

Health effects of crystalline silica in Idaho

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Acknowledgments

- **National Science Foundation**
- **Idaho State Board of Education**
- **Idaho Vital Statistics**
- **Idaho Department of Environmental Quality**

Front page
Wall Street Journal
March 22, 1993



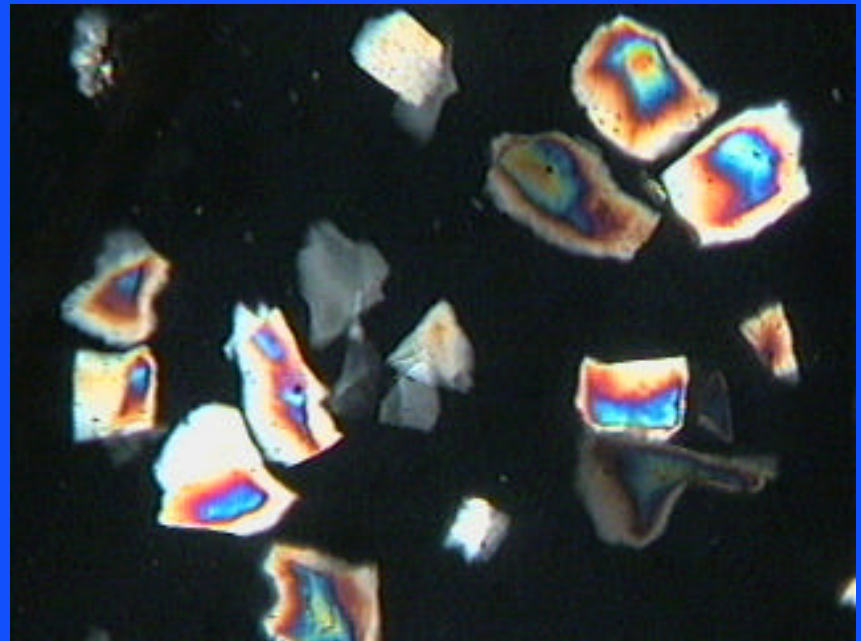
Cancer Scare
**How Sand on a Beach
Came to Be Defined
As Human Carcinogen**
**Tests Using Common Silica
Spark a Scientific Clash
Over Safety, Procedures**
Sounding Grass-Roots Alarm

By DAVID STIPP
Staff Reporter of THE WALL STREET JOURNAL
After Jim Swide recently emptied a bag of sand into his two-year-old daughter's sandbox, some words caught his eye: "may contain . . . crystalline silica . . . known to the state of California to cause cancer."
Horrified, the resident of Ukiah, in northern California, snatched his daughter



- rodents
- IARC
- OSHA
- limit to 0.1%

quartz (12%): SiO_2



Preview:

- Goals
- Background
- Experimental design
- Results



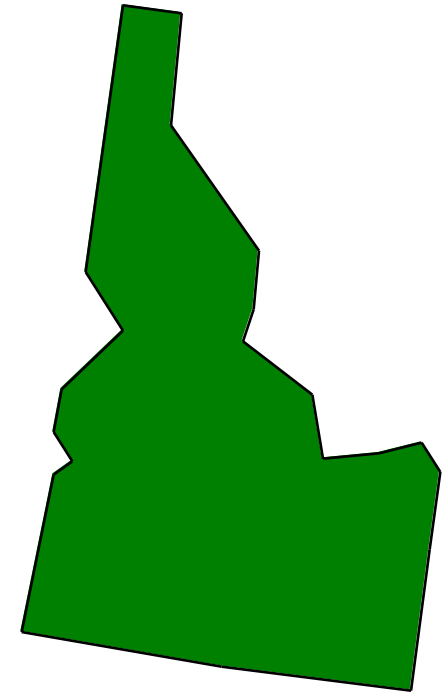
Goals

- **Characterize PM10 (i.e., amount & type).**
- **Determine if respiratory disease rates are higher in “dusty” occupations or environments.**

Pulmonary diseases 1993

- pneumoconiosis
 - silicosis: **0 'ish**
 - asbestosis: **0 'ish**
- lung cancer: **479 - 5.7%**
- COPDs
 - bronchitis: **14 - 0.2%**
 - emphysema: **87 - 1.0%**
 - asthma: **21 - 0.3%**

Total deaths: 8,360



Historically

Crystalline silica & silicosis:

- 1913 US Public Health Service: 60% silicosis rate
- 1920 US Public Health Service: Silicosis in 2 years

Currently:

- better technology & about 1 death/year in Idaho

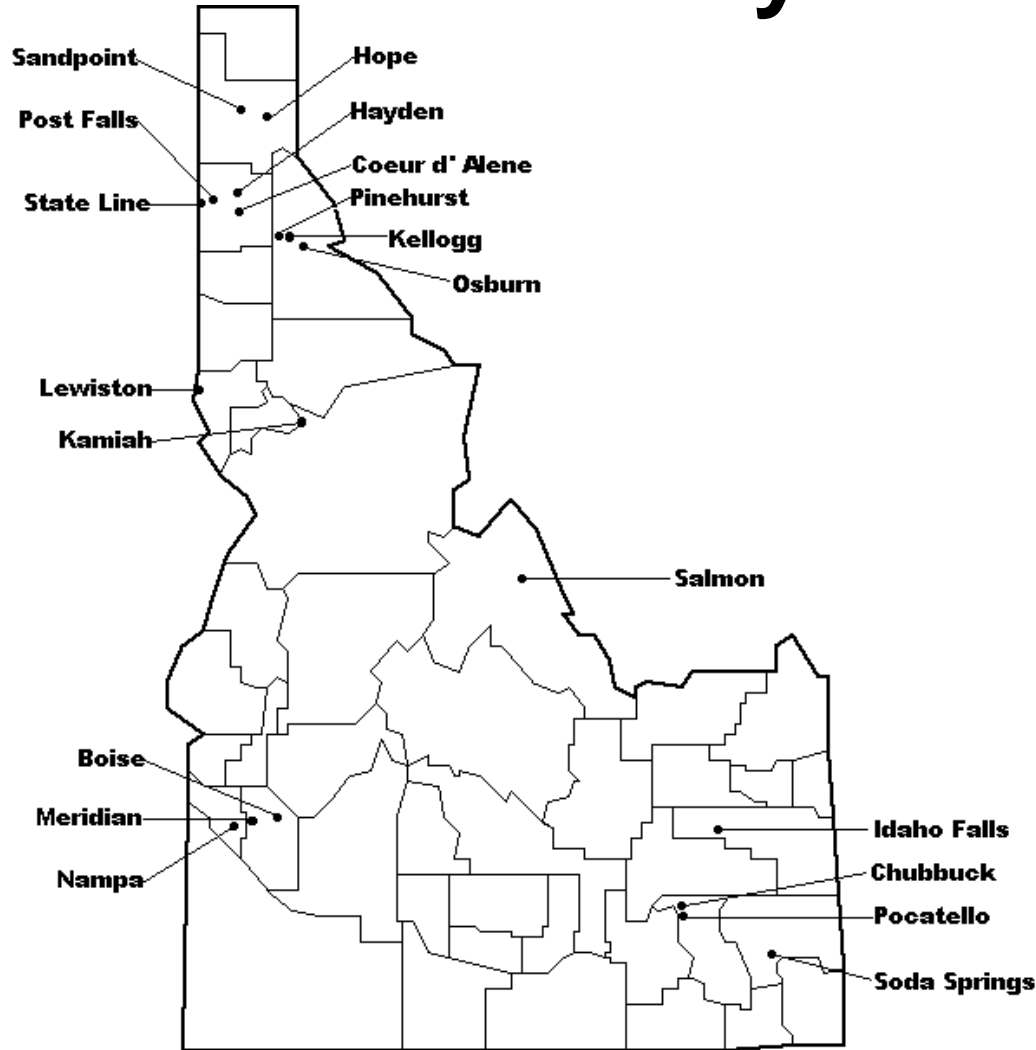
Crystalline silica & lung cancer

- **Demonstrate no linearity**
- **Tumors are different**
- **Specific rats**
- **No ambient studies**

Experimental design

- **Find PM10 levels in Idaho (DEQ)**
- **Determine PM10 mineralogy
(especially quartz)**
- **Obtain pulmonary death rates & occupations
(especially lung cancer & farmers)**

Dusty Idaho?



<u>US</u>	<u>PM10</u>
Idaho	32
Illinois	32
Utah	32
.....
Montana	16
Hawaii	15
 <u>County</u>	
Canyon	46
Lemhi	41
.....
Lewis	27
Shoshone	23

