation of the mandatory standards found at 30 C.F.R. '' 57.5001(a) and 57.5005. The respondent filed a timely answer asserting that the citation at bar was properly issued and in due course, Asarco moved to vacate the citation, and grant the contest based on the Commission=s decision in Keystone Coal Mining Corp., 16 FMSHRC 6 (January 1994). The administrative law judge, concluding that the case was controlled by Keystone, granted the motion to dismiss and vacated the citation by an unpublished Order of Dismissal on August 8, 1994. The Commission subsequently granted the Secretary of Labor=s petition for discretionary review, vacated the judge=s order, and remanded the case to the undersigned for further proceedings, holding that Athe legal basis underlying Keystone limits its application to underground coal mines@ (emphasis added), whereas this case involves an underground zinc mine.

Subsequent to the Commission=s remand in Asarco, Inc. v. Secretary of Labor, 17 FMSHRC 1 (January 1995), a substantial amount of discovery was completed by the parties, including several pre-trial depositions and a significant amount of documents were produced pursuant to request, both prior to and during the trial. The trial itself was conducted for 16 days spread over a period of time from March 25, 1996 through August 22, 1996. Additionally, three post-trial depositions for the record were also taken in September and October of 1996 and have been incorporated into the trial record.

The International Chemical Workers= Union, which is the exclusive bargaining representative for the miners working at the Young Mine, sought permission and was permitted to intervene in this proceeding as a representative of the miners. They fully participated in the trial of this case, as a party, and have filed a post-trial brief, and reply brief.

The Secretary of Labor and Asarco have likewise each filed a post-trial brief on January 31, 1997 and a reply brief on March 14, 1997.

I have considered the entire record and respective contentions of the parties in the course of my adjudication of this matter, and I make the following decision. To the extent that the proposed findings and conclusions sought by the parties are not incorporated into this decision, they are rejected.

STIPULATIONS

The parties stipulated to the following:

1. Asarco is subject to the jurisdiction of the 1977 Federal Mine Safety & Health Act and the Federal Mine Safety and Health Review Commission.

2. Citation No. 3052272 was based on one sample for airborne contaminants, which was taken over an eight-hour period on March 16, 1994 at the Young Mine. The citation issued by MSHA Inspector Dana L. Haynes, cited a violation of 30 C.F.R. ''57.5001(a) and 57.5005, and charged as follows:

> The Skip Tender on second shift was exposed to a shift-weighted average of 2.30 mg/m^3 of respirable silica bearing dust on 3/16/94. This exceeded the TLV (exposure limit) of 1.84 mg/m^3 times the sampling factor (1.20 for respirable free silica dust sampling and analysis). Respiratory protection was used, however, a respiratory protection program meeting the requirements of ANSI Z88.2-1969 was not in place. All feasible engineering controls were not

> in use to control employee=s dust exposure. An operator=s control booth was in place but not sealed adequately to prevent dust penetration. The original abatement date is for the institution of a respiratory protection program. When a respiratory protection program that meets the minimum requirements of ANSI Z88.2-1969 is in place, the abatement date will be extended to allow time for the installation of engineering controls. The analytical results received and citation issued on 4-18-94.

3. The sample was taken on a miner who was working under normal conditions in, and around, the ASkip Tender@ location, at the Young Mine.

4. The Skip Tender=s job is to operate the controls on doors which allow muck to flow from a surge bin into a chute (measuring capsule) and then into the skip for transportation to the surface. The Skip Tender sits inside a non-sealed booth, located underground next to the skip pocket, when he operates the controls. When he is not operating the controls, the Skip Tender performs clean-up of spillage, and on occasion is required to assist in the use of explosives to free Ahangups@ that occur in the dumping process.

5. Although the miner was wearing a 3M Model 87-10 respirator, the mine operator did not have in effect a respirator program consistent with the requirements of ANSI Z88.2-1969, which provides that respirators will be Afit tested@ for individual employees.

6. MSHA=s Metal/Non-metal Division=s standard procedures for sample preparation, collection, transportation, analysis and compliance determinations were utilized to obtain and process the sample upon which the citation is based.

7. MSHA=s Metal/Non-metal Division=s standard procedures for sample preparation, collection, transportation, analysis and compliance determinations are described in the relevant parts of the Metal/Non-metal Health Inspections Procedures Handbook and NIOSH Manual of Analytical Methods 7500.

8. The sampling apparatus used to collect the sample -- an SKC Model No. 30 constant flow pump -- was calibrated for the sampling that was conducted and the sampling apparatus was functioning in its normal operating condition.

9. Constant flow pumps are designed so that it is not necessary to calibrate the pump during an eight-hour sampling period and to achieve a 1.7 liter per minute flow rate if properly calibrated.

10. An electronic Gillibrator calibration device was used to measure the pump flow rate before and after the sampling shift.

11. Even when properly calibrated, there is some variation in the flow rate of the SKC Model No. 30 constant flow pump used to collect the sample during the eight-hour period in which the sample was taken.

12. In making a calculation for compliance purposes, MSHA allows a co-efficient of variation (ACV@) of 5 percent to account for variations in pump flow rate.

13. The 10mm nylon cyclone device that was used in taking the sample was the proper size and type of cyclone for use in sampling for respirable silica bearing dust and the cyclone was properly maintained.

14. The proper hose, filter and sampling cassette for use in sampling for respirable silica bearing dust were used in collecting the sample.

15. In making a calculation for compliance purposes, MSHA allows a co-efficient of variation (ACV@) of 7 percent to account for variations in weighing accuracy.

16. In making a calculation for compliance purposes, MSHA allows a CV of 11 percent to account for variations in the results associated with the use of X-ray diffraction technology.

17. The MSHA Denver laboratory weighed the sample to determine the weight of the total sample. The X-ray diffraction process was used to determine the weight of the silica in the sample. The silica weight was divided by the total sample weight and multiplied by 100 to determine the percentage of silica in the sample.

18. The threshold limit value (the ATLV@) for silica bearing dust in mg/m^3 is determined by placing the percentage of silica into the following formula, which is found in the 1973 ACGIH Threshold Limit Value Manual: 10 mg/m^3 divided by the percentage respirable silica+2. MSHA then multiplies the TLV by 1.2 for respirable silica bearing dust samples to attempt to assure a 95 percent confidence level, and to attempt to account for the co-efficients of variations described in Stipulation Nos. 12, 15 and 16. The 1.20 error factor is found on page A-11 of the MSHA Health Inspection Procedures Book. The result of this calculation provides the exposure limit (AEL@) which MSHA utilizes for enforcement purposes in comparing the results of the single eight-hour time weighted average sample to the EL.

19. To determine whether a sample taken over an eight-hour period demonstrates an eight-hour time weighted average concentration of respirable silica bearing dust that is above the calculated EL, MSHA divides the total weight of the contaminant by .816. The .816 value is a result of multiplying the pump flow rate in liters per minute (1.7), the sampling period in minutes (480 minutes) and 0.001 l/m^3. This formula is found on page A-4 of the Health Inspection Procedures handbook.

20. The violation was abated on March 14, 1995.

21. Asarco is a large operator, the proposed assessment will not affect its ability to stay in business, it had a better than average history of compliance, and the citation was abated in good faith. The parties agree that the proposed $178.00 penalty is appropriate if the violation is upheld.

22. The parties agree that due to a clerical error the penalty was paid inadvertently by Asarco but that such inadvertent payment does not moot this case or affect Asarco=s ability to challenge the citation at issue.

APPLICABLE REGULATORY PROVISIONS

1. 30 C.F.R. ' 57.5001(a) provides as follows:

' 57.5001 -- Exposure limits for airborne contaminants.

Except as permitted by ' 57.5005 -

> (a) Except as provided in paragraph (b), the exposure to airborne contaminants shall not exceed, on the basis of a time weighted average, the threshold limit values adopted by the American Conference of Governmental Industrial Hygienists, as set forth and explained in the 1973 edition of the Conference=s publication, entitled ATLV=s Threshold Limit Values for Chemical Substances in Workroom Air Adopted by ACGIH for 1973,@ pages 1 through 54, which are hereby incorporated by reference and made a part hereof. This publication may be obtained from the American Conference of Governmental Industrial Hygienists by writing to the Secretary-Treasurer, P.O. Box 1937, Cincinnati, Ohio 45201, or may be examined in any Metal and Nonmetal Mine Safety and Health District or Subdistrict Office of the Mine Safety and Health Administration. Excursions above the listed thresholds shall not be of a greater magnitude than is characterized as permissible by the Conference.

2. 30 C.F.R. ' 57.5005 provides in pertinent part as follows:

' 57.5005 -- Control of Exposure to airborne contaminants.

Control of employee exposure to harmful airborne contaminants shall be, insofar as feasible, by prevention of contamination, removal by exhaust ventilation, or by dilution with uncontaminated air. However, where accepted engineering control measures have not been developed or when necessary by the nature of work involved (for example, while establishing controls or occasional entry into hazardous atmospheres to perform maintenance or investigation), employees may work for reasonable periods

> of time in concentrations of airborne contaminants exceeding permissible levels if they are protected by appropriate respiratory protective equipment. Whenever respiratory protective equipment is used a program for selection, maintenance, training, fitting, supervision, cleaning, and use shall meet the following minimum requirements:
>
> (a) Mine Safety and Health Administration approved respirators which are applicable and suitable for the purpose intended shall be furnished, and employees shall use the protective equipment in accordance with training and instruction.
>
> (b) A respirator program consistent with the requirements of ANSI Z88.2-1969, published by the American National Standards Institute and entitled AAmerican National Standards Practices for Respiratory Protection ANSI Z88.2-1969,@ approved August 11, 1969, which is hereby incorporated by reference and made a part hereof. This publication may be obtained from the American National Standards Institute, Inc., 1430 Broadway, New York, New York 10018, or may be examined in any Metal and Nonmetal Mine Safety and Health District or Subdistrict Office of the Mine Safety and Health Administration . . . .@

THE SECRETARY=S EVIDENCE

Margie E. Zalesak

Ms. Zalesak has been Chief of MSHA=s Metal/Nonmetal Administration=s Health Division (AHealth Division@) since July 1993. (Secretary=s Exhibit 1; Tr. 59-60). She began working in the Health Division in 1981, and became a certified industrial hygienist in 1983. (Tr. 61-62, 67-68). From 1978 to 1981, she was a compliance officer for OSHA. (Tr. 65-66). Ms. Zalesak is a member of ACGIH and she was a member of ACGIH=s TLV Committee between 1984 and 1995. (Tr. 68, 74). Ms. Zalesak was offered as an expert witness in industrial hygiene practices; in sampling strategies and the use of sampling equipment in industrial hygiene; and in MSHA=s regulatory practices. (Tr. 77-80).

Ms. Zalesak testified that one mission of the Health Division is to ensure the health of metal/nonmetal miners by conducting inspections to determine whether mine operators are following MSHA regulations on airborne contaminants. (Tr. 38, 80-81). She emphasized that the Metal/Nonmetal Administration is one of two enforcement arms within MSHA, the second being the Coal Mine Safety and Health Administration. The airborne contaminant regulations in Sections 57.5001(a) and 57.5005, have been promulgated and are enforced by the Metal/Nonmetal Administration. They are not applicable to coal mines. (Tr. 81-83, 85).

Ms. Zalesak noted that the distinction between metal/nonmetal and coal mining operations with regard to airborne contaminants was made when Sections 57.5001(a)/.5005 were first enacted; when the Department of the Interior, Bureau of Mines -- MSHA=s predecessor -- proposed an air quality standard expressly relating to metal/nonmetal mines, 34 Fed. Reg. 667, 677 (Jan. 16, 1969). (Secretary=s Exhibit 2; Tr. 92-94). A final version of that proposal was adopted in 1970, 35 Fed. Reg. 18590 (Dec. 8, 1970). (Secretary=s Exhibit 3; Tr. 94-95). And, in 1974, the current language in Sections 57.5001(a)/.5005 was adopted, with the only substantive change to the 1970 sections being incorporation by reference of the publication Aentitled >TLV=s Threshold Limit Values for Chemical Substances in Workroom Air Adopted by ACGIH for 1973,= pages 1 through 54 . . . @ (ATLV for 1973@) into Section 57.5001(a), 39 Fed. Reg. 24319 (July 1, 1974). (Secretary=s Exhibit 4; Tr. 97-98). Ms. Zalesak further testified that since 1974, Sections 57.5001(a)/.5005 have not been changed and they were the regulatory requirements relied on by MSHA when the citation in this case was issued on March 16, 1994. (Tr. 99, 101, 275).

Pursuant to Sections 57.5001(a)/.5005, Ms. Zalesak indicated that MSHA regulates airborne contaminants in the form of dust which can be inhaled and have hazardous effects on miners when inhaled. Specifically, Section 57.5001(a) prohibits any miner from being exposed to such airborne dust contaminants beyond certain limits set out in TLV for 1973. Section 57.5005 is a sister regulation in that it requires mine operators to use engineering and administrative controls for reducing harmful exposure and, in certain circumstances, to provide miners with approved and fit-tested respiratory protective equipment. She stated that Section 57.5005 comes into play only when possible violation of Section 57.5001(a) is at issue. (Tr. 85-88).

Ms. Zalesak considers a TLV, as incorporated into Section 57.5001(a) from TLV for 1973 (Secretary=s Exhibit 8), to be Aan occupational exposure limit@ (AOEL@) for a miner. Its value can be a Aceiling@ or never to be exceeded limit in terms of exposure. Or, its value can be a time-weighted average (ATWA@) thereby permitting exposures over the TLV value (Apermissible excursions@) either during a miner=s work shift (ATWA-TLV@) or only for short periods during the work shift, *i.e.*, a short-term exposure limit (ATWA-STEL@). (Tr. 105, 107, 110, 212-214). In this case, the airborne contamination citation was for Arespirable silica bearing dust@ which Ms. Zalesak stated is in the TWA-TLV category and is on page 32 of TLV for 1973. (Secretary=s Exhibit 8 at Mineral Dusts, Silica, Crystalline Quartz). The TWA-TLV=s excursion factor is on page 52. (Secretary=s Exhibit 8 at Appendix D). She testified that MSHA has

always used this TWA-TLV in enforcing Sections 57.5001(a)/.5005 respirable silica bearing dust violations. (Tr. 202-203, 215-216, 359).

Ms. Zalesak testified that when MSHA samples miners for airborne contaminants in the TWA-TLV category, the sample is collected during the miner=s work shift: Afrom the time that the miner comes on board to the time he goes home.@ MSHA refers to this as a Afull shift sample@ -- frequently referred to in this proceeding as a Asingle shift sample@ -- and it is the sampling procedure used in the Amajority@ of silica cases. (Tr. 110, 112, 529). MSHA does not consider the full shift sampling procedure as a means of showing the miner=s average exposure over an extended period of time, rather that A[t]he sample is accurate for what that miner was exposed to that day . . . .@ (Tr. 115-116, 179, 532). A[W]e=re not determining whether the person will get a disease.@ AThe exposure was set [by MSHA in Section 57.5001(a)] to prevent development of the disease . . . . [I]f we keep exposure below that, then there will be an ultimate elimination of disease.@ (Tr. 3321-3322).

