# Appendix I

## Estimation of Costs to State and Local Agencies, and Air Pollution Control and Air Quality Management Districts from the 1990 Control Measure for Asbestos-Containing Serpentine Rock in Surfacing Applications

COST ESTIMATES FOR STATE AND LOCAL GOVERNMENT

For Asbestos-Containing Serpentine Regulation

## 1. Cost Estimates for State Agencies

The state agencies affected by this regulation are those agencies which build or maintain roads that are fully or partially surfaced with serpentine aggregate (i.e., gravel roads with serpentine aggregate). The staff of the Air Resources Board (ARB) has conducted a telephone survey to determine which agencies build or maintain roads. Based on this survey, the ARB believes that the following three state agencies may incur costs as a result of this regulation: California Department of Transportation, California Department of Forestry, and California Department of Parks and Recreation. Costs for these agencies are discussed below.

With the exception of these three state agencies, we believe other state agencies would incur no costs or negligible costs as a result of this regulation, because no other state agency builds or maintains any significant number of roads surfaced with serpentine aggregate.

### a. California Department of Transportation (CalTrans)

CalTrans has the responsibility to maintain an extensive network of roads throughout the state. While the vast majority of these roads are paved roads, some paved roads have shoulders surfaced with aggregate, and CalTrans also maintains a few gravel roads. CalTrans representatives have worked closely with the ARB in developing this regulation and have supplied the ARB with a written estimate of the costs they believe that they will incur as a result of of this regulation. This cost estimate is included with this package as Attachment A.

Caltrans believes that some of the aggregate they use to surface roads and road shoulders may contain serpentine. Some of this aggregate is directly produced by CalTrans from local sources located near various roads, and other aggregate is purchased by CalTrans from outside sources. For material produced by CalTrans from local sources, CalTrans believes that within the first year after the regulations are adopted they will spend approximately $25,000 to survey and test their sources of surfacing material to determine if they contain unacceptable levels of asbestos. CalTrans staff believes that approximately one to 10 percent of their current sites may contain more than 10 percent serpentine and that it would be more cost effective to buy aggregate material from commercial sources than to test these sites for asbestos. They have estimated that they would have additional costs of up to $178,000 per year to purchase this additional material. Hence, in the first year, CalTrans could spend an additional $203,000 as a result of this regulation. Annually thereafter, CalTrans costs are estimated to be $178,000.

b. California Department of Forestry (CDF)

CDF staff believe that they will incur no testing costs as a result of this regulation because they do not produce their own aggregate from local sources. However, CDF staff has estimated that 60% of their $50,000 budget that is allotted for unpaved roads might be indirectly affected by the regulation because they may choose to purchase more expensive alternate material instead of the serpentine that they currently buy. We estimate that CDF could incur an increased cost of $20,000 per year (see Attachment B).

c. California Department of Parks and Recreation (DPR)

DPR staff believe that they may have a few limited sources of local aggregate and may incur a maximum of $1,000 in testing costs. They also believe that any other costs as a result of this regulation will be minimal as compared to their annual budget of $1.5 million for roads (paved and unpaved). They stated that only service roads and fire roads are likely to be unpaved and that there should not be a significant number of these roads surfaced with serpentine material.

## 2. Cost Estimates for Local Air Pollution Control Districts and Air Quality Management Districts

The ARB usually estimates costs for local air pollution control and air quality management districts (districts) based on the size of the district; larger urban districts generally have higher costs than smaller rural districts. For this regulation, however, we did not estimate the costs based on district size because the districts most affected by this regulation will be those which have substantial serpentine rock deposits and facilities which produce serpentine rock. Many of these districts are small rural districts. We expect the total costs to districts known to have serpentine rock to be higher because they are more likely to have facilities that produce serpentine rock. However, some of the cost components used to calculate total district costs may be higher for the districts known to have little or no serpentine. This is because some of the larger districts surveyed, even though they are known to have little or no serpentine, have higher labor rates and more facilities for which they must determine if the facilities have serpentine. All the tables, formulas and assumptions we used are in Attachment C.

Cost estimates have been based on a telephone survey of 15 districts. Ten of the fifteen districts surveyed are districts that have known serpentine deposits and five of the fifteen have little or no serpentine deposits. The remaining 26 districts may or may not have serpentine deposits. Therefore total costs to these 26 districts were calculated based on the midpoint of the average cost for the 10 districts surveyed known to have serpentine and the average cost for the 5 districts surveyed known to have little or no serpentine. The costs to the local air pollution control districts and air quality management districts have been estimated for three categories: 1) surveyed districts known to have serpentine, 2) surveyed districts known to have little or no serpentine, and 3) districts not surveyed.