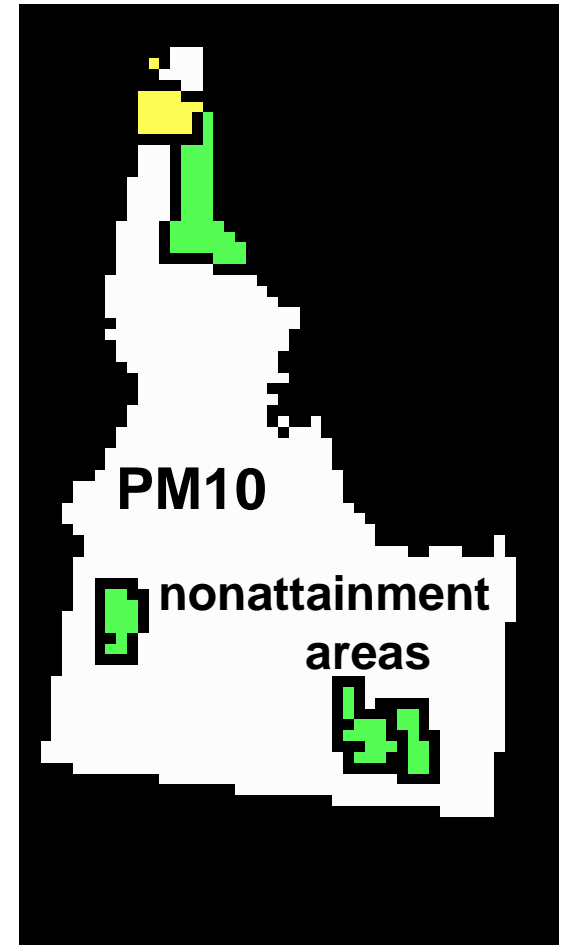
PM10 Sample collection

Moscow PM10



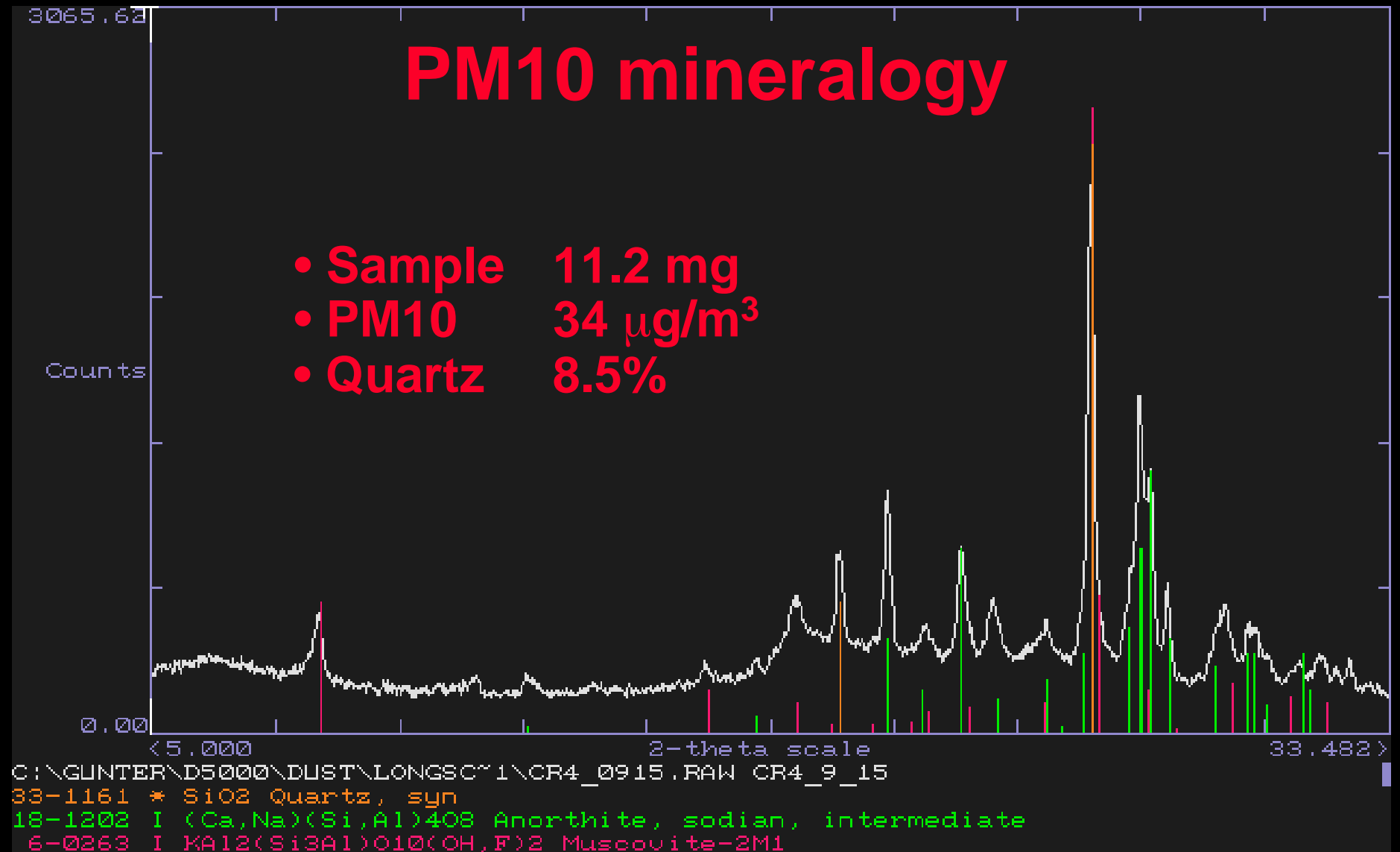
Month Renfrew Hall

July	26
August	26
September	35
October	21
November	10
