Green Chemistry at the Local Level: Precautionary Policies to Reduce Toxic Chemicals

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If it's legal to buy it must be safe to use...
Scientific Uncertainty

80,000 chemicals in commerce
Small percentage have “complete” information
Chemical Production Shows No Sign of Slowing Down
Low doses matter

Expression of estrogen-responsive gene to DES in utero
Changes in Prevalence of ASDs among Children 8 Years Old, 2002 to 2006

Center for Disease Control and Prevention
Autism on the rise

Number of people in California with autism:

As of January: 26,576

Source: California Department of Developmental Services

The Chronicle
End-Of-Pipe Challenge for Local Governments
There’s always a new “emerging contaminant”
Need policy tools that move up-stream. That lead to product redesign
12 Principles of Green Chemistry*

1. Waste Prevention
2. Atom Economy
3. Less Hazardous Chemical Syntheses
4. Designing Safer Chemicals
5. Safer Solvents and Auxiliaries
6. Design for Energy Efficiency
7. Use of Renewable Feed stocks
8. Reduce Derivatives
9. Catalysis
10. Design for Degradation
11. Real-time analysis for Pollution Prevention
12. Inherently Safer Chemistry for Accident Prevention

Vorsorge prinzip
The Precautionary Approach

It is NOT sufficient to ask:

Is it legal?
Is it safe?

We also MUST ask:
Is it necessary?
How to determine if it's necessary?

- What is an acceptable level of harm?
- Single activity considered

- Is this potentially hazardous activity (product) necessary?
- What less hazardous options are available?
- How little damage is possible?
- Multiple activities compared
Who decides if it’s necessary?
Government Procurement

[Images of prohibited items, certification logos, and a playground scene]
Gardeners ask: “Is it necessary?”

- 90% reduction in RoundUp because often it is not necessary
  - Goats, hand weeding, flamers, compost tea
  - Prevention: mulch, sealing cracks
  - Acceptance (lawns as meadows)
Sometimes RoundUp is the alternative that minimizes harm.

Median Strips

Airport Runways

Invasive weeds in “Natural Areas”
Promoting the “good guys”
Safer alternatives?
These petroleum solvents are made by

Chevron

EXXON

Mobil

Shell
<table>
<thead>
<tr>
<th>Category</th>
<th>Definition</th>
<th>UF-200</th>
<th>Pure Dry</th>
<th>Eco Solv</th>
<th>Shell Sol</th>
<th>Standard</th>
<th>GreenEarth</th>
<th>Rynex</th>
<th>CO2 - Miscell</th>
<th>CO2</th>
<th>Wet Clean</th>
<th>Perc</th>
<th>Propyl bromide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cancer, Mutagenicity and Genotoxicity</td>
<td>Mutagens, interferes with conception/ Teratogen, interferes with fetal development. Data includes evidence of carcinogenicity in animals.</td>
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<tr>
<td>Reproductive &amp; Developmental Effects</td>
<td>Reducing reduction in fertility &amp; birth outcomes, including but not limited to birth weight, including physical and metabolic birth defects that are present at birth or manifest later, and effects on development of any kind, including, but not limited to, motor or cognitive effects that result from exposure during pregnancy.</td>
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<tr>
<td>Neurological and neuro developmental effects</td>
<td>Substance that is capable of destroying or adversely affecting nerve tissue</td>
<td>Dizziness at high concentrations</td>
<td>Neurotoxicity of mineral spirits</td>
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<tr>
<td>Endocrine Disruption</td>
<td>Alter(s) function(s) of the endocrine system and consequently causes adverse health effects in an intact organism, or its progeny, or subpopulations</td>
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<tr>
<td>Systemic Effect</td>
<td>Adverse effect manifests as either a generalized nature or that occurs at a site distant from the point of entry of a substance; a systemic effect requires absorption and distribution of the substance in the body</td>
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<tr>
<td>Persistent, Bioaccumulative and Toxic (PBT)</td>
<td>Chemical that accumulates to toxic levels in animal tissue or organs and are toxic to humans or animals. Concentrations in the environment increase over time, increasing the probability of adverse toxic effect</td>
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<tr>
<td>Toxic to aquatic organisms</td>
<td>Adverse effects of marine life that result from being exposed to a toxic substance</td>
<td>Fish and Benthic Toxicity</td>
<td>Moderately toxic to aquatic environments</td>
<td></td>
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</tbody>
</table>