The costs that districts will incur as a result of this regulation include the following: costs to formally adopt the regulation, costs to identify the number of serpentine facilities within each district, and costs to enforce the regulation (including any additional staff time necessary to handle public complaints that may arise as a result of the adoption of the regulation). Each of these costs is discussed below.

**Adoption Costs**

We assumed that all districts will incur costs associated with the initial adoption of the control measure. Based on the survey, the average cost for adopting this regulation for individual districts is approximately $4,000 to districts known to have serpentine, $5,000 to the districts known to have little or no serpentine, and $4,500 (midpoint of the two averages) to the 26 districts not surveyed.

**Costs to Identify Facilities**

a. First year cost

In addition to the costs incurred by the districts for adoption of this regulation, we expect districts to incur costs for determining the number of serpentine facilities within their district. We assumed that a district will spend, at most, 64 hours to determine the number of serpentine facilities in their district. The average, first year costs for determining the number of facilities could be $800 for each of the ten districts known to have serpentine, and $1,600 for each of the five districts known to have little or no serpentine. For those districts not surveyed, the average, first year cost for determining the number of serpentine facilities is estimated to be $1,200 (the midpoint of the two averages). We also assumed that all the facilities located in districts known to have serpentine would indeed have serpentine. For districts known to have little or no serpentine, we assumed that 10% of the facilities have serpentine.

b. Annual cost

We assumed that there would be no annual costs to the districts for identification of serpentine facilities. We made this assumption because the determination of serpentine facilities conducted in the first year, should not change substantially without the district's knowledge of new serpentine facilities or facilities closing.

**Enforcement Costs**

a. First year cost

In addition to adoption and identification cost incurred by the district, we expect districts to incur costs for enforcement of this regulation. The enforcement costs include inspection costs and costs for addressing any additional complaints.

For inspections, we assumed that a district would inspect a serpentine facility once a year and audit the facility's receipts of record quarterly. Inspection costs would include district staff time spent at the facility

(including travel time), sampling and testing costs (estimated to be $230 per serpentine facility), and costs for quarterly audits. The average inspection cost for the first year to a district known to have serpentine is $7,000. For a district known to have little or no serpentine, the average, first year inspection cost is $5,000. The average, first year inspection cost for the 26 districts not surveyed is estimated to be $6,000 (the midpoint of the two averages).

We assumed that the districts will work on average approximately 4 hours per additional complaint as a result of this regulation. For a district known to have little or no serpentine, we assumed that there would be no additional complaints. (The five districts surveyed under this category believe that they would have no additional complaints as a result of this regulation.) Therefore, there would be no costs for complaints to districts that have no serpentine deposits. The average number of additional complaints in the first year for a district known to have serpentine are estimated at 45. The average number of additional complaints per year for the 26 districts not surveyed are assumed to be 20. The average individual district cost to a district known to have serpentine, for addressing any additional complaints in the first year, is $6,000. The average individual district cost to the districts not surveyed, for addressing additional complaints in the first year, is estimated to be $3,000 (the midpoint of the two averages).

By adding the average costs for enforcement and additional complaints, the average first year enforcement cost to the districts known to have serpentine is $13,000. The average first year enforcement cost to the districts known to have little or no serpentine is $5,000. The average first year enforcement cost to the districts not surveyed is estimated to be $9,000 (the midpoint of the two averages).

b. Annual cost

The average annual inspection cost to the districts are assumed to remain the same as in the first year. The additional complaints, however, should decrease. We assumed that a district known to have serpentine would have, on average, about 20 complaints annually. The districts not surveyed would have about 10 annually. The average annual cost for additional complaints to districts known to have serpentine is $3,000. To the districts not surveyed, the average annual cost is estimated to be $1,500 (the midpoint of the two averages). Districts known to have little or no serpentine are assumed to have no costs for additional complaints.

Again, by adding the average first year enforcement cost to the annual costs for addressing additional complaints, the average annual enforcement cost to the districts known to have serpentine is $10,000. The average annual enforcement cost to the districts known to have little or no serpentine is $5,000. The average annual enforcement cost to the districts not surveyed is estimated to be $7,500 (the midpoint of the two averages).

