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Environmental Asbestos: Problems Associated with PLM Soil Analysis

Jennifer A. Decker
Nancy Woo
U.S. Environmental Protection Agency
San Francisco, California
Ann M. McDonald
Woodward-Clyde Consultants
Oakland, California

ABSTRACT

Experience with laboratories and a review of data generated through the Superfund process confirm a lack of standardized sample preparation techniques and counting rules using Polarized Light Microscopy for asbestos-laden soil samples. Variation in analytical procedures reduces comparability of data generated by different laboratories. The absence of a standardized analytical technique makes decision-making difficult and may be affecting remedial consistency from site to site. As such, PLM soil results should be limited in use to characterization of spatial boundaries of contamination and for preparation of qualitative risk assessments. Extrapolation from soils data to quantitative risk assessments is not recommended until an adequate standardized methodology for the analysis of asbestos in soils has been adopted. National research needs are highlighted.

INTRODUCTION

The U.S. EPA "Interim Method for the Determination of Asbestos in Bulk Insulation Samples" is specifically designed to estimate the concentrations of total asbestos content in building materials. Due to the lack of any other published methodology, this "Interim Bulk Method"[1,2] has become the industry standard for quantifying asbestos concentrations in soils. However, this technique has not been evaluated for accuracy or precision for soil analysis.

This study compares Polarized Light Microscopy (PLM) analyses from three laboratories used for the RI at the Atlas and Coalinga Asbestos sites. These data are compared with results from six other asbestos sites and the Research Triangle Institute (RTI) bulk asbestos round robin program. The review highlights the need for a standardized risk-based analytical methodology specifically designed for asbestos in soils. Until a method is developed, PLM soil sample results should not be relied upon to quantify asbestos concentrations for contaminant transport or risk assessment models.

The Atlas Asbestos Mine site is located within the New Idria serpentinite mass, a 50-mi.^{2} serpentinite formation rich in chrysotile asbestos in California. The Coalinga Asbestos site is located just southeast of the New Idria formation and the Atlas site. Both sites contain abandoned asbestos mill facilities, tailings piles and associated open pit mines. These sites were listed on the NPL in 1984. The principal health concern is inhalation of air-borne asbestos-laden dust by local residents and site visitors.

SOIL ANALYSES BY POLARIZED LIGHT MICROSCOPY

(PLM) Soil samples for the Atlas and Coalinga Superfund sites were sent to three laboratories—EMS Laboratory, McCrone Environmental Services and Med-Tox Associates—for PLM analysis as specified by the EPA Interim Bulk Method. Each laboratory used the PLM "field of view" estimation technique to determine the asbestos content of soil samples.

Laboratory Consistencies

Data sheets and personal communications with the laboratories confirm that the microscopists generally agree on the overall identification of serpentine structures and mineral content in the Atlas and Coalinga soil samples.[3-8] The microscopists confirm the samples are more complex than typical chrysotile product samples. The soils contain high concentrations of chrysotile, antigorite, and lizardite, minerals having the same basic chemical formula ($Mg_3SiO_2O_5(OH)_4$) but different crystal structures. These minerals exist as polymorphs of each other and as both asbestiform and non-asbestiform aggregates.[4,9-15] The combination of minerals causes somewhat unusual optical properties such as higher refractive indices when compared to chrysotile from other ore bodies. Central stop dispersion staining colors observed by McCrone are noted to be more typically associated with antigorite, a non-fibrous form of serpentine.[5] EMS and McCrone both report gold to magenta dispersion staining colors.[16] To more accurately characterize the PLM-DS results, TEM was performed on a subset of samples. The analyses confirm that the serpentine minerals in the samples are principally chrysotile asbestos structures.[3-8,16]

ANALYTICAL DIFFERENCES BETWEEN LABORATORIES

There are four major variables in PLM analyses among the laboratories which are:

- Sample preparation prior to analysis
- Differences in analytical techniques
- Lack of standardized terminology and chrysotile/serpentine classification schemes
- Fundamental differences in counting rules

Sample Preparation

Sample preparation techniques differ among the laboratories, principally on sieving and the use of grinding by mortar and pestle.[3,6,8,14,16-19] The EMS samples are sieved and separated into fine (<2mm) and coarse fractions (>2mm); without grinding the fine fraction, the samples are prepared for PLM analysis. Based on the presence or absence of asbestos in the fine fraction, coarse fractions are lightly ground as necessary for analysis. McCrone sample preparation is similar to EMS and includes sieving samples into size fractions of gravel (<2mm), sand (50µm-2mm) and silt and clay (>50µm) without grinding. Sample preparation by Med-Tox includes lightly grinding soil samples for a few seconds to one minute each with a mortar and pestle (Table 1).

