Cal/OSHA PEL's: Community Standards for Worker Exposure Limits?

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In California, the Division of Occupational Safety and Health (DOSH), usually referred to as Cal/OSHA, wants to finalize an approach to setting acceptable worker chemical inhalation levels that would draw on analyses used for Proposition 65. The result may be Permissible Exposure Levels (PELs) that are orders of magnitude lower than those currently in use. All other things being equal, a manufacturer would select a chemical with a high PEL over one with a low PEL. Since California is frequently a leader for regulations nationwide and globally, what happens in California can be of interest or concern to all.

While at first glance it might appear that setting a lower PEL number for any given chemical would be desirable in that it would be more protective of workers, we have concerns that the approach will ultimately be confusing, will not reflect risks to workers, and may actually be counterproductive.

To explain our concern over use of the community exposure approach, we provide calculations and examples of what the lower worker PELs could be, if they are based on analyses used for community exposures to air toxics. We then explain why studies and analyses for worker and community exposure are and should be different and specifically targeted. We then explain why different analyses for worker and community exposure have been and should be used including population differences, continuity of exposure, and duration of exposure. We conclude with potential consequences of adopting PELs based on community exposure.

You can provide input to Cal/OSHA by January 31, 2007. SQRC comments to Cal/OSHA, including line-by-line comments on the draft Cal/OSHA document, are available on our website.

Background

Historically, there have been separate standards for worker safety and environmental or community safety, even though the plethora of resulting regulations can be confusing. While we have long felt that there ought to be better coordination among regulatory agencies to avoid conflicting regulations, regulations impacting workers and communities are, and probably ought to be, looked at from separate perspectives to minimize exposure impacts on those particular groups. At the same time, setting standards for worker exposure limits, including PELs and other Occupational Exposure Limits (OELs), have been slow. The process has not always been transparent (i.e. available to the public), and there have been concerns that industry may influence the final decision, to the detriment of the worker. In fact, many animal studies are sponsored and some OELs are developed by the manufacturers of the chemical.

Cal/OSHA is working to formalize and expedite the PEL development process with recognition of the limited resources available at the State level. Notably, they may use the results of analysis as well as reference exposure levels developed by the Office of Environmental Health Hazard Assessment. OEHHA is the group that develops the reference levels that are used as a basis for a number of community safety regulations and programs including Proposition 65.

These reference levels are mathematically determined exposure values which, when all assumptions are factored in, would theoretically result in one excess cancer death per 100,000 exposed persons during a lifetime (70 years) of exposure. If adopted, the approach is likely to yield PELs that may have to be looked at with a different perspective than exposure limits adopted by Federal OSHA or by professional organizations, which very often set workplace exposure limits corresponding to risk levels reflecting an increase cancer risk of one excess cancer death per 1,000 exposed persons during a 30 year working career (40 hours per week).

The approach has been fostered by Project WorkSafe. Advocacy work by Project WorkSafe in support of the environmental risk analysis began in 1995. Based on the most recent Cal/OSHA draft of the PEL development policy, and on our observations at the December 13th meeting in Oakland, it appears that Cal/OSHA may incorporate the Worksafe approach. A thorough, science-based, transparent, supportable PEL process is a positive step. However, in our opinion, placing emphasis on studies and analyses geared to community safety is inappropriate and may be counterproductive to worker safety. The SQRC comments to the California Division of Occupational Safety and Health (DOSH) are available on our website
http://sqrc.org/Newsletter%201/PELDevDraft3SQRCcomments.pdf

You can download the Cal/OSHA Draft #3 of the PEL development policy and procedure document and submit your comments by January 31, 2007.
http://www.dir.ca.gov/dosh/doshreg/5155Meetings.htm
Even if you choose not to comment, we suggest tracking the progress of the Cal/OSHA PEL plans.

To put the Cal/OSHA PEL development process into perspective let's explore:
What might the PEL numbers look like?
How do worker safety and community exposure risks, studies, and analyses differ?
What are some consequences of the lower numbers?

Much lower worker safety numbers

We do not know exactly how Cal/OSHA would set worker exposure limits. However, if the Proposition 65 No Significant Risk Level (NSRL) exposure limits were converted to 8 hour TWA's, the numbers would be far lower than those developed by Federal OSHA, ACGIH (American Conference of Industrial Hygienists), or AIHA (American Industrial Hygiene Association). A number of compounds are listed in the accompanying summary table. Please be aware that lower numbers typically indicate a less favorable worker exposure profile and signal the need for more process controls.