**Individual District Cost**

a. First year cost

We assumed that the district's first year cost would include costs for adoption of the regulation, determining the number of serpentine facilities, and enforcement. For a district known to have serpentine, the average, first year individual district cost is $18,000. For a district known to have little or no serpentine, the average, first year individual district cost is $11,000. For the 26 districts not surveyed, the average, first year individual district cost is estimated to be $14,500 (the midpoint of the two averages).

b. Annual cost

We assumed that the district cost annually thereafter would include enforcement only. For districts known to have serpentine, the average individual district cost is $10,000 annually thereafter. For districts known to have little or no serpentine, the average, individual district cost is $5,000 annually thereafter. For the 26 districts not surveyed, the average, individual district cost is estimated to be $7,500 (the midpoint of the two averages).

**Total Statewide Costs for all Districts**

In order to calculate statewide district costs, we have taken the total cost to the districts surveyed that are known to have serpentine and added this amount to the total cost calculated for the districts surveyed known to have little or no serpentine. We also added the total estimated cost for the 26 districts not surveyed. To calculate this cost, we took the midpoint of the two group averages and multiplied it by 26. The first year statewide district cost is $600,000. Annually thereafter, the statewide district cost is $300,000.

(Attachment C contains the information on which we based our cost to the local air pollution control and air quality management districts.)

ATTACHMENT A:

Memo by California Department of Transportation
Explaining the Costs Expected to be Incurred
as a Result of this Regulation

State of California

Business, Transportation and Housing Agency

# Memorandum

To: R. O. Lightcap, Chief
Division of Project Development

Attention Gary Winters, Chief
Office of Hazardous Waste Management

Date: January 12, 1990

File No.:

From: **DEPARTMENT OF TRANSPORTATION**
**DIVISION OF HIGHWAY MAINTENANCE**

Subject: Asbestos-Containing Serpentine

I have been requested by Jose Gomez of the Air Resources Board to provide an estimate of cost to Caltrans maintenance should the proposed Asbestos Airborne Toxic Control Measure (as described in draft dated 1/8/90) be implemented.

It is estimated that it would cost Caltrans maintenance forces $25,000 initially, and at least $178,000 per year to comply. Attached to this memorandum are details upon which this estimate is based. This matter has been discussed with Marvin McCauley and Paul Benson of TransLab.

D. E. Delvey, Chief
District Liaison Branch C

Attachment

cc: MLMcCauley - TransLab w/Attachment
PEBenson - TransLab w/Attachment
JGomez - Air Resources Board w/Attachment

DED:vs

Attachment

Following is a discussion of the estimated cost to Caltrans maintenance forces should the proposed Asbestos Airborne Toxic Control Measure -- Asbestos-Containing Serpentine (as described in draft dated 1/8/90) be implemented.

Caltrans has about 15,900 shoulder-miles of unsurfaced shoulders statewide. During the past fiscal year (88/89) maintenance forces performed work on 43,700 shoulder-miles (indicating, on average, shoulders were worked on almost three times per year). This work cost $12,112,000, of which 14.7% was for materials.

Most of the time (perhaps 2/3) maintenance works on unsurfaced shoulders, no material is added; the motor-grader reshapes the existing material to smooth out ruts and rivulets, and to restore the backing material even with the edge of pavement where it has been eroded away by traffic and rainfall runoff. In those cases where material is hauled in to repair the unsurfaced shoulders, it is obtained about half the time from non-commercial sources at little or no cost. These sources would include cut widening at selected nearby sites within the right of way, Caltrans owned or leased material sites, borrow agreements with private owners, permits with other public agencies (counties, BLM, Forestry, etc.). The remaining hauled-in material is obtained from commercial sources. The material cost, 14.7% of $121,112,000 = $1,780,000, would be primarily for hauled-in material obtained from commercial sources.

The primary effect of the Asbestos Airborne Toxic Control Measure would be on hauled-in material from non-commercial sources. Based on the writer's experience in District 11, it is estimated that Maintenance utilizes several hundred (say 400) of these sites statewide. The measure would require that a registered geologist review all such sites to determine if any site contains at least ten percent serpentine material. It is felt that approximately four sites per day could be reviewed by the geologist, allowing time for travel, site inspection and reporting. At $250 per day this would cost $25,000.