Table 1
Use of Grinding and Sieving Techniques for PLM Soil Sample Preparations

Site Name / Laboratory Name	Grinding with Mortar/Pestle	Sieves
Atlas/Coalinga EMS	No	>2mm coarse <2mm fine
Atlas/Coalinga McCrone	No	Sieved 41/60 samples into >2mm gravel 50um-2mm sand <50um silt/clay
Atlas/Coalinga Med-Tox	Yes, mortar/pestle; few seconds to one minute/sample	No
City of Coalinga IT Lab	Yes, homogenized in 250 ml jars; no mortar/pestle	No
Asbestos in Roads Study Med-Tox	Yes, few seconds to one minute/sample	Yes, used a 200-mesh screen to separate silt & coarse fractions
Globe, Arizona TMA/EAL	Microscopist no longer at lab so follow-up no possible.	
Copper Cove Roads/ Copperopolis EAL Lab	Yes, sufficient time to reduce veins, etc. to free fibers/total asbestos measured	No
South Bay Asbestos Versar	No	Yes, used sieve to separate .710, .355 and .250 mm fraction
Quarry Samples Clayton	Yes, lightly	No

Since the EPA Interim Bulk Method states that sample preparation is "dependent upon the samples encountered and personal preferences" of the microscopist, each of these techniques is within the margin of acceptability for PLM sample preparation. Grinding, for example, is only one of the six acceptable means for obtaining a homogenous, representative subsample.[1,2] Further review of sample preparation techniques from other asbestos Superfund removal and remedial sites[20-26] indicates similarly widespread inter-laboratory variations in the use of sieving and grinding (Table 1).

Some bias due to grinding and sieving soils is expected, although the magnitude of the bias caused by the preparation differences is unknown without a standard for comparison.[16] It is well documented in asbestos studies that natural serpentine minerals and manufactured asbestos-laden products including chrysotile structures are easily broken into elongated cleavage fragments and free fibers by natural weathering processes, and by chemical or mechanical disturbances in vitro, in vivo and in the general environment.[9,10,27-36] McCrone's sample report, for example, notes that the matted fibers "displaced more pronounced fibrosity upon crushing."[5] This easily fragmented characteristic of chrysotile is an important factor in soil concentrations, and sample preparation should be standardized to eliminate this variable in the PLM analytical procedure.

Analytical Methods

In addition to sample preparation techniques, the wide range of asbestos content in these soils is due in part to the different analytical techniques employed by the laboratories (Table 2). All three laboratories use the "field of view" estimation technique with dispersion staining (PLM/DS). EMS and Med-Tox results are reported as per cent area.[3,4,6] McCrone analyzes by PLM/DS and stereomicroscopy, reporting results as per cent volume.[4,5] Of the other laboratories listed on Table 2, one uses the point count technique.[20] As the EPA Interim Bulk Method specifies use of point counting or "an equivalent estimation method," no standardization of methodology or units is assured.

Table 2
Analytical Techniques for PLM Soil Analyses

Site Name / Laboratory Name	Analytical Techniques
Atlas/Coalinga EMS Laboratory	PLM/DS Visual Estimates TEM
Atlas/Coalinga McCrone	PLM/DS Stereomicroscopy
Atlas/Coalinga Med-Tox	PLM/DS Visual Estimates TEM
City of Coalinga IT Lab	Point Count PLM/DS TEM
Asbestos in Roads Study Med-Tox	PLM/DS Visual Estimates TEM
Globe, Arizona TMA/EAL	Visual Estimates
Copper Cove Roads Copperopolis EAL Lab	PLM/DS TEM
South Bay Asbestos Versar	PLM/DS Stereomicroscopy
Quarry Samples	Visual Estimates

* Analytical methods include: Point Count, Visual/field of view estimation, PLM/Dispersion Staining, Stereomicroscopy and Transmission Electron Microscopy (TEM).