December	7



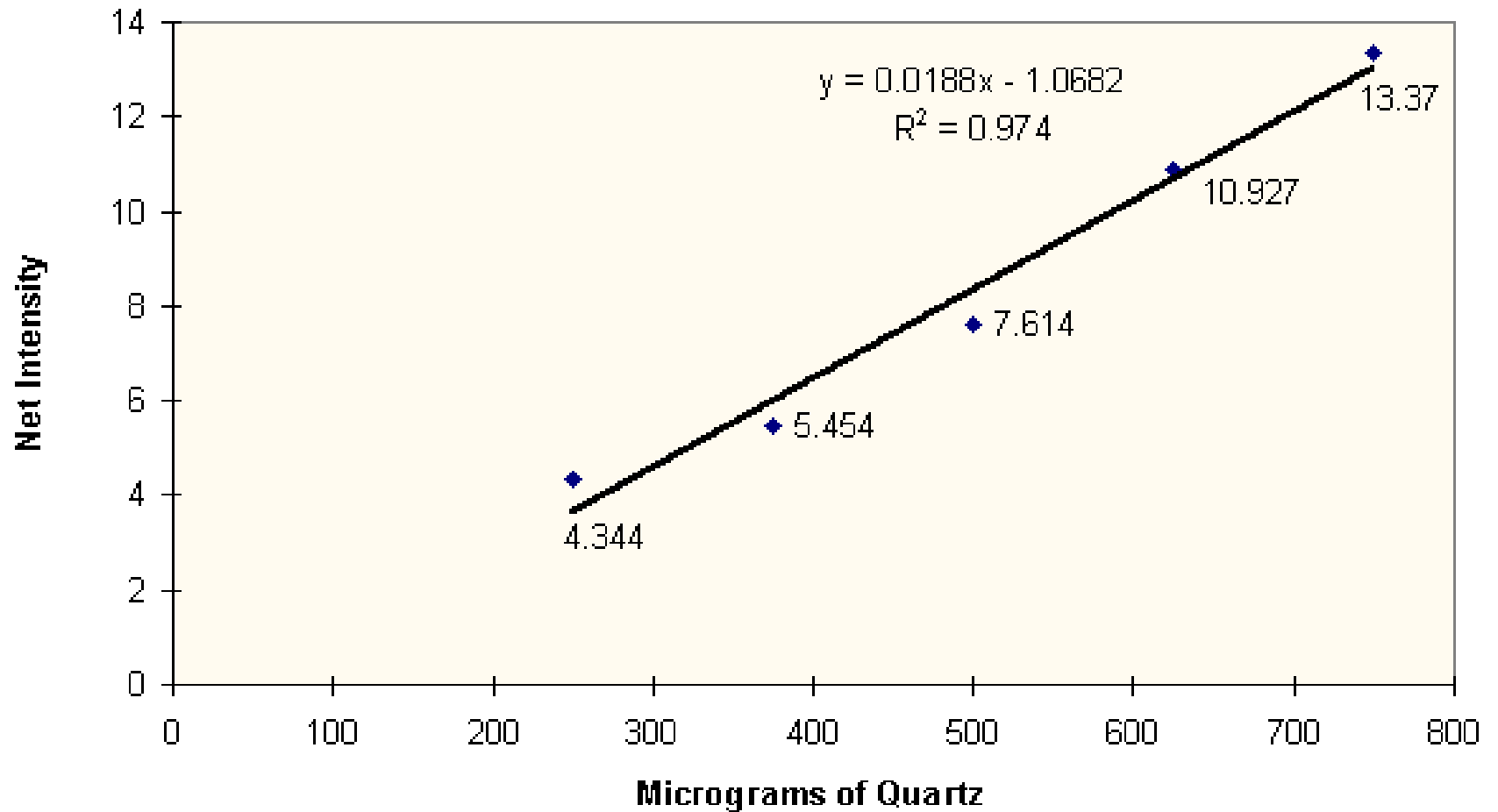
PM10 mineralogy

- Sample 11.2 mg
- PM10 34 $\mu\text{g}/\text{m}^3$
- Quartz 8.5%

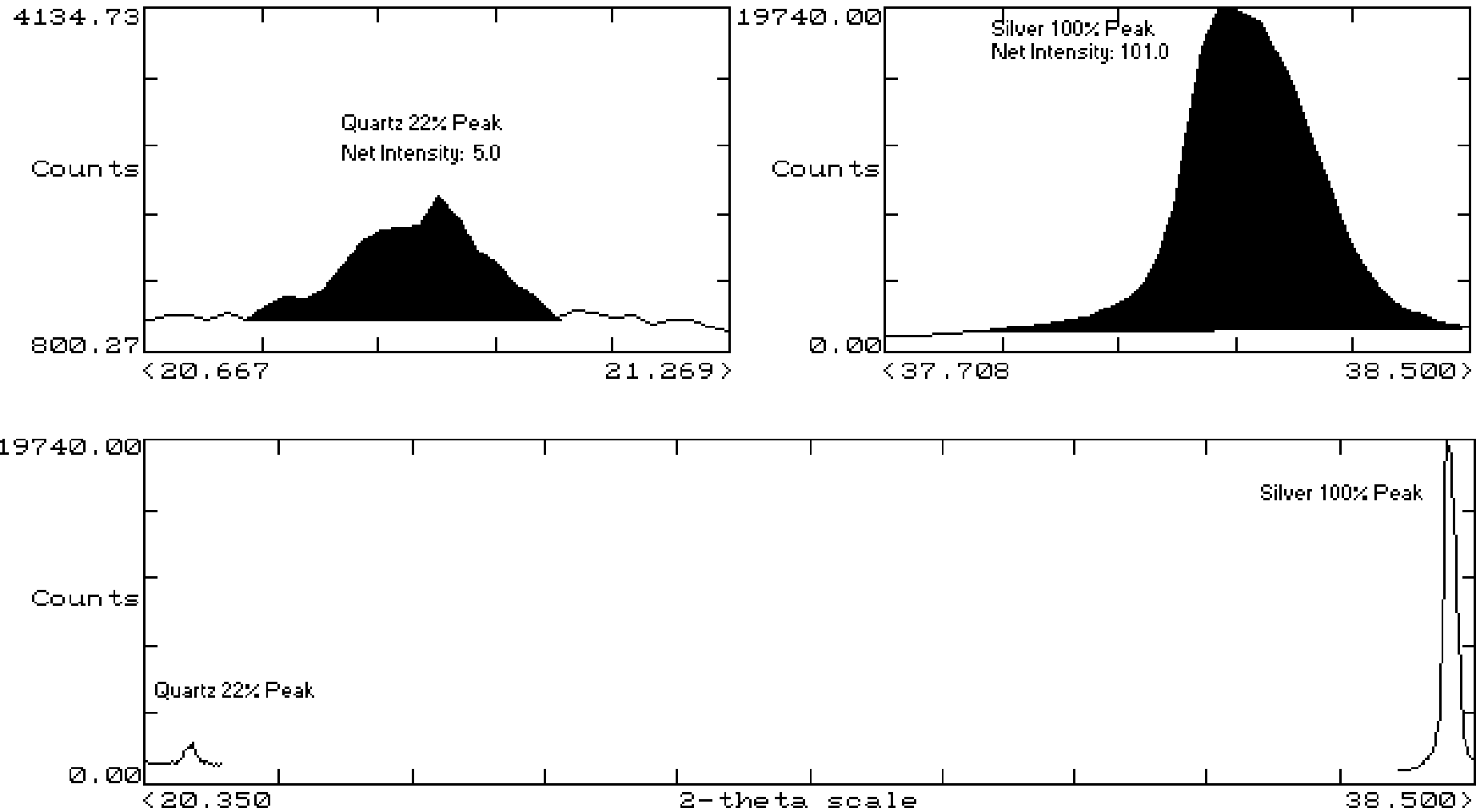


How to quantify quartz?