She further explained that MSHA is aware that there will be Atemporal@ variations in airborne contaminant concentrations for sampled miners; that from day to day, changes in activities, production, and engineering controls, for example, may affect the level of exposure. MSHA does not take this into consideration for enforcement purposes; again, because evaluation is being sought of the risk for the miner on the sampled day. (Tr. 339-349, 539-542, 3317-3319).

Ms. Zalesak acknowledged that in connection with TWA-TLVs, reference is made in TLV for 1973 to a A7 or 8-hour workday *and a 40-hour workweek.*@ (Secretary=s Exhibit 8 at 1 (emphasis added)). Based on her reading of TLV for 1973 and knowledge of ACGIH; and her professional knowledge of the issues of novel work schedules and articles on that subject, she stated that when ACGIH was developing TWA-TLVs, it was assuming that the miner being sampled would be working a Atraditional@ work shift which is a 8-hour day/5-day workweek. By including the 40-hour workweek language in TLV for 1973, therefore, ACGIH was attempting Ato put the parameters about which you could rely of this [TWA-TLV] limit to be protective.@ She further acknowledged that TLV for 1973 also contains the sentence: AIn some instances it may be permissible to calculate the average concentration *for a workweek* rather than for a workday.@ (Secretary=s Exhibit 8 at 2 (emphasis added)). But, although ACGIH Aclearly said there might be situations where it was permissible . . . ACGIH hasn=t come forward with guidance on a workweek.@ She is unaware of any statement by ACGIH that the 40-hour period is permissible for sampling for the silica TWA-TLV. MSHA does not use the AworkweekA concept. (Tr. 220, 228, 246-250, 261-268, 468-469, 565, 689, 711-712; Sec. Exhs. 5, 15-18).

Ms. Zalesak also acknowledged that the 1973 TLV publication contains the statement that TLVs Ashould be used as guides in the control of health hazards and should not be used as fine lines between safe and dangerous concentrations.@ (Secretary=s Exhibit 8 at 1). She stated, however, that when MSHA uses TLVs as the standard for issuing citations pursuant to its regulations, the agency is Anot making a determination whether the individual is getting disease.@

Rather, the TLV is used as Athe guiding rule@ for Athe limit that people should not be exposed above.@ (Tr. 467-468).

Regarding silica as an airborne contaminant, Ms. Zalesak stated that in the mining environment it is Aubiquitous@ and silica particles can be produced throughout the mining process. Although silica particles of various sizes are capable of being inhaled, only particles 10 microns or less are able to reach the lungs. She delineated how it is this fraction of silica particles which presents a health hazard to miners. Also a health hazard is dust, referred to in TLV for 1973 as Anuisance@ dust. (Secretary=s Exhibit 8 at 5). The instant citation speaks to Arespirable silica bearing dust@ because TLV for 1973=s TWA-TLV for silica includes nuisance dust in combination with silica as an airborne contaminant. (Tr. 122-123, 140).

Ms. Zalesak described the way in which silica particles in the lungs can cause silicosis, either in its acute form or the more typical, chronic, form. (Tr. 139, 142-146; Secretary=s Exhibit 5). She described the potential hazardous effects on lungs of silica particles and dust combined. (Tr. 154, 156). As an industrial hygienist, she has concluded that although there might not be a significant likelihood of developing silicosis from a single overexposure to respirable silica bearing dust, caution should be taken to avoid it. She pointed out smokers and individuals having other kinds of pulmonary diseases would probably be more vulnerable to overexposure. Moreover, silica particles have a Ahalf life@ of three or four years and, thus, if they remain in the lungs they pose a threat after even only one overexposure. In effect, overexposure is a Arisk that the person would be taking, almost like a little health accident that you=re not sure what the consequences are.@ In addition, Athere is . . . no way to stop the progression of . . . [silicosis] once the silica exposure is ended.@ There are also other possible negative health effects, such as bronchitis or a predisposition to bacterial infections such as tuberculosis. (Tr. 147-152).

In enforcing Sections 57.5001(a)/.5005, Ms. Zalesak testified that the agency considers the regulations as requiring a certain level of performance by mine operators. The regulations specify, in general, what the operators should do to protect miners from airborne contaminants -- production, administrative, engineering controls -- but they do not dictate Ain cookbook fashion@ how this should be done. A[I]t=s the operator=s responsibility to ensure compliance with the standard. (Tr. 180-188, 3314-3315).

In enforcing the required level of performance, she pointed out that MSHA currently has 308 inspectors to oversee approximately 11,000 metal/nonmetal mines and protect the health of about 220,000 miners. (Tr. 60, 83). Hence, Ms. Zalesak explained that MSHA utilizes an audit approach. Its inspectors and field office supervisors rank metal/nonmetal mines for airborne contamination and spot check them on a one-, three-, or five-year basis depending on the perceived risk factor. Data routinely collected and maintained by MSHA -- APersonal Exposure Data@ (APED@) -- which lists airborne contaminant samples taken by MSHA at each mine, are used for ranking purposes. (Tr. 157-158, 167-168, 444-447, 3386; Secretary=s Exhibit 32).

Ms. Zalesak stated that PED historical information is not considered by MSHA in determining whether to issue a citation when a sample is made because the sample represents the airborne contamination situation at the mine on the day the sample is taken. But, she noted that in this case as to the Young Mine, for ranking purposes in terms of conducting a spot check, the mine Ahad a history of compliance that there=s not ongoing problems.@ And, notwithstanding the citation that resulted, the Young Mine still maintains a low ranking. According to Ms. Zalesak, for MSHA, the citation uncovered Aa problem with the controls@ which has Abeen fixed@. (Tr. 496-497).

Ms. Zalesak testified that the inspectors in charge of spot checks may or may not be industrial hygienists; however, they are trained by MSHA and the procedures to be followed are in written form in a handbook: Health Inspections Procedures Handbook. (Tr. 278-281, 580, 704-705; Stip. 7). In the context of a TWA-TLV -- as in this case, silica -- she described the procedure whereby at the mine to be audited, the inspector will select the individual miners to be sampled by singling out high risk occupations and, next, selecting miners Ain every area and location@ of the mine. Throughout the work shift during which the sampling is made, the inspector will follow procedures -- including preparation of written field notes -- to ensure and document that the work shift is a Arepresentative shift@ during which the miner is performing Anormal activity.@ The inspector will also be checking the sampling equipment to ensure its proper operation. She emphasized that should there be departures from the norm either as to activity or equipment, the inspector is authorized to void the sampling. (Tr. 168-170, 172-176, 300-304, 580).

Ms. Zalesak further described the sampling equipment as Apersonal,@ in that the equipment is worn by the miner clipped to clothing near the head -- in the case of silica, Ait would be on the collar@ -- throughout the work shift. The sample thus obtained is considered by MSHA as indicative of the amount of airborne contaminants on that particular day which were in the miner=s breathing zone: Athe 2-foot radius around the head.@ This is a Astandard industrial hygiene@ concept for obtaining Aa sample from where the person would be breathing.@ (Tr. 171-172, 178, 293-294, 299-300, 355, 3335). She emphasized that MSHA is not attempting to determine what is going on in different parts, environments, of the mine; rather that A[o]ur exposure limits are personal samples. We=re determining - - when we=re sampling, we=re auditing that [particular miner=s] position to ensure compliance with the standard. We would want everyone to be within the standard, but we would take samples to determine that.@ (Tr. 3319).

She stated that MSHA is aware of, but does not take into consideration Aspatial@ or Aenvironmental@ variations which occur because airborne contaminants are dispersed through the environment and the level of contaminant concentration from one area to another may vary because the areas are not identically located relative to the generating source. This can cause variation in sample results obtained from personal sampling equipment simultaneously attached to the right and left lapels and, hence, when sampling equipment is within the miner=s breathing zone but in different areas. However, Ms. Zalesak emphasized that AI don=t know of any group, including NIOSH, that gives any recommendation on that, on side-to-side variability. We follow standard industrial hygiene practice.@ (Tr. 349-352, 640-645, 653-654, 3329-3332).

She further opined that even if ten samples were collected from ten different places on the miner and they produced different results, Athey would all be accurate [as opposed to Athe absolute true@] samples if the pumps were running and everything was correct . . . [o]f what they measured that day of - - of where they drew and how they were rotated and, you know, how the person moved.@ (Tr. 709-710). But, she stated that an average of the results of such multiple pump samples would not be appropriate. The more Abulk you hang on the miner, the more likelihood that you=re going to alter their work behavior . . . [and] it would affect the result.@ Moreover, an averaged result could be distorted by the miner=s work activity. AIf I had a worker that was having to bend over and lean into an activity where the face was forward, and he was right-handed or left-handed, the orientation of the sampler to where the point source [of airborne contaminants] on that side would probably be more indicative of where he was breathing than the one on the other side.@ (Tr. 3333-3335).

The components of the sampling equipment -- pump, hose, cyclone -- and their functions are described. Ms. Zalesak stated that in her opinion, the A10-millimeter Doliver@ cyclone, which contains the filter collecting the material to be tested, is consistent with directives in <u>TLV for 1973</u>. (Secretary=s Exhibit 8 at 34 n.K). Also described are the procedures the inspector follows when removing the filter from the sampling equipment and submitting it, along with a control filter, for laboratory analysis. (Tr. 218, 282, 293-299, 301-302, 310-312, 561; Secretary=s Exhibit 19).

Returned to the inspector are laboratory results indicating Athe weight gain@ -- the weight of material which was accumulated on the filter and -- as in this case involving sampling for silica -- Athe weight of the crystalline silica.@ From this, the inspector calculates the appropriate TLV from <u>TLV for 1973</u>. (Tr. 358-360; Secretary=s Exhibit 24).

The calculation procedure takes into account Asampling and analytical@ errors or variations (the ASAE@), with MSHA requiring that the TLV be modified by an Aerror factor@ in order to assure a 95% confidence level; in other words, Ato assure that there=s not an unfair penalty on the operator.@ (Tr. 3320-3321, 3394). This is the Astandard of care@ which NIOSH recommends in their sampling strategy for compliance purposes. For silica, it requires multiplying the TLV by 1.2 to account for equipment variability and limitations in connection with: Apump flow rate@ (Stip. 12); Aweighing accuracy@ (Stip. 15); and AX-ray diffraction technology@ (Stip. 16). This calculation gives the Aexposure limit@ (AEL@). Finally, when the sample is a full shift sample, MSHA requires a calculation to determine whether the sample taken over an 8-hour period demonstrates an 8-hour TWA concentration above the calculated EL. The result of this is called the Ashift-weighted average@ (ASWA@). When the SWA is compared with the EL, the SWA value must be higher than the EL value to substantiate a violation of the TLV standard in Sections 57.5001(a)/.5005. (Tr. 361-378, 523-524, 527, 625, 717; Stips. 7, 18, 19; Sec. Exhs. 25, 26).

If the SWA is higher than the EL, the inspector has no discretion other than to determine that enforcement action is warranted. (Tr. 584). No consideration will be given to TLV results for other miners/other locations at the mine being audited which may have been obtained the same day, or the day before or after. (Tr. 608). Ms. Zalesak further testified that after the abatement date in a citation, MSHA=s policy is to investigate whether the mine operator has taken corrective action. If the inspector concludes that the action was reasonable, another full shift sample would be taken to check for airborne contaminants for the occupation originally sampled and upon which the citation is based. If that sample gives results which are below the EL, the citation will be terminated. (Tr. 412-414).

With regard to alternative enforcement approaches, Ms. Zalesak rejected the suggestion that a mine=s PED historical information could be used to show an Aaverage@ exposure level for a particular occupations. It would be unreliable Abecause you wouldn=t have any additional data as to the materials being handled, what the engineering controls were, were there changes through time to protection. It would give you a historical perspective, but it would not be protective of the miner to rely on it without taking a sample.@ MSHA is looking Ato the characteristics of the worker that [sampling, not historical] day to determine if the . . . [mine operator was] in compliance with the standard on that occupation, that person.@ (Tr. 450, 607, 708-709, 3336-3338).

She also rejected the concept of a Arolling average@: for example, six samples over a year taken every other month and then averaged to determine compliance. First, once the series of sampling started, there would be Atoo many ways . . . for the operator to be able to manipulate that data, to alter the situation so it does not reflect the actual exposure of the miner.@ A[I]n my opinion, there are natural tendencies, much like trying to catch someone speeding if there=s cops - - you know the cops are coming up and you=ve seen one . . . . You can change production, You can change how often you hose down things. You can - - many things the operator has control over that would not make it a spot audit inspection that would give us a picture as to what the people were routinely working on.@ (Tr. 3340-3341, 3344-3345). Second, it would have an impact on MSHA=s Aability to respond to immediate workers= complaints for acute situations.@ AIt would commit [MSHA] resources to just a very narrow focus.@ With some 300 inspectors and 22,000 miners, Ato do a sample at 11,000 mines six time that year, by my calculations, it looks like we would be doing nothing but doing the sampling, ignoring all the other activities.@ And, A[o]ur inspectors do accident investigations. Some inspectors do special investigations, complaint hazard investigations, complaint follow-up, compliance, quite a number of activities.@ In addition, she concluded that with Aconstraints by Congress on our budget,@ is would not be Afeasible@ to increase the number of inspectors. (Tr. 3366-3371, 3374). Third, Ms. Zalesak stated that she did not believe that MSHA would be applying TLVs as required, which is in terms of Aa workday in a work shift.@ (Tr. 3372-3373).

<u>Dr. Paul Hewett</u>

Dr. Hewett, an 18-year employee of NIOSH, is an acknowledged expert in the areas of sampling strategy, data interpretation, and industrial hygiene practices. (Tr. 1651; Secretary=s Exhibit 58). Dr. Hewett testified that OEL refers to a Aconcentration and set averaging time@ and each OEL Awill have a recommended averaging time that is recommended by the originator or deviser of the OEL.@ (Tr. 1665-66). AThe rule of thumb is that it is correct to utilize the averaging time specified by the originator of the OEL, otherwise the level of protection provided by the OEL as you=ve reinterpreted it may be different from that intended by the risk assessor or the originator of the OEL.@ If, he noted, the OEL was based on an intended averaging time of eight hours, the practice of averaging multiple shifts, which might equal the OEL, would reduce the level of protection as intended by the original risk assessor. (Tr. 1666-67).

