Silicosis Outbreaks

“Those who cannot remember the past are condemned to repeat it.” George Santaynna

1910 to 1913 - 60% of Missouri lead miners found to have silicosis

1923 - 93% of Vermont granite workers found to be silicotic

1933 - 476 workers died from silicosis drilling a tunnel in West Virginia
1914-15 Missouri Lead Miner Studies (USPHS/USBM)

- Study of galena miners in the Jasper district of southwest Missouri.
- 720 miners (~¼ of the workforce) studied.
- To determine whether they were “suffering from chronic disease of the lung (silicosis and silicotuberculosis).
- Of the 720 miners examined,
  - 472 miners (66%) were suffering from pulmonary disease.
  - 330 miners (46%) manifested definite signs of silicosis, but not TB.
  - 103 (14%) had silicosis and TB (silicotuberculosis).
  - 39 (5%) had TB and no evidence of silicosis.
Barre, Vermont Granite Workers
1919 National Tuberculosis Association Study

- Hypothesis that the granite industry would have the highest mortality from silicotuberculosis of all dusty trades.
- Report found that 399 of 427 (93%) of Barre granite cutters were affected by silicosis.
- Deaths were associated with highest dust exposure among cutters using pneumatic tools.
1937 Vermont State Department of Public Health Study

- Granite Cutters die approximately 11 years younger than other Vermont males
- Silicotuberculosis was the cause of 73% of the deaths.
- For the period from 1931 to 1936
  - 75.3% of the Granite Cutters and 63.8% of the quarry workers died from silicotuberculosis.
- Compared to 3.5% for the State average and 2.2% for other Barre males.
1930’s Engineering Marvel

- Construction project driving a tunnel three miles through a sandstone mountain (3/1930-12/1931).
- Purpose to divert the flow of the New River to a hydroelectric plant near Gauley Bridge, West Virginia.
- Electrical power to be used for a ferroalloy smelting plant.
- Depression brought many workers from surrounding states – 75% of workforce was black.
Engineering Marvel Turns Into Human Nightmare

- Conditions were dusty because the crews were blasting through a sandstone formation (96-99% quartz).
- Health conditions were worsened because of dry drilling and inadequate ventilation systems.
- In building the tunnel hundreds (estimates of 461-764 of 5,000), died of an acute rapidly progressive form of silicosis.
- Most of the deceased workers were African-American migrants who worked underground.
  - 67 unclaimed corpses (5 white and 62 black) were buried in unmarked graves.
Employers Duty of Care to Workers

• “To assure safe and healthful working conditions for working men and women....” OSHA, 1970

• Silicosis Prevention Goal

“Each worker should be able to work for his/her entire employment, whether short-term or until retirement, and not experience any diminished quality of life or suffer premature mortality from respiratory disease associated with silica exposure at work.”
Third Party Litigation as an Incentive
Mississippi Silicosis Litigation – The Perfect Storm

• Late 1990s Asbestos Legislation in Congress
• Legal reform in various states
• 1998 claims increase after silicosis Verdicts – Gomez ($2 Mil, Tompkins ($7.5 Mil), and Gordon ($45 Mil)
• Asbestos lawyers
  ▪ Diversifying litigation portfolio
  ▪ Recycling asbestosis claims
  ▪ Using machinery already in place for new claims
  ▪ Courses to teach lawyers latest in “cutting edge” silicosis litigation
The Rise of Silicosis Litigation
Insurance Company Experience of ≈ 30,000 Silicosis Claims

- 66% Mississippi
- 23% Texas
- 5% Ohio
- 4% Other

- From 1990-1999 NIOSH reports only 13 silicosis deaths in Mississippi.
- 17,000 plaintiffs filed silica claims on the eve of new civil justice reforms in Mississippi, which took effect January 1, 2003.
Role of Physicians in Silicosis Fraud

• 10,000 Mississippi Cases Moved to Federal District Court in Corpus Christi, Texas (Judge Janis Jack)
• Twelve physicians accounted for ~8,000 of the 10,000 individual diagnoses.
  – These 12 screening physicians found 500 times more silicosis in one year than Mass General Hospital did in 30.
• None were treating physicians of the individuals.
• None reported this silicosis outbreak to state health departments, CDC, NIOSH or OSHA.
• None wrote to a medical journal to describe this outbreak.
Dr. Ray Harron

• February 2005 before Judge Janis Jack
• Responsible for 6,350+ Dxs = 78% of the MDL
• Admitted that he didn’t personally interview some 2,700 of the claimants and didn’t conduct physical exams or review work histories
• Had secretaries prepare the reports and stamp his name
• Two-for-One Special: Asbestosis / Silicosis Diagnoses on 1 X-ray
Silicosis Cures Asbestosis

- Silicosis: 0.6% (10 cases)
- Asbestosis: 99.4% (1577 cases)

- Silicosis: 99.7% (1582 cases)
- Asbestosis: 0.3% (5 cases)
“The Silicosis Sheriff”

