Indoor air pollution hits EPA too close to home

By Aaron Epstein
Knight-Ridder News Service

Washington – The pollution experts at the Environmental Protection Agency should know a sick building when they see it. They work in one. Yet, despite all their expertise and expenditures, they have not yet found a cure.

Sick Building Syndrome, or SBS, is an unscientific term used to describe a pattern of health symptoms linked to poor indoor air quality in workplaces, schools, homes and other buildings – but difficult to trace to any particular source. It is believed to be the cause.

Evidence for Toxicant-induced Loss of Tolerance

- Similar reports in different regions/countries
- Complaints of new intolerances for foods, alcoholic drinks, caffeine, and medications, not only chemicals
- Resemblance to addiction
- Plausible anatomic locus
- Recent animal models

U.S. Pesticide Production, All types, 1927-1988

Historical Development of Ventilation Standards in the U.S.
**Particle board**
**Traffic exhaust**
**Cigar smoke**
**Hairspray**
**Asphalt or tar**
**Insecticides**
**Felt-tip dry marking pen**
**Poorly ventilated meeting room**
**New automobile interior**
**Fabric stores**
**Hotel rooms**
**Nail polish remover**
**Perfumes**
**Cigarette smoke**
**Diesel exhaust**
**Asphalt or tar**
**Restroom deodorizers**
**Particle board**
**Traffic exhaust**
**Cigar smoke**
**Hairspray**
**Felt-tip dry marking pen**
**New automobile interior**

**TOXICANT-INDUCED LOSS OF TOLERANCE**

**Gastrointestinal**
- Irritable bowel syndrome
- Reflux

**Connective Tissue/Musculoskeletal**
- Fibromyalgia
- Carpal tunnel syndrome
- Temporomandibular joint dysfunction (TMJ) syndrome
- Arthritis
- Lupus and other auto-immune diseases

**Cardiovascular**
- Arrhythmias
- Hypertension
- Hypotension
- Raynaud’s phenomenon

**Neuropsychological**
- Attention deficit/hyperactivity disorder (ADHD)
- Depression
- Bipolar disorder
- Panic disorder
- Migraines and other headaches
- Sleep disturbances
- Autism

**Respiratory**
- Asthma
- Reactive airways dysfunction syndrome (RADS)
- Sudden death syndrome (TDS) hypersensitivity

**Skin**
- Eczema
- Hives
- Other rashes, eruptions

**Miscellaneous Syndromes**
- Chronic Fatigue Syndrome
- Implant syndromes
- Gulf War Syndrome
- Post/other disaster syndromes

**Miscellaneous**
- Gastrointestinal
- Irritable bowel syndrome
- Headaches
- Seizures
- Autism

**Ear, Nose and Throat**
- Sinusitis
- Polyps
- Tinnitus
- Recurrent otitis media

**Other**
- Autonomic nervous system
- Endocrine abnormalities
- Autonomic dysfunction

**Symptoms**
-菜

**Diagnosis**
- Sensitive Person
- Susceptible Person

**Masking**
- Low Level Exposure
- Initial Exposure Event
- Loss of Specific Tolerance

**Triggering**
- Loss of Specific Tolerance

**Symptoms**

**Addiction and Chemical Intolerance: A Shared Etiology?**

**Addiction**

**Chemical Intolerance**

**Masking**

**Exposure:**

**Time:**

**Increasing Symptom Intensity**
**Masking: Apposition**

**Relationship between TILT, Addiction and Abdiction**

1. TILT (Loss of Tolerance)
2. Avoid Withdrawal (2 strategies)
   - Avoid substance altogether
   - Take substance regularly

**Chemical Intolerance: Postulates**
**Frequency of New-onset Intolerances Reported by the First 59 Consecutive Gulf War Veterans Seen at the Houston VA Regional Referral Center**

- Chemical Inhalants: 78%
- Medications: 40% of those who took drugs
- Alcoholic beverages: 66% of alcohol users
- Caffeine: 25% of caffeine users
- Foods: 78%
  - Specific foods: 64%
  - Illness after meals: 49%
- Tobacco use: 74% of tobacco users

**New-Onset Intolerances Reported by 59 Consecutive Gulf Veterans**

- Intolerances n=52
- No Intolerances n=7

**Frequency of “Severe” Symptoms Among Three Exposure Groups versus Controls (%)**

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Gulf War Veterans</th>
<th>Pesticide-Exposed</th>
<th>Remodeling-Exposed</th>
<th>Controls N=112</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fatigue</td>
<td>78</td>
<td>68</td>
<td>52</td>
<td>3</td>
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<tr>
<td>Depression</td>
<td>29</td>
<td>49</td>
<td>33</td>
<td>6</td>
</tr>
<tr>
<td>Headaches</td>
<td>53</td>
<td>38</td>
<td>31</td>
<td>5</td>
</tr>
<tr>
<td>Shortness of breath</td>
<td>38</td>
<td>43</td>
<td>31</td>
<td>2</td>
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<tr>
<td>Asthma or wheezing</td>
<td>12</td>
<td>27</td>
<td>15</td>
<td>0</td>
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</tbody>
</table>

**Chemical Intolerance – Genotypes**

- Canadian case control study to determine whether chemically intolerant individuals differ from controls for genetic polymorphisms in drug-metabolizing enzymes
- Caucasian female cases (203) and controls (162)
- CYP2D6, NAT1, NAT2, PON1, PON2, MTHFR were genotyped
- Significant difference found in cases vs. controls for CYP2D6 (p=0.02)
  - OR CYP2D6 homozygous active=3.36 (p=0.01)
  - OR NAT2 rapid metabolizer=4.14 (p=0.01)


- CPY2D6 metabolizes centrally acting drugs and toxins such as tricyclic antidepressants, selective serotonin re-uptake inhibitors, monoamine oxidase inhibitors, amphetamines, codeine, neuroleptics, neurotoxins, and endogenous neurotransmitters
- Latter finding may be relevant to observations that poor metabolizers score higher on anxiety scales and lower on socialization scales
- NAT2 expresses arylamine transferase which determines susceptibility to aromatic amines

Theories of Disease

Theories of disease are our attempt to explain what is going on inside a "host" by postulating a general mechanism.

A "theory of disease" is a yet-to-be proven general mechanism for a class of disease.

Germ Theory of Disease

1. Many different kinds of germs cause response
2. Many different responses involving any and every organ system
3. Specific mechanisms may vary greatly (cholera vs. AIDS vs. shingles)
4. No single biomarker. Identification of specific germs took years
5. Prevention—avoidance, antiseptics, sanitation, use of gloves—preceded our knowledge of specific mechanisms

Immune Theory of Disease

1. Many different kinds of antigens cause response
2. Many different responses involving any and every organ system
3. Specific mechanisms vary greatly (poison ivy vs. allergic rhinitis vs. serum sickness)
4. No single biomarker. Identification of specific antibodies took years
5. Prevention—avoidance, allergy shots—preceded our knowledge of specific mechanisms
TILT Theory of Disease

1. Many different kinds of chemicals cause response
2. Many different responses involving any and every organ system
3. Specific mechanisms may vary greatly
4. Currently no biomarker
5. Prevention—avoidance—may precede our knowledge of specific mechanisms

The 7 A’s

- Asthma
- Autoimmune diseases
- Affective disorder
- Attention deficit/hyperactivity disorders
- Autism spectrum disorders
- Allergies
- Addiction (masking)

What is plausible depends upon the biological knowledge of the time.