He stated that ACGIH denominates OELs as TLVs. Other agencies use different terms for the same concept; *e.g.*, NIOSH refers to Arecommended exposure limits@ (RELs), which it defines for respirable silica as Aa time-weighted average for up to 10 hours per day during a 40-hour workweek.@ (Tr. 1668-71, 1677; Secretary=s Exhibit 59 at 3). NIOSH considers that if either specified work period were exceeded by an employee, the given NIOSH REL for silica (as applicable to silicosis) Amight not provide the level of protection that NIOSH assumed it would for up to a 10 hour per day 40-hour workweek.@ (Tr. 1677).

A TWA, according to Dr. Hewett, is a Acommon industrial hygiene concept@ of the Aaverage exposure over some period of time hardly ever exceeding the full shift@; with the exception being instances where STELs are recommended. (Tr. 1682-84). To his knowledge, the vast majority of OELs set by major agencies are meant to apply Ato each single shift and not to the average of multiple shifts.@ A[T]he vast majority of the ACGIH TLVs, the OSHA PELs [permissive exposure limits] certainly and NIOSH RELs are to be interpreted as single shift limits; whether or not there is an . . . [OEL] out there that is defined as a long-term limit remains to be seen, and there are some that are certainly enforced as long-term limits.@ He does not believe that ACGIH=s TWA-TLV for silica was intended to be enforced as a long-term average. (Tr. 1692-93, 1863-64, 1888-89, 3452-53, 3643).

During the 1960s, development of the personal sampling pump made possible Ameasurement@ of TWAs by Abreathing zone@ samples. He explained the concept of Abreathing zone@ and its various aspects. He stated that it is part of the state of the art in the industrial hygiene world to sample within a Abreathing zone.@ (Tr. 1835-37). And, Awe=re pretty much utilizing the same concept that the field arrived at in the late >60s, early >70s; that is, placing a respirable dust sampler within a person=s breathing zone . . . [and] having that sampler remain on the person for the duration of the shift.@ (Tr. 1685-87).

Dr. Hewett agrees with the general proposition that a sampler measurement from the breathing zone will accurately represent the exposure of the individual being sampled, although it does not represent what is entering the individual=s nose and mouth or is being deposited in the lungs. (Tr. 1898-99). He explained that Aaccuracy,@ in the industrial hygiene and environmental sciences, reflects Aboth precision and bias@ -- with Aprecision,@ in general science, denoting the repeatability of measurements and having nothing to do with how close to the true value the measurement is. (Tr. 1900, 1902). Further, he stressed that it does not follow from the foregoing that there is no concern as to what the individual Ais actually breathing.@ (Tr. 1905). The breathing zone sampling device is designed to Ameasure that fraction of any dust cloud which is capable of being held - - inhaled by a general worker, a hypothetical, if you will.@ It is right now, technologically Aimpossible to measure accurately what any single individual is exposed to . . . . In fact, this concept of true worker exposure is a mental concept.@ AThe measurements that are collected by any industrial hygienist anywhere . . . are best estimates to what individuals are exposed and are used for risk management purposes, are used to determine whether or not an environment appears to be acceptable or not acceptable. Nobody measures true exposure. I=ve not seen it done, and I doubt that it=ll be done in the near or distant future.@ (Tr. 1915-16, 2049-50).

Hence, Aaccuracy@ -- when it comes to breathing zone measurements -- is a concern with how accurate the measurement device itself is. NIOSH=s concern, therefore, is with Athe accuracy of the sampling and analytical system.@ (Tr. 1905, 1910, 1918). He further elucidated that the Awell-accepted definition@ of Amethod accuracy@ is that Aone must have a sample and analytical method that will 95 percent of the time get you within plus or minus 25 percent of the true concentration at the location of the sampling device.@ The 25 percent, rather than a lesser percentage, is dictated because A[w]e=re trying to measure concentrations that vary across a work shift that for some substances can be difficult to measure in many varying workplaces. We=re trying to come up with a reasonable concept of method accuracy that most labs can attain to.@ It is Dr. Hewett=s understanding that this accuracy criterion can be met for silica. (Tr. 3595-97).

Dr. Hewett agrees, then, that environmental variability -- such as the side-by-side factor -- in obtaining measurements will not be taken into consideration in this approach to Aaccuracy.@ (Tr. 1903-05, 1918-20, 2053-54). He emphasizes, nonetheless, that Ato the extent that it=s feasible with today=s technology . . . we are trying to estimate the individual=s true exposure . . . .@ For example, it is important Ato sample as close to the individual=s mouth and nose as possible.@ (Tr. 1906-08). Dr. Hewett does not agree, however, that an average of multiple measurements in the breathing zone necessarily will provide Aa better understanding@ of the real amount of dust that a miner is exposed to. Rather, you would have a better understanding of Awhat the exposures are across@ the area between the multiple samplers. (Tr. 1909, 2047-48). While he does not dispute the general proposition that more, instead of less, information is useful in fashioning a more accurate estimate of exposure, he considers that it would be a waste of resources to place multiple samplers in an individual=s breathing zone. AIt would be a much better effective use of those resources to sample multiple people rather than the same individual multiple times within the same work shift; [but] that is not standard industrial hygiene practice. I know of nobody that does this.@ (Tr. 1910-11).

Dr. Hewett is familiar with a study done by Drs. Corn and Hall in which they analyzed paired samples which were gathered from metal/non-metal and coal mines. (Tr. 3551-53). Dr. Hewett=s analysis of their data, however, leads to the conclusion that it shows Amore variability from shoulder and shoulder than MSHA sees from miner to miner.@ (Tr. 3554, 3560-86; Secretary=s Exhibits 81-85). Nonetheless, assuming that the amount of shoulder variation exists as reported by Drs. Corn and Hall, further analysis of their data suggests to Dr. Hewett that Aif the exposure is less than 1, more times than not, either of the pair will tell you that.@ (Tr. 3587-91; Secretary=s Exhibit 86).

Dr. Hewett agrees that day-to-day, temporal, variability is not accounted for in the definition of Aaccuracy@ he has indicated above or in MSHA= sampling system. As to the suggestion that multiple samples over repeated work shifts for an individual would be preferable for enforcement purposes, there is discussion of work in this area by Dr. Robert Spear. Dr. Hewett does not agree that Dr. Spear=s work undercuts single shift sampling. (Tr. 1920-53, 2052-53).

Specifically, with regard to ACGIH=s <u>TLV for 1973</u> and a requirement for single shift sampling, Dr. Hewett testified that such an interpretation is supported by ACGIH=s statement that Aexcursions above the TLV are permissible provided they are balanced by lower exposures during the work shift . . . .@ ACGIH is Anot talking about between shift excursions, they=re talking about within shift excursions . . . .@ (Tr. 1773, 1775). He concedes that single shift sampling is not explicitly stated as a requirement in TLV for 1973. (Tr. 3630-31).

Dr. Hewett testified that in 1991, the American Industrial Hygiene Association (AIHA) Exposure Assessment Strategy Committee recommended that Aindustrial hygienists control exposures to the extent that one is 90 or 95 percent confident that no - - that 90 or 95 percent of the measurements are less than the single shift OEL.@ The Committee also stated that Ait is inappropriate to simply compare the long-term mean or the long-term average to the single shift OEL. But if you are so inclined to do so, they recommend that it is feasible or perhaps permissible to take 1/3 of the single shift OEL and use that as your longterm limit.@ (Tr. 1693-96, 1718, 3479-81; Secretary=s Exhibit 61 at 61). Dr. Hewett agrees with this concept, that Aone maintain a work environment to the point that the majority of the exposures are less than the single shift average . . . . [It] is a concept that goes back decades.@ (Tr. 1700).

He further emphasized, therefore, that the Astandard approach@ in industrial hygiene has been Ato define a reasonably controlled work environment@ as one where on a daily basis overexposure occurs no more than 1 in 20 times. Stated differently, as one where no more than 5 percent of the shift time-weighted average (TWA) exceed the OEL. (Tr. 3453-56, 3632-33). Dr. Hewett is of the opinion that Athe long-term exposure for any individual worker subject to exposures controlled to that model is well below the relevant standard.@ (Tr. 3464). If the control model is, as has been suggested, one of Aaveraging samples,@ and thereby allowing exposure to equal the standard, the result would be a Along-term exposure that=s 2-1/2 times greater that that which would result if exposures are controlled in the normal fashion.@ (Tr. 3464-65; Secretary=s Exhibit 75).

Dr. Hewett believes that it is reasonable to collect a single measurement to accurately represent exposure to the individual. He believes that A[o]ne can estimate the average exposure across a single shift using a reasonably accurate sampling and analytical device placed in the breathing zone of a worker and worn for the full shift. It=s accurate enough for practical purposes.@ Dr. Hewett explained that Amean or average is basically the balance point of a distribution . . . . In terms of a time-weighted average [TWA], it=s the integrated average of exposures across the work shift.@ Thus, the TWA single-shift measurement, Ais an estimate of the average exposure across that shift at the location where the device was placed.@ He distinguished, therefore, that if one is interested in Along-term exposure@ -- A[i]f indeed you have a long-term standard . . . .@ -- multiple measurements over time should be collected. (Tr. 1966, 1969-71, 1975, 2051-52). It is Aaxiomatic@: Asingle measurements are inaccurate estimates of long-term exposure . . . .@ This applies to the mining industry in general. (Tr. 1962-63).

There is discussion of NIOSH=s manual regarding assessment, by both an employer and a regulatory agency, of a single contaminant sample. Dr. Hewett explained how NIOSH procedures would apply to the present facts and he concludes that pursuant to such application, the measurement here exceeded the TLV. (Tr. 1778-1817; Secretary=s Exhibits 62-64). He concedes that NIOSH=s manual does not say that sampling for silica should only be one shift, but it does discuss how you use a one-shift sample. (Tr. 1837-38, 3631-32). NIOSH=s manual was developed for OSHA and its PELs; there is no reference to MSHA. In Dr. Hewett=s opinion, however, there is no reason why Athe strategies or the methods for analyzing exposure measurements [in the manual] could not be applied in other regulatory situations.@ (Tr. 1842, 2041).

Dr. Hewett testified as to his understanding of how MSHA determines whether a single exposure measurement can be classified as noncompliance. He considers this approach to be equivalent to NIOSH=s procedure. He concludes that this case presents a noncompliance measurement. (Tr. 1823-33; Secretary=s Exhibits 65-66).

Dr. Hewett is not of the opinion that the average exposure of different workers in the Young Mine between 1980 and 1996, would be significant in determining whether a skip tender is exposed to unhealthy conditions at a particular time, except in an extraordinary circumstance; namely, that the distribution of exposure in all of the mine=s work environments is exactly the same and remains the same for a long period of time. He has never seen such constancy and professional literature suggests quite the opposite, that there is always variability. (Tr. 3482-83). Furthermore, Dr. Hewett in unaware of any text or standard reference for industrial hygiene that utilizes measurements Athat are few in number that stretch over a 15-year period@ for determining whether a particular operation, or individual working in that operation, is in compliance. (Tr. 3493).

As an industrial hygienist familiar with statistics and in response to contentions that MSHA=s Denver laboratory is unreliable, Dr. Hewett discussed a statistical comparison he made among two laboratories and the Denver laboratory used by MSHA. All three are rated proficient by PAT standards. (Tr. 3515-36; Secretary=s Exhibits 77-79). The comparison showed, in his opinion, that if he Asent a sample to any of these labs, that that measurement would come back to within plus or minus, say, 10 percent of what the reference labs would tell me that measurement would be.@ AIf I had to pick one of these labs to use, . . . I would base my opinion upon proximity to where I am, the cost of the sample, how good their turnaround time, and whether or not they have experience analyzing the measurement or the types of samples that I generate as an industrial hygienist.@ (Tr. 3536-42).

Dr. Hewett acknowledged that there is language in the <u>TLV for 1973</u> which says, in effect, that TLVs should not be adopted as fixed or legal standards. (Tr. 1732). He noted, however, that ACGIH stated in its 1995-1996 publication that it does not oppose the use of TLVs in a regulatory context. According to Dr. Hewett, AACGIH does not apply a rigorous risk assessment policy or framework to the development of each TLV . . . .@ ACGIH does not, Alike OSHA does,@ Aapply a criterion that they=re trying to generate a TLV that results in a level of protection, such that only one person in 1000, such as with the benzene, OSHA PEL, is likely to develop the adverse end result after a lifetime of exposure . . . . These are their [ACGIH=s] best estimates for safe and healthy work conditions." (Tr. 1733-34). Therefore, according to Dr. Hewett, while ACGIH might state that TLVs Ashould not be adopted as fixed or legal standards, it=s because in a legal sense you should demand more of the occupational exposure limit than the ACGIH TLV committee imparted to them.@ (Tr. 1736).

Jerry W. Gregory

Mr. Gregory has been employed at MSHA as a supervisory chemist for the Denver Safety and Health Technology Center Laboratory (Denver lab) since 1984 and prior to that since 1974 as a chemist. Mr. Gregory supervises the day-to-day operations of the lab. The lab=s function is to analyze samples collected by the Metal/Nonmetal Division of MSHA such as silica, gases, organic solvents and asbestos. Eighty-five percent of lab activity is analyzing silica samples. Quartz is one form of the family of minerals called silica (Tr. 1177). This silica analysis falls within the category of analytical chemistry. Mr. Gregory was accepted as an expert in analytical chemistry (Tr. 741-54).

The Denver lab assembles the sampling cassettes. They are pre-weighed by the Denver lab prior to being sent to the inspector for collection of silica samples. The pre-weighed cassettes are then sealed (presealed) (Tr. 797). The samples are then collected at the mine by the inspector after noting that the preseal was intact. The cassettes are again sealed (postsealed) by the inspector before they are returned to the lab (Tr. 799). The pre and post seals are to maintain the integrity of the testing process (Tr. 799). The lab receives the samples from the inspector in mailing tubes by regular mail. MSHA Form 4000-29 acts as a chain of custody and as the samples go through each step at the lab, someone fills in a line and initials it (Tr. 758-63). Secretary=s Exhibit 20 is the Form 4000-29 for the Young Mine samples at issue in this case. Each sample has a column on the form. Sample 84926 in column Number 1 is the one that is specifically at issue in this case (Tr. 765). The samples in question were all collected on March 16, 1994 from the Young Mine (Tr. 787).

The samples are returned to the lab and post-weighed to determine the amount of dust collected on the cassettes (Tr. 755). When the sample comes back to the lab, it is initially submitted to a desiccation process which removes the moisture out of the sample but does not remove silica (Tr. 765-67). It is important to remove all the water from the sample to get an accurate weight of the sample (Tr. 767). The lab, however, never examined the issue of how much dust and moisture the samples could collect because of humidity and the lab environment in the time frame between desiccation and the subsequent weighing of the sample (Tr. 946-50). There is a period of approximately 25 minutes between desiccation and weighing (Tr. 946-49).