Table 3
Terminology Used in PLM Soil Analyses Reports

Site Name / Laboratory Name	Terminology Used for Structures of Concern
Atlas/Coalinga EMS Laboratory	Chrysotile
Atlas/Coalinga McCrone	Serpentine Asbestos
Atlas/Coalinga Med-Tox	Elongate Serpentine or Chrysotile
City of Coalinga IT Lab	Chrysotile
Asbestos in Roads Study Med-Tox	Chrysotile/Antigorite
Globe, Arizona TMA/EAL	Chrysotile
Copper Cove Roads Copperopolis EAL Lab	Chrysotile
South Bay Asbestos Versar	Chrysotile or Serpentine
Quarry Samples	Chrysotile

Terminology

Another variable identified in this study is a result of non-standardized classification schemes and terminology used by each laboratory for the observed serpentine or chrysotile structures. For spatially similar samples from the Atlas and Coalinga sites, the microscopists' morphological descriptions include: white matted plates; pale green elongated serpentine; lathe-shaped bundles; acicular fibers; rounded, somewhat flattened fragments; silky, wavy bundles; harder green, elongated chips; cleavage fragments and serpentine minerals.[3,4,5,6,16] The reported structures of concern include chrysotile, serpentine asbestos, and elongate serpentine, among others (Table 3). For the end-user of the soils data, this variability in terminology makes interpretation of results very difficult.

Counting Rules

Since inter-laboratory terminology is not standardized, differences in counting rules are difficult to assess. All three laboratories count structures with aspect ratios greater than or equal to 3:1. However, discussions with the microscopists show that counting rules beyond aspect ratio definition vary based on their understanding of the end-use of the data by the clients.

EMS counted only free chrysotile fibers that could easily become air-borne without mechanical disturbances of the soil matrices; the microscopist understood that the soil results were to be used as input to an air transport model, and therefore counted only free fibers.[3,16] McCrone reported chrysotile and all fibrous chrysotile-like minerals as "serpentine asbestos"; this category included particles such as fibrous grains, matted clumps of fibers and green elongated chips;[4,5,16] McCrone attempted to estimate the total friable asbestos content of the soils. Due to the non-standard mineralogical content of these samples, Med-Tox reported both "elongate serpentine" and "chrysotile asbestos" concentrations. Elongate serpentine was defined by Med-Tox as including all serpentine fragments including chrysotile, lizardite and antigorite; this category represented the Med-Tox estimate of the maximum asbestos content of the soils. "Chrysotile asbestos" was defined by Med-Tox as having classical chrysotile properties and included bundles of fibers.[4,6,16]

"Asbestos fibers" are defined in the EPA Interim Bulk Method as having an aspect ratio of 3:1 and being positively identified as an asbestos mineral based on six optical properties.[1] These three laboratory counting procedures, therefore, are within this margin of acceptability for the Interim PLM Bulk Method. Qualitatively, the EMS results appear to represent the immediately releasable asbestos content while the Med-Tox data probably estimate the maximum quantity of potentially releasable asbestos.

However, as there is no standardized terminology or inter-laboratory quality assurance program for asbestos in soils, the accuracy of the sample results is impossible to determine.

Sample Results

A partial yet representative subset of the Atlas and Coalinga soil data is presented in Tables 4 and 5. Med-Tox and McCrone split samples show high correlation and precision (Table 4). This agreement of analytical results can most likely be attributed to extensive communication with the client before analysis of the samples, thereby ensuring both laboratories were attempting to fulfill similar objectives.

The range of asbestos concentrations reported by EMS and Med-Tox highlights the need for standardization of the PLM method (Table 5). Since the EMS and Med-Tox samples are not splits, an exact comparison of data cannot be made. Nonetheless, precision of data for similar types of soils from spatially comparable locations would be expected to be better than the >1% to 85% range of asbestos measured.[3,8,16]