- June 30, 2005, Judge Jack issued a 249-page Order regarding the 111 silica cases
  - The best (true) description of entrepreneurial litigation
  - Followed testimony from the handful of doctors who purportedly “diagnosed” thousands of those plaintiffs
  - Judge Jack concludes that there is evidence of silicosis in 1 of the 10,000 cases
“The Silicosis Sheriff”

- Condemned the mass screening process used to generate the silica claims and found that virtually every plaintiff’s diagnosis had been “manufactured for money.”
- Concluded that the methodology used to diagnose the plaintiffs was “not sufficiently reliable”
  - describing the process as an:
    - “assembly line diagnosing” and
    - “ingenious method of grossly inflating the number of positive diagnoses.”
Respirable Crystalline Silica

• What is Respirable Crystalline Silica?
  – It is a crystalline silica particle capable of reaching the most distal regions of the respiratory system.
  – Aerodynamic diameter of 10 micrometers or less.
What Is Silicosis?

- Dust disease of the lung (pneumoconioses)
  - Silicosis
  - Other examples of pneumoconioses
- Slowly progressive fibrosis of the lung (development of scar tissue)
- Inhalation and retention of respirable crystalline silica
  - High intensity of exposure
  - Long duration of exposure
- Can be disabling and lead to death
- No treatment
- 100% Preventable
Chronic Silicosis

• Simple
  – Earliest form, usually no chest symptoms
  – Fibrosis after years of exposure
  – Relatively low levels of dust
  – Fibrosis predominates in upper lung
  – Radiographically small discrete nodules
  – Typically no pulmonary impairment
Chronic Silicosis (cont’d)

• Complicated (Conglomerate)
  – Small lesions coalesce to form large lesions
  – Symptoms
    – Shortness of breath
    – Possibly cough and sputum production
  – Progressively disabling / possibly life shortening
  – Respiratory Failure / Sometimes fatal
Accelerated Silicosis

- Results from very high exposures - over a relatively short time (5-10 yrs)
- Radiographic Pattern similar to simple silicosis
  - Rounded nodular lesions in upper lungs
- Much faster progression
- Can be fatal in as little as ten years
Acute Silicosis

- Most aggressive of the silicotic diseases
  - Results from exceptionally high concentrations in a very short time (7 mo to 4 or 5 yrs)
- Characteristic nodular radiographic pattern is absent
  - X-ray changes similar to diffuse ground glass
  - Resulting from a filling of air spaces with fluid
- Death usually occurs after a few months from insufficient oxygenation of the blood
Normal and Silicotic Lung
Chronic Silicosis

- **Simple Silicosis**
  - Small discrete nodules
    (lesions < 1 cm)

- **Complicated Silicosis**
  - Lesions increase in size (>1 cm)
  - Grow together to form larger masses
Normal Chest X-ray
0/0 ILO Category
Simple Silicosis
3/3 ILO Category
Complicated Silicosis
Category C
Silicosis Conclusions

• A fibrotic lung disease that produces scarring of the lungs
• Three Types
  – Chronic
    – Simple
    – Complicated
  – Accelerated
  – Acute
• Produces characteristic rounded nodules
• Fibrosis is irreversible and there is no treatment
• Completely preventable occupational disease
1979 NIOSH Sampling Severities at Two Silica Flour Mills

- Bagger: Mill A Mean 11, Mill B Mean 15
- Housekeeping: Mill A Mean 8, Mill B Mean 1
- Mechanic: Mill A Mean 1, Mill B Mean 8
- Shipping: Mill A Mean 1, Mill B Mean 5
- Supervisor: Mill A Mean 2, Mill B Mean 1.5

Legend: Mill A Mean, Mill B Mean
2013 NIOSH Sampling
Severities at Eleven Well Completion Sites

<table>
<thead>
<tr>
<th>Role</th>
<th>Arithmetic Mean</th>
<th>Max Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>T-Belt Operator</td>
<td>8</td>
<td>27</td>
</tr>
<tr>
<td>Sand Mover Operator</td>
<td>6</td>
<td>29</td>
</tr>
<tr>
<td>Hydration Unit Operator</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>Chem Truck Operator</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Blender Operator</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Sand Coordinator</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>

Legend:
- Blue: Arithmetic Mean
- Red: Max Concentration
Comparison NIOSH Sampling Severities
Hydraulic Fracturing and Silica Flour

![Bar chart showing comparison of NIOSH sampling severities for different roles involving hydraulic fracturing and silica flour, with categories such as T-Belt Operator, Sand Mover Operator, Hydration Unit Operator, Sand Plant Bagger, Sand Plant Housekeeping, and Sand Plant Mechanic. The chart indicates the arithmetic mean and maximum concentration for each role.](image-url)
Radiographic Silicosis at Silica Flour Plants

- Current Workers, < 1 yr exposure
- Current Workers, ≥ 1 yr exposure
- Ex-workers ≥ 1 yr exposure
- Total ex and current workers