The Denver lab has an automated robotic weighing system (Tr. 767). This device uses a microbalance which can weigh substances as small as 1 microgram (.001 milligrams) (Tr. 773, 857). The balance is calibrated to a 100 milligram internal standard on a daily basis (Tr. 855-58). The lab then weighs a 200 milligram and then a 300 milligram weight to check the calibration (Tr. 858-61). However, the scale is readjusted by hand and reset to zero between every sample weighing (Tr. 863-64). The test run by MSHA for accuracy of the robotic weighing device was last performed when the device was first set up in 1989. That test consisted of weighing a single filter cone consecutively 50 times. (Tr. 925). The coefficient of variation associated with the robotic weighing device is 7 percent (Tr. 923). This means that a particular reading would be plus or minus 7 percent of a median value that had been determined (Tr. 923).

Through the use of automation and bar codes there is no chance of mistaking different samples (Tr. 769-75). The computer program makes a calculation to determine the weight of the material collected on the cassette. That calculation consists of taking the postweight and subtracting the preweight and then subtracting [or adding] the change in weight for the control filter. (Tr. 777-82). The computer generated weight is then entered onto MSHA Form 4000-29, dated and initialed (Tr. 793). The change in weight of the control filter will usually be in a range of plus or minus 30 micrograms (Tr. 783, 957). In the case at hand, however, there was a 36 microgram loss of weight on the control filter which had to be factored into the above calculation (Tr. 951-52, 957). There are unwritten procedures at the Denver lab for those instances in which the control filter exceeds the 30 microgram range of variation, but they were not followed in this case (Tr. 857-58). The weight change in the filter could possibly have been caused by environmental changes in the lab or the wear and tear of moving and handling the control filter (Tr. 967-68).

The lab uses the NIOSH 7500 Method to analyze for respirable silica dust (Tr. 757). This is an X-ray diffraction technique for analyzing the amount of silica in the samples (Tr. 758). Although Mr. Gregory unequivocally stated on direct that the Denver lab follows the NIOSH 7500 Method, during cross-examination he conceded at several points that the lab did not follow the NIOSH 7500 protocol in testing the Young Mine sample at issue in this case.

After being weighed the sample is assigned a lab number. If the adjusted dust weight on a sample is less than .1 milligrams, the sample is not analyzed for silica (Tr. 794). After being assigned a lab number, the sample goes through a preparation step which is part of the NIOSH 7500 protocol (Tr. 812). In the preparation step, the cassette is snapped apart and the filter is removed (Tr. 804-05). The filter which contains the dust is then put in a centrifuge tube (Tr. 805). The centrifuge tube contains an organic solvent, tetrahydrofuran, which dissolves the filter material and leaves the dust in suspension in the liquid (Tr. 807). The suspension is then agitated in a sonic bath and then filtered through a second filter, a silver membrane filter which is 25 millimeters in diameter (Tr. 808).

After the dust is transferred to the silver filter, an X-ray diffraction analysis is performed to determine the amount of silica in the sample (Tr. 812). In the X-ray process, the sample is irradiated by an X-ray beam which comes out of the X-ray tube. When the X-ray beam strikes the sample, some of the X-rays pass through the sample and some are bent or diffracted from the sample (Tr. 818). The X-rays which are diffracted pass through a slit into the detection system of the instrument (Tr. 819). The signal is then amplified and recorded in the computer or on a printout. (Tr. 819). The intensity of the signal is directly related to the amount of silica present on the filter. The X-ray detector is able to move up and down in relation to the sample (Tr. 818-19).

There are three major diffraction peaks of silica which the lab tries to measure to determine the amount of silica present on the filter. These angles are 26.6 degrees, 20.8 degrees, and 50.2 degrees (Tr. 820). These are characteristic peaks of the silica X-ray diffraction pattern

(Tr. 821). The most intense peak for quartz is at the 26.6 degree location. The second most intense peak is at the 20.8 degree location. The third most intense peak is at the 50.2 degree location (Tr. 823-24). The Denver lab would first look for silica at the most intense peak. Next, the lab would then check the second most intense peak to attempt to confirm the first silica measurement, but if there was interference at that peak, the lab would move on to the third most intense peak and so on (Tr. 825-27). Other minerals will peak at different locations, but those locations could be so close to the silica peaks as to cause interference at those locations. Interference is basically caused by other minerals present in the sample besides quartz (silica) (Tr. 828).

The Denver lab encounters interference problems with at least one peak in a sample approximately 50 percent of the time (Tr. 1098). The percentage of samples that have interference at two or three peaks is quite small, although it occurred with the sample at issue here (Tr. 1100-01). Normally, if there was a high quartz reading or readings that did not agree due to possible interferences, the procedure would be to test the bulk sample that was submitted along with the respirable sample in order to determine what the interferences might be (Tr. 1052). However, no bulk sample was submitted with this Young Mine sample, so when interferences were detected, the normal lab procedure could not be followed and thus they could not determine what was causing the interferences. Mr. Gregory went on to opine that the lab only receives a bulk sample from the field inspector about 50 percent of the time (Tr. 1052-53, 1099).

Normally, if a high quantity of quartz is detected at the first intensity peak, even with no interference present, the lab will reinforce its determination by measuring the quartz at the less intense quartz lines (Tr. 838-39). If the test sample contains a level of quartz above .1 milligram, 100 micrograms, the lab measures all three major quartz lines (Tr. 839). In analyzing the instant Young Mine sample, interference was found at three of the four peaks looked at (Tr. 1069). The only one without interference was the 26.6 degree peak which is the most intense peak for silica (Tr. 1069). But because there was no bulk sample, and there was interference at all the other three tested peaks, there was no way to verify the quartz measurement at the 26.6 degree peak (Tr. 1070-71). Without the bulk sample, there was no way to verify that there was not interference on the 26.6 degree peak as well.

The XRD machine is calibrated every three or four weeks (Tr. 879, 1181-85, 4033). The lab also checks the XRD calibration by using comparison samples on a daily basis but such a procedure is not a Acalibration@ (Tr. 885-92).

In the testing process, however, the Denver lab does not follow the NIOSH 7500 Method for scanning silver membrane filters through the machine before and after scanning the samples (Tr. 1143-46, 1214). The NIOSH 7500 Method also prescribes running a full scan from 10 to 80 degrees on the respirable sample as well as the bulk sample. Yet, in this case the Denver lab did not follow this procedure for either the respirable sample at issue herein or obviously the non-existent bulk sample (Tr. 1048-50). The lab also does not develop a new calibration curve each day or plot the calibration curve on a daily or even yearly basis as required by the NIOSH 7500 Method (Tr. 1154-55, 1206). The lab also did not match the known silica fingerprint against the sampling results as is prescribed by the NIOSH 7500 Method for respirable samples where interference is suspected (Tr. 1179-80).

Any sample which contains .1 milligram of quartz would be a violation of the TLV (Tr. 839). Once the X-ray results are recorded, the intensity measurement is compared to a calibration standard or calibration line that was developed prior to the analysis (Tr. 840). Then, a standard calculation contained in the NIOSH 7500 Method is performed to arrive at the total respirable dust in the sample (the total amount of quartz) (Tr. 841-42). The lab then sends the results back to the inspector. The lab offers no determination that regulations promulgated under the Mine Act have been violated (Tr. 842).

The Denver lab participates in the proficiency analytical testing program (APAT@) which compares the results of approximately 90 to 100 different labs across the country which test for silica (Tr. 892-93). The PAT program sends out the results to the labs and in each category a Ap@ for Aproficient@ is the best rating a lab can attain. The Denver lab between July 1992 and July 1995 never received a PAT rating lower than Aproficient@ (Tr. 898-05). (Secretary=s Exhibit 46).

Even though the PAT program gave the Denver lab a rating of Aproficient,@ the PAT program would give a grade of proficient if the lab was within plus or minus 3 standard deviations of the program=s reference values, which roughly could be a plus or minus 70 percent variation (Tr. 1019-20).

Dr. David L. Bartley

Dr. Bartley, who holds a Ph.D. in Physics, is currently employed by the National Institution for Occupational Safety and Health (ANIOSH@) as a research physicist (Tr. 1233, 1239). NIOSH was created along with OSHA under the Occupational Safety and Health Act of 1970 (Tr. 1233). Under the Act, NIOSH has responsibility for conducting research and providing advice for protecting the health of workers in the United States (Tr. 1234). NIOSH has a program called health hazard evaluation which gets involved with collecting samples for airborne contaminants (Tr. 1235). NIOSH has a method for analyzing silica samples known as the NIOSH 7500 Method (Tr. 1237). Dr. Bartley=s duties at NIOSH involve determining how to establish the performance of various sampling methods for analyzing gases, vapors, and aerosols including silica (Tr. 1239-40). Dr. Bartley was qualified as an expert witness concerning analytical methods, sampling equipment, and data interpretation over Asarco=s objection (Tr. 1258-77).

Dr. Bartley was familiar with continuous flow pumps in general, but not the SKC pump used to collect the sample at issue in this case (Tr. 1279). Dr. Bartley has never used an SKC pump in his research (Tr. 1507). A continuous flow pump is self-regulating, causing a constant flurry through the sampling device (Tr. 1279). The pump is self-regulating in that there is an electronic control that keeps the pump at a constant flow rate (Tr. 1279). The pump also has a pulsation dampener which oscillates and removes instances of fluctuation in the flow (Tr. 1280). Dr. Bartley did not know if the pulsation dampener was functioning on the SKC pump in question

(Tr. 1280-81). If the dampener does fail, hypothetically, the filter will pick up less material and the sample would have a negative bias (Tr. 1285-86, 1445).

The cyclone is a part of the sampling cassette. Air enters the cyclone through a tiny aperture. The air is then pulled by a pump taking a circuitous route and eventually coming up through a tube and through the filter (Tr. 1286-87). As the air makes the circular loop along the circumference of the inside of the cyclone, larger particles, because of inertia, cannot easily follow the circular route and get deposited on the inner surface of the cyclone. Some of the particles drop into the bottom of the cyclone, known as the grit pot (Tr. 1287-88). The smaller particles follow the air through the tube and get deposited on the filter (Tr. 1287-88). Any particle big enough to get through the aperture is drawn into the cyclone (Tr. 1289). The optimum orientation for the cyclone is perfectly vertical with the filter at 12:00 o=clock and the grit pot at 6:00 o=clock (Tr. 1308).

The Metal/Nonmetal Administration uses a 10 millimeter Doliver cyclone. Dr. Bartley believes that a small fraction of 10 micron sized particles would make it onto the filter using this equipment, but that the smaller particles will have a better chance of following the airstream lines inside the cyclone and making it onto the filter itself (Tr. 1289, 1321). Secretary=s Exhibit No. 52 is a chart created by Dr. Bartley which helps illustrate how larger particles drop and smaller particles rise toward the filter (Tr. 1290-91). For example, if the pump had a flow rate of 1.7 liters a minute and a 10 millimeter nylon cyclone, approximately 20 percent of the 6 micron size particles would actually reach the filter (Tr. 1301-02). The curve on the chart or graph in Exhibit 52 is called a cyclone or sampler penetration efficiency curve; or a sampling efficiency curve (Tr. 1303). The graph only goes up to 8 micron size but there is a small percentage of particles as large as 10 micrometers which do make it onto the filter (Tr. 1303). The nylon cyclone does not act as a perfect cut off point to protect against particles over 10 microns in size from being deposited on the filter (Tr. 1303-04, 1320-21, 1409-10). The flow rate of the pump used to collect the sample at bar (1.7 liters per minute as opposed to 2.0 liters per minute), increases the chances of the filter collecting particles larger than 10 microns in size (Tr. 1519-20).

The NIOSH 7500 Method specifies how a respirable silica sample should be taken and analyzed using X-ray diffraction techniques (Tr. 1325). NIOSH has adopted a standard of accuracy, a goal that the various methods are to meet, which is that 95 percent of the measurements fall within 25 percent of the true value of the concentration (Tr. 1342). The NIOSH position is to try to control the sampling and analytical accuracy through the NIOSH accuracy criterion. This means that only the sampling and analytical variability is accounted for in the NIOSH accuracy criterion. There is no accountability for environmental variability using the NIOSH Method (Tr. 1513). The environmental fluctuations of a contaminant often exceed the random variations of the sampling and analytical procedures by a factor of 10 to 20 (Tr. 1515-16, 1587-89).

The Proficiency Analytical Testing Program (APAT@) is a program that evaluates a lab=s ability to analyze samples for use in the industrial hygiene area and to help labs improve their analytical techniques (Tr. 1350-51). One of the samples sent out in the PAT program is silica (Tr. 1351). Approximately 1300 labs participate in the PAT program (Tr. 1351). PAT rates the lab=s testing as either acceptable or unacceptable. If the testing of a sample by a lab falls within three standard deviations of the reference lab=s results, the lab is given a rating of acceptable. The lab is rated proficient relative to a specific compound like silica if the testing of those samples have been acceptable for a certain period of time (Tr. 1356). NIOSH produces the results of PAT sampling analysis and sends them to the labs (Tr. 1357).

The MSHA Denver lab participated in PAT (Tr. 1357). On average, the MSHA lab sample analysis results were 18 percent less than the reference lab=s mean results (Tr. 1371, 1562). The relative standard deviation was 28 percent which means there is quite a lot of variability in the MSHA lab results around the reference mean results (Tr. 1361-62, 1371, 1562).

The Denver lab follows generally the NIOSH 7500 Method for testing samples but does not always utilize bulk samples to check for interfering minerals, which is recommended in that process (Tr. 1418, 1545-49). However, Dr. Bartley believes MSHA should be using bulk samples to identify interferences. (Tr. 1645). Also, he testified that the Denver lab is not accredited by the American Industrial Hygiene Association (AAIHA@); and, although the Denver lab participates in the PAT program, it could never serve as a PAT program reference lab because it is not accredited by AIHA (Tr. 1565-66).

The calibration standard for the X-ray diffraction process uses a standard reference material, alpha quartz, produced by the National Institute of Standards and Technology (ANIST@) (Tr. 1389). NIOSH recommends using the NIST calibration standard (Tr. 1391, 1542). Dr. Bartley did not know if you could calibrate an XRD machine using a Asolid silica disk@ (Tr. 1551-58). Mr. Gregory had previously opined that such a procedure (running a solid quartz sample through the XRD machine) is not actually a calibration (Tr. 890-91). The reference material has a size distribution such that the mass median diameter is on the order of 2 micrometers. The size was selected to match the silica size distribution (Tr. 1389, 1540). X-ray diffraction intensity per microgram of silica is a function of the particle size distribution (Tr. 1539). If the mass median particle size distribution was larger than 2 micrometers, the test would be biased to producing higher results (Tr. 1544).

Not all labs in the PAT program use the same calibration standard which may account for some of the large variation in test results (Tr. 1395-96). For silica, PAT reference lab variability is large. It would be Areal tough@ for any lab in the PAT program to be rated nonproficient for silica (Tr. 1567-68).