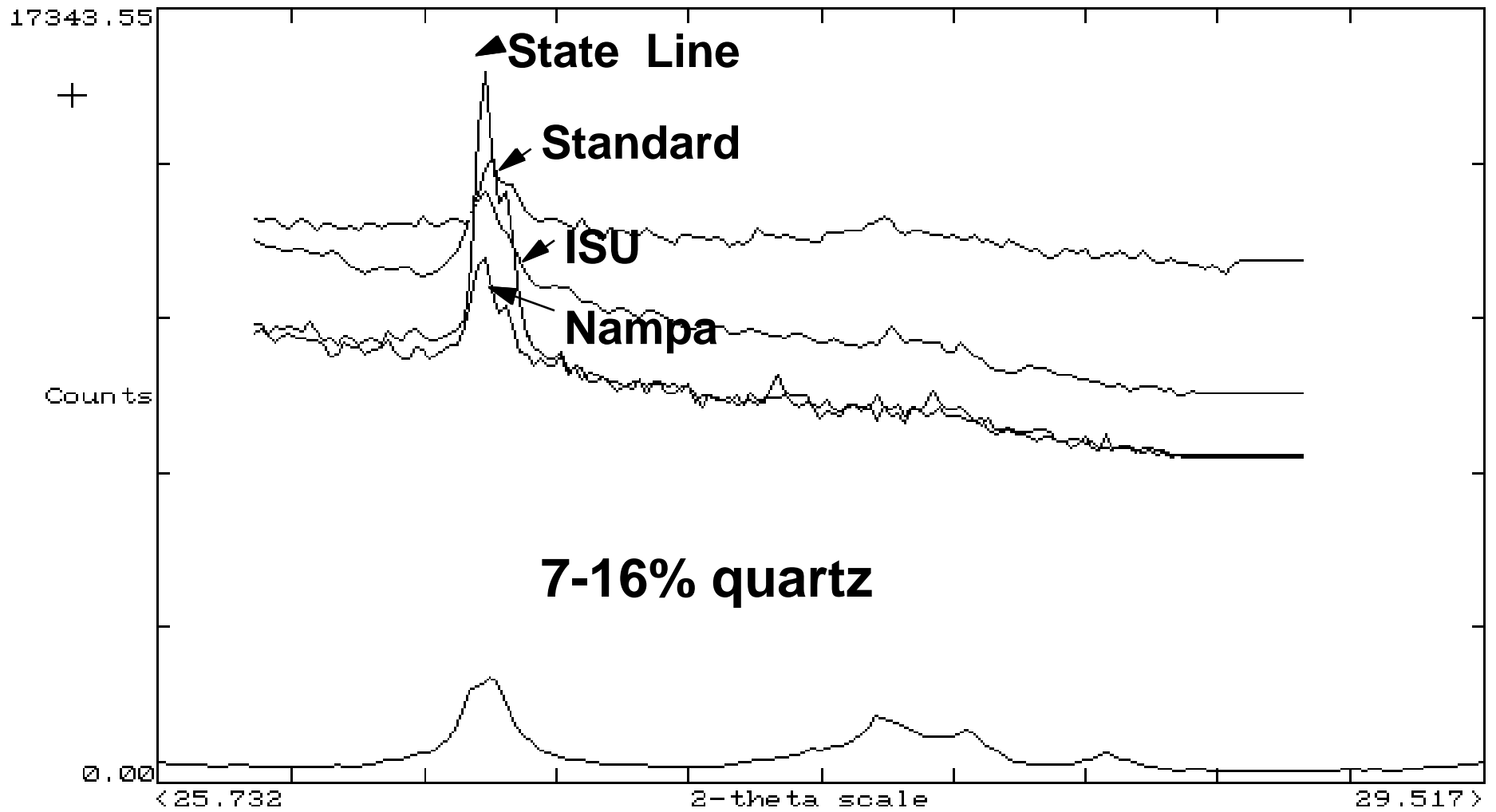
Quartz Calibration Line



Use integrated peak intensities.



Statewide quartz (i.e., glass) filters



What is PM10 composed of?

- **Approximately 10% quartz**
- **Modified internal standard method yields:
28% feldspar & 3% muscovite**
- **Volcanic ash from Mount St. Helen's eruption:
59%**
- **Confirmed by:
Synthetic PM10
Chemical analysis
Point counting**

Death & dust!