**TIER 1 SCREENING**

- **Carcinogens**
- **Sponaneous abortion and congenital malformations**
- **Prop 85 listed reproductive toxin**

**TIER 2 SCREENING**

- **Asthma and/or other respiratory effects**
- **Eye Irritant**
<table>
<thead>
<tr>
<th>Technology</th>
<th>Total Annual Cost (for first 3 years)</th>
<th>Primary Human Health and Environmental Hazards</th>
<th>Air Regulations (Bay Area Air Quality Management District)</th>
<th>Health Regulations (Department of Public Health)</th>
<th>Fire Regulations (Fire Department)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PROFESSONAL MET CLEANINGS</strong></td>
<td>$20,026</td>
<td>None identified</td>
<td>N/A</td>
<td>- Detergent, solvents should be chosen to minimize environmental concerns - Possible annual fee for hazardous material storage (if &gt;255 gal hazardous detergent stocked on site)</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>CO₂ cleaning</strong></td>
<td>$56,681</td>
<td>None identified</td>
<td>N/A</td>
<td>- Possible annual fee based on volume of CO₂ gas stored on site</td>
<td>SFFD operational permit and annual fee - Use of Class I alkane co-solvent prohibit Code 1204.1</td>
</tr>
<tr>
<td>Hydrocarbon solvents:</td>
<td>$27,755 - 229,535</td>
<td>- Neurotoxicity, eye, skin and respiratory irritation - Potential concerns for persistence and aquatic toxicity - Complex mixtures which may contain other ingredients of concern</td>
<td>Regulated under BAAQMD Rule 8-17 - Closed-loop machine required - Registration required - Permit required if &gt;200 g a year gross solvent used</td>
<td>- Annual fee for hazardous waste generated - Annual fee for hazardous material storage (255 gal stored on site) &amp; compressed gas storage (if &gt;200 ft³ N₂)</td>
<td>SFFD operational permit and annual fee - Combustible liquid (Class II) - Ventilation, automatic sprinkler system as specified in Fire Code Ch 12</td>
</tr>
<tr>
<td>GreatEarth® (DS solvent)</td>
<td>$32,716</td>
<td>- Suspected carcinogen, reproductive toxic - Liver, immune and nervous system effects - Persistent in environment; detected in fish</td>
<td>Regulated under BAAQMD Rule 8-17 - Closed-loop machine required - Registration required - Permit required if &gt;200 g a year gross solvent used</td>
<td>- Annual fee for hazardous waste generated - Annual fee for hazardous material storage (255 gal stored on site)</td>
<td>SFFD operational permit and annual fee - Combustible liquid (Class II) - Ventilation, automatic sprinkler system as specified in Fire Code Ch 12</td>
</tr>
<tr>
<td>CO₂ cleaning with Illué Technologies</td>
<td>$58,461</td>
<td>Possible use of perfluorooctanoic acid (PFOA) in Illué technology raises concerns for endocrine disruption, reproductive and developmental effects and persistence/bioaccumulation</td>
<td>N/A</td>
<td>- Possible annual fee based on volume of CO₂ gas stored on site</td>
<td>SFFD operational permit and annual fee - Use of Class I alkane co-solvent prohibit Code 1204.1</td>
</tr>
<tr>
<td><strong>Pyrex™ solvent</strong></td>
<td>$26,220</td>
<td>Chemical identity withheld as trade secret - Primary ingredient likely to be 1,2-propanediol glycol-1-buty ether (1,2-DGEBE) - DGETE structurally related to a listed Proposition 65 carcinogen and predicted to be persistent</td>
<td>Regulated under BAAQMD Rule 8-17 - Closed-loop machine required - Registration required - Permit required if &gt;200 g a year gross solvent used</td>
<td>- Annual fee for hazardous waste generated - Annual fee for hazardous material storage (255 gal stored on site)</td>
<td>SFFD operational permit and annual fee - Combustible liquid (Class II) - Ventilation, automatic sprinkler system as specified in Fire Code Ch 12</td>
</tr>
<tr>
<td><strong>Hydrocarbon solvent</strong></td>
<td>$28,328</td>
<td>- Contains aromatic hydrocarbons (e.g., benzene, a carcinogen) - Neurotoxic, eye, skin and respiratory irritation - Potential concerns for bioaccumulation and aquatic toxicity</td>
<td>Regulated under BAAQMD Rule 8-17 - Closed-loop machine required - Registration required - Permit required if &gt;200 g a year gross solvent used</td>
<td>- Annual fee for hazardous waste generated - Annual fee for hazardous material storage (255 gal stored on site)</td>
<td>SFFD operational permit and annual fee - Combustible liquid (Class II) - Ventilation, automatic sprinkler system as specified in Fire Code Ch 12</td>
</tr>
<tr>
<td><strong>PerChloroethylenes</strong></td>
<td>$27,756</td>
<td>- Carcinogen (California's Proposition 65 list) - Liver and kidney effects - Neurotoxic, eye, skin and respiratory irritation - Persistent in the environment</td>
<td>Regulated under BAAQMD Rule 11-16 - Secondary control technology required - Registration required - Permit required</td>
<td>- Annual fee for hazardous waste generated - Annual fee for hazardous material storage (255 gal stored on site)</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>1-Propyl Isomers</strong></td>
<td>--</td>
<td>Male and female reproductive toxicant and developmental toxicant (California's Proposition 65 list) - Neurotoxic, eye, skin and respiratory irritation</td>
<td>Regulated under BAAQMD Rule 11-16 - Secondary control technology required - Registration required - Permit required</td>
<td>- Annual fee for hazardous waste generated - Annual fee for hazardous material storage (255 gal stored on site)</td>
<td>ILLEGAL per CA Fire Code 1204.1 - Flammable liquid (Class I) - NFFA rating</td>
</tr>
</tbody>
</table>
Nail Salons: Recognition Program
San Francisco Follows EU Lead: Bans Sale of Phthalates in Toys...

