



Method 435

Determination of Asbestos Content of Serpentine Aggregate

Adopted: June 6, 1991

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1 PRINCIPLE AND APPLICABILITY

1.1 Principle

Asbestos fibers may be released from serpentine rock formations and are determined by microscopic techniques. The results are very sensitive to sampling procedures. The analytical results are reported in percent asbestos fibers which is the percent number of asbestos fibers contained in 400 randomly chosen particles of a bulk sample. Since the homogeneity of the material is unknown, the uncertainty in the sampling cannot be defined. The uncertainty of the analytical technique is two percent if twenty asbestos fibers are counted in a sample of 400 particles. The derivation of this uncertainty value is explained in Section 7.4.

1.2 Applicability

This method is applicable to determining asbestos content of serpentine aggregate in storage piles, on conveyor belts, and on surfaces such as roads, shoulders, and parking lots.

2 DEFINITIONS

2.1 Bulk Sample

A sample of bulk material.

2.2 Grab Sample

A sample taken from a volume of material.

2.3 Composite Sample

A mixture or blend of material from more than one grab sample.

2.4 Serpentine

Serpentinite, serpentine rock or serpentine material.

2.5 Executive Officer

The term Executive Officer as used in this method shall mean the Executive Officer of the Air Resources Board (ARB) or Air Pollution Control

Officer/Executive Officer of a local air pollution control district/air quality management district.

3 APPLICABLE SOURCES

This method can be used to obtain bulk material samples from three types of sources:

1. Serpentine aggregate storage piles
2. Serpentine aggregate conveyor belts
3. Serpentine aggregate covered surfaces

4 SAMPLING APPARATUS

4.1 Serpentine Aggregate Storage Piles

Tube insertion often provides the simplest method of aggregate material investigation and sampling. Insertion tubes shall be adequate to provide a relatively rapid continuous penetration force.

4.1.1 Thin-walled tubes should be manufactured as shown in Figure 1. The tube should have an outside diameter between 2 to 5 inches and be made of metal or plastic having adequate strength for penetration into aggregate piles. These tubes shall be clean and free of surface irregularities including projecting weld seams. Further information on these tubes can be found in Table 1 and ASTM D 1587-83, which is incorporated herein by reference.

4.1.2 The insertion tube can be made out of commercially available two inch PVC Schedule 40 pipe. Further information on the tube can be found in Table 2.

4.1.3 A round point shovel may be used.

4.2 Serpentine Aggregate Conveyor Belts

4.2.1 Sampling of aggregate off a conveyor belt requires a hand trowel, a small brush, and a dust pan.

4.2.2 Two templates as shown in Figure 2 are needed to isolate material on the conveyor belt.

4.2.3 An automated belt sampler may be used.

4.3 Serpentine Aggregate Covered Surfaces

A shovel, a hand or machine-operated auger or other suitable equipment can be used to collect samples of aggregate materials on covered surfaces.

4.3.1 Hand-Operated Augers.

4.3.1.1 Helical Augers-Small lightweight augers such as spiral-type augers and ship-type augers may be used. A description of these augers can be found in ASTM D1452-80, which is incorporated herein by reference.

4.3.1.2 Orchard barrel and open spiral-type tubular augers may be used to collect samples. These augers range in size from 1.5 through 8 inches, and have the common characteristic of appearing essentially tubular when viewed from the digging end. Further description of these auger types can be found in ASTM D1452-80.

4.3.1.3 Clam Shell or Iwan-Type post-hole augers may be used to collect samples from surfaces generally 2 through 8 inches in diameter and have a common mean of blocking the escape of soil from the auger. Further description of these augers can be found in ASTM D1452-80.

4.3.2 Machine-Operated Augers

Machine-Operated Augers such as helical augers and stinger augers may be used. These augers are normally operated by heavy-duty, high-torque machines, designed for heavy construction work. Further description of these augers can be found in ASTM D1452-80.

4.3.3 A round point shovel can also be used to obtain a sample of aggregate covered surface material.

5 SAMPLING

The sampling procedure has been developed to provide an unbiased collection of bulk samples. A sampling plan, including a description of how the grab samples will be randomly collected and the number of samples to be collected, shall be developed. Prior to conducting any sampling the sampling plan shall be submitted to the Executive Officer for approval, if the sampling is conducted for determining compliance with a rule or regulation. The amount of composite 200 mesh material, as described below, shall be sufficient to provide a sample to the source or Executive Officer, if requested, and a sample to be archived for future use.

A single test as described below shall cover:

a) 1000 tons of aggregate for piles and conveyor belts, or

- b) one acre aggregate covered surface, or
- c) one mile of aggregate covered road, or
- d) two acres or two miles of dual aggregate covered shoulders.

Exposure to airborne asbestos fibers is a health hazard. Asbestos has been listed by the Governor as causing cancer and identified by the Air Resources Board as a toxic air contaminant. Serpentine aggregate may contain asbestos. Bulk samples collected can contain friable asbestos fibers and may release fibers during sampling, handling or crushing steps. Adequate safety precautions should be followed to minimize the inhalation of asbestos fibers. Crushing should be carried out in a ventilated hood with continuous airflow (negative pressure) exhausting through an HEPA filter. Handling of samples without these precautions may result in the inhalation of airborne asbestos fibers.

5.1 Serpentine Aggregate Storage Piles

Serpentine aggregate storage piles typically have a conical or a triangular prism shape. The aggregate is introduced at the top of the pile and is allowed to flow over the side. This action, called sloughing, causes a size segregation to occur with the finer material deposited towards the top of the pile.

The locations where grab samples will be taken are randomly chosen over the surface of the pile. The method of randomly choosing the sampling locations is left up to sampling personnel but must follow the procedures specified in the sampling plan. For 1000 tons of product, a grab sample shall be taken at a minimum of three randomly chosen sampling locations. A minimum of three grab samples shall be taken even if the product pile contains less than 1000 tons of material. The slough is raked or shoveled away from the sampling location. A sampling apparatus is inserted one foot into the pile and the material is removed and is placed in an appropriate sized sampling container. Some of the possible sampling apparatus is discussed in Section 4.1. Each of the grab samples shall be placed in the same sample container. This composited sample shall be crushed to produce a material with a nominal size of less than three-eighths of an inch. Before crushing, the sample must be adequately dried. ASTM Method C-702-80, which is incorporated herein by reference, shall be used to reduce the size of the crushed grab sample to a one pint aliquot. The one pint aliquot shall be further crushed using a Braun mill or equivalent to produce a material of which the majority shall be less than 200 Tyler mesh. An aliquot of the 200 mesh material shall be put into a labeled sealed container. The label shall contain all the information described in Section 6 (except item 4).

5.2 Serpentine Aggregate Conveyor Belts.

Serpentine aggregate is transported from the rock crushing plant to a product stacking belt and finally to a storage pile or to a waiting truck for delivery to a buyer.

The grab samples shall be taken from the product stacking belt or if this is not possible then at the first transfer point before the stockpile. The grab samples shall be collected by stopping the belt a minimum of three times or using an automated sampler. The method of randomly choosing the sampling locations and intervals is left up to sampling personnel but must follow the procedure specified in the sampling plan. For 1000 tons of product, a grab sample is taken at a minimum of three randomly selected intervals. A minimum of three samples shall be taken even if the generated product is less than 1000 tons. Each time the belt is stopped to take a grab sample, templates, as shown in Figure 2, are placed a minimum of six inches apart to isolate the material on the belt. The material within the templates is removed with a small shovel or with a brush and a dust pan for the finer material and is placed in an appropriate sized sampling container. Each of the grab samples shall be placed in the same sample container. This composited sample shall be crushed to produce a material with a nominal size of less than three-eighths of an inch. Before crushing, the sample must be adequately dried. ASTM Method C-702-80, which is incorporated herein by reference, shall be used to reduce the size of the crushed grab sample to a one pint aliquot. The one pint aliquot shall be further crushed using a Braun mill or equivalent to produce a material which the majority of which shall be less than 200 Tyler mesh. An aliquot of the 200 mesh material shall be put into a labeled sealed container. The label must contain all the information listed in Section 6 (except item 4).

5.3 Serpentine Aggregate Covered Surfaces

5.3.1 Serpentine Aggregate Covered Roads

A serpentine aggregate-covered road shall be characterized by taking grab samples from a minimum of three randomly chosen locations per mile of road. The method of randomly choosing the sampling locations is left up to sampling personnel but must follow the procedures specified in the sampling plan. A minimum of three samples shall be taken even if the road is less than one mile long. Section 4.3 describes some of the possible sampling apparatus used to collect the grab samples. Grab samples shall not contain underlying soils. Each of the grab samples shall be placed in the same sample container. This composited sample shall be crushed to produce a material with a nominal size of less than three-eighths of an inch. Before crushing, the sample must be adequately dried. ASTM Method C-702-80 shall be used to reduce the size of the crushed grab sample to a one pint aliquot. The one pint aliquot shall be further crushed using a Braun mill or equivalent to produce a material which the majority shall be less than 200 Tyler mesh. An aliquot of the 200 mesh material shall be put into a labeled sealed container. The label must contain all the information listed in Section 6 (except item 4).

5.3.2 Serpentine Aggregate Covered Areas

A serpentine aggregate-covered play yard or parking lot shall be characterized by taking grab samples from a minimum of three randomly chosen locations per acre. The method of randomly choosing the sampling locations is left up to sampling personnel but must follow the procedure specified in the sampling plan. A minimum of three samples shall be taken even if the area is less than one acre. Section 4.3 describes some of the possible sampling apparatus for collecting the sample. Grab samples shall not contain underlying soils. Each of the grab samples shall be placed in the same sample container. This composited sample shall be crushed to produce a material with a nominal size of less than three-eighths of an inch. Before crushing, the sample must be adequately dried. ASTM Method C-702-80 shall be used to reduce the size of the crushed grab sample to a one pint aliquot. The one pint aliquot shall be further crushed using a Braun mill or equivalent to produce a material which the majority shall be less than 200 Tyler mesh. An aliquot of the 200 mesh material shall be put into a labeled sealed container. The label must contain all the information listed in Section 6 (except item 4).

5.3.3 Serpentine Aggregate Covered Road Shoulders

The sampling procedure specified in Section 5.3.1 or 5.3.2 shall be used for road shoulders covered with serpentine aggregate. The only difference is that a minimum of three grab samples shall be taken over a length of two miles of shoulder or over an area of two acres of shoulder surface. The word shoulder is meant to imply shoulders on both sides of the road. For serpentine aggregated covered shoulders, the sampling plan specified in Section 5 shall indicate whether the samples are collected on a two mile or two acre basis.

6 SAMPLING LOG

A sample log must be kept showing:

- 1) A unique sample number.
- 2) Facility name.
- 3) Facility address or location where sample is taken.
- 4) A rough sketch, video tape, or photograph of the specific sampling locations.
- 5) Date and time of sampling.
- 6) Name of person performing sampling.

7 ANALYTICAL PROCEDURE

7.1 Principle and Applicability

Samples of serpentine aggregate taken for asbestos identification are first examined for homogeneity and preliminary fiber identification at low magnification. Positive identification of suspect fibers is made by analysis of subsamples with the polarized light microscope.

The principles of optical mineralogy are well established.^{2,3} A light microscope equipped with two polarizing filters coupled with dispersion staining is used to observe specific optical characteristics of a sample. The use of plane polarized light allows the determination of refractive indices along specific crystallographic axes. Morphology and color are also observed. A retardation plate is placed in the polarized light path for determination of the sign of elongation using orthoscopic illumination. Orientation of the two filters such that their vibration planes are perpendicular (crossed polars) allows observation of the birefringence and extinction characteristics of anisotropic particles.

Quantitative analysis involves the use of point counting. Point counting is a standard technique in petrography for determining the relative areas occupied by separate minerals in thin sections of rock. Background information on the use of point counting³ and the interpretation of point count data⁴ is available.

This method is applicable to all bulk samples of serpentine aggregate submitted for identification and quantification of asbestos components.