THE CONTESTANT=S EVIDENCE

Dr. Morton Corn

Dr. Corn is a Ph.D. industrial hygienist who is the Director of the Division of Environmental Health Engineering at Johns Hopkins University=s School of Hygiene and Public Health. He headed OSHA from 1975 to 1977 (Asarco Exhibit 21; Tr. 2338-40). Dr. Corn was offered as an expert witness in industrial hygiene and regulatory approaches, and more specifically in the assessment and control of occupational hazards respecting the silica content of respirable mine dust (Tr. 2349-50, 2354-55).

Dr. Corn stated that the ACGIH threshold-limit value (TLV) time-weighted average for silica is a long-term and not a short-term average (Tr. 2363). As a chronic disease, short-term exposure limits have no applicability to silica; there is no evidence in the scientific literature that a short-term exposure to a chronic disease agent has a significant impact on the course of a multi-decade disease (Tr. 2365). And the scientific community recognizes these are long-term standards, since they are promulgated against the background that disease resulting from overexposure takes decades to develop (Tr. 2363-65). The standard is derived from epidemiological studies over lifetimes (Tr. 2932-33). No Aceiling value,@ as that term is used by industrial hygienists, exists for silica exposure (Tr. 2365-66).

Based on a summary of OSHA and NIOSH measurements of respirable dust samples containing crystalline silica collected at the Asarco Young Mine between 1980 and 1995 (Asarco Exhibit 27), Dr. Corn had concluded that the mine was Awell within@ compliance with the ACGIH TLV (Tr. 2407). The ratio of the concentration to the exposure limit showed just two samples that exceeded the limit during that period (Tr. 2407-08). He concluded that the dust was well within the MSHA standard (Tr. 2407). Seven samples were taken respecting the skip tender -- enough to calculate a mean -- and the ratio of his exposure to the limit was approximately one-half (Tr. 2408-09, 2928-29). Further, the ratio of silica concentration to the exposure limit, .29 (Asarco Exhibit 27; Tr. 2933), led Dr. Corn to conclude that the people in this mine were, by a good margin of safety, exposed to lower dust levels when compared to the ACGIH TLV (Tr. 2934). He concluded that the mine adheres to the MSHA standard and that the exposure of the skip tender adheres to that standard (Tr. 2930).

Dr. Corn also visited the Young Mine. His purpose was to get an overall feel for the mine and, more particularly, for the skip tender position (Tr. 2355-56, 3039). He had earlier reviewed the results of sampling in the mine performed by MSHA and NIOSH (Tr. 2356). Those measurements were the primary determinant in forming his conclusions; the visit was merely Aconfirmatory@ (Tr. 3034) and involved no measurements (Tr. 2915).

In his visit Dr. Corn attempted to determine the nature of the dust sources and the control of dust and to observe the circumstances under which the skip tender performed his duties (Tr. 3020-21). He observed full skip filling (Tr. 3023-24). He noted that the mine material, which falls into a chute, has a tendency to lock up and not flow to the skip car. The skip tender utilizes a Ahigh pressure@ water hose to lubricate it (Tr. 3043). About 60-70 percent of the time he used that hose. While the primary purpose of the hose may not be dust suppression, its use constituted a Avery effective@ dust suppression technique, Dr. Corn stated (Tr. 2357, 2905-09). Assisting in ventilation were an auxiliary axial flow fan adjacent to the skip tender and an optional respirator (Tr. 2357, 2760, 2910-12). Additionally, two airshaftways behind the operator supplied and removed air (Tr. 2915). Based on his observation and questioning, Dr. Corn stated that he had observed a Arepresentative@ day in terms of dustiness (Tr. 3025). He concluded that the Young Mine was a wet and low-dust mine (Tr. 2356, 2922) and that the workers were not at excess risk (Tr. 2955).

In his view, one sample is neither significant nor indicative of what is happening in a mine (Tr. 2409, 2944). It does not offer any insight into understanding silica exposure in a mine (Tr. 2378), and Adoesn=t tell me anything about this person=s exposure@ (Tr. 2954). If you take one sample, A[y]ou literally don=t know where you are@ (Tr. 2392); it is Ameaningless@ (Tr. 2408). Additionally, it is not Ascientifically reasonable@ to use a single sample to determine compliance with the ACGIH TLV for silica (Tr. 2389-90). No regulatory strategy can rely on one sample (Tr. 2962). Nor is it scientifically valid to measure one full shift sample in determining compliance with the ACGIH standard (Tr. 2366-67).

Dr. Corn noted that ACGIH has suggested that samples may be taken for a week to help understand a work environment and to try to reasonably approximate a long-term average (Tr. 2803-04). Yet you must obtain multiple samples (Tr. 2804-08). The average for the 1980-1995 period of time as expressed in Asarco Exhibit 27, nonetheless, is Afar more relevant@ than one week. However, fewer samples are needed to determine whether a mine meets a standard than to accurately determine exposures over a period of time (Tr. 2871-72). Dr. Corn acknowledged that recent samples showing significantly different numbers than older samples might indicate some change in the level of exposure. But, he added, a sufficient confidence level for the latter period would nonetheless require multiple samples (Tr. 2947-48).

Dr. Corn was asked whether the average level of contaminant at a particular point could be determined by taking a full eight-hour sample and then averaging the total mass collected. He replied that it could not because there is fluctuation at that point. The worker is moving around, and thus his environment is changing (Tr. 2872-77). You must measure the different environments, which is the integrated measure of the whole mine (Tr. 2932).

Dr. Corn conceded that the ACGIH silica standard involves uncertainty due to variation (Tr. 2374). Dust measurements can vary greatly. The major sources of variability are the fluctuating environment, techniques for sampling, and time (Tr. 2372-74). Variation between mines is perhaps the largest environmental variable (Tr. 2374, 2388, 2810). A study funded by the American Mining Congress and the Bituminous Coal Operator=s Association (Tr. 2436) and performed by Dr. Corn and others in which he performed paired sampling -- two samples on opposite lapels of a miner=s breathing zone in a mine environment -- found Asignificant variation@ (Tr. 2382). He found at least a 25 percent variation in the percent of free silica in paired samples in 50 percent of the respirable mine dust samples (Tr. 2384). Variation was chiefly associated with occupation, time, and sampling or statistical error (Asarco Exhibit 23; Tr. 2386-87, 2781). Dr. Corn concluded that in order to come within 1 **2** percent of the true value of free silica, six paired samples were needed (Asarco Exhibit 23, figure 5; Asarco Exhibit 22; Tr. 2383-84, 2386, 2798, 2856). Six samples Agives you the confidence of the average that you get@ (Tr. 2799).

A study must be considered in the context of the particular mine being inspected. A mine known to have high variation or high amounts of dust would require more samples; a low-dust mine requires fewer (Tr. 2794-97). This is how OSHA enforcement is performed today, Dr. Corn testified; the compliance officer, who recommends to the area director whether to cite or not to cite, would examine the historical sampling done by OSHA or NIOSH at a site prior to making a recommendation (Tr. 2369-70). For a historically low-dust mine like the Young Mine, for example, you would place Areasonable confidence@ in a fewer-sample result (Tr. 2857-58). He suggested a minimum of three samples on the same occupation in a twelve-month period, averaged with historic samples (Tr. 2848-55). In any event, the number to be used should be in the context of professional judgment (Tr. 2367).

Dr. Corn was questioned about the reliability of the methods used to determine average dust exposure and about the sources and extent of variation. He conceded that while industrial hygienists assume that what is in the breathing zone -- usually defined as a one-foot radius around the head (Tr. 2779) -- accurately portrays what is inhaled, studies have shown variation (Tr. 2766). If a worker were standing further away, say 20 feet, greater variation might be found -- if a worker were near Aactive points of generation of dust,@ for example (Tr. 2780-81). But Dr. Corn did not concede that the amount of contaminant measured in a person=s breathing zone generally might be somewhat different from the amount actually entering that person=s respiratory tract (Tr. 2767). Variations in a worker=s breathing zone, further, would be fairly constant from day to day in the same mine, assuming other variables, such as mining method, water content, and silica content, remained pretty constant (Tr. 2772-73). Different variations appear to exist in different job categories (Tr. 2773-74). It is also possible -- depending on the work task -- for two workers doing the same job to have different variations within their breathing zones (Tr. 2774-75). Finally, Dr. Corn conceded that while a properly adjusted 10-millimeter nylon cyclone provides a reliable estimate of the respirable mine dust (as defined by the ACGIH TLV booklet) under laboratory conditions, it does not necessarily do so in the field (Tr. 2748, 2750).

Dr. Corn would not say that less dust would be inhaled if a standard which the air could not exceed rather than an average amount over time were enforced (Tr. 2822-24). But he would agree that it is likely that if a population=s average exposure is at the TLV, a significant proportion of the population will have experienced exposure levels far in excess of the TLV (Tr. 2834-35).

Dr. Corn also stated that the spread of results between the laboratories in Pittsburgh and Denver (Asarco Exhibit15) indicated that the Denver laboratory performance could not support a single sample citation on analytical capability alone (Tr. 2401). He termed the analytical proficiency Aunacceptable@ (Tr. 2416; see also Tr. 2424). The servicer of the X-ray diffraction equipment at the Denver lab found problems necessitating, in his opinion, that the lab be shut down temporarily to straighten out its problems (Tr. 2841-47, 3063; Asarco Exhibit 30).

Dr. Thomas A. Hall

Dr. Hall is a Ph.D. industrial hygienist who is currently an assistant professor at the University of Oklahoma (Asarco Exhibit 28; Tr. 2472). He was offered as an expert in occupational health, industrial hygiene, sampling strategies and analysis, and statistical analysis (Tr. 2473-74, 2476).

Dr. Hall initially testified about the TLV for silica. Like Dr. Corn, he stated that it is based on long-term chronic exposures because silica is a long-term hazard. Inhalation of crystalline silica at relatively high concentrations typically results in silicosis after 40 years of exposure (Tr. 2479, 2684). A TLV, however, should not be considered a fine line between compliance and noncompliance (Tr. 2484) or between safe and unsafe environments (Tr. 2716). The values are to be considered guidelines for professionals to evaluate the environment (Tr. 2484, 2717).

The TLV refers to time-weighted concentrations for a seven- to eight-hour workday and 40-hour workweek (Tr. 2479-80, 2682-83). Approximately six samples, each collected for a full working day, should be taken to determine whether a TLV has been exceeded (Tr. 2480-81, 2713). The period of time over which the samples should be taken would depend on the sampling history (Tr. 2480). In the absence of such a history, Dr. Hall testified, the samples should be taken over a minimum of two weeks (Tr. 2481). In any event he recommends sampling at least once every two months (Tr. 2713-14).

Dr. Hall agreed with Dr. Corn that a single sample is not a valid estimator of exposure over time (Tr. 2500, 3786). A single eight-hour sample, he said, Adoes not provide an accurate estimate of what the exposure or the concentration of the dust in the breathing air is@ (Tr. 2482). It does not account for the variability in the silica and dust concentrations in the breathing zone (Tr. 2482-83, 2583-84). (He defined the breathing zone, which is thought to Aapproximate@ the air the miner breathes (Tr. 2483), as about a 1- to 2-foot sphere around the head of the individual (Tr. 2482, 2583)). A single sample does not tell you where within a range you fall (Tr. 2500, 2551-52); the sample at issue Acould fall anywhere within a spectrum of potential values@ (Tr. 2551). Samples must be looked at over periods of time and in the context in which they were taken (Tr. 2500-01, 2547, 2550-51). Even two samples give you a better estimate than one, but two still do not give you an accurate estimate of the true concentration (Tr. 2495).

Dr. Hall concurred that a single sample could indicate changes in the breathing environment. But before he would make that conclusion, he would inspect the mine, review the work position, and, like Dr. Corn, collect additional samples (Tr. 2503, 2508). He recommends a moving average of six samples. This involves, after a sufficient number of samples have been collected, dropping the results of the earliest sample following collection of the latest one (Tr. 2510-11). This method of collection looks at long-term trends of exposure, which is appropriate for a chronic toxin such as silica (Tr. 2509).

Dr. Hall also testified about paired sampling, in which monitors are typically placed on a worker=s opposite lapels (Tr. 2484). Dramatically different results may occur, whether for concentrations of silica or respirable dust (Tr. 2485). Variability is of several types: 1) environmental, which is dependent on worker movement, worker orientation, and the amount of dust in the air (Tr. 2485-86); 2) temporal variability, which concerns the change in exposure across a day and from day to day (Tr. 2486), and 3) sampling and analytical error (SAE). In the instant case, the method of analysis was X-ray diffraction (Tr. 2486-87). SAE is thought to encompass 5-10 percent of the total variability (Tr. 2487-88). The dominant variability is environmental (Tr. 2488).

It was stipulated that MSHA assumes an SAE variation of 11 percent for the XRD analysis when they make compliance determinations (Tr. 2514). But Dr. Hall determined that the variation should be closer to 20 percent (Tr. 2514-19; Asarco Exhibit 18). The X-ray diffraction method of analysis used in this case can increase overall variability, he said (Tr. 2719-20). Asarco Exhibit 36 examines the proficiency analytical testing (PAT) results for silica analysis at the Denver and Pittsburgh laboratories. Neither came within NIOSH=s definitions of accuracy. To come within the definition, the Denver lab would have generated no more than 8 of the 175 results at more than 25 percent of the reference value; instead it generated 47, or more than 26 percent (Asarco Exhibit 36, p. 1; Tr. 3771). Similarly, Pittsburgh generated 69 results more than 25 percent different from the reference value, or 49 percent -- well more than the 5 percent figure accepted by NIOSH (Asarco Exhibit 36, p. 2; Tr. 3772). SAE may be as much as 70 percent or greater for single samples. From this data Dr. Hall concluded that MSHA=s overall error factor of 20 percent should be much greater (Tr. 3773-74, 3798). It was maybe half of what it should be (Tr. 2734-35). Dr. Hall=s confidence level -- considering only sampling and analytical error -- would not be MSHA=s 95 percent, but something closer to 50-60 percent (Tr. 2735-36).

Dr. Hall further stated, based on the testimony of Mr. Gregory, that the Denver lab appears to have Aloose@ procedures; he would be concerned about the validity of their results (Tr. 2536-38). Further, their recordkeeping was not adequate (Tr. 2539).

A study co-conducted by Drs. Hall and Corn found Aconsiderable@ variability in both respirable mine dust and silica in both coal and metal/nonmetal mines (Tr. 2489-91; Asarco Exhibit 23). Pair-sampling investigators had set a distance of 14 inches between lapels (Tr. 2611). Paired respirable dust samples showed a ratio in excess of 1.25 -- meaning the measure in one lapel was higher by 25 percent or more than in the other -- in as much as 50 percent of the samples, and at least 10 percent of the samples had a ratio of 2 (Tr. 2492-93). At least half of paired free silica samples had a difference of 1.7 percent, and for at least 10 percent, the difference was approximately 7.7 percent (Tr. 2493-94). This study, Dr. Hall concluded, demonstrates how much variability exists in the breathing zone (Tr. 2495).