These lower numbers will impact analysis and actions by industry and by communities impacted by industrial activities. Industry looks for higher PEL numbers. In comparing two process chemicals, most companies would be concerned at a four-fold difference in the PEL (say, 100 ppm versus 25 ppm); and they would be very concerned about an order of magnitude difference in PEL's (say, a chemical with a PEL of 100 ppm versus one with a PEL of 10 ppm).

For example Perchloroethylene (PCE, tetrachloroethylene) could have a worker exposure level six orders of magnitude lower than that for ACGIH (0.00021 ppm potential California versus 25 ppm ACGIH). Using a similar analysis, Methylene chloride (dichloromethane) could have a worker exposure level between three and four orders of magnitude lower than that set by Federal OSHA (0.0058 ppm potential California versus 25 ppm for Federal OSHA).

Hexavalent chromium could have a California PEL of 0.0001 ug/m3 versus the new 5 ug/m3 Federal OSHA level or 10 ug/m3 ACGIH. Industry had been operating at approximately 10 times the level specified by the new Federal OSHA standard. You may be aware that many in industry consider that it will difficult to monitor levels to assure compliance with the new Federal standard. The California PEL could be between 3 and 4 orders of magnitude lower than that of the new Federal OSHA level.

Interpretation of the California PEL's is likely to be challenging. As indicated in the accompanying table, a simple conversion factor could not be used to correlate Cal/OSHA PEL with other PEL's or OEL's.

As it is, worker exposure levels may differ depending on the regulatory and professional group generating the levels. Most exposure levels are recommended, because there are very few Federal standards. As we indicated, sometimes, individual chemical producers will supply an occupational exposure level based on their own studies. There is concern that these levels may be overly-lax and may not be based on peer-reviewed studies. On the other hand, in at least a few instances, a very low limit may be set because the chemical producer has not yet completed animal studies.

Chemical	Type of Toxicity	CAS No.	Date Listed	NSRL or MADL (µg/day)[a]	Possible Calif. PEL TWA (1)	Current ACGIH TLV, 8 hr TWA
Acetaldehyde	cancer	75-07-0	1-Apr-88	90 (inhalation)	0.005 ppm	25 ppm
2-Acetylaminofluorene	cancer	53-96-3	1-Jul-87	0.2		
Acrylamide	cancer	79-06-1	1-Jan-90	0.2	0.02 ug/m3	30 ug/m3
Acrylonitrile	cancer	107-13-1	1-Jul-87	0.7	0.000032 ppm	2 ppm
Aniline	cancer	62-53-3	1-Jan-90	100	0.0026 ppm	2 ppm
o-Anisidine	cancer	90-04-0	1-Jul-87	5	0.5 ug/m3	500 ug/m3
Arsenic (inorganic arsenic compounds)	cancer	--	27-Feb-87	0.06 (inhalation) 10 (except inhalation)	0.006 ug/m3	10 ug/m3
Asbestos	cancer	1332-21-4	27-Feb-87	100 fibers/day (inhalation)	0.00001 fibers/cc	0.1 fibers/cc
Benzene	cancer	71-43-2	27-Feb-87	6.4 (oral) 13 (inhalation)	0.0004 ppm	0.5 ppm
Benzene	developmental, male	71-43-2	26-Dec-97	24 (oral) 49 (inhalation)	0.0015 ppm	0.5 ppm