EPA INTERIM METHOD FOR INSULATION VERSUS SOIL SAMPLES

The Research Triangle Institute (RTI) December 1987 Bulk Analysis Round acceptance criteria for asbestos content of building material split samples ranges from <1% to 80% area.[37] Similar ranges of acceptability can be seen in all other rounds as well. RTI describes the laboratory performances as assessed on the basis of correct identification of "positive" (containing < or = 1% asbestos) and "negative" (> or = 1% asbestos) or false negatives using the Interim Bulk Method. "Although the criteria are lenient," the RTI report states, "they recognize the basic concern of the public—the presence or absence of asbestos fibers in a submitted sample." The Interim Bulk Method was designed for use as a screening tool, recognizing the typical asbestos content and size range of insulation and building materials (generally 5-20% asbestos and longer fibers). Identification of the presence or absence of asbestos is the current goal, not precise quantification of asbestos content. However, in order to use soil data for hazardous waste site characterization and as input to risk assessments, accurate quantification of the asbestos content becomes the goal.

The ASTM is in the process of peer reviewing a more quantitative PLM bulk analytical methodology for insulation materials. This effort and the RTI round robin program may improve quantitation.[16,38]

However, a more quantitative methodology for bulk insulation is not sufficient for analysis of asbestos content in soils. The RTI round robin and building samples are more homogenous than is commonplace with environmental asbestos samples. Soils containing high concentrations of non-asbestiform serpentine material, cellulose, particulates and other interferences can cause difficulties in conclusive identification of chrysotile fibers by skilled microscopists.[33,35,36] The limits of optical resolution of light microscopy do not allow short or narrow fibers to be easily quantified.[16,38] Moreover, TEM soil samples and air monitoring data from the Atlas and Coalinga sites confirm that short fibers are typical of the asbestos deposits in the New Idria

Table 4
Inter-laboratory Comparison of Atlas and Coalinga Split Soil Samples*

Lab	Med-Tox		McCrone
Soil Type	Elongate Serpentine % Area	Chrysotile Asbestos %Area	Serpentine Asbestos % Volume
Mine/Mill Tailings	80% 65%	60% 25%	85% 80%
Serpentine Formation	85%	50%	65%
Streambeds	15%	5%	32.5%
Alluvial Fan	1%	1%	1%

* The Med-Tox and McCrone data are from split samples. These five samples from five soil types (i.e. mill tailings, streambeds, etc.) are representative of the 60 samples reviewed for this study.

Table 5
Results of Non-split, Spatially Comparable Samples from the Atlas and Coalinga Sites*

Lab	EMS	Med-Tox	
Soil Type	Chrysotile Asbestos % Area	Elongate Serpentine % Area	Chrysotile Asbestos %Area
Mine/Mill Tailings	<1% 1%	80% 65%	60% 25%
Serpentine Formation	1%	85%	50%
Streambeds	<1%	15%	5%
Alluvial Fan	<1%	1%	1%

* These five EMS and Med-Tox samples are not splits of the identical soil samples. However, the EMS and Med-Tox sample locations are spatially comparable as listed under "soil type" and should have a lower range of asbestos content. This range is representative of the 64 EMS and 60 Med-Tox sample results reviewed for this study.

Formation. In light of these and other differences between insulation materials and soil samples, the use of the Interim Bulk Method may be inappropriate for quantitation of asbestos in soils.

Table 6
Summary of Inter-laboratory Comparisons of PLM Sample Preparation and Analytical Techniques