Next came California...

And then the Nation.
Other San Francisco Product Bans...
The power of information
Cell Phones
As of June 2008, There Were More Than 262 Million Wireless Subscribers in the U.S.

Source: CTIA Semi-Annual Survey
We use our phones twice as much as the nearest country.

### How the U.S. Stacks Up Against Other Countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Subscribers**</th>
<th>Average Consumers' Minutes of Use per Month**</th>
<th>Average Revenue per Minute – A Measure of the Effective Price per Voice Minute**</th>
<th>Efficient Use of Spectrum – Subscribers Served per MHz of Spectrum Allocated</th>
<th>Spectrum Assigned for Commercial Wireless Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>262.7m</td>
<td>848</td>
<td>$0.05</td>
<td>742,147</td>
<td>354 MHz*</td>
</tr>
<tr>
<td>Japan</td>
<td>107.7m</td>
<td>137</td>
<td>$0.25</td>
<td>310,374</td>
<td>347 MHz</td>
</tr>
<tr>
<td>Germany</td>
<td>103.4m</td>
<td>104</td>
<td>$0.21</td>
<td>339,016</td>
<td>305 MHz</td>
</tr>
<tr>
<td>U.K.</td>
<td>74.4m</td>
<td>190</td>
<td>$0.16</td>
<td>210,884</td>
<td>352.8 MHz</td>
</tr>
<tr>
<td>France</td>
<td>55.4m</td>
<td>249</td>
<td>$0.17</td>
<td>147,772</td>
<td>374.9 MHz</td>
</tr>
<tr>
<td>Italy</td>
<td>90.1m</td>
<td>138</td>
<td>$0.18</td>
<td>289,338</td>
<td>311.4 MHz</td>
</tr>
<tr>
<td>Canada</td>
<td>20.6m</td>
<td>446</td>
<td>$0.11</td>
<td>100,487</td>
<td>205 MHz</td>
</tr>
<tr>
<td>Spain</td>
<td>51.2m</td>
<td>164</td>
<td>$0.24</td>
<td>143,016</td>
<td>358 MHz</td>
</tr>
<tr>
<td>S. Korea</td>
<td>45.0m</td>
<td>320</td>
<td>$0.11</td>
<td>193,133</td>
<td>233 MHz</td>
</tr>
<tr>
<td>Mexico</td>
<td>73.2m</td>
<td>187</td>
<td>$0.09</td>
<td>612,500</td>
<td>120 MHz</td>
</tr>
</tbody>
</table>

*Figure includes AWS-1 and 700 MHz spectrum not yet in use.