7.2 Range

The analytical method may be used for analysis of samples containing from 0 to 100 percent asbestos. The upper detection limit is 100 percent. The lower detection limit is 0.25 percent.

7.3 Interferences

Fibrous organic and inorganic constituents of bulk samples may interfere with the identification and quantitation of the asbestos content. Fine particles of other materials may also adhere to fibers to an extent sufficient to cause confusion in the identification.

7.4 Analytical Uncertainty

The uncertainty method is two percent if twenty asbestos fibers are counted in a sample of 400 particles. The uncertainty of the analytical method may be assessed by a 95% confidence interval for the true percentage of asbestos fibers in the rock. The number of asbestos fibers in the sample is assumed to have a

binomial distribution. If twenty asbestos fibers are found in a sample of 400 particles, a one-sided confidence interval for the true percentage has an upper bound of seven percent or an analytical uncertainty of two percent.¹¹ The confidence interval used here is an "exact" interval computed directly from the binomial distribution.

7.5 Apparatus

7.5.1 Microscope

A low-power binocular microscope, preferably stereoscopic, is used to examine the bulk sample as received.

- * Microscope: binocular, 10-45X
- * Light Source: incandescent, fluorescent, halogen or fiber optic
- * Forceps, Dissecting Needles, and Probes
- * Glassine Paper, Clean Glass Plate, or Petri dish
- * Compound microscope requirements: A polarized light microscope complete with polarizer, analyzer, port for wave retardation plate, 360° graduated rotating stage, substage condenser, lamp, and lamp iris
- * Polarized Light Microscope: described above
- * Objective Lenses: 10X
- * Dispersion Staining Objective Lens: 10X
- * Ocular Lens: 10X
- * Eyepiece Reticule: 25 point or 100 point Chalkley Point Array or cross-hair
- * Compensator Plate: 550 millimicron retardation
- * First Order Red I Compensator: 530 nanometers

7.6 Reagents

Refractive Index Liquids: 1.490 - 1.570, 1.590 - 1.720 in increments of 0.002 or 0.004.

Refractive Index Liquids for Dispersion Staining: High-dispersion series, 1.550, 1.605, 1.630 (optional).

UICC Asbestos Reference Sample Set: Available from UICC MRC Pneumoconiosis Unit, Lisndough Hospital Penarth, Glamorgan CF6 1xw, UK and commercial distributors.

Tremolite-asbestos: Available from J. T. Baker.

Actinolite-asbestos: Available from J. T. Baker.

Chrysotile, Amosite, and Crocidolite is available from the National Institute of Standards and Technology.

Anthophyllite, Tremolite, Actinolite will be available from the National Institute of Standards and Technology during the first quarter of 1990.

8 PROCEDURES

Exposure to airborne asbestos fibers is a health hazard. Bulk samples submitted for analysis are usually friable and may release fibers during handling or matrix reduction steps. All samples and slide preparations should be carried out in a ventilated hood or glove box with continuous airflow (negative pressure) exhausting through an HEPA filter. Handling of samples without these precautions may result in exposure of the analyst and contamination of samples by airborne fibers.

8.1 Sample Preparation

An aliquot of bulk material is removed from the one pint sample container. The aliquot is spread out on a glass slide. A drop of staining solution with appropriate refractive index is added to the aliquot. A cover slide is placed on top of the sample slide.

The first preparation should use the refractive index solution for Chrysotile. If during the identification phase other asbestiforms are suspected to be present in the sample, due to their morphology, then additional analyses shall be performed with the appropriate solutions. Report the percentages of each asbestiform and combine percentages to determine total asbestos concentrations.

8.2 Fiber Identification

Positive identification of asbestos requires the determination of the following optical properties:

Morphology (3 to 1 minimum aspect ratio)
Color and pleochroism

Refractive indices
Birefringence
Extinction characteristics
Sign of elongation

Table 3 lists the above properties for commercial asbestos fibers. Natural variations in the conditions under which deposits of asbestiform minerals are formed will occasionally produce exceptions to the published values and differences from the UICC standards. The sign of elongation is determined by use of the compensator plate and crossed polars. Refractive indices may be determined by the Becke line test. Becke line test or dispersion staining shall be used to identify asbestos fibers. Central stop dispersion staining colors are presented in Table 4. Available high-dispersion (HD) liquids should be used.

8.3 Quantification of Asbestos Content

Asbestos quantification is performed by a point-counting procedure. An ocular reticle (point array) or cross-hair is used to visually superimpose points on the microscope field of view. The point counting rules are as follows:

1. Record the number of points positioned directly above each particle or fiber.
2. Record only one point if two points are positioned over same particle or fiber.
3. Record the number of points positioned on the edge of a particle or fiber.
4. If an asbestos fiber and a matrix particle overlap so that a point is superimposed on their visual intersection, a point is scored for both categories.
5. If a test point lies over an ambiguous structure, no particle or fiber is recorded. Examples of "ambiguous" structures are:
 - a) fibers whose dispersion colors are difficult to see
 - b) structures too small to categorize
6. A fiber mat or bundle is counted as one fiber.

For the purpose of the method, "asbestos fibers" are defined as mineral fibers having an aspect ratio greater than 3:1 and being positively identified as one of the minerals in Table 3.

A total of 400 points superimposed on either asbestos fibers or nonasbestos matrix material must be counted over at least eight different preparations of representative subsamples. Take eight forceps samples and mount each

separately with the appropriate refractive index liquid. The preparation should not be heavily loaded. The sample should be uniformly dispersed to avoid overlapping particles and allow 25 - 50 percent empty area within the fields of view. Count 50 nonempty points on each preparation, using either

A reticle with 100 points (Chalkley Point Array) and counting 25 points in at least two randomly selected fields.

or

A reticle with 25 points (Chalkley Point Array) and counting at least two randomly selected fields.

or

A reticle with a standard cross-hair and counting at least 50 randomly selected fields.

For samples with mixtures of isotropic and anisotropic materials present, viewing the sample with slightly uncrossed polars or the addition of the compensator plate to the polarized light path will allow simultaneous discrimination of both particle types. Quantitation should be performed at 100X. Confirmation of the quantitation result by a second analyst on 10 percent of the analyzed samples should be used as standard quality control procedure. All optical properties in Section 8.2 shall be determined to positively identify asbestos.

EXCEPTION I

If the sample is suspected of containing no asbestos a visual technique can be used to report that the sample does not contain asbestos. The rules are as follows:

1. Prepare three slides as described in Section 8.3.
2. View 10 fields per preparation. Identify all fibers.
3. If all fibers are nonasbestos, report no asbestos were found and that visual technique was used.
4. If one fiber is determined to be asbestos, discontinue the visual method and perform the point counting technique as described above.

EXCEPTION II

If the sample is suspected to have an asbestos content in excess of ten percent, a visual technique can be used to report that the sample contains greater than

ten percent asbestos. The standard operating procedure of the visual technique allowed in the National Institute of Standards and Technology's National Voluntary Laboratory Accreditation Program, Bulk Asbestos Handbook, National Institute of Standards and Technology publication number NISTIR 88-3879 dated October 1988, which is incorporated herein by reference, shall be followed.

9.0 CALCULATIONS

The percent asbestos is calculated as follows:

$$\% \text{ asbestos} = (a/n) 100\%$$

a = number of asbestos counts,
n = number of nonempty points counted (400)

If a = 0, report "No asbestos detected"
If a > 0, report the calculated value to the nearest 0.25%

If "no asbestos detected" is reported by the point counting technique, the analyst may report the observation of asbestos fibers in the non-counted portions of the sample.

10.0 ALTERNATIVE METHODS

10.1 Alternative Sampling Methods

Alternate sampling methods may be used as long as they are substantially equivalent to the sampling methods discussed in Section 5 and approved by the Executive Officer of the Air Resources Board. The ARB Executive Officer may require the submittal of test data or other information to demonstrate equivalency.

10.2 Analytical Methods

An alternative analytical method may be used as long as it produces results substantially equivalent to the results produced by the point counting method and approved by the Executive Officer of the Air Resources Board. The ARB Executive Officer may require the submittal of test data or other information to demonstrate equivalency.

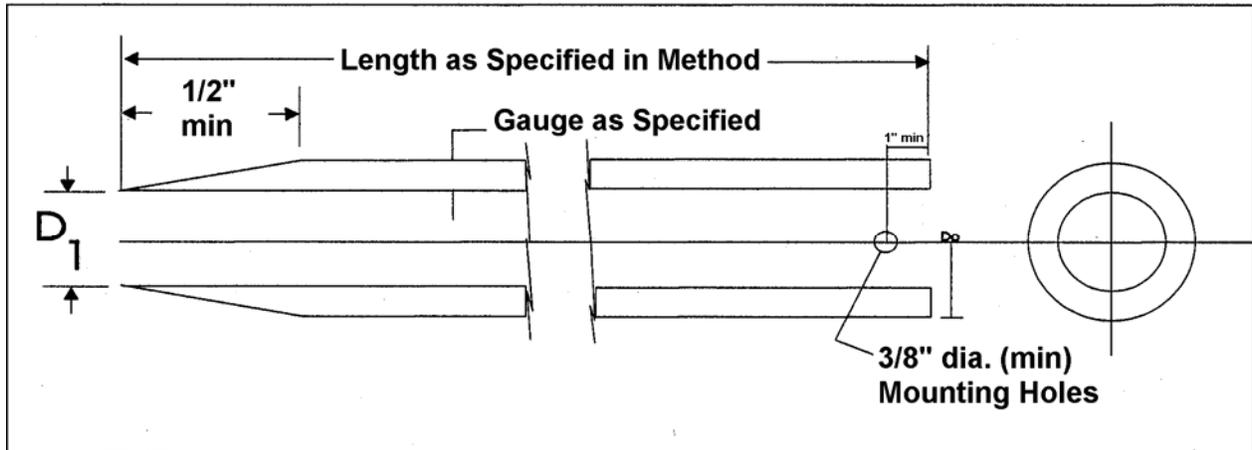
11.0 REFERENCES

- 1) G. S. Koch, Jr., R. F. Link, Statistical Analysis of Geological Data, New York, Dover Publications, Inc., December 1985.
- 2) Paul F. Kerr, Optical Mineralogy, 4th ed., New York, McGraw-Hill, 1977.

- 3) E.M. Chamot and C. W. Mason, Handbook of Chemical Microscopy, Volume One, 3rd ed, New York: John Wiley & Sons, 1958.
- 4) F. Chayes, Petrographic Model Analysis: An Elementary Statistical Appraisal, New York: John Wiley & Sons, 1958.
- 5) E. P. Brantly, Jr., K. W. Gold, I. E. Myers, and D. E. Lentzen, Bulk Sample Analysis for Asbestos Content: Evaluation of the Tentative Method, U. S. Environmental Protection Agency, October 1981.
- 6) U. S. Environmental Protection Agency, Asbestos-Containing Materials in School Buildings: A Guidance Document, Parts 1 and 2 EPA/OTS No. C00090m Narcg 1979.
- 7) D. Lucas, T. Harwell, and A. V. Rao, Asbestos Containing Materials in School Buildings: Guidance for Asbestos Analytical Programs, EPA 580/13-80-017a, U. S. Environmental Protection Agency, December 1980.
- 8) D. H. Taylor and J. S. Bloom, Hexametaphosphate Pretreatment of Insulation Samples for Identification of Fibrous Constituents, Microscope, 28, 1980.
- 9) W. J. Campbell, R. L. Blake, L. L. Brown, E. E. Cather, and J. J. Sjoberg. Selected Silicate Minerals and Their Asbestiform Varieties: Mineralogical Definitions and Identification-Characterization, U. S. Bureau of Mines Information Circular 8751, 1977.
- 10) Walter C. McCrone, Asbestos Particle Atlas, Ann Arbor, Ann Arbor Science Publishers, June 1980.
- 11) John Moore, Biostatistician, Personnel Communication, February 8, 1990.