SMRs

(standard mortality ratios)

$$\text{SMR} = \frac{\text{Observed death rates}}{\text{Expected death rates}} * 100$$

$$\text{Error} = \frac{\text{SMR}}{\sqrt{\text{Observed deaths}}}$$

Lung Cancer SMRs

- **Idaho rate / US rate -> 84(1)**
- **Farmer rate / Idaho rate -> 88(3)**
- **Non-farmer rate / Idaho rate -> 102(1)**

County results

	SMR	%	PM10	“
Shoshone	149(8)	32	23	50
Valley	145(17)	13	na	34

Latah	79(6)	12	46	32

Franklin	27(6)	12	35	35
Madison	24(5)	4	na	14
average	100	20	35	22

SMR = for Idaho rate, % = smoking rate, “ = inches of precipitation per year

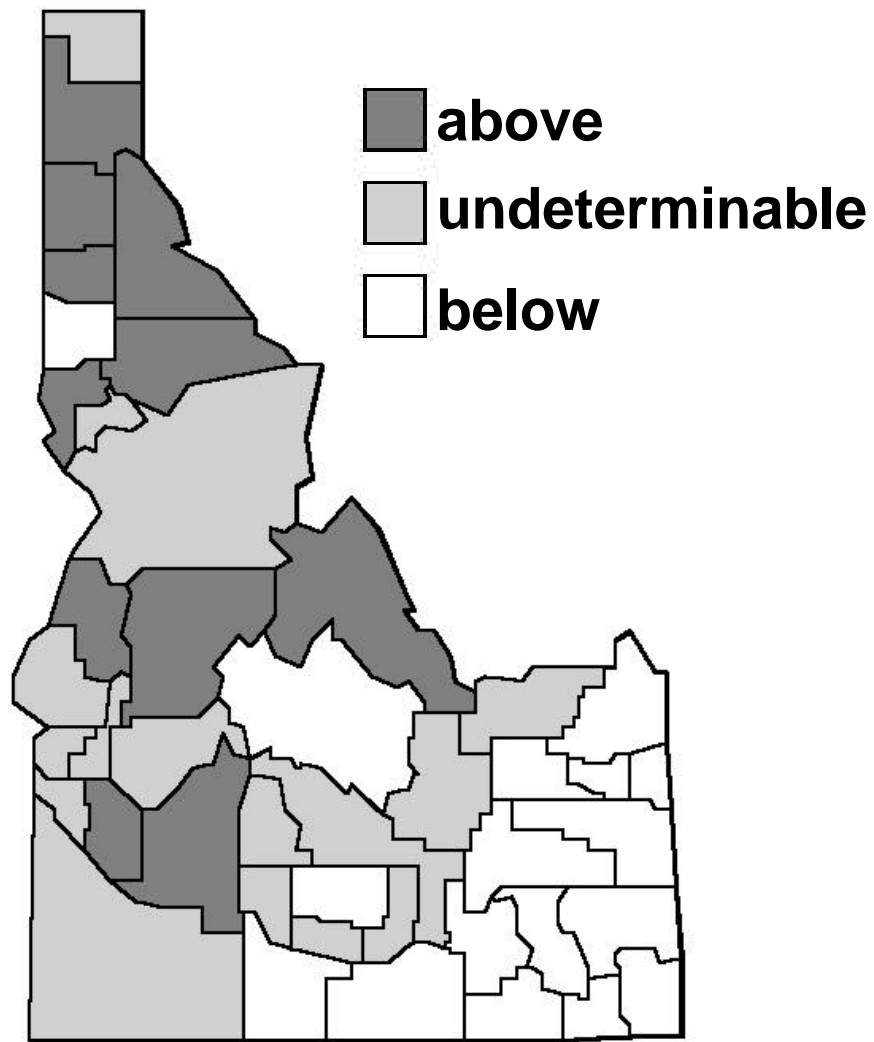
Confounders

- Age:
1980 census population distributions
- Two smoking corrections
NMLS study:

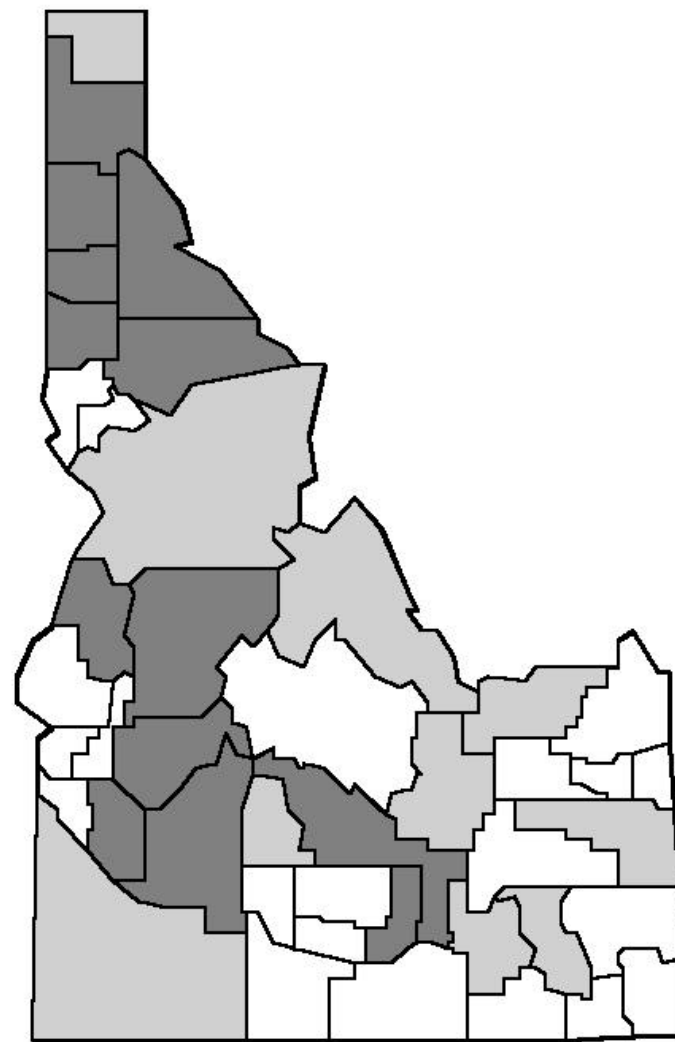
$$\frac{(\text{proportion smoking in a population}) * (RR-1) + 1}{(\text{proportion smoking total population}) * (RR-1) + 1}$$

