Occupational Health Screenings of Former Atomic Weapons Workers in Southeastern Iowa

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Goal:

- Identifying, locating, and providing former IAAP AEC workers employed in manufacture of nuclear weapons between 1949-1975 with medical evaluation of long term health effects that might have resulted from employment
IOWA ARMY AMMUNITION PLANT (IAAP)

Located in Middletown, IA (Des Moines County) ~ 70 miles south from Iowa City

Over 19,000 acres of Government Owned – Contractor Operated (GOCO) establishment

>1000 buildings, 142 miles of roads and 103 miles of railroad tracks

Built between 1941-1943 as conventional munitions Loading, Assembly and Packing (LAP) facility

Still in operation - current workforce approx. 1,000 employees
Atomic weapons assembled, disassembled and repaired between 1949-1975 on Line 1 under AEC (pre-DoE) contractual agreements with Silas Mason.

Between 1949-1951 the only large scale manufacturer of nuclear weapons in the country.

Production moved in 1975 to Pantex, IAAP’s sister Plant in Amarillo, TX.
Estimated 5,000 workers (M>F ~80%) worked on AEC Line 1 (workers subgroup Division B) between 1949 and 1975.

Considerable cross-over of workforce with adjacent conventional munitions manufacturing lines (70-80% worked on both lines).

Main exposures:

- Ionizing radiation
- Beryllium
- Asbestos
- Solvents
- High explosives
- Isocyanates
- Epoxy adhesives
- Curing agents
RESULTS
New Cancers Detected through Screenings

- Lung 7 (1.0%; N=734 CXR) + 2 post/s
- Thyroid (intrathoracic) 1 (0.1%; N=734 CXR)
- Colon 1 (0.2%; N= 652 Hemoccult)
- Prostate 4 (3%; N=139 PSA)
- CLL 1 (0.1%; N=932 CBC)
- Mesothelioma 2 (0.3%; N=734 CXR)
### RESULTS

**Sensitization to Beryllium**

N = 38 (3.5%) with at least one abnormal Beryllium Lymphocyte Proliferation Test (BeLPT)

<table>
<thead>
<tr>
<th>BeLPT result</th>
<th>Abnormal BeLPT (ever)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>44</td>
</tr>
<tr>
<td>1</td>
<td>23</td>
<td>628</td>
</tr>
<tr>
<td>0</td>
<td>7</td>
<td>339</td>
</tr>
<tr>
<td>Total</td>
<td>36*</td>
<td>1,011*</td>
</tr>
</tbody>
</table>

* N= 37 - no job code information available to establish Be exposure category

\( \chi^2 = 13.70 \) (exp. 2) vs. (exp. 0)  
\( p < 0.05 \)

**Odds of abnormal BeLPT in those exposed (1,2) vs. not exposed (0)**

\( OR = 2.09 \) (95% CI – 0.91 to 4.82)

**Odds of abnormal BeLPT in those exposed to highest exposure (2) vs. no exposure (0)**

\( OR = 6.60 \) (95% CI - 2.12 to 20.54)

\( \chi^2 \) for linear trend = 8.12; \( p < 0.005 \)
## RESULTS

### Lung Disease Screening

**Parenchymal abnormalities only - ILO >0/1**

<table>
<thead>
<tr>
<th>ILO review</th>
<th>ILO review</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Be exp</td>
<td>ILO =&gt;1/0</td>
<td>ILO =&gt;2/1</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>45</td>
<td>2</td>
</tr>
<tr>
<td>0</td>
<td>22</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>70*</td>
<td>4*</td>
</tr>
</tbody>
</table>

\(\chi^2 = 0.44\) (high exposure cat 1,2 vs. no exposure cat 0)
\(p = 0.51\)

**Odds of parenchymal abnormalities in those exposed (1,2) vs. not exposed (0)**
\(OR = 1.20\) (95% CI 0.71 to 2.04)

**Odds of parenchymal abnormalities in those exposed to highest exposures (2) vs. no exposure (0)**
\(OR = 1.00\) (95% CI 0.28 to 3.54)

**Odds of dramatic pulmonary fibrosis (ILO =>2/1) in those exposed to highest exposures (2) vs. no exposure (0)**
\(OR = 7.33\) (95% CI 0.45 to 120.35)

*N=26 - no job code information available to establish Be exposure category*
RESULTS
Lung Disease Screening

Parenchymal and/or pleural abnormalities*

- Parenchymal =>1/0 $\quad N = 72 \ (9.5\%)$
  $\Rightarrow 2/1 \quad N = 4 \ (0.5\%)$

- Pleural $\quad N = 47 \ (6.3\%)$

- Parenchymal and pleural $\quad N = 36 \ (4.9\%)$
  $\Rightarrow 2/1 \quad N = 5 \ (0.7\%)$

Overall prevalence of IPF reported at 14/100,000 with 75+ y.o. at 88/100,000  (Raghu et al, 2006)

*752 CXRs reviewed by at least 1 ILO reader with the highest reading for 2 and 3 readers reported
RESULTS

History of Lung Disease
(Screening Interviews/Qnnaires)

– Wegener’s granulomatosis  \( N = 2/1,000 \)
  – Prevalence reported at 1/100,000 (Bernalillo County Registry, NM, Coultas et al, 1994)

– Sarcoidosis  \( N = 2/1,000 \)
  – Prevalence reported at 8/100,000 (Bernalillo County Registry, NM, Coultas et al, 1994)

– Bronchiolitis Obliterans
  Organizing Pneumonia B.O.O.P  \( N = 1/1,000 \)
Elevated rate of Beryllium sensitization despite low exposures

Fibrotic lung diseases more prevalent than expected (is this an age, smoking or pneumoconiotic effect?)

Implications for more widespread screenings of DoE populations and other workforces utilizing Be alloys