Figure 1

Thin Wall Tube for Sampling



- Note 1 Minimum of two mounting holes on opposite sides for 2 to 3 inch diameter sampler.
- Note 2 Minimum of four mounting holes spaced at 90 for samplers 4 inch diameter and larger.
- Note 3 Tube held with hardened screws.
- Note 4 Two inch outside-diameter tubes are specified with an 18-gauge wall thickness to comply with area ratio criteria accepted for "undisturbed samples." Users are advised that such tubing is difficult to locate and can be extremely expensive in small quantities. Sixteen-gauge tubes are generally readily available.

Table 1
Suitable Thin Walled Steel Sample Tube^A

OUTSIDE DIAMETER:				
	2	3	5	
inches				
millimeters	50.8	76.2	127	
WALL THICKNESS:				
Bwg	18	16	11	
inches	0.049	0.065	0.120	
millimeters	1.24	1.65	3.05	
TUBE LENGTH:				
inches	36	36	54	
meters	0.91	0.91	1.45	
CLEARANCE RATIO, %	1	1	1	

^A The three diameters recommended in Table 1 are indicated for purposes of standardization, and are not intended to indicate that sampling tubes of intermediate or larger diameters are not acceptable. Lengths of tubes shown are illustrative. Proper lengths to be determined as suited to field conditions.

Table 2

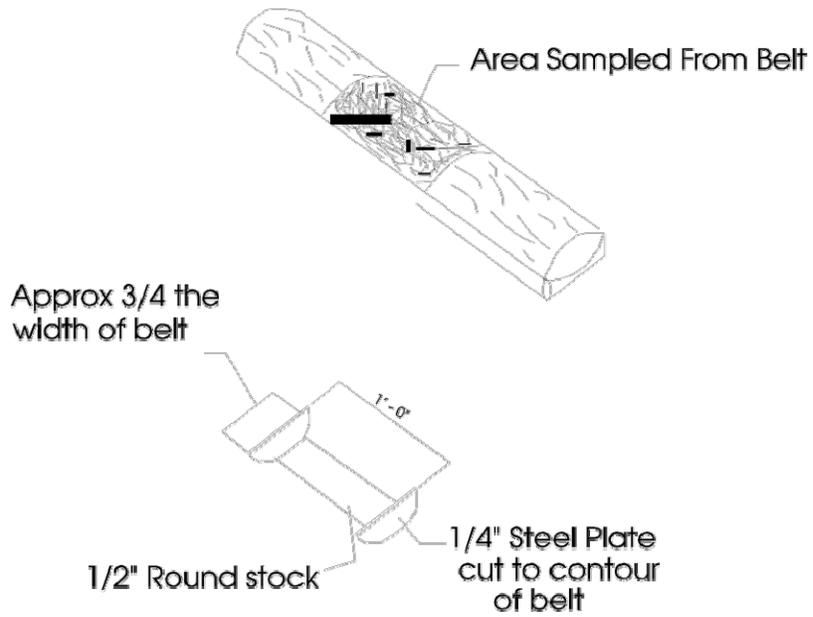
Dimensional Tolerances for Thin Walled Tubes

Nominal Tube Diameters from Table 1^A Tolerances, inches

Size Outside Diameter	2	3	4
Outside Diameter	+0.007 -0.000	+0.010 -0.000	+0.015 -0.000
Inside Diameter	+0.000 -0.007	+0.000 -0.010	+0.000 -0.015
Wall Thickness	+0.007	+0.010	+0.015
Ovality	0.015	0.020	0.030
Straightness	0.030/ft	0.030/ft	0.030/ft

^A Intermediate or larger diameters should be proportional. Tolerances shown are essentially standard commercial manufacturing tolerances for seamless steel mechanical tubing. Specify only two of the first three tolerances; O. D. and I. D. or O. D. and Wall, or I. D. and Wall.

Figure 2



Typical Template to Drag Sample off Belt

Table 3

Optical Properties of Asbestos Fibers

Mineral	Morphology ^a , color	Refractive Indices ^b		Birefringence	Extinction	Sign of Elongation
		alpha	gamma			
Chrysotile (asbestiform serpentine)	Wavy fibers. Fiber bundles have splayed ends and "kinks." Aspect ratio typically >10:1. Colorless ^c , nonpleochroic.	1.493 - 1.560	1.517 - 1.562 ^f (normally 1.556)	0.002 - 0.014	to fiber length	+ (length slow)
Amosite (asbestiform grunerite)	Straight, rigid fibers. Aspect ratio typically >10:1. Colorless to brown, nonpleochroic or weakly so. Opaque inclusions may be present.	1.635 - 1.696	1.655 - 1.729 ^f (normally 1.696 - 1.710)	0.020 - 0.33	to fiber length	+ (length slow)
Crocidolite (asbestiform riebeckite)	Straight, rigid fibers. Thick fibers and bundles common, blue to purple-blue in color. Pleochroic. Birefringence is generally masked by blue color.	1.654 - 1.701	1.668 - 1.717 (normally close to 1.700)	0.014 - 0.016	to fiber length	- (length fast)
Anthophyllite-asbestos	Straight fibers and fiber bundles showing splayed ends. Colorless to light brown. Pleochroism absent.	1.596 - 1.652	1.615 - 1.676 ^f	0.019 - 0.024	to fiber length	+ (length slow)
Tremolite-actinolite-asbestos	Straight and curved fibers and fiber bundles. Large bundles show splayed ends. Tremolite is colorless and actinolite is green. Weakly to moderately pleochroic.	1.599 - 1.668	1.622 - 1.688 ^f	0.023 - 0.020	to fiber length	+ (length slow)

^a From Reference 6; colors cited are seen by observation with plane polarized light.

^b From References 7 and 9.

^c Fibers subjected to heating may be brownish.

^d Fibers defined as having aspect ratio >3:1.

^e to fiber length.

^f || to fiber length.

Table 4
Central Stop Dispersion Staining Colors^a

Mineral	RI Liquid	nu	nu
Chrysotile	1.550HD	blue	blue-magenta
Amosite	1.680	blue-magenta to pale blue	golden-yellow
	1.550HD	yellow to white	yellow to white
Crocidolite ^b	1.700	red-magenta	blue-magenta
	1.550HD	yellow to white	yellow to white
Anthophyllite	1.605HD	blue	gold to gold-magenta
Tremolite	1.605HD ^c	pale blue	yellow
Actinolite	1.630HD	gold-magenta to blue	gold
	1.630HD ^c	magenta	golden-yellow

^a From Reference 10.

^b Blue absorption color.

^c Oblique extinction view.

Appendix C

FINAL REGULATION ORDER

ASBESTOS AIRBORNE TOXIC CONTROL MEASURE FOR SURFACING APPLICATIONS

Section 93106. Asbestos Airborne Toxic Control Measure for Surfacing Applications.

(a) Effective Date. No later than November 13, 2001, each air pollution control and air quality management district must:

- (1) Implement and enforce the requirements of this section, or
- (2) Propose their own asbestos airborne toxic control measure as provided in Health and Safety Code section 39666(d).

(b) Applicability.

This section shall apply to any person who produces, sells, supplies, offers for sale or supply, uses, applies, or transports any of the following materials:

- (1) Aggregate material extracted from property where any portion of the property is located in a geographic ultramafic rock unit (as defined in subsection (i)(9)); or
- (2) Aggregate material extracted from property that is **NOT** located in a geographic ultramafic rock unit (as defined in subsection (i)(9)) if the material has been:
 - (A) Evaluated at the request of the Air Pollution Control Officer (APCO) and determined to be ultramafic rock or serpentine;
 - (B) Tested at the request of the APCO and determined to have an asbestos content of 0.25 percent or greater, as determined using an approved asbestos bulk test method; or
 - (C) Determined by the owner/operator of a facility to be ultramafic rock, or serpentine, or material that has an asbestos content of 0.25 percent or greater.
- (3) Any mixture of aggregate material that contains ten percent (10%) or more of any of the materials listed above in subsection (b)(1) or (b)(2).

(c) Prohibition On the Use, Sale, and Supply of Restricted Aggregate Material.

Unless one of the exemptions in subsection (f) applies, no person shall use, apply, sell, supply, or offer for sale or supply any restricted material (as defined in subdivision (i)(20)) for surfacing, unless it has been tested using an approved asbestos bulk test method and determined to have an asbestos content that is less than 0.25 percent.

(d) Requirements to Provide Notice with Restricted Material.

(1) *Requirements for Producers of Restricted Material for Surfacing Applications:* Any producer who sells, supplies, or offers for sale or supply restricted material for surfacing that has been tested using an approved asbestos bulk test method and determined to have an asbestos content that is less than 0.25 percent must provide to the recipient of the restricted material a written receipt that contains the following information:

- (A) The amount of restricted material that was sold or supplied;
- (B) The date that the restricted material was sold or supplied;
- (C) The dates that the restricted material was sampled and tested, or verification that the material is exempt under subsection (f)(7); and
- (D) A statement that the asbestos content of the restricted material is less than 0.25 percent.

(2) *Requirements for Persons – Other than Producers – Who Sell or Supply Restricted Material for Surfacing Applications:* Any person, other than a producer, who sells, supplies, or offers for sale or supply restricted material for surfacing must provide to the recipient of the material a written receipt which specifies the following information:

- (A) The amount of restricted material that was sold or supplied;
- (B) The date that the restricted material was sold or supplied; and
- (C) A statement that the asbestos content of the restricted material is less than 0.25 percent.

(3) *Requirements for the Sale or Supply of Restricted Materials for Non-Surfacing Applications:* Any person who sells, supplies, or offers for sale or supply restricted material for non-surfacing applications must provide with each sale or supply a written receipt containing the following statement:

**“WARNING!
This material may contain asbestos.**

It is unlawful to use this material for surfacing or any application in which it would remain exposed and subject to possible disturbances.

Extreme care should be taken when handling this material to minimize the generation of dust.”

(e) Recordkeeping and Reporting Requirements.

- (1) *Recordkeeping Requirements for Persons Who Use Restricted Material for Surfacing:* Any person who uses or applies restricted material for surfacing must retain any written receipt or other record verifying that the material has an asbestos content of less than 0.25 percent for a minimum period of seven years from the date of use or application.
- (2) *Recordkeeping Requirements for Persons Who Transport Restricted Material:* Any person who transports restricted material must maintain a copy of all receipts or records required by subsection (d) with the material at all times during transit and application.
- (3) *Recordkeeping Requirements for Persons Who Sell or Supply Restricted Material:* Any person who sells, supplies, or offers restricted material for sale or supply must retain copies of all receipts or records required by subsection (d) for a minimum period of seven years from the date of sale or supply.
- (4) *Reporting Requirements for Persons Who Use, Sell, or Supply Restricted Material:* Any person who uses restricted material for surfacing, sells, supplies, or offers restricted material for sale or supply must provide receipts and test results to the APCO for review upon request.

(f) Exemptions.

- (1) *Sand and Gravel Operations:* The requirements of subsections (c), (d), and (e) shall not apply to aggregate material extracted from a sand and gravel operation. A "sand and gravel operation" means any aggregate-producing facility operating in alluvial deposits.
- (2) *Roads Located at Quarries or Mines:* The requirements of subsection (c) shall not apply to roads at quarries or mines that are located in a geographic ultramafic rock unit, an ultramafic rock deposit, or a serpentine deposit, provided that the aggregate material was obtained on site from the quarry or mine property.