If at least 10% serpentine was determined to be present, testing costs could be incurred to determine the percent asbestos or, as appears likely, it would be cheaper to go to a new source free of serpentine. It is estimated that between 1% and 10% of our present sites would contain at least 10% serpentine. Thus, it is believed that up to 40 new sources of material would need to be obtained.

Because the use of aggregate base for maintenance is not great, perhaps only a hundred cubic yards per mile per year, it would often be cheaper to buy the material from a commercial source than to extensively test for asbestos <u>or</u> to acquire, develop and use new serpentine - free sites. (In some remote areas, there will be no commercial sites reasonably available - but this is likely to be rare.)

If we assume we would discontinue use of 10% of our present non-commercial sites, and, instead, purchase commercial material it is foreseeable that our material costs would increase by 10% or $178,000 per year, based on the estimate that half our present material is purchased from commercial sources.

There are many other unknowns involved, such as whether commercial prices would increase significantly if the measure is adopted. However, it is felt that it would be very uncertain to base any estimates on these other factors.

ATTACHMENT B:

Cost Calculations for the California Department of Forestry

## Procedure Used to Estimate Cost Increase to the California Department of Forestry (CDF)

CDF staff believe that about $30,000 out of their $50,000 annual budget for unpaved roads could be affected by the proposed regulation. We made the following conservative assumptions in estimating the potential cost to CDF.

- All of the $30,000 is used to buy serpentine material
- The material is purchased at a local source at $5/ton (transportation cost is minimal - 50 cents per ton)
- The department buys river rock as the alternative material at $6/ton (not available locally)
- Transportation cost is assumed to add about $3/ton to the price of river rock

Material purchased per year (assumed to be serpentine) = ($ spent/year)/(price/ton)

= ($30,000/year)/($5.50/ton)

= 5,450 tons/year

Additional cost to purchase alternative material (river rock):

Additional cost = (# of tons/year) * (price of river rock - price of serpentine)

= (5,450 tons/year) * ($9 - $5.50)

= $19,075/year

~ $20,000/year

The percent increase in the Department's budget to maintain current level of operations:

Percent increase = ($19,075/$50,000)*(100)
= 38 percent
~ 40 percent

It should be noted that this is a conservative estimate because we've assumed that all of the $30,000 dollars is used to buy serpentine material that would no longer be available. Also, we assumed that they currently buy all their material from local sources which minimize their baseline transportation costs. We believe that the actual cost increase should not exceed the cost estimated above.

ATTACHMENT C:

Tables, Formulas, and Assumptions used in Calculating Costs to the Local Air Pollution Control and Air Quality Management Districts

Table 1

DISTRICT COSTS*
(estimated)

| Categories | # of Districts | First Year Avg. Cost | Annual Avg. Cost |
|---|---|---|---|
| Non-serpentine areas | 5 | $11,000 | $ 5,000 |
| Serpentine areas | 10 | $18,000 | $10,000 |
| Not surveyed ** | 26 | $14,500 | $ 7,500 |

* District costs have been based on a telephone survey of 15 districts that we conducted in January 1990.

** For the 26 districts not surveyed, we assumed the midpoint of the average costs from the non-serpentine areas and the serpentine areas surveyed.

Table 2

DISTRICT PERSON YEARS (PYS) REQUIRED
(estimated)

| Categories | # of Districts | First Year | Annual |
|---|---|---|---|
| Non-serpentine areas | 5 | .13 | .05 |
| Serpentine areas | 10 | .25 | .12 |
| Not surveyed * | 26 | .19 | .09 |

* For the 26 districts not surveyed, we assumed the midpoint of the average costs from the non-serpentine areas and the serpentine areas surveyed.

Table 3

COST TO DISTRICTS (Non-Serpentine Areas)
(Worksheet)

| Dist. # | # of Fac. * (w/serp) | Ins. Time (hrs/yr/f) | Qrtly Aud (hrs/yr/f) | Labor Rate ($/hr) | Testing ($) | Inspect Cost ($) | Compits ($) | Enforce 1st Yr ($) | ID Cost ($) | Adoption ($) | 1st Year Total Cost ($) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 27(3) | 8 | 64 | 40 | 690 | 9,330 | 0 | 9,330 | 2,560 | 0 | 11,890 |
| 9 | 8(1) | 5 | 28 | 30 | 230 | 1,220 | 0 | 1,220 | 840 | 4,000 | 6,060 |
| 10 | 1(0) | 6 | 16 | 30 | 0 | 0 | 0 | 0 | 480 | 4,000 | 4,480 |
| 14 | 41(4) | 10 | 64 | 50 | 920 | 15,720 | 0 | 15,720 | 3,200 | 10,000 | 28,920 |
| 15 | 1(0) | 6 | 28 | 30 | 0 | 0 | 0 | 0 | 840 | 5,000 | 5,840 |
| Avg. | | 7 | 40 | 36 | 368 | 5,254 | 0 | 5,254 | 1,584 | 4,600 | 11,438 |