Site Name Lab Name	No. Samples (1)	Analy. Method (2)	Sample Prep Grinding (3)	Sieves (4)
Atlas/Coalinga EMS	64	% Area Visual PLM/DS TEM	No	>2mm coarse <2mm fine
	Description of Structures: Chrysotile; free fibers of 3:1 aspect ratio; large, non-fibrous, nonrespirable particles not counted even if could see veins Comments by Lab: Strong evidence of fibrous material in serpentine; attempted to estimate abestos available for immediate release, not total serpentine-bound chrysotile. Understood data to be used as input to air transport model. (1-2 hrs/sample)			
McCrone	60	% Vol PLM/DS Stereo	No	Sieved 41/60 >2mm gravel 50um-2mm sand <50um silt/cl
	Description of Structures: Serpentine Asbestos; plates of matted serpentine represented the dominant morphology of asbestos; less abundant, harder green elongated chips became more fibrous when crushed at 40X. (1-2 hrs/sample)			
(A/C cont.) Med-Tox	60	% Area Visual PLM/DS TEM	Yes. Mortar & pestle; seconds to 1 min/sample	No
	Description of Structures/Comments by Lab: Elongate Serpentine; only particles with 3:1 aspect ratio, including antigorite, lizardite and chrysotile. Includes non-asbestiform structures and is probably maximum releasable asbestos in samples. Chrysotile; definite chrysotile only with 3:1 aspect ratio; includes bundles with fibrous split ends. (1-3 hrs/sample)			
City of Coalinga IT Lab	454	% Area Point Count Few TEM & DS	Partial; were homogenized in 250 ml jar before prep. No mortar/pes	No
	Description of Structures: Chrysotile; aspect ratios 3:1; if no appearance of fibers, were not counted; non-asbestiform lizardite, antigorite were not counted. Verbal Comments by Lab: Lab performed analysis looking for fibrous materials. Lab uses point count as no standard written methodology exists for field estimation, noting that dups analyzed by other labs for other sites routinely give higher results than IT. (20 min./sample)			
Asbestos in Roads Study Med-Tox	18	% Area PLM-DS and TEM	Yes. Few seconds to 1 min/sample	Yes. Used a 200-mesh screen; interested in silt & coarse
	Description of Structures: Chrysotile/antigorite; contained fibrous chrysotile and other non-fibrous antigorite, picrolite; non-disaggregated, tightly-bound fibers of 3:1 aspect ratio. Sample analysis rushed which may have affected results.			
Globe, AZ TMA/EAL	Visual estimation used on all PLM samples; as microscopist no longer at lab for discussions, no follow-up possible.			
Copper Cove Roads Copperopolis EAL Lab	29	% Vol PLM-DS & few TEM	Yes. Sufficient time to reduce veins to free fibers for est. of total asbestos	No
	Structure of Concern/Lab Reports: Chrysotile; sample observed to have high concentrations of antigorite, lizardite, quartz, feldspar and misc. particles in samples of 30-70% chrysotile; grinding time key as concern was to quantify total asbestos content potentially available for release with high vehicular activity on roads.			
South Bay Asbestos Versar	11	% Area Stereo and few PLM-DS	No.	Yes. Used a sieve to separate .710, .355 and .250 mm fractions
	Description of Structures: Chrysotile; fibers with 3:1 aspect ratio; included free fibers and chrysotile associated with particulates; tightly-bound matts counted. Serpentine; contained chrysotile and other fibers; included non-asbestiform serpentine rock and serpentine-bound chrysotile.			
Quarry Samples Clayton Labs	50	% area Visual Est.	Yes, lightly	No
	Description of Structures: Chrysotile; counted aspect ratio 3:1, >5um length; looked for asbestiform characteristics.			

1) Sample number is the total number of soil samples reviewed for the purposes of this paper only and is a subset of the total samples taken at each site.

2) Analytical methods include: Point Count, Visual/field Estimation, PLM/Dispersion Staining, Stereomicroscopy and Transmission Electron Microscopy (TEM).

3 and 4) Grinding and sieving procedures are based on the written lab reports, if available, or on discussions with the microscopists.

SOIL RESULTS FOR ASSESSMENT OF ASBESTOS EXPOSURES AND RISK

Asbestos literature clearly indicates a correlation between the respirability and carcinogenicity of air-borne asbestos structures. Overall carcinogenicity of asbestos is determined by physical characteristics such as length, aspect ratio, aerodynamic diameter, and durability of the fibers. More specifically, penetration of fibers into the alveolar spaces of the lungs and correlation with increased incidences of asbestos-related disease appear to relate to the concentrations of fibers having both diameters of 0.025µm or less and lengths of more than 5 to 8µm [9,10,13,28-32,39-44] Although shorter fibers (>5 µm) have been shown to be less carcinogenic than long, thin structures, short fibers appear to be biologically active with no known concentration below which there is no risk.[28,39-42,44-47] As stated by W. Nicholson in *Airborne Levels of Mineral Fibres in the Non-occupational Environment*, "Because of their much greater number, fibres >5 µm may be the dominant contributors to the cancer risk of a particular aerosol."[46] The issue of short fiber risk is particularly important for asbestos waste sites due to long-term exposures to low concentrations of predominantly shorter fibers. Other particulates and debris associated with the asbestos may also influence the biological activity of the fibers.[32] Unfortunately, definitive resolution of the issue of the carcinogenicity of short chrysotile fibers is very likely years away.[9,10,28-32,41]