- (3) *Maintenance Operations on Existing Roads:* The requirements of subsections (c), (d), and (e) shall not apply to maintenance operations on any existing road surface if no additional restricted material is applied to the road surface.
- (4) *Emergency Road Repairs:* The APCO may issue a temporary exemption from the requirements of subsections (c), (d), and (e) to an applicant who demonstrates that a road repair is necessary due to a landslide, flood, or other emergency, and that the use of aggregate material other than restricted material is not feasible for this repair. The APCO shall specify the time during which such exemption shall be effective; however, no exemption shall remain in effect longer than 90 days.
- (5) *Asphalt and Concrete Materials:* The requirements of subsections (c), (d), and (e) shall not apply to restricted material that is an integral part of the production of asphalt concrete, portland cement concrete or other similarly cemented materials; or construction of an asphalt or a portland cement concrete surface as long as all of the restricted material is incorporated into or completely covered by the asphalt or portland cement concrete.
- (6) *Landfill Operations:* The use and application requirements of subsection (c) shall not apply to landfill operations, except for the surfacing of public-access roads used by vehicular traffic.
- (7) *Geologic Evaluation:* The APCO may provide an exemption from subsections (c), (d), and (e) for aggregate material extracted from within a geographic ultramafic rock unit if a registered geologist has conducted a geologic evaluation of the property from which the aggregate material is obtained and determined that serpentine or ultramafic rock is not likely to be found on the property. Before an exemption can be granted, the owner/operator must provide a copy of a report detailing the geologic evaluation to the APCO for his or her consideration.
 - (A) At a minimum, the geologic evaluation must include:
 1. A general description of the property and the proposed use;
 2. A detailed site characterization, which may include:
 - i. A physical site inspection;
 - ii. Offsite geologic evaluation of adjacent property;
 - iii. Evaluation of existing geological maps and studies of the site and surrounding area;
 - iv. Development of geologic maps of the site and vicinity;
 - v. Identification and description of geologic units, rock and soil types, and features that could be related to the

- presence of ultramafic rocks, serpentine, or asbestos mineralization;
- vi. A subsurface investigation to evaluate the nature and extent of geologic materials in the subsurface where extensive vertical excavation is planned; methods of subsurface investigation may include, but are not limited to borings, test pits, trenching, and geophysical surveys;
3. A classification of rock types found must conform to the nomenclature based on the International Union of Geological Science system;
 4. A description of the sampling procedures used;
 5. A description of the analytical procedures used, which may include mineralogical analyses, petrographic analyses, chemical analyses, or analyses for asbestos content;
 6. An archive of collected rock samples for third party examination; and
 7. A geologic evaluation report documenting observations, methods, data, and findings; the format and content of the report should follow the Guidelines for Engineering Geologic Reports issued by the State Board of Registration for Geologists and Geophysicists.
- (B) The APCO shall respond to a request for an exemption within 90 days of the receipt of the application.
- (C) If the request for an exemption is denied, the APCO shall provide written reasons for the denial.
- (D) *Expiration of the Geologic Exemption:* If the owner/operator discovers any ultramafic rock or serpentine on the property after the exemption is granted, then:
1. The owner/operator must comply with the requirements of subsections (c), (d), and (e) immediately following the discovery; and
 2. The owner/operator must report the discovery of ultramafic rock or serpentine to the APCO within 24 hours; and
 3. The exemption under subsection (f)(7) shall expire and cease to be effective.

- (8) *Limited Access Surfaces:* The APCO may provide an exemption from the requirements of subsection (c) for the use of restricted material on limited access surfaces, if the owner/operator can demonstrate that:
- (A) No alternative aggregate materials are reasonably available; and
 - (B) The surface is not located in an area zoned or identified in a land use plan for residential, recreational, or commercial use.
 - (C) The APCO shall respond to a request for an exemption within 90 days of the receipt of the application.
 - (D) If the request for an exemption is denied, the APCO shall provide written reasons for the denial.

“Limited access surface” means any surface not subject to vehicular travel or pedestrian access that has an incline of twenty (20) percent or greater.

(9) *Surfacing Applications in Remote Locations:*

- (A) The APCO may provide an exemption from the requirements of subsection (c) if the owner/operator can demonstrate that:
 - 1. The surface is located in a remote location (as defined in subsection (i)(19)); and
 - 2. No alternative aggregate materials are reasonably available; and
 - 3. All aggregate material used for surfacing has been tested according to an approved asbestos bulk test method and determined to have an asbestos content of one (1.0) percent or less; except that the APCO may allow the use of restricted material with an asbestos content up to five (5.0) percent if the owner/operator can demonstrate that restricted material with an asbestos content of one (1.0) percent or less is not reasonably available.
- (B) Before providing this exemption, the APCO shall:
 - 1. Consider the following information: county land use plans, the current use of the surrounding land, and the current and anticipated zoning designations;

2. Provide public notice and solicit comments for a 30-day period;
3. Require that any surface exempted pursuant to this subsection be posted with a permanent sign alerting the public to potential asbestos exposures; and
4. Require that any exemption shall be valid for no longer than three years; but if the owner/operator cannot demonstrate that all the criteria listed in subdivision (f)(9)(A) are met at the time of reapplication, the exemption shall not be renewed.

(C) The APCO may grant an exemption when the distance from the road or other surface to the nearest receptor is less than one mile if **ALL** of the following criteria are met:

1. The criteria listed above in subsections (f)(9)(A)2. and 3., and subsection (f)(9)(B) must be met:
2. Any receptor located within one mile from the road or other surface must **NOT** be any of the following:
 - i. A permanent resident (i.e., a person that resides at the receptor point for six months or more in a year), or
 - ii. A permanent business (i.e., business that operates at the receptor point for six months or more in a year), or
 - iii. A school or daycare center;
3. The road or other surface must be located on private property;
4. The entrance points to the road or other surface from any public thoroughfare must be gated and posted with a sign as required in subsection (f)(9)(B)3.;
5. The applicant for the exemption must provide to the APCO an estimate of the average traffic volume on the road or other surface and the methodology used to make the estimate; and
6. Whenever the traffic volume exceeds or is anticipated to exceed 20 vehicle passes per day, the owner/operator must:
 - i. Treat the road or other surface with a dust control method that is at least 70 percent effective; and
 - ii. Maintain records of the application and type of the dust control method for a minimum period of seven years; and

iii. Provide the records of the applications of the dust control method to the APCO upon request.

(D) The APCO shall respond to any application for an exemption within 90 days of the receipt of the application.

(E) If the request for an exemption is denied, the APCO shall provide written reasons for the denial.

(10) *Roads Located at Construction Sites:* The requirements of subsections (c), (d), and (e) shall not apply to restricted material used for the construction of temporary road surfaces located at on-going construction sites where vehicle traffic is limited to construction personnel and equipment. This exemption does not apply to the use of restricted material for temporary roads for public use.

(11) *Riprap:* The requirements of subsection (c) (d), and (e) shall not apply to restricted material used for riprap. "Riprap" means the material used to construct a loose assemblage of stones along a water course or shoreline to prevent erosion or provide stability.

(g) Requirements to Perform a Geologic Evaluation or Asbestos Testing.

Pursuant to the requirements of Health and Safety Code section 41511, the APCO or the Executive Officer of the ARB may require an owner/operator to perform:

(1) A geologic evaluation for the presence of ultramafic rock or serpentine on any property from which aggregate material is extracted; or

(2) Testing for the asbestos content of any aggregate material sold, supplied, offered for sale or supply, or used for surfacing.

(h) Applicable Test Methods.

(1) *Ultramafic Rock:* The ultramafic rock composition of any material shall be determined using a standard analysis technique including, but not limited to, color index assessment, microscopic examination, petrographic analysis or rock thin sections, or chemical analysis techniques, such as X-ray fluorescence spectrometry or inductively coupled plasma analysis.

(2) *Asbestos Testing:* ARB Test Method 435 or an alternative asbestos bulk test method approved in writing by the Executive Officer of the Air Resources Board shall be used to determine compliance with this section. For the purposes of determining compliance with this section, references

in ARB Test Method 435 to “serpentine aggregate” shall mean “aggregate material.”

- (3) *Averaging of Test Results:* If ARB Test Method 435 or an alternative approved asbestos bulk test method has been used to perform two or more tests on any one volume of aggregate material, whether by the same or a different person, the arithmetic average of these test results shall be used to determine the asbestos content of the aggregate material.
- (4) *Sampling Frequency:* For the purposes of this section, the sampling frequency required for determining the asbestos content of any aggregate material shall be no less than one composite sample per 1000 tons of aggregate material processed, as specified in ARB Test Method 435, unless the APCO approves an alternative sampling frequency as follows:
 - (A) The APCO may approve an alternative sampling frequency after reviewing and verifying the authenticity of the following information, which shall be provided by the owner/operator of the quarry:
 1. An established history of analytical test results demonstrating that no aggregate material sampled and tested in accordance with an approved asbestos bulk test method had an asbestos content that was 0.25 percent or greater;
 2. The established history of analytical test results must include:
 - i. Test results from ten percent of the expected total yield over the life of the quarry, as stated in any permit issued pursuant to the California Surface Mining and Reclamation Act, Public Resources Code, Division 2, Chapter 9, Section 2710 et seq.; or
 - ii. Test results that cover at least two years of production of surfacing material; this production amount must be verified with sales receipts and testing results as required in subsection (e)(3);
 3. A geologic evaluation of the quarry that has been conducted in accordance with the provisions in subsection (f)(7);
 4. Any permits issued pursuant to the California Surface Mining and Reclamation Act, Public Resources Code, Division 2, Chapter 9, Section 2710 et seq.;
 5. Sales receipts retained by the quarry pursuant to subsections (d) and (e)(3).

- (B) The APCO shall not approve any alternate sampling frequency that requires less than one test per 100,000 tons of aggregate material processed for surfacing.
- (C) If any of the aggregate material tested is determined to have an asbestos content of 0.25 percent or greater using an alternative sampling frequency approved by the APCO, the owner/operator must:
 - 1. Resume the sampling frequency specified in ARB Test Method 435 immediately after receiving the test results; and
 - 2. Report the detection of asbestos and provide a copy of the analytical test results to the APCO within 48 hours after receiving the test results.

(i) **Definitions.** For the purposes of this section, the following definitions shall apply:

- (1) "Aggregate" means a mixture of mineral fragments, sand, gravel, cobbles, rocks, stones, or similar minerals that may or may not be crushed or screened. "Aggregate" does not include elemental metals, gemstones, petroleum products, organic materials, or mineral ore to be processed offsite of the property from which it was extracted.
- (2) "Alluvial deposit" means any deposit of sediments laid down by running water including, but not limited to, streams and rivers.
- (3) "APCO" means the executive officer, air pollution control officer; or the designee of the executive officer or air pollution control officer of any air pollution control or air quality management district created or continued in existence pursuant to Part 3 (commencing with section 40000), Division 26, Health and Safety Code;
- (4) "Approved asbestos bulk test method" means ARB Test Method 435 or an alternative asbestos bulk test method approved in writing by the Executive Officer of the Air Resources Board.
- (5) "ARB" means the California Air Resources Board.
- (6) "ARB Test Method 435" means the test method specified in title 17, California Code of Regulations, section 94147.
- (7) "Asbestos" means asbestiforms of the following minerals: chrysotile (fibrous serpentine), crocidolite (fibrous riebeckite), amosite (fibrous

cummingtonite--grunerite), fibrous tremolite, fibrous actinolite, and fibrous anthophyllite.

- (8) "Decoration/landscaping" means the application or use of aggregate materials for aesthetic purposes.
- (9) "Geographic ultramafic rock unit" means a geographic area that is designated as an ultramafic rock unit or ultrabasic rock unit, including the unit boundary line, on any of the maps referenced in Appendix A.
- (10) "Geologic evaluation" means an evaluation of a property, as specified in subsection (f)(7), to determine the presence of various rock types, including ultramafic rock, serpentinite, or other metamorphic derivatives of ultramafic rock.
- (11) "Limited access surface" means any surface not subject to vehicular travel or pedestrian access that has an incline greater than twenty (20) percent.
- (12) "Non-surfacing applications" means any application of aggregate material that will not remain a part of the uppermost layer, such as fill, base rock, or drain rock.
- (13) "Owner/operator" or "person" includes, but is not limited to:
 - (A) An individual, trust, firm, joint stock company, business concern, partnership, limited liability company, association, or corporation including, but not limited to, a government corporation;
 - (B) Any city, county, district, commission, the state or any department, agency, or political subdivision thereof, any interstate body, and the federal government or any department or agency thereof to the extent permitted by law; or
 - (C) A project proponent and any of its contractors or subcontractors.
- (14) "Producer" means any person that extracts and processes aggregate material from the ground.
- (15) "Property" means any real property including, but not limited to, any contiguous parcel or parcels of land and anything attached to, or erected on it.
- (16) "Quarry" means a facility or operation that obtains stone from the earth by means of cutting, digging, excavating, or blasting.