Chemical	Type of Toxicity	CAS No.	Date Listed	NSRL or MADL (µg/day)[a]	Possible Calif. PEL TWA (1)	Current ACGIH TLV, 8 hr TWA
Benzyl chloride	cancer	100-44-7	1-Jan-90	4	0.000077 ppm	1.0 ppm
Beryllium				0.1	0.01ug/m3	0.05 ug/m3
Bromoform	cancer	75-25-2	1-Apr-91	64	0.00062 ppm	0.5 ppm
1,3-Butadiene	cancer	106-99-0	1-Apr-88	0.4	0.000018 ppm	2.0 ppm
Cadmium				0.05 (inhalation)	0.005 ug/m3	10 ug/m3
Captafol	cancer	2425-06-1	1-Oct-88	5	0.5 ug/m3	100 ug/m3
Captan	cancer	133-06-2	1-Jan-90	300	0.03 mg/m3	5 mg/m3
Carbon tetrachloride	cancer	56-23-5	1-Oct-87	5	0.000079 ppm	5 ppm
Chlordane	cancer	57-74-9	1-Jul-88	0.5	0.05 ug/m3	500 ug/m3
Chloroethane (Ethyl chloride)	cancer	75-00-3	1-Jul-90	150	0.0057 ppm	100 ppm
Chloroform	cancer	67-66-3	1-Oct-87	20 (oral) 40 (inhalation)	0.00082 ppm	10 ppm
Chromium (hexavalent compounds)	cancer	---	27-Feb-87	0.001 (inhalation)	0.0001 ug/m3	10 ug/m3
Coke oven emissions	cancer	---	27-Feb-87	0.3	0.03 ug/m3	20 ug/m3
DDVP (Dichlorvos)	cancer	62-73-7	1-Jan-89	2	0.2 ug/m3	100 ug/m3
1,2-Dibromo-3-chloropropane (DBCP)	cancer	96-12-8	1-Jul-87	0.1	0.001 ppb	1.0 ppb (OSHA)
1,2-Dibromo-3-chloropropane (DBCP)	male	96-12-8	27-Feb-87	3.1 (oral) 4.3 (inhalation)	0.045 ppb	1.0 ppb (OSHA)
p-Dichlorobenzene	cancer	106-46-7	1-Jan-89	20	0.00033 ppm	10 ppm
1,1-Dichloroethane	cancer	75-34-3	1-Jan-90	100	0.0025 ppm	100 ppm
Dichloromethane (Methylene chloride)	cancer	75-09-2	1-Apr-88	50 200 (inhalation)	0.0058 ppm	25 ppm (OSHA)
Dieldrin	cancer	60-57-1	1-Jul-88	0.04	0.004 ug/m3	250 ug/m3
Di(2-ethylhexyl)phthalate	cancer	117-81-7	1-Jan-88	310	0.031 mg/m3	5 mg/m3
2,4-Dinitrotoluene	cancer	121-14-2	1-Jul-88	2	0.2 ug/m3	200 ug/m3
1,4-Dioxane	cancer	123-91-1	1-Jan-88	30	0.00083 ppm	20 ppm
Epichlorohydrin	cancer	106-89-8	1-Oct-87	9	0.00024 ppm	0.5 ppm
Ethylene dibromide	cancer	106-93-4	1-Jul-87	0.2 (oral) 3 (inhalation)	0.000039 ppm	20 ppm (OSHA)
Ethylene dichloride (1,2-Dichloroethane)	cancer	107-06-2	1-Oct-87	10	0.00025 ppm	10 ppm
Ethylene glycol monomethyl ether	developmental, male	109-86-4	1-Jan-89	63 (oral)	0.002 ppm	0.1 ppm
Ethylene glycol monomethyl ether acetate	developmental, male	110-49-6	1-Jan-93	98 (oral)	0.002 ppm	0.1 ppm
Ethyleneimine	cancer	151-56-4	1-Jan-88	0.01	0.00057 ppb	500 ppb
Ethylene oxide	cancer	75-21-8	1-Jul-87	2	0.00011 ppm	1.0 ppm
Ethylene oxide	female	75-21-8	27-Feb-	20	0.0011 ppm	1.0 ppm