| | Annual Inspection ($) | Annual Complaints ($) | Annual Enforcement Cost ($) | Person Years First Year | Person Years Annually Thereafter |
|---|---|---|---|---|---|
| | 9,330 | 0 | 9,330 | .13 | .10 |
| | 1,220 | 0 | 1,220 | .09 | .02 |
| | 0 | 0 | 0 | .07 | .00 |
| | 15,720 | 0 | 15,720 | .27 | .14 |
| | 0 | 0 | 0 | .09 | .00 |
| Avg. | 5,254 | 0 | 5,254 | .13 | .05 |

* The number of facilities was taken from the 1989 Division of Mines and Geology data base.

Table 4

COST TO DISTRICTS (Serpentine Areas)
(Worksheet)

| Dist. # | # of Fac. * (w/serp) | Ins. Time (hrs/yr/f) | Qrtly Aud (hrs/yr/f) | Labor Rate ($/hr) | Testing ($) | Inspect Cost ($) | Complts ($) | Enforce 1st Yr ($) | ID Cost ($) | Adoption ($) | 1st Year Total Cost ($) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 5(5) | 8 | 16 | 35 | 1,150 | 5,350 | 6,300 | 11,650 | 560 | 1,000 | 13,210 |
| 3 | 5(5) | 4 | 8 | 30 | 1,150 | 2,950 | 5,400 | 8,350 | 240 | 5,000 | 13,590 |
| 4 | 31(31) | 6 | 8 | 30 | 7,130 | 20,150 | 5,400 | 25,550 | 240 | 15,000 | 40,790 |
| 5 | 3(3) | 6 | 16 | 40 | 690 | 3,330 | 7,200 | 10,530 | 640 | 5,000 | 16,170 |
| 6 | 7(7) | 4 | 32 | 40 | 1,610 | 11,690 | 7,200 | 18,190 | 1,280 | 500 | 20,670 |
| 7 | 3(3) | 4 | 64 | 25 | 690 | 5,790 | 4,500 | 10,290 | 1,600 | 3,000 | 14,890 |
| 8 | 3(3) | 8 | 36 | 20 | 690 | 3,330 | 3,600 | 6,930 | 720 | 5,000 | 12,650 |
| 11 | 3(3) | 6 | 24 | 20 | 690 | 2,490 | 3,600 | 6,090 | 480 | 5,000 | 11,570 |
| 12 | 11(11) | 6 | 16 | 40 | 2,530 | 12,210 | 7,200 | 19,410 | 640 | 3,000 | 23,050 |
| 13 | 1(1) | 8 | 32 | 55 | 230 | 2,430 | 9,900 | 12,330 | 1,760 | 200 | 14,290 |
| Avg. | | 6 | 25.2 | 33.5 | 1,656 | 6,972 | 6,030 | 13,002 | 816 | 4,270 | 18,088 |

| | Annual Inspection ($) | Annual Complaints ($) | Annual Enforcement Cost ($) | Person Years First Year | Person Years Annually Thereafter |
|---|---|---|---|---|---|
| | 5,350 | 2,800 | 8,150 | .17 | .10 |
| | 2,950 | 2,400 | 5,350 | .20 | .07 |
| | 20,150 | 2,400 | 22,550 | .54 | .25 |
| | 3,330 | 3,200 | 6,530 | .19 | .07 |
| | 11,690 | 3,200 | 14,890 | .23 | .16 |
| | 5,790 | 2,000 | 7,790 | .27 | .14 |
| | 3,330 | 1,600 | 4,930 | .29 | .10 |
| | 2,490 | 1,600 | 4,090 | .26 | .08 |
| | 12,210 | 3,200 | 15,410 | .25 | .15 |
| | 2,430 | 4,400 | 6,830 | .12 | .06 |
| Avg. | 6,972 | 2,680 | 9,652 | .25 | .12 |

* The number of facilities was taken from the 1989 Divisions of Mines and Geology data base.

