Application of Industrial Hygiene Principles in Kazakhstan

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Work Performed by

- The Center for Health Protection and Environmental Projects
  - Almaty, Kazakhstan
- Government Scientists in Kazakhstan
- SHARE International, Inc.
  - Camp Dresser & McKee Inc. (CDM)
    - Denver, Colorado and Cambridge, Massachusetts
- Chemistry and Industrial Hygiene (C&IH)
  - Wheat Ridge, Colorado
Special Thanks

◆ The Niton Corporation for donating use of XRF to provide on-site soil and air measurements in Kazakhstan
Republic of Kazakhstan: a Country in Central Asia
Republic of Kazakhstan
Kazakhstan Economy

- Industrial: 33%
- Agriculture, forestry, fisheries: 9%
- Construction: 7%
- Trade: 14%
- Transportation: 13%
- Other: 24%

Total: 100%
Gross domestic product (GDP), mln. tenge

Kazakhstan: Active Development of Economy

Gross domestic product (GDP), mln. US dollars
Roadmap

- Discussion of various aspects of the status of occupational health and occupational health professionals in Kazakhstan
- Interweave personal experiences with the bulleted presentation
- Conclude with a summary of opportunities that exist in that nation
Availability of Qualified EHS Professionals

- Soviet educational system developed highly qualified scientists, engineers and doctors
- Qualified EHS practitioners employed by government often recruited by private concerns, especially if they have international experience
Availability of Qualified EHS Professionals

- Qualified practitioners difficult to find, hire and retain
  - Persons trained in social science, math, science and medicine become involved
  - Highly qualified professionals tend to be spread thin and overworked
- Terms and roles of IH/OH practitioners difficult to explain
Adequacy of Education and Training

- IH-specific programs are generally not emphasized at the university level
- No professional equivalent IH/OH – more of a team approach to fill IH role
- Post-graduate training generally not specialized toward EHS practitioners
Availability of Support

- I am not aware of Kazakhstani:
  - Professional occupational hygiene associations
  - Unified occupational hygiene comprehensive curriculum in universities
  - Occupational hygiene journals
Workplace Evaluations

- Internationally-owned businesses, and companies selling internationally tend to have EHS management systems in place
  - ISO 14001 & OHSAS 18001
  - Auditing and certification opportunities exist to verify and maintain EHS systems
- Local licensing requirements exist
- Workplace concerns generally take back seat to environmental concerns
Occupational Health Regulations Summary

- Prior Soviet standards adopted
- Desire to move to risk-based environmental and occupational standards
  - Resistance to change
- Self monitoring reports and plans are required to be submitted to both the Ministry of Health Care and Ministry of Labor
<table>
<thead>
<tr>
<th>Element</th>
<th>US</th>
<th>Dutch</th>
<th>Canada</th>
<th>Germany</th>
<th>Kazakhstan</th>
<th>Australia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pb</td>
<td>400</td>
<td>530</td>
<td>140</td>
<td>400</td>
<td>32</td>
<td>300</td>
</tr>
<tr>
<td>Cr</td>
<td>390</td>
<td>380</td>
<td>220</td>
<td>400</td>
<td></td>
<td>100*</td>
</tr>
<tr>
<td>As</td>
<td>10**</td>
<td>55</td>
<td></td>
<td></td>
<td>2</td>
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<tr>
<td>Hg</td>
<td>23</td>
<td>10</td>
<td></td>
<td></td>
<td>2.1</td>
<td></td>
</tr>
</tbody>
</table>

*Hexavalent only
**Background
Enforcement Activities

- Occupational Exposure Limits Set by Ministry of Health Care
- Enforcement responsibility shared by Ministries of Health Care and Labor
- Inspections limited by:
  - advance notice required (one week)
  - no unannounced visits
- Few instruments or analytical equipment available for exposure assessment
- Ministries typically understaffed and underpaid
Lead Smelting
Measuring Metals in Soil using Niton XL-700 XRF
Measuring Lead Paint in
Blood Donors Awaiting the Skin Prick
The Skin Prick
Proud of Their Bravery
Measuring Lead in Blood by ASV
A Few Other Specific Observations in Shymkent
Area within 1000 ppm
14.6 square km
## Metals in Soil

<table>
<thead>
<tr>
<th>City</th>
<th>Pb (mg/kg)</th>
<th>As (mg/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Almaty</td>
<td>7 – 97</td>
<td>ND - 22</td>
</tr>
<tr>
<td>Pavlodar</td>
<td>53 – 5,568</td>
<td>153 - 874</td>
</tr>
<tr>
<td>Ust-Kamen</td>
<td>53 – 1,410</td>
<td>1 - 95</td>
</tr>
<tr>
<td>Taldy Korgan</td>
<td>33 – 5,958</td>
<td>ND - 160</td>
</tr>
<tr>
<td>Tekeli</td>
<td>43 - 3,612</td>
<td>9.3 - 88</td>
</tr>
<tr>
<td>Shymkent</td>
<td>49 – 24,896</td>
<td>ND - 2,539</td>
</tr>
<tr>
<td>Kyzlorda</td>
<td>29 – 5,628</td>
<td>9.3 - 756</td>
</tr>
</tbody>
</table>
# Air Sample Results by Location