Best fit line:

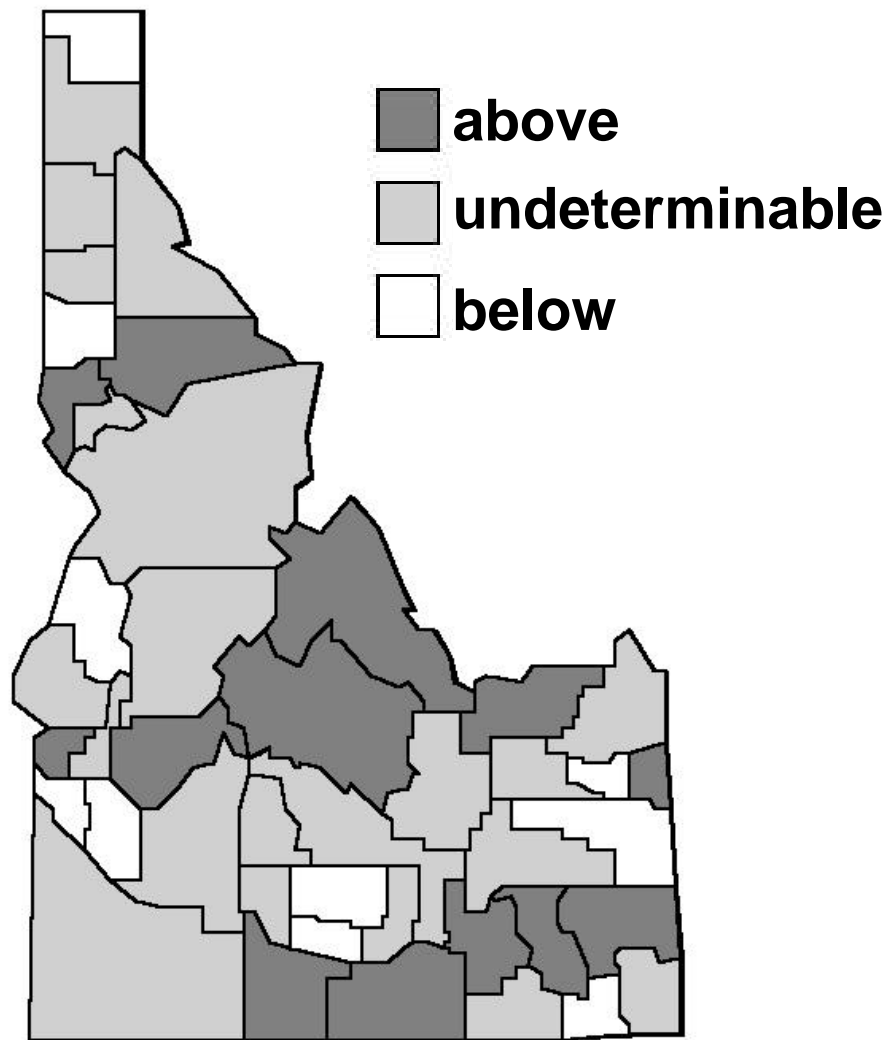
Smoking rate vs. Lung cancer SMR



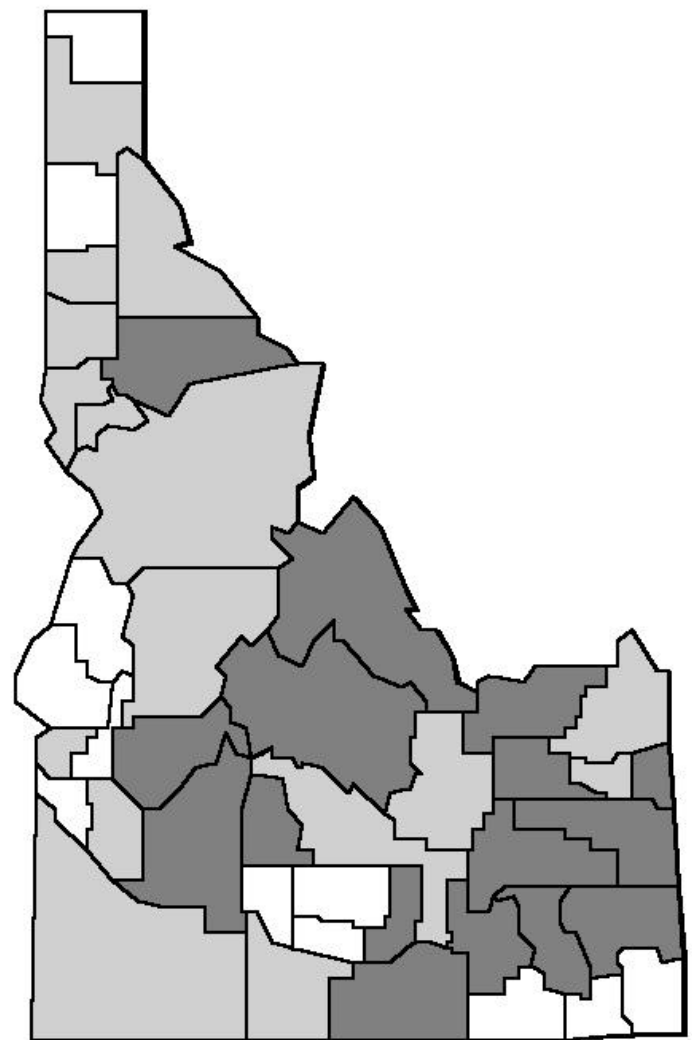
Uncorrected lung cancer SMRs



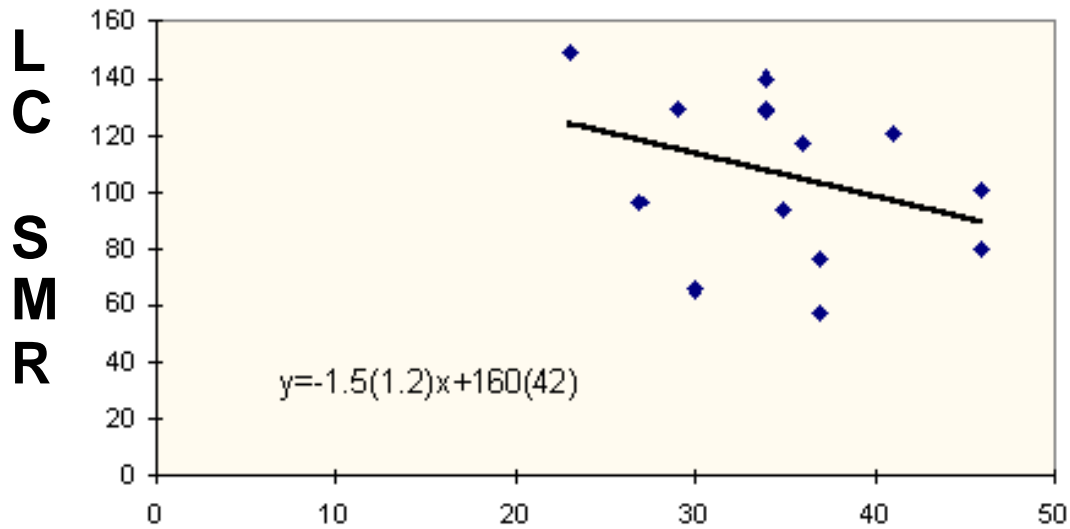
Corrected lung cancer SMRs



Uncorrected COPDs SMRs



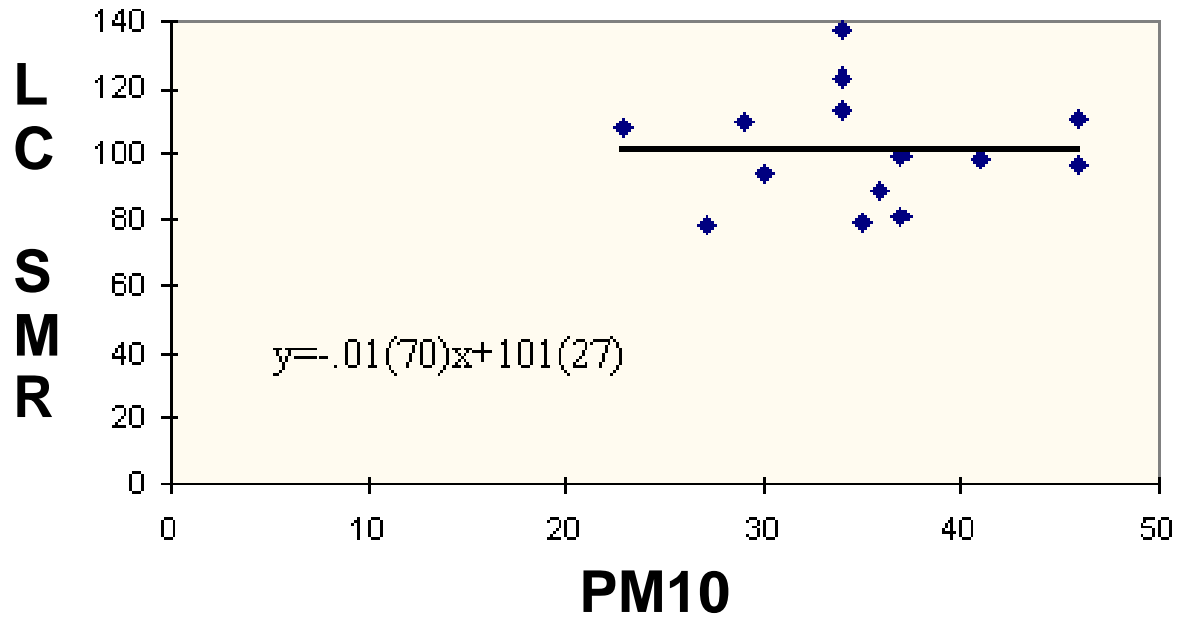
Corrected COPDs SMRs



← **Uncorrected data**

PM10

Age/smoking corrected data →



Conclusions

- Idaho has high PM10 levels with a large quartz component.
- Idaho lung cancer rates are below US levels.
- Farmers have no higher lung cancer rate than non-farmers.
- Current data show no trend between SMRs and PM10 levels.