## FORMULAS FOR FIRST YEAR COSTS

1. Audit & Inspection Time = Quarterly Audit Time (hrs./yr./serp.fac.) + Inspection Time (hrs./yr./serp.fac.)

2. Sampling and Testing Cost = $230 x # of Serp. Facilities

3. Inspection Cost = [# of Serp. Facilities x Labor Rate x Audit & Inspection Time] + Sampling and Testing Cost

4. 1st Year Complaint Cost = (Labor Rate) x (4 hrs./complaint) x (# of 1st year complaints)

   # of complaints (1st year) for districts with serpentine = 45
   # of complaints (1st year) for districts without serp. = 0
   # of complaints (1st year) for districts not surveyed = 20

5. 1st Year Enforcement Cost = Inspection Cost + 1st Year Complaint Cost

6. Identification Cost = Labor Rate x Quarterly Audit Time (hrs./yr/serp.fac.)

7. Adoption Cost = Based on estimated amounts given by the 15 districts surveyed

8. 1st Yr. Total Cost = 1st Year Enforcement + Identification Cost + Adoption Cost

9. 1st Year Statewide Cost = Total 1st Year Cost to Dist. w/Serp. (10) + Total 1st Year Cost to Dist. w/o Serp. (5) + Total 1st Year Cost to Dist. Not Surveyed (26)

10. Total 1st Yr. Cost to Dists. = $\left[\frac{\text{Avg. 1st Yr. Cost to Dist. w/Serp.} + \text{Avg. 1st Yr. Cost to Dist. w/o Serp.}}{2}\right]$ x # of Dist. Not Surveyed

## FORMULAS FOR ANNUAL COSTS

1. Audit & Inspection Time = Quarterly Audit Time (hrs./yr./serp.fac.) + Inspection Time (hrs./yr./serp.fac.)

2. Sampling and Testing Cost = $230 x # of Serp. Facilities

3. Inspection Cost = [# of Serp. Facilities x Labor Rate x Audit & Inspection Time] + Sampling and Testing Cost

4. Annual Complaint Cost = (Labor Rate) x (4 hrs./complaint) x (# of Annual complaints)

   # of annual complaints for districts with serpentine = 20
   # of annual complaints for districts without serp. = 0
   # of annual complaints for districts not surveyed = 10

5. Annual Enforcement Cost = Inspection Cost + Annual Complaint Cost

6. Annual Total Cost = Annual Enforcement Cost

7. Annual Statewide Cost = Total Annual Cost to Dist. w/Serp. (10) + Total Annual Cost to Dist. w/o Serp. (5) + Total Annual Cost to Dist. Not Surveyed (26)

8. Total Annual Cost to Dists. = $\left[\frac{\text{Avg. Annual Cost to Dist. w/Serp.} + \text{Avg. Annual Cost to Dist. w/o Serp.}}{2}\right]$ x # of Dist. Not Surveyed

## FORMULAS FOR FIRST YEAR PERSON YEARS

Audit & Inspection Time = Quarterly Audit Time (hrs./yr./serp.fac.) + Inspection Time (hrs./yr./serp.fac.)

First Year Complaint Time = # of 1st Year Complaints x 4 Hours/Complaint

# of 1st year complaints for districts with serpentine = 45
# of 1st year complaints for districts without serpentine = 0
# of 1st year complaints for districts not surveyed = 20

Identification Time = Quarterly Audit Time (hrs./yr./serp.fac.)

Adoption Time = $\frac{\text{Adoption Cost}}{\text{Labor Rate}}$

$$\text{First Year Person Years} = \frac{\left[\text{\# of Serp. Facilities} \times \text{Audit \& Inspect. Time}\right] + \text{1st Year Complaint Time} + \text{Identification Time} + \text{Adoption Time}}{\text{2080 hrs/yr}}$$

## FORMULAS FOR ANNUAL PERSON YEARS

Audit & Inspection Time = Quarterly Audit Time (hrs./yr./serp.fac.) + Inspection Time (hrs./yr./serp.fac.)

Annual Complaint Time = # of Annual Complaints x 4 Hours/Complaint

# of annual complaints for districts with serpentine = 20
# of annual complaints for districts without serpentine = 0
# of annual complaints for districts not surveyed = 10

$$\text{Annual Person Years} = \frac{\left[\text{\# of Serp. Facilities} \times \text{Audit \& Inspection Time}\right] + \text{Annual Complaint Time}}{2080 \text{ hrs/yr}}$$