- (17) "Receipt" means any written acknowledgement that a specified amount of restricted material was received, delivered, or purchased. Receipts include, but are not limited to, bills of sale, bills of lading, and notices of transfer.
- (18) "Registered geologist" means an individual that is currently licensed as a geologist with the State of California, Department of Consumer Affairs, Board of Geology and Geophysicists.
- (19) "Remote location" means any location that is at least one (1.0) mile from the location of a receptor. "Receptor" includes, but is not limited to, any hospital, school, day care center, work site, business, residence, and permanent campground. The distance to the nearest receptor is to be measured from the outermost limit of the area to be disturbed or road surface, whichever is closer.
- (20) "Restricted material" means any of the following:
- (A) Aggregate material extracted from property where any portion of the property is located in a geographic ultramafic rock unit (as defined in subsection (i)(9)); and
 - (B) Aggregate material extracted from property that is **NOT** located in a geographic ultramafic rock unit (as defined in subsection (i)(9)) if the material has been:
 - 1. Evaluated at the request of the Air Pollution Control Officer (APCO) and determined to be ultramafic rock or serpentine;
 - 2. Tested at the request of the APCO and determined to have an asbestos content of 0.25 percent or greater; or
 - 3. Determined by the owner/operator of a facility to be ultramafic rock, serpentine, or aggregate material that has an asbestos content of 0.25 percent or greater.
 - (C) Any mixture of aggregate material that contains ten percent (10%) or more of any of the materials listed above in subsections (i)(20)(A) or (i)(20)(B), or any combination thereof, shall also be considered "restricted material."
- (21) "Riprap" means material used to construct a loose assemblage of stones along a water course or shoreline to prevent erosion or provide stability.
- (22) "Road surface" means the traveled way of a road and any shoulder which extends up to ten (10) feet from the edge of the traveled way.

- (23) "Sand and gravel operation" means any aggregate-producing facility operating in alluvial deposits.
- (24) "Serpentine" means any form of the following hydrous magnesium silicate minerals: antigorite, lizardite, and chrysotile.
- (25) "Serpentinite" means a rock consisting almost entirely of serpentine, although small amounts of other minerals such as magnetite, chromite, talc, brucite, and tremolite-actinolite may also be present. "Serpentinite" is a metamorphic derivative of the ultramafic rocks, peridotite, pyroxenite, or dunite.
- (26) "Surfacing" means the act of providing or creating a temporary or permanent covering for a surface used for pedestrians, motor vehicles, non-motor vehicles, decoration, landscaping, soil stabilization, or erosion control. Examples of surfaces include, but are not limited to, roads, road shoulders, streets, access roads, alleys, lanes, driveways, parking lots, playgrounds, trails, squares, plazas, and fairgrounds. For the purposes of this section, "surfacing" does not include creating a covering composed of asphalt concrete or portland cement concrete.
- (27) "Ultrabasic rock" means ultramafic rock.
- (28) "Ultramafic rock" means an igneous rock composed of 90 percent or greater of one or a combination of the following iron/magnesium-rich, dark-colored silicate minerals: olivine, pyroxene, or more rarely amphibole. For the purposes of this section, "ultramafic rock" includes the following rock types: dunite, pyroxenite, and peridotite; and their metamorphic derivatives.

NOTE: Authority cited: Sections 39600, 39601, 39650, 39658, 39659, 39666, and 41511, Health and Safety Code. Reference: Sections 39650, 39658, 39659, 39666, and 41511, Health and Safety Code.

APPENDIX A

California Department of Conservation Division of Mines and Geology

AVAILABLE GEOLOGIC MAPS FOR CALIFORNIA

GEOLOGIC ATLASES OF CALIFORNIA Scale 1:250,000

GEOLOGIC ATLAS OF CALIFORNIA: ALTURAS

Compiled by Gay, T.E. and others, 1958

GEOLOGIC ATLAS OF CALIFORNIA: BAKERSFIELD

Compiled by Smith, A.R., 1964 (reprinted 1992)

GEOLOGIC ATLAS OF CALIFORNIA: DEATH VALLEY

Compiled by Streitz, R.L. and Stinson, M.C., 1974 (reprinted 1991)

GEOLOGIC ATLAS OF CALIFORNIA: FRESNO

Compiled by Matthews, R.A. and Burnett, J.L, 1965 (reprinted 1991)

GEOLOGIC ATLAS OF CALIFORNIA: LONG BEACH

Compiled by Jennings, C.W., 1962 (reprinted 1992)

GEOLOGIC ATLAS OF CALIFORNIA: LOS ANGELES

Compiled by Jennings, C.W. and Strand, R.G., 1969 (reprinted 1991)

GEOLOGIC ATLAS OF CALIFORNIA: MARIPOSA

Compiled by Strand, R.G., 1967 (reprinted 1991)

GEOLOGIC ATLAS OF CALIFORNIA: NEEDLES

Compiled by Bishop, C.C., 1963 (reprinted 1992)

GEOLOGIC ATLAS OF CALIFORNIA: REDDING

Compiled by Strand, R.G., 1962

GEOLOGIC ATLAS OF CALIFORNIA: SALTON SEA

Compiled by Jennings, C.W., 1967 (reprinted 1992)

GEOLOGIC ATLAS OF CALIFORNIA: SAN LUIS OBISPO

Compiled by Jennings, C.W., 1958 (reprinted 1992)

GEOLOGIC ATLAS OF CALIFORNIA: SAN DIEGO - EL CENTRO

Compiled by Strand, R.G., 1962 (reprinted 1992)

GEOLOGIC ATLAS OF CALIFORNIA: SANTA ANA
Compiled by Rogers, T.H., (reprinted 1992)

GEOLOGIC ATLAS OF CALIFORNIA: SANTA CRUZ
Compiled by Jennings, C.W. and Strand, R.G., 1958 (reprinted 1992)

GEOLOGIC ATLAS OF CALIFORNIA: SANTA MARIA
Compiled by Jennings, C.W., 1959 (reprinted 1992)

GEOLOGIC ATLAS OF CALIFORNIA: UKIAH
Compiled by Jennings, C.W. and Strand, R.G., 1960 (reprinted 1992)

GEOLOGIC ATLAS OF CALIFORNIA: WALKER LAKE
Compiled by Koenig, J.B., 1963 (reprinted 1992)

REGIONAL GEOLOGIC MAP SERIES Scale 1:250,000

GEOLOGIC MAP OF THE SACRAMENTO QUADRANGLE
(set of four sheets)
Compiled by Wagner, D.L. and others, 1981

GEOLOGIC MAP OF THE SANTA ROSA QUADRANGLE
(set of five sheets)
Compiled by Wagner and D.L., Bortugno, E.J. (reprinted 1999)

GEOLOGIC MAP OF THE SAN BERNARDINO QUADRANGLE
(set of five sheets)
Compiled by Bortugno, E.J., and Spittler, T.E. (reprinted 1998)

GEOLOGIC MAP OF THE WEED QUADRANGLE
(set of four sheets)
By Wagner, D.L. and Saucedo, G.J., 1987

GEOLOGIC MAP OF THE SAN FRANCISCO-SAN JOSE QUADRANGLE
(set of five sheets)
By Wagner, D.L., Bortugno, E.J. and McJunkin, R.D., 1990
Color-coded faults

LOCAL GEOLOGIC MAPS

AREAS MORE LIKELY TO CONTAIN NATURALLY-OCCURRING ASBESTOS
IN WESTERN EL DORADO COUNTY, CALIFORNIA
By Ron Churchill, March 2000
Scale 1:100,000

SERPENTINITE SURVEY OF LAKE COUNTY, CALIFORNIA- MAP A,
ULTRAMAFIC, ULTRABASIC, AND SERPENTINE ROCK AND SOILS OF LAKE
COUNTY,

Adopted: March 2, 1992

Scale: 1:100,000

Appendix D

FINAL REGULATION ORDER

ASBESTOS AIRBORNE TOXIC CONTROL MEASURE FOR CONSTRUCTION, GRADING, QUARRYING, AND SURFACE MINING OPERATIONS

Section 93105. Asbestos Airborne Toxic Control Measure for Construction, Grading, Quarrying, and Surface Mining Operations.

(a) Effective Date.

- (1) No later than 120 days after the approval of this section by the Office of Administrative Law, each air pollution control and air quality management district must:
 - (A) Implement and enforce the requirements of this section; or
 - (B) Propose their own asbestos airborne toxic control measure as provided in Health & Safety Code section 39666(d).
- (2) *Pre-existing Operations:* The owner/operator of any project in which the construction, grading, quarrying, or surface mining operation started before the effective date of this section shall comply with this section by:
 - (A) The date the district begins implementing and enforcing this section as required in subsection (a)(1)(A); or
 - (B) The compliance date specified in the airborne toxic control measure adopted by the district as required in subsection (a)(1)(B).

(b) Applicability. Unless one of the specific exemptions specified in subsection (c) applies, this section shall apply to any construction, grading, quarrying, or surface mining operation on any property that meets any of the following criteria:

- (1) Any portion of the area to be disturbed is located in a geographic ultramafic rock unit; or
- (2) Any portion of the area to be disturbed has naturally-occurring asbestos, serpentine, or ultramafic rock as determined by the owner/operator, or the Air Pollution Control Officer (APCO); or
- (3) Naturally-occurring asbestos, serpentine, or ultramafic rock is discovered by the owner/operator, a registered geologist, or the APCO in the area to be disturbed after the start of any construction, grading, quarrying, or surface mining operation.

(c) General Exemptions.

- (1) *Geologic Evaluation:* The APCO may provide an exemption from this section for any property that meets the criterion in subsection (b)(1) if a registered geologist has conducted a geologic evaluation of the property and determined that no serpentine or ultramafic rock is likely to be found in the area to be disturbed. Before an exemption can be granted, the owner/operator must provide a copy of a report detailing the geologic evaluation to the APCO for his or her consideration.
- (A) At a minimum, the geologic evaluation must include:
1. A general description of the property and the proposed use;
 2. A detailed site characterization which may include:
 - i. A physical site inspection;
 - ii. Offsite geologic evaluation of adjacent property;
 - iii. Evaluation of existing geological maps and studies of the site and surrounding area;
 - iv. Development of geologic maps of the site and vicinity;
 - v. Identification and description of geologic units, rock and soil types, and features that could be related to the presence of ultramafic rocks, serpentine, or asbestos mineralization; and
 - vi. A subsurface investigation to evaluate the nature and extent of geologic materials in the subsurface where vertical excavation is planned; methods of subsurface investigation may include, but are not limited to borings, test pits, trenching, and geophysical surveys;
 3. A classification of rock types found must conform to the nomenclature based on the International Union of Geological Science system;
 4. A description of the sampling procedures used;
 5. A description of the analytical procedures used, which may include mineralogical analyses, petrographic analyses, chemical analyses, or analyses for asbestos content;
 6. An archive of collected rock samples for third party examination; and
 7. A geologic evaluation report documenting observations, methods, data, and findings; the format and content of the report should follow the Guidelines for Engineering Geologic

Reports issued by the State Board of Registration for Geologists and Geophysicists.

- (B) The district may request any additional tests or other information needed to evaluate an application for exemption.
 - (C) The district shall grant or deny a request for an exemption within 90 days of the receipt of a complete application.
 - (D) If the request for an exemption is denied, the APCO shall provide written reasons for the denial.
 - (E) *Expiration of the Geologic Exemption:* If the owner/operator discovers any naturally-occurring asbestos, serpentine, or ultramafic rock in the area to be disturbed after the exemption is granted, then:
 - 1. The owner/operator must comply with the requirements of this section;
 - 2. The owner/operator must report the discovery of the naturally-occurring asbestos, serpentine, or ultramafic rock to the APCO no later than the next business day; and
 - 3. The exemption under subsection (c)(1) shall expire and cease to be effective.
- (2) If a method is developed to accurately demonstrate that property located in a geographic ultramafic rock unit has no detectable asbestos in the area to be disturbed, then the ARB Executive Officer shall propose to the Board for adoption a regulatory amendment allowing the method to be utilized, as appropriate, to obtain an exemption from the requirements specified in this section.
- (3) *Agriculture and Timber Harvesting:* This section shall not apply to agricultural operations or timber harvesting except for construction of roads and buildings. Construction of roads is subject to the requirements of subsection (e) if the road is part of a construction or grading operation, quarry, or surface mine, and is subject to the requirements of subsection (d) if the road is not part of a construction or grading operation, quarry, or surface mine.
- (4) *Homeowners and Tenants:* Individuals engaged in covered activities on residential property they own or occupy are exempt from subsections (e)(1) and (e)(3)(A).