<table>
<thead>
<tr>
<th>Location</th>
<th>No.</th>
<th>Distance from Plant (km)</th>
<th>Direction</th>
<th>Mean (µg/m³)</th>
<th>Max (µg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>House</td>
<td>18</td>
<td>0.7</td>
<td>S</td>
<td>4.8</td>
<td>15.8</td>
</tr>
<tr>
<td>Sholpan</td>
<td>16</td>
<td>1.0</td>
<td>N</td>
<td>7.9</td>
<td>31.4</td>
</tr>
<tr>
<td>School #5</td>
<td>14</td>
<td>1.5</td>
<td>NE</td>
<td>3.6</td>
<td>8.4</td>
</tr>
<tr>
<td>School #48</td>
<td>16</td>
<td>1.5</td>
<td>SE</td>
<td>4.9</td>
<td>14.5</td>
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<tr>
<td>School #49</td>
<td>10</td>
<td>1.7</td>
<td>SW</td>
<td>5.2</td>
<td>10.8</td>
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<tr>
<td>Salem</td>
<td>11</td>
<td>2.5</td>
<td>E</td>
<td>2.5</td>
<td>3.8</td>
</tr>
<tr>
<td>All Locations</td>
<td>85</td>
<td>---</td>
<td>---</td>
<td>5.0</td>
<td>31.4</td>
</tr>
</tbody>
</table>
## Lead in Blood of Children: Comparison Among Cities

<table>
<thead>
<tr>
<th>City</th>
<th>No.</th>
<th>Mean (µg/dL)</th>
<th>Maximum (µg/dL)</th>
<th>&gt;10 µg/dL (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kyzylorda</td>
<td>303</td>
<td>6.0</td>
<td>25</td>
<td>7</td>
</tr>
<tr>
<td>Pavlodar</td>
<td>160</td>
<td>5.4</td>
<td>30.3</td>
<td>9</td>
</tr>
<tr>
<td>Ust Kamen</td>
<td>243</td>
<td>6.6</td>
<td>29.4</td>
<td>15</td>
</tr>
<tr>
<td>Almaty</td>
<td>70</td>
<td>6.1</td>
<td>23.6</td>
<td>16</td>
</tr>
<tr>
<td>Tekeli</td>
<td>75</td>
<td>8.7</td>
<td>38.4</td>
<td>16</td>
</tr>
<tr>
<td>Taldy Korgan</td>
<td>70</td>
<td>8.9</td>
<td>32.0</td>
<td>20</td>
</tr>
<tr>
<td>Shymkent</td>
<td>157</td>
<td>20.7</td>
<td>103</td>
<td>66</td>
</tr>
</tbody>
</table>
Estimated lung cancer risks from heavy metal exposure -- As, Cd, Cr (VI)
(Assumes Pb at 6.5 µg/m³ in air and ratios of metals in air same as in soil)

<table>
<thead>
<tr>
<th>Metal</th>
<th>Air (µg/m³)</th>
<th>10 years child/10 years adult</th>
<th>70 year lifetime (adult parameters)</th>
<th>US Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>As</td>
<td>0.4</td>
<td>1.4 x 10⁻³</td>
<td>2.3 x 10⁻³</td>
<td>--</td>
</tr>
<tr>
<td>Cd</td>
<td>0.24</td>
<td>3.5 x 10⁻⁴</td>
<td>5.7 x 10⁻⁴</td>
<td>--</td>
</tr>
<tr>
<td>Cr (VI)</td>
<td>0.14</td>
<td>9.2 x 10⁻⁴</td>
<td>1.5 x 10⁻³</td>
<td>--</td>
</tr>
<tr>
<td>Total Risk</td>
<td>--</td>
<td>2.7 x 10⁻³</td>
<td>4.4 x 10⁻³</td>
<td>Typically 1 x 10⁻⁶</td>
</tr>
</tbody>
</table>
Summary of Shymkent Risks

- Community around smelter at more risk than any US site known and among world’s top situations
  - Number of children potentially affected
  - Soil lead levels
  - Levels of blood in children
  - Carcinogenic inhalation risks
ЧТОБЫ РЕБЕНКОК СТАЛ УМНЕЕ

Свинец - ценный цветной металл, с которым связана история и современность г. Шымкента. Но, к сожалению, свинец негативно влияет на формирование нервной системы ребенка и развивающийся детский мозг. В результате этого у детей, особенно в возрасте до семи лет, понижается внимание, нарушается координация движений и страдает память.

Как же этого избежать? Свинец, как правило, накапливается в почве и в пыли, которая оседает на твердых поверхностях. А в организм ребенка он попадает через грязные руки. В ваших силах защитить ребенка от вредного влияния свинца, следуя очень простым правилам:

- Не разрешайте ребенку держать руки во рту;
- Мойте ребенку руки после прогулок и перед едой;
- Не разрешайте ребенку есть на улице;
- Кротко обрезайте ногти ребенка;
- Каждый день проводите влажную уборку комнат и чистку ковров;
- Не кормите ребенка из окрашенной керамической посуды;
- Сегодня от вас зависит будущее ваших детей - будущее нашей нации!

Prognosis for Future

- Rapidly growing economy
- Rich in raw materials
- Growing middle class in cities
- Poverty seen in countryside, small villages and some cities
- Serious social problems remain
Death rate (per 100,000): Comparative Cluster Analysis of Standardized Data

Cluster 1 – av. EU, UK, France etc
Cluster 2 – Ireland, Bulgaria, Latvia etc
Cluster 3 – Kazakhstan, Russia, Ukraine etc
Prognosis for Future (Continued)

- Presidential goal of being in world’s top 50 economies in next few years
- Ministry of Environmental Protection tasked to plan corresponding environmental initiative
- Funding levels for environmental issues increasing with economic growth
- All ministry heads are cabinet level positions (Labor, Environment, Health)
What we can do to help

- Increase awareness of occupational health and related practitioners
- Introduce an OH/IH curricula at the university level
- Work with Ministries of Labor and Health Care to introduce risk-based EHS standards
- Develop practical exposure control and regulatory compliance strategies
- Control banding?