Chemical	Type of Toxicity	CAS No.	Date Listed	NSRL or MADL (µg/day)[a]	Possible Calif. PEL TWA (1)	Current ACGIH TLV, 8 hr TWA
			87			
Folpet	cancer	133-07-3	1-Jan-89	200		
Formaldehyde (gas)	cancer	50-00-0	1-Jan-88	40	0.0033 ppm	0.3 ppm
Heptachlor	cancer	76-44-8	1-Jul-88	0.2	0.02 ug/m3	50 ug/m3
Heptachlor epoxide	cancer	1024-57-3	1-Jul-88	0.08	0.008 ug/m3	50 ug/m3
Hexachlorobenzene	cancer	118-74-1	1-Oct-87	0.4	0.04 ug/m3	2.0 ug/m3
Hydrazine	cancer	302-01-2	1-Jan-88	0.04	0.003 ppb	10 ppb
Isobutyl nitrite	cancer	542-56-3	1-May-96	7.4	0.00018 ppm	1.0 ppm [C]
Lead	developmental, female, male	---	27-Feb-87	0.5	0.05 ug/m3	50 ug/m3
2-Methylaziridine (Propyleneimine)	cancer	75-55-8	1-Jan-88	0.028	0.0000011 ppm	2.0 ppm
Methyl bromide, as a structural fumigant	developmental	74-83-9	1-Jan-93	810 (inhalation)	0.02 ppm	1.0 ppm
4,4'-Methylene bis(2-chloroaniline)	cancer	101-14-4	1-Jul-87	0.5	0.0045 ppb	10 ppb
4,4'-Methylenedianiline	cancer	101-77-9	1-Jan-88	0.4	0.0049 ppb	100 ppb
Methylhydrazine				0.058 (oral) 0.090 (inhalation)	0.0048 ppb	10 ppb
Naphthalene	cancer	91-20-3	19-Apr-02	5.8	0.00011 ppm	10 ppm
Nickel refinery dust from the pyrometallurgical process	cancer	---	1-Oct-87	0.8	0.08 ug/m3	100 ug/m3
Nickel subsulfide	cancer	12035-72-2	1-Oct-87	0.4	0.04 ug/m3	100 ug/m3
Pentachlorophenol	cancer	87-86-5	1-Jan-90	40	4.0 ug/m3	500 ug/m3
o-Phenylenediamine				26	2.6 ug/m3	100 ug/m3
Phenyl glycidyl ether	cancer	122-60-1	1-Oct-90	5	0.08 ppb	100 ppb
Phenylhydrazine				1	0.023 ppb	100 ppb
beta-Propiolactone	cancer	57-57-8	1-Jan-88	0.05	0.0017 ppb	500 ppb
1,1,2,2-Tetrachloroethane	cancer	79-34-5	1-Jul-90	3	0.000044 ppm	1.0 ppm
Tetrachloroethylene (Perchloroethylene)	cancer	127-18-4	1-Apr-88	14	0.00021 ppm	25 ppm
Tetranitromethane	cancer	509-14-8	1-Jul-90	0.059	0.00073 ppb	5 ppb
Toluene	developmental	108-88-3	1-Jan-91	7000[b]	0.19 ppm	20 ppm
Toluene diisocyanate	cancer	26471-62-5	1-Oct-89	20	0.28 ppb	1.0 ppb
o-Toluidine	cancer	95-53-4	1-Jan-88	4	0.00009 ppm	2.0 ppm
Trichloroethylene	cancer	79-01-6	1-Apr-88	50 (oral) 80 (inhalation)	0.0015 ppm	10 ppm
Vinyl chloride	cancer	75-01-4	27-Feb-87	3	0.00012 ppm	1.0 ppm

Chemical	Type of Toxicity	CAS No.	Date Listed	NSRL or MADL (µg/day)[a]	Possible Calif. PEL TWA (1)	Current ACGIH TLV, 8 hr TWA
Vinyl trichloride (1,1,2-Trichloroethane)	cancer	79-00-5	1-Oct-90	10	0.00018 ppm	10 ppm
2,6-Xylidine (2,6-Dimethylaniline)	cancer	87-62-7	1-Jan-91	110	0.0022 ppm	0.5 ppm

a Where a source or product results in exposures by multiple routes, the total exposure must be considered. For example, the MADL for benzene is exceeded when the absorbed dose exceeds 24 μg/day. If only inhalation and oral exposure occurs, the benzene MADL is exceeded when: (oral dose ÷ 24 μg/day) + (inhalation dose ÷ 24 μg/day) > 1.0.

b Level represents absorbed dose (rounded from 6,525 μg/day). Since 100% of ingested toluene is absorbed, oral dose is equivalent to administered dose. It is assumed that roughly 50% of the dose administered by the inhalation route is absorbed. Therefore the MADL for inhaled toluene is 13,000 μg/day (rounded from 13,050 μg/day), corresponding to an absorbed dose of 6,525 μg/day.

(1) To calculate Possible California PEL Equivalent 8 hr. TWA, assume:

A. Daily dose (NSRL/MADL) is accumulated in an 8 hr. shift.
B. During an 8 hr. shift 10 m3 of air is breathed

Exposure level (mg/m3) to attain daily dose (NSRL):
mg/m3 = NSRL (ug/day)/(10 m3/day X 1000)
PPM = (mg/m3 X 24.45)/Mol. Wt.
PPM = (NSRL [ug/day] X 24.45)/(Mol. Wt. X 10,000)

NSRL = No Significant Risk Level
MADL = Maximum Allowable Dose Level

Why use different analyses for worker exposure and community exposure?
Historically, worker exposure levels have been set differently than levels for the general population for a number of good reasons.

Makeup of the population
The general community population includes everyone – the worker, the athlete, the very young, the exceedingly aged, the healthy, and the chronically-infirm. When studies (including animal studies) are performed to assess the consequences of community exposure to potentially toxic materials, including air toxics, sensitive populations are included.