(5) *Sand and Gravel Operations:* The APCO may provide an exemption for crushing, screening and conveying equipment, stockpiles, and off-site material transport at a sand and gravel operation if the operation processes only materials from an alluvial deposit.

(A) The district shall grant or deny a request for an exemption within ninety (90) days of the receipt of a complete application.

(B) If the request for an exemption is denied, the APCO shall provide written reasons for the denial.

(d) Requirements for Road Construction and Maintenance. These requirements shall apply to roads that are not part of a construction or grading project, quarry, or surface mine.

(1) No person shall conduct any road construction or maintenance activities that disturb any area that meets any criterion listed in subsections (b)(1) or (b)(2) unless all of the following conditions are met.

(A) The APCO is notified in writing at least fourteen (14) days before the beginning of the activity or in accordance with a procedure approved by the district.

(B) All the following dust control measures are implemented during any road construction or maintenance activity:

1. Unpaved areas subject to vehicle traffic must be stabilized by being kept adequately wetted, treated with a chemical dust suppressant, or covered with material that contains less than 0.25 percent asbestos;

2. The speed of any vehicles and equipment traveling across unpaved areas must be no more than fifteen (15) miles per hour unless the road surface and surrounding area is sufficiently stabilized to prevent vehicles and equipment traveling more than 15 miles per hour from emitting dust that is visible crossing the project boundaries;

3. Storage piles and disturbed areas not subject to vehicular traffic must be stabilized by being kept adequately wetted, treated with a chemical dust suppressant, or covered with material that contains less than 0.25 percent asbestos; and

4. Activities must be conducted so that no track-out from any road construction project is visible on any paved roadway open to the public.

- (C) Equipment and operations must not cause the emission of any dust that is visible crossing the project boundaries.
- (2) No person shall conduct any road construction or maintenance activity that disturbs the ground surface in an area that meets the criteria in subsection (b)(3) unless:
 - (A) The APCO is notified no later than the next business day of the discovery that the area meets the criteria in subsection (b)(3); and
 - (B) The requirements of subsections (d)(1)(B) through (d)(1)(C), are implemented within twenty-four (24) hours of the discovery.
- (3) *Exemptions from the Requirements for Road Construction and Maintenance.* The following exemptions may apply in addition to the applicable general exemptions specified in subsection (c).
 - (A) *Emergency Road Repairs:* Subsection (d)(1)(A) shall not apply when construction of a road or firebreak, or a road repair is necessary due to a landslide, flood, or other emergency or to mitigate a condition that constitutes an imminent hazard to the public. The owner/operator shall notify the APCO no later than the next business day of the action taken and the condition establishing the applicability of this subsection.
 - (B) *Remote locations:* The APCO may provide an exemption from the requirements of subsection (d) for any activity which will occur at a remote location.
 - 1. The district shall grant or deny a request for an exemption within ninety (90) days of the receipt of a complete application.
 - 2. If the request for an exemption is denied, the APCO shall provide written reasons for the denial.

(e) Requirements for Construction and Grading Operations.

- (1) *Areas of one acre or less meeting the criteria in subsections (b)(1) or (b)(2):* No person shall engage in any construction or grading operation on property where the area to be disturbed is **one (1.0) acre or less** unless all of the following dust mitigation measures are initiated at the start and maintained throughout the duration of the construction or grading activity:

- (A) Construction vehicle speed at the work site must be limited to fifteen (15) miles per hour or less;
 - (B) Prior to any ground disturbance, sufficient water must be applied to the area to be disturbed to prevent visible emissions from crossing the property line;
 - (C) Areas to be graded or excavated must be kept adequately wetted to prevent visible emissions from crossing the property line;
 - (D) Storage piles must be kept adequately wetted, treated with a chemical dust suppressant, or covered when material is not being added to or removed from the pile;
 - (E) Equipment must be washed down before moving from the property onto a paved public road; and
 - (F) Visible track-out on the paved public road must be cleaned using wet sweeping or a HEPA filter equipped vacuum device within twenty-four (24) hours.
- (2) *Areas greater than one acre meeting the criteria in subsections (b)(1) or (b)(2):* No person shall engage in any construction or grading operation on property where the area to be disturbed is **greater than one (1.0) acre** unless:
- (A) An Asbestos Dust Mitigation Plan for the operation has been:
 - 1. Submitted to and approved by the district before the start of any construction or grading activity; and
 - 2. The provisions of that dust mitigation plan are implemented at the beginning and maintained throughout the duration of the construction or grading activity; and
 - (B) For a project started before the effective date of this section for which an asbestos dust mitigation plan was submitted at least sixty (60) days before the effective date, and for which the district has not yet approved the asbestos dust mitigation plan:
 - 1. The measures in subsection (e)(1) must be implemented and maintained until the district-approved asbestos dust mitigation plan is implemented; and
 - 2. The provisions of the district-approved asbestos dust mitigation plan must be implemented within fourteen (14)

days of district approval of the plan and maintained throughout the remainder of the construction or grading activity.

- (3) *Property that meets the criteria in subsection (b)(3)*: No person shall engage in any construction or grading operation unless the following requirements are met:
- (A) The owner/operator notifies the district of the discovery of naturally-occurring asbestos, serpentine, or ultramafic rock no later than the next business day;
 - (B) The dust mitigation measures in subsection (e)(1) are implemented within twenty-four (24) hours after determining that the property meets the criteria in subsection (b)(3); and
 - (C) For operations in which the area to be disturbed is **one (1.0) acre or less**, the dust mitigation measures in subsection (e)(1) are maintained throughout the duration of the construction or grading activity; or
 - (D) For operations in which the area to be disturbed is **greater than one (1.0) acre**, the owner/operator must:
 - 1. Submit an asbestos dust mitigation plan to the district within fourteen (14) days of the discovery of naturally-occurring asbestos, serpentine, or ultramafic rock;
 - 2. Maintain the dust mitigation measures in subsection (e)(1) until the provisions of the district-approved asbestos dust mitigation plan are implemented;
 - 3. Implement the provisions of the district-approved asbestos dust mitigation plan within fourteen (14) days of district approval of the plan; and
 - 4. Maintain the provisions of the district-approved asbestos dust mitigation plan throughout the remainder of the construction or grading activity.
- (4) *Asbestos Dust Mitigation Plans*: An Asbestos Dust Mitigation Plan must specify dust mitigation practices which are sufficient to ensure that no equipment or operation emits dust that is visible crossing the property line, and must include one or more provisions addressing **each** of the following topics.

- (A) Track-out prevention and control measures which shall include:
1. Removal of any visible track-out from a paved public road at any location where vehicles exit the work site; this shall be accomplished using wet sweeping or a HEPA filter equipped vacuum device at the end of the work day or at least one time per day; and
 2. Installation of one or more of the following track-out prevention measures:
 - i. A gravel pad designed using good engineering practices to clean the tires of exiting vehicles;
 - ii. A tire shaker;
 - iii. A wheel wash system;
 - iv. Pavement extending for not less than fifty (50) consecutive feet from the intersection with the paved public road; or
 - v. Any other measure as effective as the measures listed above.
- (B) Keeping active storage piles adequately wetted or covered with tarps.
- (C) Control for disturbed surface areas and storage piles that will remain inactive for more than seven (7) days, which shall include one or more of the following:
1. Keep the surface adequately wetted;
 2. Establishment and maintenance of surface crusting sufficient to satisfy the test in subsection (h)(6);
 3. Application of chemical dust suppressants or chemical stabilizers according to the manufacturers' recommendations;
 4. Covering with tarp(s) or vegetative cover;
 5. Installation of wind barriers of fifty (50) percent porosity around three (3) sides of a storage pile;
 6. Installation of wind barriers across open areas; or
 7. Any other measure as effective as the measures listed above.

- (D) Control for traffic on on-site unpaved roads, parking lots, and staging areas which shall include:
1. A maximum vehicle speed limit of fifteen (15) miles per hour or less; and
 2. One or more of the following:
 - i. Watering every two hours of active operations or sufficiently often to keep the area adequately wetted;
 - ii. Applying chemical dust suppressants consistent with manufacturer's directions;
 - iii. Maintaining a gravel cover with a silt content that is less than five (5) percent and asbestos content that is less than 0.25 percent, as determined using an approved asbestos bulk test method, to a depth of three (3) inches on the surface being used for travel; or
 - iv. Any other measure as effective as the measures listed above.
- (E) Control for earthmoving activities which shall include one or more of the following:
1. Pre-wetting the ground to the depth of anticipated cuts;
 2. Suspending grading operations when wind speeds are high enough to result in dust emissions crossing the property line, despite the application of dust mitigation measures;
 3. Application of water prior to any land clearing; or
 4. Any other measure as effective as the measures listed above.
- (F) *Control for off-site transport.* The owner/operator shall ensure that no trucks are allowed to transport excavated material off-site unless:
1. Trucks are maintained such that no spillage can occur from holes or other openings in cargo compartments; and
 2. Loads are adequately wetted and either:
 - i. Covered with tarps; or
 - ii. Loaded such that the material does not touch the front, back, or sides of the cargo compartment at any point less than six inches from the top and that no point of the load extends above the top of the cargo compartment.

(G) *Post construction stabilization of disturbed areas.* Upon completion of the project, disturbed surfaces shall be stabilized using one or more of the following methods:

1. Establishment of a vegetative cover;
2. Placement of at least three (3.0) inches of non-asbestos-containing material;
3. Paving;
4. Any other measure deemed sufficient to prevent wind speeds of ten (10) miles per hour or greater from causing visible dust emissions.

(H) *Air monitoring for asbestos (if required by the APCO).*

1. If required by the district APCO, the plan must include an air-monitoring component.
2. The air monitoring component shall specify the following:
 - i. Type of air sampling device(s);
 - ii. Siting of air sampling device(s);
 - iii. Sampling duration and frequency; and
 - iv. Analytical method.

(I) *Frequency of reporting:* The plan shall state how often the items specified in subsection (e)(5)(B), and any other items identified in the plan, will be reported to the district.

(5) *Recordkeeping and Reporting Requirements.*

(A) *Recordkeeping Requirements:* The owner/operator shall maintain all of the following records for at least seven (7) years following the completion of the construction project:

1. The results of any air monitoring conducted at the request of the APCO;
2. The documentation for any geologic evaluation conducted on the property for the purposes of obtaining an exemption, except the archive of collected samples which may be discarded at the expiration of the exemption or one (1) year after the exemption is granted whichever is less; and

3. The results of any asbestos bulk sampling that meets any of the following conditions:
 - i. The asbestos bulk sampling was conducted by the owner/operator to document the applicability of or compliance with this section, or
 - ii. The asbestos bulk sampling was done at the request of the district APCO.

(B) *Reporting Requirements:* The owner/operator of any grading or construction operation subject to this section shall submit the following to the District:

1. The results of any air monitoring conducted at the request of the APCO; and
2. The results of any asbestos bulk sampling that meets any of the following conditions:
 - i. Asbestos bulk sampling conducted by the owner/operator to document applicability of or compliance with this section; or
 - ii. Asbestos bulk sampling done at the request of the APCO.

(f) Requirements for Quarrying and Surface Mining Operations.