Ideally, the end-use of the soil sampling data should determine both the sample preparation techniques and counting rules. As inhalation is the route of exposure posing the greatest risk, any friable portion of asbestos-laden soil is of potential concern. Fiber dimensions should be conserved in soil samples in order to extrapolate from occupational data to ambient air risks. Alteration of fiber size distribution by sample preparation should not be done unless total mass of asbestos is to be used as a measure of potential exposure. Changes in the fiber size distribution also reduce the usefulness of the soil data for comparison with air monitoring data. Additionally, soil results are often the basis for soil emission factors for lifetime risk models.[7,11,23,39,47-49] Wide ranges of soil results such as those presented in this paper lead to model outputs and risk calculations that can vary by many orders of magnitude. As the importance of quantification of risk and risk-based cleanup criteria increases in Superfund and the hazardous waste industry, precise quantification of asbestos soil concentrations and the determination of the relationships between those concentrations, emission models and risk become more critical goals. Risk-derived counting rules and analytical techniques should be established so that health experts make decisions about fibers of concern.

THE NEED FOR A STANDARDIZED, RISK-BASED ANALYTICAL METHOD

Asbestos experts and agencies nationwide see the need for additional research to determine a regulatory standard for ambient asbestos exposures and to solve some of the analytical problems discussed in this paper. [9,10,16,28,38] Although microscopist training and experience with PLM sample analysis greatly improve reproducibility and precision,[16] the laboratories interviewed for the purposes of this study recognize the need for more a specific protocol and a quality assurance program for PLM soil analysis.[16-38] Possibilities for a soil methodology include using a combination of techniques such as PLM-DS, X-ray diffraction and scanning electron microscopy.

TEM analysis of soils has been proposed by some as a conservative approach for measuring the total amount of asbestos that could potentially act as an emission source when the soil matrix is disturbed.[16,38,51] However, TEM analysis of soils may not be an affordable alternative to PLM for large investigations. Based on currently available technology, TEM may not be a useful measure of asbestos content if the results are to be used for quantification of risk or for inter-laboratory and site-to-site data comparisons. Some of the concerns about the use of TEM include the extrapolation from minute samples to total site characterization; the high costs associated with obtaining a statistically significant number of samples; the absence of a standardized written soil methodology; total asbestos mass being dominated by a few veins or large particles; and size fraction loss due to grinding for TEM sample preparation.[16,38,50-52] A comparison of the Atlas and Coalinga PLM and TEM data will be presented in a future paper, but initial data reviews indicate that TEM and PLM results have no apparent correlation.

In addition to analytical techniques, standardized sample preparation procedures, terminology and counting rules need to be specified. Immediately releasable asbestos fibers and maximum friable asbestos content might be used for calculating current and future potential risk, respectively. Reporting formats should be standardized to include, among others: descriptions of sample preparation, equipment used, optical properties, detailed descriptions of counting parameters, observed interferences, and comments. Quality assurance might include intra-laboratory checks and an inter-laboratory round robin program.

POLICY ISSUES.

Considerable effort has been made by EPA, other regulatory agencies at the county and state levels, and private industry in search of appropriate analytical methodologies for soil sampling.[20,25,39,48,51,60] Moreover, non-standardized methodologies raise concerns associated with the lack of consistency for cleanup criteria, the defense of capital and maintenance costs for remediation, and the unclear risks to the public.

The 1988 EPA Report to Congress on asbestos-containing materials in buildings[61] suggests that EPA serve as a clearinghouse for evolving asbestos technical information related to public buildings. The report discusses the option of the Federal government supporting much of the research needed to fill the data gaps for regulating asbestos in buildings. The EPA Administrator's cover letter to the report states, "The nation's study and research program should be proportional to the magnitude of the public investment in controlling the problem which is contemplated." Asbestos regulation and remedial costs for NPL and non-NPL sites have similar financial impacts on all levels of government and private industry based on the number of abandoned asbestos sites identified to date (i.e. [39,57,59]). The costs of investigations and remediation at the existing NPL and removal sites alone will ultimately amount to millions of dollars. The magnitude of the potential expenditures at asbestos waste sites warrants a national investment in the development of sampling protocols to justify those costs and make technically sound decisions.