Radiation Penetrates Deeper into Younger Brains

Figure 1. Estimation of the penetration of electromagnetic radiation from a cell phone based on age (Frequency GSM 900 Mhz) (On the right, a scale showing the Specific Absorption Rate at different depths, in W/kg) [1]*
Younger and younger users

“Babyphone … developed for the kids aged 3 to 8…”
**Point of Purchase Display**

---

**LG NEON**
- Full QWERTY keyboard
- 2.0MP camera
- Stereo Bluetooth® technology
- Monthly Geek Squad Black Tie Protection for $6.99

**FREE!**

**at&t**

<table>
<thead>
<tr>
<th>Family Plan</th>
<th>2 Year Upgrade Plan</th>
<th>Regular Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Phones purchased for lines 2-5)</td>
<td>(Individual and Family Plans)</td>
<td>(Without activation)</td>
</tr>
<tr>
<td><strong>FREE!</strong></td>
<td><strong>FREE!</strong></td>
<td><strong>249.99</strong></td>
</tr>
</tbody>
</table>

**NATION PLANS REQUIRE MINIMUM $20 /MONTH TEXT OR DATA PLAN.**
See a Sales Associate for details.

---

**SAR: Specific Absorption Rate**
- **This Phone:** [SAR] out of 1.6
- SAR: Maximum microwave power absorbed by the head or body
- Ask at counter for supplemental information sheet

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**Printed: 01/24/2010 09:31 AM**
LEARN HOW TO REDUCE YOUR EXPOSURE TO CELL PHONE RADIATION.

New city law makes it easier for consumers to learn their cell phone’s maximum radiation level, also known as the Specific Absorption Rate, or SAR.
Understanding Cell Phone Radiation

A debate exists about whether wireless phone use is linked to cancer and other illnesses. Specific Absorption Rate or SAR, is a measure of the type of radiation absorbed by the head and body when using a cell phone.

The Federal Communications Commission (FCC) requires that cell phones have SAR values of less than 1.6 watts per kilogram of body weight, as averaged over one gram of tissue, when used as directed by the manufacturer. Actual SAR levels during use can vary due to factors such as orientation to and distance from the head or body, proximity to a cell tower, and design of the phone.

Tips for Reducing Exposure to Cell Phone Radiation

Maximum SAR values are required to be posted in San Francisco stores offering cell phones. If you are concerned about cell phone radiation, you may choose to buy a cell phone with a lower maximum radiation (SAR) level.

In addition, the FCC advises that those concerned about the risks of cell phone radiation can take the following precautions:

- Use an earpiece, headset, or speaker function. Earpieces, headsets and speaker functions help keep cell phones away from the head, and thus can greatly reduce radiation exposure to your head. However, because wireless earpieces also emit a small amount of radiation, turn them off when not in use.

- Keep distance between cell phones and your body. Cell phone radiation is continually emitted from your phone when it is on. The further the phone is from your body, the less radiation your body absorbs.

- Text instead of talking. Limiting talk time can reduce radiation exposure. Never text while driving.

Learn more:

Federal Communications Commission
FCC.gov/cgb/consumerfacts/mobilephone.html

SF Department of the Environment
SFEnvironment.org/cellphoneradiation • (415) 355-3700
SAN FRANCISCO

Wireless industry sues over law

City wants cell phone radiation levels posted in stores

By John Wildermuth
Chronicle Staff Writer

A cellular industry group went to court Friday to quash San Francisco’s landmark ordinance requiring radiation levels to be publicly listed for every cell phone sold in the city.

The ordinance overwhelmingly approved last month by the Board of Supervisors “will confuse and mislead the public” by suggesting that the level of radiation emitted by federal-ly approved phones has a relation to health risks, CTIA, the wireless industry’s association, said in its suit, which was filed in federal court in San Francisco.

“The message sent to con-

Radiation continues on C3

“This law is not an attack on the wireless industry or their products. This is a modest ... measure which ... takes information ... and makes it more accessible and easier to find.”

Mayor Gavin Newsom
The Bigger Picture: Chemicals Policy Reform

AB 1879

www.dtsc.ca.gov

CA Dept. of Toxic Substance Control
The Precautionary Principle offers a powerful vision for moving forward.
The Precautionary Principle

≠ Zero risk

≠ Zero science

≠ Loss of jobs

≠ Predetermined outcome (i.e. ban)

= Minimize harm

= Maximize info./science

= Increase innovation

= Transparent Process for public decision making
So that when we ask:

**It is legal?**

Confident our laws are protective of all life

**Is it safe?**

Sufficient data and testing so that we understand chemical effects on organisms and ecosystems

**Is it necessary?**

Affected communities are at the table, all are empowered to examine alternatives, and to choose those that minimize harm