(1) No person shall engage in any quarrying or surface mining operation that meets the criteria of subsections (b)(1) or (b)(2) unless an Asbestos Dust Mitigation Plan for the operation has been submitted to and approved by the District and the fugitive dust mitigation measures specified in the Plan are implemented and maintained throughout the duration of any quarrying or surface mining operation except,

(A) *Pre-existing Operations:* The owner or operator of any quarrying or surface mining operation that was in operation before the date this section is implemented as determined pursuant to subsection (a) that has not obtained district approval of the asbestos dust mitigation plan may continue operating if all the following conditions are met:

1. The owner/operator has submitted an asbestos dust mitigation plan to the district at least sixty (60) days prior to the date specified in subsection (a);
2. The owner/operator implements all of the dust mitigation measures specified in subsections (f)(2)(B) and (f)(2)(C) by the effective date specified in subsection (a) and maintains

them until the provisions of an approved asbestos dust mitigation plan are implemented; and

3. The owner/operator implements the provisions of the asbestos dust mitigation plan within fourteen (14) days following district approval of the plan.

(B) *Mineral exploration activities:* Mineral exploration activities as defined in the California Public Resources Code section 2714(d) in an area meeting any of the conditions of subsection (b) are not required to submit an asbestos dust mitigation plan but shall instead implement and maintain the following measures throughout the duration of the activity:

1. Limit vehicle speeds on the site to fifteen (15) miles per hour or less;
2. Apply sufficient water during any ground disturbance to prevent visible dust from crossing the property line;
3. Keep disturbed areas and storage piles adequately wetted until they are permanently stabilized;
4. Install a track-out prevention device designed to prevent track-out onto any paved public road;
5. Clean up any visible track-out at the end of the workday or at a minimum within twenty-four (24) hours; and
6. Cover, treat with a chemical dust suppressant, or otherwise stabilize any disturbed areas when operations cease for more than seven (7) days.

(2) The owner/operator of any quarry or surface mine that meets any of the criteria in subsection (b)(3) shall:

- (A) Notify the APCO no later than the next business day of the discovery.
- (B) Implement all the following measures within twenty-four (24) hours following the discovery:
 1. Keep stock and working piles adequately wetted during the addition and removal of material;

2. Keep on-site unpaved roads, parking lots, and staging areas stabilized using one of the following measures:
 - i. Adequately wetted; or
 - ii. Controlled using dust palliatives or suppressants; or
 - iii. paving; or
 - iv. Covered to a depth of three (3) inches with gravel that contains less than 0.25 percent asbestos as determined using an approved asbestos bulk test method;
 3. Keep exposed areas and inactive stockpiles that are prone to mechanical or wind disturbances:
 - i. Adequately wetted; or
 - ii. Controlled using dust palliatives or suppressants, paving, wind berms or breaks; or
 - iii. Covered with tarps or material that contains less than 0.25 percent asbestos as determined using an approved asbestos bulk test method;
 4. Ensure that materials to be quarried, excavated, or graded are adequately wetted;
 5. Ensure that all loads are adequately wetted before and during truck loading operations;
 6. Ensure that all trucks transporting materials off-site meet the conditions of either paragraph i or paragraph ii at the time the truck leaves the site:
 - i. Loads are adequately wetted and covered with tarps; or
 - ii. Loads are adequately wetted and the material does not touch the front back or sides of the cargo compartment at any point less than six (6) inches from the top and no point of the load extends above the top of the cargo compartment; and
 7. Limit vehicle speeds within the quarry or surface mining operation to fifteen (15) miles per hour or less.
- (C) Implement all of the following measures within fourteen (14) days of the determination that the operation meets any of the criteria in subsection (b)(3).
1. Measures to ensure that material being excavated, crushed, screened, loaded, transferred or conveyed does not result in any dust that is visible crossing the property line.

2. Measures to ensure that no grinding mill, screening operation, or transfer point on a belt conveyor discharges into the air any visible emissions other than uncombined water vapor, for a period aggregating more than three minutes in any one hour which are:
 - i. Fifty percent as dark or darker in shade as that designated as number one on the Ringlemann Chart, as published by the United States Bureau of Mines; or
 - ii. Of such opacity as to obscure an observers view to a degree equal to or greater than smoke as described in subsection (f)(2)(C)2.i. or ten (10) percent opacity.
3. Measures to ensure that no crusher discharges into the air any visible emissions other than uncombined water vapor, for a period aggregating more than three minutes in any one hour which are:
 - i. Seventy-five percent as dark or darker in shade as that designated as number one on the Ringlemann Chart, as published by the United States Bureau of Mines; or
 - ii. Of such opacity as to obscure an observers view to a degree equal to or greater than smoke as described in subsection (f)(3)(C)3.i. or fifteen (15) percent opacity.
4. Measures for material handling sufficient to meet the requirements of subsections (f)(2)(C)1. through (f)(2)(C)3. Such measures may include the following:
 - i. Installation and operation of spraybars on all conveyors; and
 - ii. Installation of shrouds at all drop points.
5. Track-out control and prevention measures which shall include:
 - i. Installation of a gravel pad, grizzly, tire washing system, or paving at least fifty (50) feet of the access road, and
 - ii. Cleaning any visible track-out off the paved public road using wet sweeping or a HEPA filter equipped vacuum device at the end of each workday.
6. Stabilization of all on-site roads, parking lots, and staging areas open to the public by one of the following methods:
 - i. Pave with asphalt or concrete, or
 - ii. Treat with a chemical dust suppressant applied according to manufacturers directions, or
 - iii. Maintain a gravel cover that has a depth of at least three (3) inches and contains less than 0.25 percent asbestos

as determined using an approved asbestos bulk test method.

- (D) Submit an Asbestos Dust Mitigation Plan to the District within fourteen (14) days and maintain the measures specified in subsections (f)(2)(B) and (f)(2)(C) until the asbestos dust mitigation measures in the district-approved Asbestos Dust Mitigation Plan are implemented.
- (3) An Asbestos Dust Mitigation Plan required by subsections (f)(1) and (f)(2)(D) must include sections which address each of the following topics.
- (A) A Fugitive Dust Mitigation Component which shall, at a minimum, include the measures specified in subsections (f)(2)(B) and (f)(2)(C), unless the APCO determines that it is appropriate to add, omit, or modify these measures depending on site-specific parameters. The plan shall also require that:
 - 1. Equipment and operations do not emit dust that is visible crossing the property line;
 - 2. Crushers do not discharge into the air any visible emissions other than uncombined water vapor, for a period aggregating more than three minutes in any one hour, which is:
 - i. Seventy-five percent as dark or darker in shade as that designated as number one on the Ringlemann Chart, as published by the United States Bureau of Mines; or
 - ii. Of such opacity as to obscure an observers view to a degree equal to or greater than smoke as described in subsection (f)(3)(A)2.i. or fifteen (15) percent opacity; and
 - 3. Grinding mills, screening operations, and transfer points on belt conveyors do not discharge into the air any visible emissions other than uncombined water vapor, for a period aggregating more than three minutes in any one hour, which is:
 - i. Fifty percent as dark or darker in shade as that designated as number one on the Ringlemann Chart, as published by the United States Bureau of Mines; or
 - ii. Of such opacity as to obscure an observers view to a degree equal to or greater than smoke as described in subsection (f)(3)(A)3.i. or ten (10) percent opacity.

- (B) *Air monitoring for asbestos (if required by the APCO).*
 - 1. If required by the district APCO, the plan must include an air monitoring component.
 - 2. The air monitoring component shall specify the following:
 - i. Type of air sampling device(s);
 - ii. Siting of air sampling device(s);
 - iii. Sampling duration and frequency; and
 - iv. Analytical method.
- (C) *Frequency of reporting.* The plan shall state how often the items specified in subsection (f)(5)(B), and any other items identified in the plan, will be reported to the district.
- (4) Upon petition by the owner/operator the APCO may approve the use of requirements or restrictions established under other regulatory programs to meet the requirements of subsection (f) under the following conditions:
 - (A) The requirements or restrictions are equivalent to or more stringent than the requirements of subsection (f); and
 - (B) The requirements or restrictions are enforceable by the APCO.
- (5) *Recordkeeping and Reporting Requirements:* The owner/operator of a surface mining or quarrying operation subject to this section must comply with the following recordkeeping and reporting requirements.
 - (A) *Recordkeeping Requirements:* The owner/operator shall maintain all of the following records for at least seven (7) years:
 - 1. The results of any air monitoring conducted at the request of the APCO;
 - 2. The documentation for any geologic evaluation conducted on the property for the purpose of obtaining an exemption except, the archive of collected rock samples which may be discarded at the expiration of the exemption or one (1) year after the district granted or denied the exemption, whichever comes first; and
 - 3. The results of any asbestos bulk sampling that meets any of the following conditions:

- i. The asbestos bulk sampling was conducted by the owner/operator to document the applicability of, or compliance with this section; or
- ii. The asbestos bulk sampling was done at the request of the district APCO.

(B) *Reporting Requirements:* The owner/operator shall submit the following to the District:

1. The results of any air monitoring conducted at the request of the APCO;
2. The documentation of any geologic evaluation conducted on the property in question; and
3. The results of any asbestos bulk sampling that meets any of the following conditions:
 - i. Asbestos bulk sampling conducted by the owner/operator to document applicability of or compliance with this section; or
 - ii. Asbestos bulk sampling done at the request of the district APCO.

(g) **Air Monitoring for Asbestos.** Pursuant to the requirements of Health and Safety Code section 41511:

- (1) Air monitoring may be required by the district APCO.
- (2) The APCO may revise the asbestos dust mitigation plan on the basis of the results of the air monitoring.

(h) **Test Methods.**

- (1) *Ultramafic Rock:* The ultramafic rock composition of any material shall be determined using standard analysis techniques including, but not limited to, color index assessment, microscopic examination, petrographic analysis or rock thin sections, or chemical analysis techniques, such as X-ray fluorescence spectrometry or inductively coupled plasma analysis.
- (2) *Bulk Sampling Methods:* ARB Test Method 435, or an alternative asbestos bulk test method approved in writing by the Executive Officer of the California Air Resources Board, shall be used to determine the asbestos content of a bulk sample. For the purposes of determining compliance with this section, references in ARB Test Method 435 to "serpentine aggregate" shall mean "gravel" or other "bulk materials" to be tested for asbestos content.

- (3) *Analysis of Air Samples:* Analysis of all air samples shall follow the analytical method specified by the United States Environmental Protection Agency, Asbestos Hazard Emergency Response Act (AHERA) criteria for asbestos (40 CFR, Part 763 Subpart E, Appendix A, adopted October 30, 1987), with the following exceptions:
 - (A) The analytical sensitivity shall be 0.001 structures per cubic centimeter (0.001 s/cc); and
 - (B) All asbestos structures with an aspect ratio greater than three to one (3 to1) shall be counted irrespective of length.
- (4) The results of the analysis of air samples shall be reported as transmission electron microscopy (TEM) asbestos structures per cubic centimeter (s/cc).
- (5) *Adequately Wetted:* Field determination of “adequately wetted” shall be as follows:
 - (A) If the district-approved asbestos dust mitigation plan has specified a percent moisture content for specific materials the determination shall be as specified in the district-approved asbestos dust mitigation plan; or
 - (B) If no moisture threshold is specified in a district-approved asbestos dust mitigation plan, a sample of at least one (1) quart in volume shall be taken from the top three (3) inches of a road, or bare area or from the surface of a stockpile. The sample shall be poured out from a height of four (4) feet onto a clean hard surface. The material shall be considered to be adequately wetted if there is no observable dust emitted when the material is dropped.
- (6) *Surface Crusting:* “Measurement of the stability of surface crusting on horizontal surfaces” shall be as follows:
 - (A) Where a visible crust exists, drop a steel ball with a diameter of 15.9 millimeters (0.625 inches) and a mass ranging from 16 to 17 grams from a distance of 30 centimeters (one foot) directly above (at a 90 degree angle perpendicular to) the ground surface. If blowsand (thin deposits of loose grains covering less than 50 percent of the surface that have not originated from the surface being tested) is present, clear the blowsand from the surfaces to be tested before dropping the steel ball.