<table>
<thead>
<tr>
<th></th>
<th>Simple Silicosis</th>
<th>Complicated Silicosis</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Workers, &lt; 1 yr exposure</td>
<td>25</td>
<td>0</td>
<td>25</td>
</tr>
<tr>
<td>Current Workers, ≥ 1 yr exposure</td>
<td>0</td>
<td>7 (41%)</td>
<td>7</td>
</tr>
<tr>
<td>Ex-workers ≥ 1 yr exposure</td>
<td>0</td>
<td>16 (88%)</td>
<td>16</td>
</tr>
<tr>
<td>Total ex and current workers</td>
<td>25 (100%)</td>
<td>23 (38%)</td>
<td>48</td>
</tr>
</tbody>
</table>
Seven Steps of a Silicosis Prevention Program

• Management Commitment to Implementation;
• Occupation Health Program Implementation;
• Dust Exposure Assessment;
• Medical Surveillance;
• Dust Control;
• Employee Involvement; and
• Smoking Cessation Program.
Silicosis Prevention Company

Commitment

• Truism – senior management commitment is imperative for a program to have a chance at success
  – Silicosis prevention cannot be only a health and safety department responsibility

• What is management commitment?
  – Commitment:
    • Understand silica and silicosis issues:
      – Again, silicosis prevention not only for health & safety
      – General understanding of silica health effects, IH issues
Message From a CEO

• Silicosis in the workplace – a management failure.
  – Not caused by a brief lapse in attention, a one time (or even more frequent) violation of work rules
  – Not a function of an aged work force
  – Isn’t caused by impairment due to drugs or alcohol
  – Caused by subjecting workers to prolonged (years) unprotected overexposure to RCS

• No excuse that they didn’t know (1) about silica and silicosis; (2) what the RCS exposures were; (3) how to reduce exposure
• Had to “drop the ball” for consistently for years
Implementation of OHP

• Written program aimed to prevent silicosis and the progression of silicosis among workers.

• Objective is to achieve lifetime of work in a RCS environment without:
  – Developing silicosis
  – Suffering from pulmonary function loss
    • Or loss of quality of life
  – Experiencing premature mortality from silica exposure
Workplace Dust Surveys

• The goal of this part of the OHP is to collect enough personal breathing zone samples from all employees exposed to industrial sand so that cumulative individual exposure assessments can be made.

• Personal – Collected from worker’s breathing zone;

• General Area – Collected from ambient work environment; and

• Real-Time Aerosol Monitor (RAM) – Personal Data Ram (PdR) either from worker or from general area.
Too Much Respirable Dust

Hot loading
Medical Surveillance Objectives

• Establish a Baseline for Assessing Changes
  – Each Worker Serves as His/Her Own Control
  – Ability to Recognize Early Changes is Greatly Enhanced

• Detect Abnormalities Consistent with Silicosis at an Early Stage

• Prevent Development of Complicated Silicosis
Medical Surveillance Objectives (cont’d)

• All silica exposed workers
• Every 2 to 4 years
• Inform the Worker of Occupational and Non-Occupational Abnormalities
• Identify Hazardous Working Conditions for Needed Controls
• Develop Data for Epidemiology Studies
Baseline and Periodic Exams

- Medical history that focuses on the presence of respiratory symptoms, smoking habits, and previous exposures to occupational dusts
- A physical examination to assess the general condition of the worker and respiratory status of the worker.
- A 14-by-17-inch posteroanterior (PA) chest X-ray.
- Pulmonary function tests that include spirometric measurements FEV1 and forced FVC.
  - In accordance with the 2005 ATS-ERS Standardization of Spirometry guidelines.
- Baseline tuberculin test.
Dust Control

• Control of hazards from exposures to RCS and the elimination of silicosis is the primary and single most important reason for developing a comprehensive silicosis prevention program.

• Little point to dust sampling, medical surveillance, training or any other program component if the results of those efforts do not prompt necessary controls measures.

• In other words, if this program element fails to control hazardous dust exposures the silicosis prevention program is a failure.

• Control dust exposures through the use of engineering, administrative controls and personal protection.
Silicosis Prevention Employee Involvement

• Training:
  – Training on disease and prevention
    • USS silicosis training won DOL award late 1990s
      – “Your Respiratory Health”
      – Present in small group “seminar” to all employees
      – Updated on a periodic basis
    • USS presented on training at National Conference to Prevent Silicosis, 1997
      – Unimin, Badger, USS, NISA present on other topics
      – The only companies that brought employees to conference
  • Cooperative training with MSHA/NIOSH-BoM
    – NISA and MSHA, with Unimin and USS assistance, developed training materials for mining industry
    – Developed MSHA materials out of Jackson
    – Building design study
Silicosis Prevention Employee Involvement (3 Steps)

1. Providing information, instruction and training to help employees become informed about how to work safely and protect their health.

2. Engaging workers through a genuine exchange of views regarding worker health and safety.
   – Does not take away the right of managers to manage – they must still make the final decision – but it does mean that employees will be asked for their views and that these will be considered before decisions regarding health and safety are taken.

3. Full involvement in health and safety where workers and employers trust each other and work together to manage health and safety. This goes further than simply consulting with workers. It means agreeing to solve problems together.
Smoking Cessation Program

• Objective of this element is to reduce the impact of smoking on the health effects of silica exposure

• Three basic elements:
  – Adopt and implement a policy on smoking cessation
  – Education of worker concerning the health effects of smoking employees
  – Offer assistance to employees to stop smoking
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