CONCLUSIONS

Many experts have called for improvements in methodologies for asbestos sampling and analytical techniques. Based on this study of the Atlas and Coalinga data and inter-laboratory variations at six other sites, a risk-based analytical methodology specifically designed for asbestos in soils is needed. Standardized sample preparation and analytical techniques, terminology, counting methodologies and data reporting formats are essential for reduction of variables for quantification of asbestos in soils. A nationwide inter-laboratory quality assurance program is recommended.

Until a standardized soil analytical methodology is developed, the currently available data base supports taking only limited soil samples for identification of spatial limits of asbestos contamination and for enforcement purposes. Sampling with the objective of quantifying asbestos concentrations, in particular as data input to air emission or risk modeling efforts, should be discouraged.

DISCLAIMER:

This paper does not in any way reflect the opinion of the U.S. EPA and should not be construed to represent official Agency policy.

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DATE:	03/14/2008 at 01:15:00 PM
BRIEFING FOR:	CONGRESSIONAL COURTESY BRIEFING
PREPARED BY:	David Lawler — Geologist — 916 978-4360
FROM:	Mike Pool — California State Director — 916 978-4600
SUBJECT:	ARSENIC CONTAMINATION ISSUES ASSOCIATED WITH HISTORIC AND MODERN MINING OPERATIONS ON CALIFORNIA BLM LANDS.

PURPOSE OF THE BRIEFING DOCUMENT:

During the 2005-2007 time period, the California abandoned mine lands (AML) program staff discovered nearly a dozen sites with significant off-site arsenic discharges from abandoned or recently inactive mines on BLM lands in the California Desert District (CDD). The discovery and reporting of additional AML sites with significant arsenic contamination issues are expected to continue over the next several years.

ISSUES:

Current Status: The BLM California AML program has recently developed a 5-year strategic plan for the Desert District. The plan focuses on AML mine site characterization, prioritization and remediation for both environmental health hazards (e.g. arsenic-contaminated mine sites and watersheds) and physical safety hazards in residential and high-use recreational areas on or near BLM lands.

BLM, federal and industry toxicologists are involved in a series of arsenic health studies and assessments at major mine sites, including the historical mining operations on the public lands near Randsburg and Johannesburg in northwestern San Bernardino and northeastern Kern County. These studies typically involve the assessment of several types of potential arsenic exposure for humans, including dermal contact with mine tailings, airborne exposure from dust, and water runoff carrying arsenic during storm events. Potential impacts to sensitive or threatened species, such as the California Desert tortoise may have also occurred . Most of these CDD historic mine arsenic contamination sites involve processed mine wastes (i.e. mill tailing and waste rock) that have discharged offsite and have migrated adjacent to or within residential areas, nearby schools or high-use recreational areas. The western portion of the CDD is in a classic "urban interface area" characterized by rapid urbanization and residential subdivision expansion into desert areas that until recently were sparcely populated.

A recent ongoing OIG investigation of the California AML program has recommended that all AML sites with significant potential human health and environmental impacts must be formally reported immediately to the appropriate regulatory authorities. A formal reporting process has recently been implemented. As soon as the CERLCA release of a toxic substance (arsenic) has been discovered and confirmed, the National Response Center (NRC) is notified within a 24-hour period. BLM news releases and early alerts are compiled and sent out prior to NRC notification. In addition, local congressional staff are notified when an arsenic contaminated AML site has been identified within their respective district. BLM and the state of California environmental regulatory agencies are working cooperatively to insure that environmental and hazmat responsibilities are being properly addressed under both state and federal laws.

MAIN DECISION OR MESSAGE:

A formal discovery and site reporting process has been implemented. An interagency technical team was created to focus on these numerous potential high-risk arsenic AML sites. The team provides comprehensive and rapid assessment of arsenic technical issues to BLM specialists and management, including the scope and extent of contamination. This data is assimilated into technical reports and guidance for effective decision-making by field and state office management.

BUREAU PERSPECTIVE:

Technical reports and guidance provide effective decision-making tools for field and state management, allowing implementation of reasonable CERLA remedial and removal actions for migitating the effects the arsenic-contaminated mine wastes at priority AML sites.

CONTACT:	David Lawler	Geologist	916 978-4360