In a study of respirable mine dust at the Skyline mine, Dr. Hall determined that 50 percent or more of paired samples had differences of greater than 11 percent; 10 percent had differences equal to or greater than 73 percent (Tr. 2597, 2719). Some of the variation between samples may be caused by analytical variation (Tr. 2614), Dr. Hall said. He agreed that breathing zone variations between paired samples might be applied in a compliance/noncompliance determination (Tr. 2607).

Dr. Hall visited the Young Mine with Dr. Corn (Tr. 2548). He agreed that the mine was Avery wet@ (Tr. 2549, 2641), and that there was Aconsiderable air flow@ at the skip tender position

(Tr. 2549), although he did not measure the air flow (Tr. 2640), and acknowledged that his conclusion concerning wetness was based only on observation (Tr. 2641-42). Like Dr. Corn, he testified that the water applied to the chute -- used to lubricate and free the materials (Tr. 2645) -- is an effective dust suppressant (Tr. 2549). In questioning the mine manager and the skip tender, he determined that the mine had not changed its production methods significantly -- that is, not by more than 10 percent on a shift basis (Tr. 2502, 2641, 2646-48).

Dr. Hall prepared the tables of Asarco=s Exhibit 27 (Tr. 2496). He testified that the estimates of the percentage of quartz in the samples were conservative. In support of his conclusion, he noted that for samples in which no quartz was detected, Dr. Corn decided that they would assume a minimum of .7 percent quartz (Tr. 2542-43; Asarco Exhibit 27, pp. 5-6). Further, the percent quartz in the sample at issue, 4.5 percent, falls very close to the upper 95 percent confidence interval of 4.6 percent, meaning that 90 percent of the time the quartz values (estimated on a conservative basis) are less than this value (Tr. 2544-45).

Further, the measured concentration of the sample at issue, approximately 104 micrograms per cubic meter, was just 4 micrograms per cubic meter of silica in excess of the 100-microgram TLV standard -- probably a statistically insignificant difference (Tr. 2546-47, 2573, 2730-31). MSHA=s estimate that the sample was 50 percent above the TLV also overstates the risk associated with quartz, because the MSHA estimate includes respirable dust as a component of the TLV (Tr. 2730-31).

Like Dr. Corn, Dr. Hall explained that the average ratio of the concentration of respirable dust to the exposure limit over the 1980-95 period at the Young Mine was .29, or approximately 1/3 of the permissible level of allowable exposure (Tr. 2506; Asarco Exhibit 27, p. 6). At the skip tender position, the ratio of the concentration of respirable dust to the exposure limit was .55, indicating that the exposure was approximately half of the TLV over the 1980-95 period (Tr. 2507; Asarco Exhibit 27, p. 1). Additionally, he said, six of the seven samples taken at the skip tender position Aindicate rather strongly@ that the environment Ahas low concentrations of respirable dust and silica@ (Tr. 2501). On cross-examination, Dr. Hall acknowledged that determining the average exposure of an individual over a 15-year period really depends on professional judgment (Tr. 2653). Six samples are generally acceptable, but he agreed that 20 would be better than six (Tr. 2654). Samples should be collected where there is an indication of a potential for increased exposure (Tr. 2655), such as if conditions in the mine had changed (Tr. 2657). Dr. Hall reiterated his conclusion that the sampling history at the Young Mine indicates a low level of exposure (Tr. 2654).

<u>FINDINGS OF FACT</u>

1. MSHA issued the citation at bar after determining that a skip tender working at the Young Mine was exposed to concentrations of respirable silica bearing mine dust at levels that exceeded the permissible concentrations established in 30 C.F.R. '57.5001.

2. The violative determination was based on analytical results derived from a sample collected within the skip tender=s Abreathing zone@ over a single work shift, or stated another way, an eight-hour period, on March 16, 1994. That analysis demonstrated to the satisfaction of MSHA that the skip tender was exposed to a shift-weighted average of 2.30 mg/m^3 of respirable silica bearing mine dust on that date.

3. The permissible concentration limit, or Athreshold limit value@ (TLV), for silica is determined pursuant to a formula developed by the ACGIH--10/Percent Silica + 2 and incorporated by reference into 30 C.F.R. ' 57.5001.

4. In this instance, MSHA=s Denver laboratory used a robotic weighing device to determine that 1876 micrograms of total mine dust were collected on the sample filter during the sampling period. And they used an X-ray diffraction (XRD) instrument to determine that 85 micrograms of silica were collected on the sample filter during the sampling period. Therefore, the percentage of silica in the concentration of total respirable dust was computed to be 4.5 percent. Accordingly, the TLV for the skip tender on that shift on March 16, 1994 was 1.53 mg/m^3.

5. In determining whether to issue a citation for an exposure exceeding the silica dust TLV, MSHA adjusts the TLV upward by 20 percent to account for the potential effects of sampling and analytical error on the gravimetric and analytical results. In this instance, applying the 20 percent error factor to the TLV, MSHA calculated an Aenforcement level@ of 1.84 mg/m^3, which is determinative of whether a citation will or will not be issued in the case. Since 2.30 mg/m^3 (derived by the process described in Stipulation No. 19) is greater than 1.84 mg/m^3, the inspector had no discretion but to write the subject citation, which he did upon the receipt of the analytical results on April 18, 1994.

6. Exposure to silica particles and other respirable dust particles at levels above the TLV can eventually cause silicosis, a disease that diminishes the respiratory system and which may eventually be fatal. At or below the TLV level, most people will have sufficient time to Arecover@ from exposures on one shift before being re-exposed on a following shift.

7. MSHA used a properly calibrated SKC Model No. 30 constant flow pump and a 10 millimeter, nylon cyclone to collect the respirable dust sample at issue herein pursuant to their normal sampling procedure. The cyclone is used to separate particles that are larger than 10 micrometers (microns) from the smaller, respirable particles. Dust particles are drawn into the cyclone using a Aconstant flow@ pump, which operates at a constant flow rate throughout the collection period. In this case, the pump was calibrated before and after the sample was taken to assure that the actual flow rate was within 5 percent of the desired flow rate of 1.7 liters per minute throughout the 8-hour sampling period. Ideally, at this flow rate, larger Aoversize@ particles (defined as those particles greater than 10 microns in diameter) are captured on the surface of the cyclone or fall into the grit pot, while only the smaller, respirable particles are collected on the sample filter.

Nevertheless, the 10 millimeter cyclone is acknowledged by MSHA to permit oversize non-respirable particles through to the filter to some degree, as a general proposition. However, there is no direct evidence in the record, one way or the other, concerning the sample at issue in this case, with regard to the presence or absence on the filter of oversize particles, or if present, to what extent.

8. The MSHA Denver laboratory does void dust samples if visual inspection reveals the presence of Anon-respirable particles@ significantly in excess of 10 micrometers (particles become visible to the eye at 40 microns in diameter). Like the Denver laboratory, the NIOSH laboratory also has no established procedure for detecting non-visible particles that exceed 10 microns in diameter, instead relying on the sampling instruments and individuals experienced in sampling procedures to assure a proper particle size distribution. Since the sample at issue in this case was properly collected by a trained MSHA inspector using instruments designed to produce the proper particle size distribution and the sample weighed only 1.876 milligrams, it is unlikely (although not impossible) that it contained a significant number of particles exceeding 10 microns in diameter. The actual number of oversize particles that were on the sample, if any, is of course, unknown.

9. When sampling for silica dust, the MSHA inspector selects the miner, or miners, perceived to be at the greatest risk of exposure to high levels of silica dust. The inspector attaches the sampling apparatus to the miner=s person, placing the sampling train within the miner=s Abreathing zone,@ defined by MSHA as a location within a 2-foot radius of the miner=s head. When the miner begins his work shift, the inspector activates the sampling apparatus and continuously collects a sample from within the miner=s breathing zone for the entire length of the work shift. During the work shift, the inspector periodically returns to examine the operation of the sampling apparatus and to assure that the sampling apparatus is not being mishandled by the miner. At the completion of the work shift, the inspector takes possession of the sampling equipment and removes the sampling cassette containing the filter from the sampling apparatus. The inspector also determines whether the shift was a representative work shift for the miner sampled and whether there were any factors that affected the operation of the sampling pump or the integrity of the sample during the work shift.

10. After the sample is collected over the shift, the inspector sends the sample to MSHA=s Denver laboratory for analysis to determine the concentration of respirable mine dust and the mass of silica on the sample filter.

11. MSHA=s Denver laboratory is not accredited by the American Industrial Hygiene Association, the accepted accreditation body in the United States. In contrast, the labs used by NIOSH and OSHA are so accredited.

12. The mass measurement of respirable mine dust collected during the sampling period is determined at the Denver laboratory with a robotic weighing device (RWD).

13. Each filter that is used to collect respirable material is weighed at the laboratory before it is assembled in the sampling cassette and sent to field offices. After the sample is

collected, the inspectors return the sampling cassettes to the laboratory in specially designed mailing containers. At the lab, the filter is removed from the cassette and desiccated to remove moisture from the sample and to allow the sample to acclimate to laboratory environmental conditions. After desiccation, the filter is placed on a rack with other filters. The filters are automatically removed from this rack by the arm of the RWD and placed onto the RWD=s balance. The filter is then weighed by the RWD, and the results recorded by computer.

14. In order to determine the weight change associated with an individual filter, the pre-sample weight is subtracted by computer from the post-sample weight. The difference is the change in filter mass allegedly attributable to the sample. However, MSHA recognizes that in some cases, including the case at bar, factors other than respirable dust may influence the change in filter mass. For that reason, a Acontrol filter,@ coming from the same manufacturer=s lot as the filter used to collect the sample is utilized for comparison purposes. This control filter is not exposed to the mining environment, but is carried by the inspector and accompanies the actual sample taken in the mine and analyzed in the laboratory.

15. MSHA typically expects a maximum of approximately 30 micrograms of positive or negative change in the control filter, and if that range is exceeded by any appreciable amount, the laboratory would normally disregard the control filter or at least reweigh it. The Denver lab has no formal or written procedure, however, to deal with this phenomenon and even though the normal or usual range was exceeded by 20 percent in this case, the Aunwritten@ procedure to investigate such an anomalous result was not followed by MSHA lab personnel. The unexplained loss of weight on the control filter caused MSHA to add 36 micrograms of weight to the reading obtained from the RWD for the sample at issue in this case. However, in this case, it is important to note that the non-compliance determination would not have been affected. The sample at bar would still have been cited even if the lab had not added the 36 micrograms to the total weight.

16. The MSHA Denver lab begins the XRD process by transferring the respirable material from the sample filter onto a silver membrane filter using a centrifuge tube containing tetrahydrofuran that dissolves the sample filter and evenly distributes the dust in a liquid suspension. The suspension containing the respirable dust is then placed on the silver membrane filter which provides an even distribution of particles and lowers the background intensity inherent in the diffraction process. This filter is then placed on the XRD instrument for analysis.

17. The XRD instrument is programmed to direct the X-ray beam onto the silver membrane filter at pre-established angles, which correspond to the known silica diffraction peaks of greatest intensity. The process begins with the most intense silica diffraction peak (reflecting through an angle of 26.6 degrees). A result is produced that can be converted into a silica mass measurement by comparing the intensity to a calibration standard that was developed prior to the analysis.

18. MSHA is aware that there are numerous minerals that interfere with the XRD silica analysis. For that reason, the lab then performs the same process at the second most intense silica diffraction peak (reflecting through an angle of 20.8 degrees) and performs a similar calculation based on the results derived at the second most intense peak. If the results derived from the

calculations at the two most intense peaks are consistent, the lab concludes that the detected mass is pure silica, with no interferences present, as opposed to silica in conjunction with another mineral.

19. If there is not agreement between the first two results, as was the case with the sample at issue herein, where the second peak was subject to interferences, the lab will continue the process at several additional peaks of known but lesser intensity in order to attempt to determine the mass of silica present. In fact, MSHA encountered an interference at each of the last three peaks it scanned on the sample at issue in this case, and therefore relied only on the first, unverified peak to issue the citation at bar. The lab never determined what other minerals were interfering with its analysis of the sample at bar and were unable to check the bulk sample for the interfering minerals since no bulk sample was available to be analyzed in this particular case. Since there never was agreement between any two peaks on the citation sample at issue herein, it was especially important to be able to rely on a bulk sample in this case to identify interferences. However, in this case, MSHA=s Denver lab was unable to follow their own Astandard procedure@ to check the bulk sample for the interfering minerals because the inspector failed to send the lab a bulk sample along with his collected respirable samples.

20. Although the NIOSH 7500 Method requires a bulk sample to be collected and analyzed to identify interferences, the MSHA Denver laboratory does not follow this procedure approximately half the time because the lab only receives bulk samples from the inspector for about half of the field samples it analyzes. NIOSH, on the other hand, does follow this procedure to identify interferences and Dr. Bartley, a NIOSH employee who testified as an expert on MSHA=s behalf opined that MSHA should follow it too.

21. MSHA professes to follow the NIOSH 7500 Method for XRD silica analysis at its Denver lab, but in point of fact, it does not in several important respects. At least it did not in connection with the sample at issue in this case, and to some extent, does not as a general rule. These deviations in procedure are particularly significant because MSHA adopts the precision estimate for the NIOSH 7500 Method, even though that error factor is based upon the experience of other labs that analyze samples under more controlled conditions.

22. The NIOSH 7500 Method dated May 15, 1989 was in effect at the time that the sample at issue in this proceeding was analyzed and was the version that the MSHA Denver laboratory based their own analytical procedures on that resulted in the issuance of the citation at bar.

23. The Denver lab does not scan blank silver membrane filters before each sample as required by the NIOSH 7500 Method.

24. The Denver lab does not run full scans from 10 to 80 degrees on respirable or bulk samples analyzed by the XRD process as required by the NIOSH 7500 Method.

25. While the NIOSH 7500 Method requires calibration of the XRD machine each day, the Denver lab calibrates the instrument every three to four weeks. The Denver lab also does not

prepare the calibration standards required by the NIOSH 7500 Method. In contrast, NIOSH calibrates at every sample set, and Dr. Bartley, who appeared as MSHA=s expert believes that MSHA should do likewise.

26. Although MSHA has the diffraction Afingerprint@ for silica, in less than one percent of the cases, does the Denver lab attempt to match the fingerprint to analyses it creates of silica presence on samples. No such comparison was made in the instant case.