- (B) A sufficient crust is determined to exist if, when the ball is dropped according to subsection (h)(6)(A), the ball does not sink into the surface so that it is partially or fully surrounded by loose grains and, upon removing the ball, the surface on which it was dropped has not been pulverized so that loose grains are visible.
- (C) Drop the ball three times each in three representative test areas within a survey area measuring 1 foot by 1 foot that represents a random portion of the surface being evaluated. The test area shall be deemed to have passed if at least two of the three times the ball was dropped, the results met the criteria in subsection (h)(6)(B). If all three test areas pass, the area shall be deemed to be "sufficiently crusted".

(i) **Definitions.** For the purposes of this section, the following definitions shall apply:

- (1) "Access road" means any road extending from a public thoroughfare onto the property of a construction project, quarry, or surface mining operation.
- (2) "Adequately wetted" means sufficiently moistened with water to minimize the release of particulate matter into the ambient air as determined by the test method(s) in subsection (h)(5).
- (3) "Agricultural operation" means activities necessary for the growing and harvesting of crops or raising of fowl or animals.
- (4) "APCO" means the executive officer, air pollution control officer, or the designee of the executive officer or air pollution control officer of any air pollution control or air quality management district created or continued in existence pursuant to Part 3 (commencing with section 40000), Division 26, Health and Safety Code.
- (5) "Approved asbestos bulk test method" means ARB Test Method 435 or an alternative asbestos bulk test method approved in writing by the Executive Officer of the California Air Resources Board.
- (6) "ARB" means the California Air Resources Board.
- (7) "ARB Test Method 435" means the test method specified in title 17, California Code of Regulations, section 94147.
- (8) "Asbestos" means asbestiforms of the following minerals: chrysotile (fibrous serpentine), crocidolite (fibrous riebeckite), amosite (fibrous cummingtonite--grunerite), fibrous tremolite, fibrous actinolite, and fibrous anthophyllite.

- (9) "Asbestos-containing material" means any material that has an asbestos content of 0.25 percent or greater.
- (10) "Asbestos Dust Mitigation Plan" means a detailed written document specifying measures that would be implemented to minimize the emissions of asbestos-laden dust.
- (11) "Carry-out" or "track-out" means any bulk material that adheres to and agglomerates on the exterior surfaces of motor vehicles, haul trucks, and/or equipment, including tires, and that has fallen or been deposited onto a paved public roadway.
- (12) "Construction," "grading," "construction or grading operation" and "construction or grading activity" mean any surface disturbance conducted with powered equipment or any related activity, including, but not limited to, all surface and subsurface cuts and fills, excavation, trenching, stockpiling, bulldozing, and landfills.
- (13) "District" means any air pollution control or air quality management district created or continued in existence pursuant to Part 3 (commencing with section 40000), Division 26, Health and Safety Code.
- (14) "Geographic ultramafic rock unit" means a geographic area that is designated as an ultramafic rock unit or ultrabasic rock unit, including the unit boundary line, on any of the maps referenced in Appendix A.
- (15) "Geologic evaluation" means an evaluation of a property to determine the presence of various types of rocks, including ultramafic rock, serpentinite, or other metamorphic derivatives of ultramafic rock.
- (16) "Gravel pad" means a layer of gravel, rock, or crushed rock which is at least one inch or larger in diameter and less than five (5) percent silt content, maintained at the point of intersection of a paved public roadway and a work site entrance to dislodge mud, dirt, and debris from tires of motor vehicles and haul trucks prior to leaving a worksite.
- (17) "Grizzly" means a device used to dislodge mud, dirt, and debris from the tires and undercarriage of motor vehicles and haul trucks prior to leaving the work site.
- (18) "HEPA filter" means a High Efficiency Particulate Air filter used to remove particles less than one (1) micron in aerodynamic diameter and operates at removal efficiencies of 99.9 percent or greater.

- (19) "Naturally-occurring asbestos" means asbestos that has not been processed in an asbestos mill.
- (20) "Owner/operator" or "person" includes, but is not limited to:
- (A) An individual, trust, firm, joint stock company, business concern, partnership, limited liability company, association, or corporation including, but not limited to, a government corporation;
 - (B) Any city, county, district, commission, the state or any department, agency, or political subdivision thereof, any interstate body, and the federal government or any department or agency thereof to the extent permitted by law; or
 - (C) A project proponent and any of its contractors or subcontractors.
- (21) "Paving" means creating a cover consisting of portland cement, asphalt concrete, or chip seal.
- (22) "Project Boundaries" means the right-of-way and any construction easements adjacent to and necessary for the purposes of a specific road construction project or maintenance activity.
- (23) "Property" means any real property including, but not limited to, any contiguous parcel or parcels of land and anything attached to, or erected on it.
- (24) "Quarrying" means the act of obtaining stone from the earth by means of cutting, digging, excavating, or blasting and includes processes used to convert the excavated material into commercial products.
- (25) "Registered geologist" means an individual that is currently licensed as a geologist with the State of California, Department of Consumer Affairs, Board of Geology and Geophysicists.
- (26) "Remote location" means any location that is at least one (1.0) mile from the location of a receptor. "Receptor" includes, but is not limited to, any hospital, school, day care center, work site, business, residence, and permanent campground. The distance to the nearest receptor is to be measured from the outermost limit of the area to be disturbed or road surface, whichever is closer.
- (27) "Road Construction and Maintenance" means the activities undertaken to build roads, highways, railroads, bridges, culverts, drains and other works incidental to road or highway construction, and maintenance activities that involve grading or excavation. Road Construction and Maintenance does

not include the construction of rest stops, maintenance buildings, or parking lots. These excluded activities are subject to the requirements of subsection (e).

- (28) "Road surface" means the traveled way of a road and any shoulder which may extend up ten (10) feet from the edge of the traveled way.
- (29) "Sand and Gravel Operation" means any facility operating in alluvial deposits.
- (30) "Serpentine" means any form of the following hydrous magnesium silicate minerals: antigorite, lizardite, and chrysotile.
- (31) "Serpentinite" means a rock consisting almost entirely of serpentine, although small amounts of other minerals such as magnetite, chromite, talc, brucite, and tremolite-actinolite may also be present. "Serpentinite" is a metamorphic derivative of the ultramafic rocks, peridotite, pyroxenite, or dunite.
- (32) "Surface mining" means all, or any part of, the process involved in the mining of minerals on mined lands by removing overburden and mining directly from the mineral deposit, open-pit mining of minerals naturally exposed, mining by the auger method, dredging and quarrying, or surface work incident to an underground mine. "Surface mining" includes, but is not limited to, in place distillation or retorting or leaching, the production and disposal of mining waste, prospecting and exploratory activities or any activity subject to regulation under the Surface Mining and Reclamation Act of 1975, Public Resources Code section 2700 et seq.
- (33) "Ultrabasic rock" means ultramafic rock.
- (34) "Ultramafic rock" means an igneous rock composed of 90 percent or greater of one or a combination of the following iron/magnesium-rich, dark-colored silicate minerals: olivine, pyroxene, or more rarely amphibole. For the purposes of this section, "ultramafic rock" includes the following rock types: dunite, pyroxenite, and peridotite; and their metamorphic derivatives.
- (35) "Visible emissions" means any particulate matter that is visually detectable without the aid of instruments other than corrective lenses.

NOTE: Authority cited: Sections 39600, 39601, 39650, 39658, 39659, 39666, and 41511, Health and Safety Code. Reference: Sections 39650, 39658, 39659, 39666, and 41511, Health and Safety Code.

APPENDIX A

California Department of Conservation Division of Mines and Geology

AVAILABLE GEOLOGIC MAPS FOR CALIFORNIA

GEOLOGIC ATLASES OF CALIFORNIA Scale 1:250,000

GEOLOGIC ATLAS OF CALIFORNIA: ALTURAS

Compiled by Gay, T.E. and others, 1958

GEOLOGIC ATLAS OF CALIFORNIA: BAKERSFIELD

Compiled by Smith, A.R., 1964 (reprinted 1992)

GEOLOGIC ATLAS OF CALIFORNIA: DEATH VALLEY

Compiled by Streitz, R.L. and Stinson, M.C., 1974 (reprinted 1991)

GEOLOGIC ATLAS OF CALIFORNIA: FRESNO

Compiled by Matthews, R.A. and Burnett, J.L., 1965 (reprinted 1991)

GEOLOGIC ATLAS OF CALIFORNIA: KINGMAN

Compiled by Jennings, C.W., 1961

GEOLOGIC ATLAS OF CALIFORNIA: LONG BEACH

Compiled by Jennings, C.W., 1962 (reprinted 1992)

GEOLOGIC ATLAS OF CALIFORNIA: LOS ANGELES

Compiled by Jennings, C.W. and Strand, R.G., 1969 (reprinted 1991)

GEOLOGIC ATLAS OF CALIFORNIA: MARIPOSA

Compiled by Strand, R.G., 1967 (reprinted 1991)

GEOLOGIC ATLAS OF CALIFORNIA: NEEDLES

Compiled by Bishop, C.C., 1963 (reprinted 1992)

GEOLOGIC ATLAS OF CALIFORNIA: REDDING

Compiled by Strand, R.G., 1962

GEOLOGIC ATLAS OF CALIFORNIA: SALTON SEA

Compiled by Jennings, C.W., 1967 (reprinted 1992)

GEOLOGIC ATLAS OF CALIFORNIA: SAN LUIS OBISPO

Compiled by Jennings, C.W., 1958 (reprinted 1992)

GEOLOGIC ATLAS OF CALIFORNIA: SAN DIEGO - EL CENTRO
Compiled by Strand, R.G., 1962 (reprinted 1992)

GEOLOGIC ATLAS OF CALIFORNIA: SANTA ANA
Compiled by Rogers, T.H., (reprinted 1992)

GEOLOGIC ATLAS OF CALIFORNIA: SANTA CRUZ
Compiled by Jennings, C.W. and Strand, R.G., 1958 (reprinted 1992)

GEOLOGIC ATLAS OF CALIFORNIA: SANTA MARIA
Compiled by Jennings, C.W., 1959 (reprinted 1992)

GEOLOGIC ATLAS OF CALIFORNIA: TRONA
Compiled by Jennings, C.W., 1962

GEOLOGIC ATLAS OF CALIFORNIA: UKIAH
Compiled by Jennings, C.W. and Strand, R.G., 1960 (reprinted 1992)

GEOLOGIC ATLAS OF CALIFORNIA: WALKER LAKE
Compiled by Koenig, J.B., 1963 (reprinted 1992)

GEOLOGIC ATLAS OF CALIFORNIA: WESTWOOD
Compiled by Lyndon, P.A. and others, 1960

REGIONAL GEOLOGIC MAP SERIES Scale 1:250,000

GEOLOGIC MAP OF THE CHICO QUADRANGLE
(set of five sheets)
By Saucedo, G.J. and Wagner, D.L., 1992

GEOLOGIC MAP OF THE SACRAMENTO QUADRANGLE
(set of four sheets)
Compiled by Wagner, D.L. and others, 1981

GEOLOGIC MAP OF THE SANTA ROSA QUADRANGLE
(set of five sheets)
Compiled by Wagner, D.L. and Bortugno, E.J. (reprinted 1999)

GEOLOGIC MAP OF THE SAN BERNARDINO QUADRANGLE
(set of five sheets)
Compiled by Bortugno, E.J. and Spittler, T.E. (reprinted 1998)

GEOLOGIC MAP OF THE WEED QUADRANGLE
(set of four sheets)
By Wagner, D.L. and Saucedo, G.J., 1987

GEOLOGIC MAP OF THE SAN FRANCISCO-SAN JOSE QUADRANGLE
(set of five sheets)
By Wagner, D.L., Bortugno, E.J. and McJunkin, R.D., 1990
Color-coded faults

LOCAL GEOLOGIC MAPS

AREAS MORE LIKELY TO CONTAIN NATURALLY-OCCURRING ASBESTOS
IN WESTERN EL DORADO COUNTY, CALIFORNIA
By Ron Churchill, March 2000
Scale 1:100,000

SERPENTINITE SURVEY OF LAKE COUNTY, CALIFORNIA – MAP A,
ULTRAMAFIC, ULTRABASIC, AND SERPENTINE ROCK AND SOILS OF LAKE
COUNTY,
Adopted: March 2, 1992
Scale: 1:100,000