27. MSHA deviates from the NIOSH 7500 Method and/or their own internal laboratory procedures in at least three important areas: (1) A significant amount of the time, the lab does not account for interferences which are known to exist at the various silica diffraction peaks; (2) the lab does not calibrate its XRD equipment in accordance with the Method; and (3) the lab does not have an effective methodology to screen out oversize particles which can both overstate the weight of the respirable dust on any sample and adversely affect the XRD analysis of the silica in the dust.

DISCUSSION, FURTHER FINDINGS, AND CONCLUSIONS

I. MSHA=s ASingle-Shift@ Sampling Enforcement Strategy

This case is before me on remand from the Commission. Asarco, Inc. v. Secretary of Labor, 17 FMSHRC 1 (1995). In directing further proceedings, the Commission indicated that Asarco is questioning and I should consider Athe merits of single-shift sampling,@ *id.* at 3, 5. In pursuing that question before me, Asarco has framed the issue to be decided as whether MSHA=s single sample strategy complies with the plain meaning of its own regulation. (Post-Hearing Brief at 1-2; Reply Brief at 1-2). The Secretary=s view of the posture of the case accords; namely, that Asarco has challenged the enforcement strategy that MSHA has adopted to determine compliance with a mandatory regulation promulgated pursuant to the Mine Act. (Post-Hearing Brief at 7; *see also* Union Reply Brief at 1).

This issue has been thoroughly addressed by the parties in the evidentiary submissions entered in the record and in post-hearing and reply briefs. Indeed, at the hearing, broad leeway was given for exploration of matters even, at best, remotely relevant to the issue. I conclude, after due consideration and for the following reasons, that single-shift sampling as used by MSHA as an enforcement strategy is consistent with the regulation and is reasonably calculated to further the goal of protecting the health of miners who work in underground metal and nonmetal mines. The strategy is not, therefore, a basis upon which Citation No. 3052272 issued to Asarco at its Young Mine, a zinc mine, should be vacated.

Asarco contends that MSHA is failing properly to enforce a mine operator=s compliance with Section 57.5001(a) because MSHA fails to collect a sufficient number of samples to determine accurately the concentrations of respirable silica dust to which miners are exposed. (*See*, *e.g.*, Reply Brief at 4, 5-6). Since MSHA is interpreting and applying its own regulation, the enforcement strategy selected by the agency must be accorded significant deference.

The task of the administrative law judge is Anot to determine whether the Secretary=s interpretation of the regulation charged to his administration is the one . . . [he] would reach if deciding the question as a matter of first impression.@ Rather, the judge should Adefer to the Secretary=s interpretation of his regulations unless it is clearly erroneous.@ Energy West Mining Co. v. FMSHRC, 40 F.3d 457, 462 (D.C. Cir. 1994), relying on Udall v. Tallman, 380 U.S. 1, 16-17 (1965). *See also* Secretary of Labor v. Buffalo Crushed Stone, Inc., 19 FMSHRC 231 (February 1997). As the Commission has noted, it is not its (nor a judge=s) task Ato devise the best method of monitoring injuries sustained by miners but to determine whether the Secretary=s method, as implemented by the regulations, is reasonable.@ Energy West Mining Co., 15 FMSHRC 587, 592 (1993). Failure of the Commission, or the judge, to extend the appropriate deference to the Secretary=s interpretation of his own regulation and of the Mine Act is a basis to reverse the Commission=s, or the judge=s, decision. *See* Secretary of Labor v. Cannelton Industries, Inc., 867 F.2d 1432 (D.C. Cir. 1989).

The U.S. Court of Appeals for the Fourth Circuit in Secretary of Labor v. Mutual Mining, Inc., 80 F. 3d 110, 114 (1996) has held that:

> The Secretary=s role of rulemaking and enforcement explains this deference to the Secretary=s interpretations of the [Mine] Act. In order to promulgate health and safety standards in the first instance, the Secretary must evaluate a wide variety of information regarding the operation of the mining industry. And in enforcing these standards -- through, for instance, periodic inspections of mines and issuance of citations -- the Secretary comes into constant contact with the daily operations of the mines. *See* Martin v. OSHRC, 499 U.S. 144, 152 (1991). In short, developing rules and enforcing them endows the Secretary with the >historical familiarity and policymaking expertise,= *id*. at 153, that are the basis for judicial deference to agencies.

See also Secretary of Labor v. FMSHRC, No. 96-1164 (D.C. Cir. May 2, 1997) (AWe have >several times observed that the primary purpose of the Mine Safety Act was to protect mining=s most valuable resource -- the miner[,] and that Congress intended the Act to be liberally construed to achieve this goal.= [Citing Cannelton Industries, *supra*, 867 F.2d at 1437.]@).

Moreover, the Supreme Court has held that Abroad@ deference is warranted when the agency=s action involves the evaluation of a complex and highly technical regulatory program within the area of the agency=s expertise. Thomas Jefferson University v. Shalala, 512 U.S. 504 (1994). *See also* Huls America, Inc. v. Browner, 83 F.3d 445, 452 (D.C. Cir. 1996) (according Aextreme@ deference when scientific and technical matters are involved). Moreover, when confronted with the merits of two respirable dust sampling methods applied by MSHA to coal mines, the Tenth Circuit noted that the ASecretary has discretion to adopt any sampling method that approximates exposure with reasonable accuracy@ and the Secretary Ais not required to impose an arguably superior sampling method as long as the one he imposes is reasonably calculated to prevent excessive exposure to respirable dust.@ The Court expressly stated that Aour task is not to determine which method is better.@ American Mining Congress v. Marshall, 671 F.2d 1251, 1256 (10th Cir. 1982).

To the contrary, Asarco argues that the Secretary=s position, here, that single-shift sampling comports with the regulation and MSHA=s mission, is not entitled to deference. The chief reason advanced is that MSHA, assertedly, has taken inconsistent positions on single versus multiple samples. (Post-Hearing Brief at 33-35; Reply Brief at 6-8). The record undisputedly shows, however, that Section 57.5001(a) is specifically applicable to underground metal and nonmetal mines and has been virtually the same since first enacted in 1970; and, since 1974, identical to that relied on in this case. The record likewise shows that MSHA has consistently used single-shift samples for enforcement of the regulation.

I find, furthermore, that it is irrelevant to compare multiple-shift sampling used by MSHA for coal mines with single-shift sampling used for metal and nonmetal mines. The Commission held in its remand decision in this case that the legal underpinnings relied on for coal=s multiple samples are not applicable to metal and nonmetal mines. Asarco, *supra*, 17 FMSHRC at 5. In addition, the Commission pointed out that the Secretary has stated his intention to use single-shift samples as well as multiple-shift samples to enforce the respirable dust standard in coal mines, *see* 59 Fed. Reg. 8356 (Feb. 18, 1994). *Id*. at 5 n.4. Thus, it is merely reemphasized, here, that MSHA=s enforcement trend, overall, is toward, not away from single-shift sampling. (*See also* Secretary=s Reply Brief at 31-32; Union Reply Brief at 13).

In light of the foregoing and, thus, bearing in mind the deference due to the Secretary=s decision to use single samples in enforcing Section 57.5001(a), I turn to the mission MSHA is fulfilling. The record shows that it is to protect the health of miners; but not, as Asarco argues, by enforcing a mine operator=s obligation to maintain, over time, working conditions throughout the mine which meet a permissible airborne contaminant exposure standard set by the agency. Rather, MSHA=s approach is from the perspective of individual miners who may be overexposed to airborne contaminants at any time and in any place in the mine, and for whom even one such incident may have health repercussions, either immediately or in the future. There is much in the record before me suggesting that in underground mining, constancy in the airborne contaminant environment is not to be expected -- or is likely achievable -- on either a long- or short-term basis. MSHA, in any event, has made clear that Section 57.5001(a) is not intended to protect miners simply from long-term overexposure and its effects. While that is a goal to be desired, the regulation is directed to the detection of overexposure on a given day by sampling individual miners at their work station during their normal work shift.

This kind of detection is accomplished by spot checking mines, with frequency -- on a one-, three-, or five-year schedule -- dictated by the perceived risk factor at each mine for its miners. When the mines are checked, an MSHA inspector selects miners to wear personal sampling equipment throughout their work shift to sample exposure to airborne contaminants, with the work shift monitored by the inspector for normality. MSHA acknowledges that this approach has been adopted, in large part, because of scarce resources and budgetary constraints. The agency currently has only 308 inspectors to oversee approximately 110,000 metal and nonmetal mines employing some 220,000 miners. And, aside from enforcement of Section 57.5001(a), MSHA=s inspectors perform many other health and safety activities. It is to be noted, nonetheless, that when spot checking results in issuance of a citation for a violation of Section 57.5001(a) because of an overexposure to a sampled miner, the inspector will return to the mine to sample the same miner, again, to ensure that the mine operator has eliminated the cause for excessive exposure.

Therefore, it is by means of periodically auditing what is going on in a mine -- vis-à-vis a miner sampled for the audit -- that MSHA seeks, under Section 57.5001(a), to ensure that mine operators are aware of their ongoing obligation to provide a healthy working environment at all times for all miners. Accordingly, I find that neither conditions in the mine as a whole nor the mine=s history of airborne contaminant sampling -- whether by the mine operator or MSHA -- is considered by MSHA in citing a violation of Section 57.5001(a), nor should they be, given the purpose of the regulation.

The airborne contaminant exposure standard against which a mine operator=s compliance with Section 57.5001(a) is judged, is, *in part*, a list of Athreshold value limits@ (TLVs), each applicable to a particular airborne contaminant. These TLVs are then modified by MSHA -- to account for Asampling and analytical@ errors (SAE) -- to establish an Aexposure limit@ (EL) which, in turn, is compared with a Ashift-weighted average@ (SWA) calculation when the sample has been taken over a full shift. The SWA value must be higher than the EL value to substantiate a violation of Section 57.5001(a). Thus, it is the foregoing process, *in entirety*, which constitutes MSHA=s compliance standard for Section 57.5001(a). (*See* Stipulations 18-19; Zalesak, Tr. 361-78, 523-24, 527, 625, 717).

It is to be noted that Asarco is not questioning TLV values used by MSHA, per se, or the concept of SAE adjustment. Moreover, quite clearly, SAE adjustment works to the advantage of mine operators because it raises the concentration level given in the TLV. That increase currently amounts to 20 percent. It also cannot be discounted -- as an advantage to mine operators -- that MSHA projects SAE adjustment on TLV concentration levels set out more than 20 years ago.

Thus, Section 57.5001(a) provides that Athe exposure to airborne contaminants shall not exceed, on the basis of a time weighted average [TWA], the threshold value limits [TLVs] adopted by the American Conference of Governmental Industrial Hygienists [ACGIH] . . . .@ Thereafter, incorporated by reference into the presently effective Section 57.5001(a) are pages 1 through 54 of ATLV=s Threshold Limit Values for Chemical Substances in Workroom Air Adopted by ACGIH for 1973.@ (TLV for 1973 at Secretary=s Exhibit 8).

On pages 1 and 3 of TLV for 1973 there are statements that:

> Threshold limit values refer to airborne concentrations of substances and represent conditions under which it is believed that nearly all workers may be repeatedly exposed day after day without adverse effect. Because of the wide variation in individual susceptibility, however, a small percentage of workers may experience discomfort from some substances at concentrations at or below the threshold limit, a smaller percentage may be

> affected more seriously by aggravation of a pre-existing condition or by development of an occupational illness.
>
> * * * * *
>
> They [TLVs] should be used as guides in the control of health hazards and should not be used as fine lines between safe and dangerous concentrations.
>
> * * * * *
>
> In spite of the fact that serious injury is not believed likely as a result of exposure to the threshold limit concentrations, the best practice is to maintain concentrations of all atmospheric contaminants as low as is practical.

The record shows that the TLVs, so defined, are consistent with MSHA=s stated objective for Section 57.5001(a). I conclude, therefore, that the TLVs have been embraced by the agency as recognized and scientifically established limits of exposure and are used as Aguides@ in an enforcement strategy aimed at enforcing the obligation of mine operators to protect their miners, Aday after day,@ from overexposure. Asarco is misguided in asserting that MSHA is using TLVs as Afine lines@ of demarcation between Asafe@ and Adangerous.@ (Post-Hearing Brief at 9). The record shows that MSHA is cognizant that the effect of exposure beyond a TLV -- let alone, of exposure at or below -- can vary widely from individual to individual. Almost any level of concentration may be safe, on the one the one hand, and dangerous, on the other, depending on the physical condition of the miner exposed to it. MSHA is not seeking to determine, through TLVs, whether a miner Ais getting disease.@ (Zalesak, Tr. 147-52, 467-68).

On pages 1-2 of <u>TLV for 1973</u> (emphasis added) there are statements that:

> Threshold limit values refer to time-weighted concentrations for a 7 or *8-hour workday and 40-hour workweek.*
>
> .
>
> * * * * *
>
> Time-weighted averages [TWAs] permit excursions above the limit provided they are compensated by equivalent excursions below the limit during the workday. *In some instances it may permissible to calculate the average concentration for a workweek rather than for a workday*.

The language just highlighted, apparently, is the catalyst for Asarco=s attack on MSHA=s use of single-shift sampling to enforce Section 57.5001(a). It is by reliance on these phrases that Asarco primarily alleges that the regulation=s TLVs are Along-term@ averages and, consequently, must be sampled for Aover more than one single 8 hour shift.@ (Post-Hearing Brief at 8, citing Drs. Corn and Hall).

I am compelled to note that the record is devoid of any indication as to why, after more than 20 years of enforcing Section 57.5001(a) by single samples pursuant to this language, a multiple sample position has suddenly surfaced. In this regard, it is further puzzling because there is no evidence that since 1973, there has been a scientific or technical development invalidating a single sample procedure. Dr. Hall, an expert witness for Asarco, testified that in the world of industrial hygiene, there is a Awide range@ of sampling procedures (including single-shift sampling), all with their own strengths and weaknesses. He has testified that there is no perfect sampling strategy. (Hall, Tr. 2688-89).

It appears, therefore, that Asarco fervently believes that multiple sampling would be a better way for MSHA to use the 1973 TLVs in enforcing Section 57.5001(a). But, as earlier found, this is not a matter for me to decide. My task is confined to whether MSHA=s interpretation of Section 57.5001(a), to require the use of single-shift sampling, is consistent with the language of the regulation and Ais reasonably calculated to prevent excessive exposure to respirable dust,@ American Mining Congress, *supra,* 671 F.2d at 1256.

Asarco=s same expert, Dr. Hall, has acknowledged that when one looks at TLV for 1973, there is no sampling strategy delineated for users of the document. (Hall, Tr. 2688; *see also* Hewett, Tr. 3630-31). Accordingly, I am not surprised that different sampling approaches might be projected on the foregoing A8-hour workday and 40-hour workweek@ language. However, the Secretary=s position is that Aworkweek@ places parameters on the reliability of a TWA-TLV, which is for exposure up to an 8-hour workday per 40-hour workweek; in other words, for a work shift in terms of the traditional working schedule rather than a novel one (longer hours a day per fewer days a week, etc.). The Secretary rejects the notion that Aworkweek,@ in this sentence, is referring to multiple exposure averages in sampling for TWA-TLVs listed in TLV for 1973.

The Secretary=s further position is that although TLV for 1973 suggests that there might be Asome instances@ calling for multiple samples to arrive at an Aaverage concentration for a workweek,@ no guidance has been forthcoming from ACGIH as to what those circumstances might be. MSHA=s expert witness, Dr. Hewett, states that the pronouncement in TLV for 1973 definitively pointing to single samples as the sampling method for TWA-TLVs is that their TWAs Apermit excursions above the limit provided they are compensated by equivalent excursions below the limit *during the workday*.@ (Emphasis added). According to Dr. Hewett, ACGIH is not talking about Abetween shift excursions,@ ACGIH is talking about Awithin shift excursions@ and, consequently, about TWA-TLVs which are sampled for within the work shift time-frame. (Hewett, Tr. 1773, 1775).

Based on the record before me, including the TLV for 1973 language quoted above, I conclude that MSHA=s use of single-shift sampling is a permissible sampling strategy --if not the required one -- for determining TWA-TLVs within the meaning of Section 57.5001(a). Moreover, such conclusion is reinforced by the earlier finding herein that these TWA-TLVs do not constitute the entire exposure standard for which mine operators are held accountable pursuant to Section 57.5001(a). Through SAE adjustment, Section 57.5001(a)=s overexposure level is higher than TWA-TLVs would otherwise permit. In short, consistent with a single-shift sampling strategy, the regulation holds mine operators accountable for overexposing individual miners on a given day, during a normal work shift, at one discrete location in the mine.

In this context, I am equally persuaded that MSHA=s use of single-shift sampling is a reasonable means of ascertaining, to the requisite degree of accuracy, whether the enforcement concentration level standard in Section 57.5001(a) has been exceeded. Asarco argues that Ano single 8 hour sample can provide an accurate representation of worker exposure,@ largely because MSHA does not consider Aenvironmental variability@ within a miner=s breathing zone. According to Asarco, it has been demonstrated that when samplers are placed on a miner=s opposite lapels, different exposure amounts will result. (Post-Hearing Brief at 11-14, 43-44).

The Secretary does not dispute that there can be such variation in contaminant concentration in an individual=s breathing zone. But, it is pointed out that scientific and technical limitations prohibit anyone from determining what an individual is actually breathing. Therefore, the accepted practice used by industrial hygienists is to *estimate* an individual=s *exposure* concentration level, with that estimate derived from a sample collected by a device placed within the breathing zone. Dr. Hewitt states, ANobody measures true exposure, I=ve not seen it done, and I doubt that it=ll be done in the near or distant future.@ (Hewitt, Tr. 1915-16, 2049-50).

In sum, I conclude that MSHA=s single-shift sampling enforcement strategy is consistent with the language in Section 57.5001(a) and is a reasonable means for determining and preventing excessive exposure to airborne contaminants in underground metal and nonmetal mines consistent with the intent of the regulation.

II. <u>Collection and Laboratory Analysis of the Dust Sample at Bar</u>

Given that MSHA=s single-shift sampling strategy is a Areasonable@ one, I now turn to the issue of the dust sample that was collected on March 16, 1994 in the Young Mine, later analyzed at MSHA=s Denver lab and subsequently cited in Citation No. 3052272.

Unlike nearly everyone else that was involved in the trial of this case, I am primarily interested in the dust sample at issue in this case. After all, it is Citation No. 3052272 that has been contested. That citation concerns a <u>particular</u> dust sample that was collected by an MSHA inspector and later analyzed by MSHA at its Denver laboratory.

MSHA uses a variety of scientific instruments to collect dust samples and analyze them for silica. Some variation is inherent in the operation of these instruments, which is described by a Acoefficient of variation@ (ACV@) that recognizes that analytical instrumentation will produce results that deviate to some extent from the true value. Since several independent instruments are used to collect and analyze silica dust samples, MSHA developed an error factor that accounts for all of the independent CVs associated with each of the instruments. MSHA determined the error factor associated with the entire sampling and analytical process for silica dust to be 20 percent. They use that error factor to effectively increase the TLV by 20 percent for respirable silica bearing dust samples to attempt to assure a 95 percent confidence level that the TLV itself was exceeded. [1]

Asarco, on the other hand, makes a credible claim that MSHA=s reliance on the NIOSH 7500 Method=s error factor is unreasonable because, among other objectionable practices, MSHA does not follow the NIOSH 7500 protocol. Asarco believes, for example, that there is far greater variability attributable to the XRD analysis of a sample than MSHA allows for in its error factor, and at least for the sample at bar, I agree.

MSHA=s stated error factor of 20 percent is only reliable if MSHA=s lab in fact adheres to the essential aspects of the 7500 Method, which they did not do in this particular case. In this particular instance, there were also several deviations from their own laboratory procedures, let alone the 7500 Method.

When sampling in the mines, MSHA uses a 10 millimeter, nylon cyclone to separate particles that are larger than 10 micrometers from the smaller, respirable particles. Dust particles are drawn into the cyclone using a constant flow pump, which operates at a steady and constant flow rate throughout the collection period. The pump is calibrated before and after the sample is taken to assure that the actual flow rate was within 5 percent of the desired flow rate throughout the 8-hour sampling period. The pump draws air at a rate of 1.7 liters per minute, which is the proper flow rate for the cyclone. At this flow rate, the majority of the larger non-respirable particles are captured on the surface of the cyclone or fall into the grit pot, while the smaller, respirable particles are collected on the sample filter.

When sampling for silica dust, the MSHA inspector selects the mine, or miners, perceived to be at the greatest risk of exposure to high levels of silica bearing dust. The inspector then collects the sample using the procedure described in Finding of Fact No. 9, and when the sample has been collected over the shift, sends the sample to the Denver lab for weighing and analysis.

I find that MSHA uses a reasonable sample collection procedure utilizing scientifically recognized sampling equipment. I also find that the particular sample at issue herein was collected in accordance with MSHA=s standard procedure over a Anormal@ work shift.

After the collected sample arrives at the Denver lab, it is prepared and weighed by the robotic weighing device as described in Finding of Fact Nos. 13-15.

Asarco complains in this instance that the unexplained loss of weight on the control filter caused MSHA to add .036 milligrams (36 micrograms) to the weight reading they obtained from the robotic weighing device. Further, the lab in this instance failed to follow their own informal procedure to investigate this anomalous result. Rather, they simply processed the compliance sample notwithstanding the unexplained and unexpected weight gain on the control filter.

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1 In this case, MSHA issued a citation not because it determined that the actual average exposure was 2.30 mg/m^3, but rather because it determined, with 95 percent confidence, that the average exposure exceeded the TLV.

However, as I stated earlier in the findings of fact, this particular sample would have been cited regardless of the additional 36 micrograms added to the sample weight. I therefore find that to be a harmless error in this instance.

A problem somewhat related to the weighing process is MSHA=s admitted failure to screen for oversize particles which can geometrically overstate dust weight and also adversely impact XRD analysis. I noted in Finding of Fact Nos. 7-8 that there is no evidence of oversize particles being an issue with this particular sample, but it is admitted by MSHA experts that the 10-millimeter cyclone does permit oversize particles through to the filter. Per Tom Tomb, who is Mr. Gregory=s peer at MSHA=s Pittsburgh lab, it would not be a complicated procedure to examine the sample to see whether it has any particles that exceed 10 microns in diameter using a microscope and a light grid. He expressed no opinion as to why they don=t do that at the Denver lab, although because the sample has been run through the 10-millimeter nylon cyclone, he would not be concerned in any event.

Sample collection and weighing aside, the more serious problem with the citing of the sample at bar lies with the XRD analysis performed at the Denver lab. MSHA uses a CV of 11 percent to account for variations in the results associated with the use of the XRD technology. Asarco argues that the coefficient of variation attributable to MSHA=s XRD analysis in the ranges of silica most commonly found on samples is closer to 20 percent. Using this number for the XRD, Asarco extrapolates that a more appropriate error factor for MSHA to apply to silica samples analyzed at its Denver lab would be 40 percent vice the 20 percent that is actually used.

A starting point for this discussion is the NIOSH 7500 Method for XRD analysis. Early on in the trial of this case, MSHA claimed they used this protocol to analyze samples for respirable silica dust. Mr. Gregory testified:

> A. At the present time, we use the NIOSH 7500 Method.
>
> *   *   *
>
> Q. To your knowledge, are there any parts of this protocol that MSHA disregards in doing its analytical work?
>
> A. No.

(Tr. 757-58).

This original version of events would soon change. This witness, MSHA=s expert on the XRD process and indeed, the person responsible for the analysis of these samples at the Denver lab, would soon retreat from his above-quoted testimony. MSHA in fact did <u>not</u> follow this NIOSH protocol in this case for the analysis of this sample in many important respects. In addition, the Denver lab also failed to follow their own Astandard procedure@ in analyzing this sample. The following discussion will address only the most significant particulars. But clearly enough to vacate this citation, beyond any doubt.

The XRD instrument and analysis of this particular sample is described in detail in Finding of Fact Nos. 16-20. Suffice it to repeat here only that the lab determined that they encountered interference from another mineral besides silica on at least three of the four known silica diffraction peaks and in the end relied only on the first, unverified peak to issue the instant citation. They are unable to determine what mineral was causing the interference. Mr. Gregory testified that: A[W]e didn=t check for interferences on this particular sample.@ (Tr. 1051). The reason followed.

Mr. Gregory explained:

> The standard procedure would be that when respirable samples are submitted, a bulk sample is also submitted. And if we got some unusually high quartz readings or series of readings that did not agree, normally the procedure would be to look at the bulk sample that was submitted along with the respirable samples in order to determine what the interferences might be.
>
> * * *
>
> Q. . . . . Are you saying there was a bulk sample submitted from the Asarco Young Mine together with the sample in this case?
> A. As it turns out, there was not.
>
> Q. Why wasn=t there?
>
> A. That would be something that the inspector would be responsible for. So I don=t know the answer to that.

(Tr. 1052).

The importance of the missing bulk sample was admitted by Mr. Gregory:

> Q. You only looked at four peaks, and you had three that you knew you had interference on and one that you did not believe you had interference on.
>
> How did you verify that you didn=t have interference on the first peak, the 26.6 peak?
>
> A. I think we=ve already talked about this, and I=ve testified to the fact that the normal procedure would be to look at the bulk sample if it=s provided and look for interference at whatever specific peak one may be trying to measure.
>
> Q. But you didn=t have a bulk sample here?

A. No, no, in this case that procedure -- we could not follow that procedure.

(Tr. 1070).

With no bulk sample available in this instance, there was no method of verifying that the most intense peak of silica measured at 26.6 degrees was interference free. Yet MSHA did not void this sample, but rather used it as the basis for the citation at bar. Even Counsel for the Secretary acknowledged at this point that this particular sample would be very difficult to sustain.[2] I have to agree.

On cross-examination, Mr. Gregory admitted to several deviations from the NIOSH 7500 Method. For example, he was asked:

Q. You don=t follow the 7500 Method requirements for scanning blank silver filters through the machine before and after scanning samples, do you?

A. Not precisely, no. . . .

(Tr. 1143).

With regard to running full scans from 10 to 80 degrees on respirable samples analyzed by the XRD machine, Mr. Gregory was asked:

Q. [A]lthough the NIOSH 7500 Method requires the full scan on respirable samples, you [Denver lab] didn=t perform one on the respirable sample in this case, did you?

A. No, we didn=t.

---

[2] In a colloquy with the Court, Mr. Turow candidly stated:
Frankly, this aberration I think places into question whether this particular sample, whether the XRD process for this particular sample can be supported because in this case apparently the lab didn=t use its standard procedure for this particular sample. . . . [I]t=s going to be very hard for us to bear our burden of proof with respect to this particular sample, which as your Honor has pointed out, is the issue before the Court. . . .[F]rankly, the sample itself may not be able to withstand the burden of proof.

(Tr. 1083-86).

(Tr. 1150).

Other deviations from the NIOSH 7500 Method for XRD analysis are already contained in the findings of fact, supra, and I will not reiterate them here. See Finding of Fact Nos. 25-27.

I conclude that MSHA=s utilization of the NIOSH 7500 Method=s error factor is unwarranted, at least as it concerns the sample at bar, because MSHA did not follow the NIOSH 7500 protocol in analyzing this sample.

I also conclude that MSHA=s Astandard procedures@ are not standardized with NIOSH-accepted procedures, are not replicable by the public (mining industry) and seem to vary from day to day and sample to sample. Moreover, in several important respects, the MSHA lab did not even comply with its own internal Astandard@ procedures.

Accordingly, I conclude that the Secretary=s failure to meet his burden of proof regarding reliability of the XRD analysis of the particular sample at issue in this case must result in the instant citation being vacated. MSHA=s failure to account for the actual variability experienced at its Denver lab using a hybrid standard/non-standard procedure loosely based on the NIOSH Method makes the result unreliable. I have no confidence in its accuracy. What I would suggest as a Afix@ is that MSHA develop a written laboratory procedure for the XRD analysis of silica incorporating the essential aspects of the NIOSH 7500 Method. And then, most importantly, once that procedure is in place, follow it, so that all parties interested in the resultant analysis have some point of reference to begin a critical evaluation of that result, should they choose to do so. As it is, the analytical procedure appears so haphazard that no one can be sure of what procedure they are actually following on any particular sample on any given day.

Furthermore, on July 8, 1996, Asarco filed a motion for declaratory relief wherein it requested that this court issue Aa declaration that the MSHA Denver laboratory cannot reliably report the amount of silica present on any single sample that it analyses under its current analysis procedures.@ Based on the foregoing findings of fact and conclusions of law pertaining to the sample at issue herein, that motion IS GRANTED.

Asarco=s motion for sanctions against the Secretary of Labor for discovery-related issues IS DENIED. I believe counsel for the Secretary of Labor did a commendable job providing documentation pursuant to Asarco=s many demands.

Lastly, I am mindful that I have not discussed every evidentiary basis for every contention of each of the parties contained in this voluminous record of trial. However, I have read and considered everything that is in the record and discussed those portions which I felt were necessary to my determination.

ORDER

On the basis of the foregoing findings and conclusions, Asarco=s contest IS GRANTED, and the Contested Citation No. 3052272 IS VACATED.

Roy J. Maurer
Administrative Law Judge [3]

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[3] Although I was the presiding judge during the trial of this case, on March 1, 1997, in the midst of the briefing schedule, I was transferred from the Commission to the U.S. Department of Transportation. I have, however, through the above-stamped issuance date of this decision, remained an administrative law judge appointed pursuant to 5 U.S.C. ' 3105.

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