The worker population is a sub-set of presumably healthy individuals who are able to work; and analyses to determine allowable exposure levels reflect this healthy population. Five year old children and ninety-five year old grandmas do not constitute the worker population.

A worker exposure level based on risks to the entire population will be skewed exceedingly low; and perhaps it may be skewed inappropriately low. This may lead to manufacturers selecting a more dangerous, unknown process chemical – but more about that later.

Continuity of exposure
Typically, when animal studies are conducted to determine worker exposure limits, the exposure to the chemical emulates the work week. Therefore, such studies provide for "recovery time." Initially, you might think it would be protective of everyone to simply assume continuous exposure by workers, but this is not realistic. Realistically, workers do not work 24 hours per day, 7 days per week. However, in local communities, there is the potential for continuous exposure to air toxics.

Let's provide an analogy, with the understanding that all analogies have limitations. Suppose we were trying to determine how long a maritime rescue crew could remain in choppy water where there would be intermittent submersion. To develop guidelines, a study might be conducted in which volunteers submerged themselves for, say 30 seconds, then treaded water for 2 minutes, then submerged themselves for another 30 seconds. Industrial hygienists and occupational health specialists might come up with a total time (perhaps even hours) of complete but *intermittent* water submersion that would be protective of healthy rescue workers under those conditions. The same time of *continuous* immersion in water by that same population would likely be fatal. Certainly, this total intermittent immersion in water might not be protective of the general population (including the young, the old - i.e. the sensitive populations).

Duration of Exposure
Exposure levels, including inhalation exposure, tend to be lower for communities than for workers. For workers, exposure is based on a full-time career, assuming that the worker will be exposed to the chemical day over the course of a normal work-week. For the community, risks are calculated based on exposure 24/7 for a full lifetime.

Understanding and accepting risks
In a company, the worker understands the risk of chemical exposure and the risk of other job related exposures. He or she has a choice in taking the job and receives compensation and other benefits. The worker is typically trained (hopefully educated) in the use of that chemical. A number of process controls and/or personal protection options are available.

In the community, there are no such choices. The exposure to the chemicals is passive, involuntary, and without benefit. Typically, personal protection options are not available. Children should not have to avoid playing in a schoolyard to avoid airborne toxins; and schools should not need complex filtration systems to protect students.

The concepts and analysis of "risk-risk" or "risk acceptance" are complex and beyond the scope of this paper, however, it is clear that workers have choices and options that are not available to people in the surrounding community.

Some Consequences

Marginalize the numbers? Or attempt to comply?
If the numbers are very low, it is possible that they will be roundly-ignored. As a resident of California, "Prop 65" signs are ubiquitous. The Prop. 65 signs warning of hazardous chemicals are in laundry rooms, department stores, as well as near factories. I, for one, have become oblivious to many of them. However, for Cal/OSHA PELs, there is likely to be a list of numbers associated with hundreds if not thousands of chemicals; and these numbers are likely to be far lower than those currently available. Putting the numbers in perspective may be difficult; and companies may feel compelled to attempt to stay below those numbers in the workplace. In some cases, it may be difficult to do the metrics to detect the toxics at very low levels; in other cases, control measures may not be feasible, even at a high price.

Out of the frying pan, into the fire – the numbers game
Let's face it – a low number constitutes a risk; a risk constitutes a liability for the company. Consider a situation where a company has a choice of several hypothetical but plausible process chemicals.

Chemical A: 100 ppm PEL, Federal OSHA; 10 ppm Cal/OSHA

Chemical B: 200 ppm PEL ACGIH; 10 ppm Cal/OSHA

Chemical C: 200 ppm PEL, Federal OSHA; 0.0001 ppm Cal/OSHA

Chemical D: 100 ppm OEL (occupational exposure level, based on manufacturers' estimates); no number available Cal/OSHA

Chemical E: single identifiable chemical, no occupational exposure level or PEL available, very limited toxicity studies

Chemical F: blend of chemicals, no occupational exposure level or PEL available, very limited toxicity studies

Let's remember that typically, the higher number the better. Some companies even have a policy of not using chemicals with a worker exposure level below 100 ppm. If those companies considered the Cal/OSHA numbers, they would choose D. If not, they might have A, B, and C as options. B would likely be the first choice, and this would be selected even if the process had to be modified in such a manner that took four times as long to complete the process with B as with A, C, or D.

What is even more disturbing is that, in my experience, all too many companies would select Chemicals E or F on the grounds that no numbers are available. This policy, while perhaps understandable, is not supportive of worker safety. If Chemical F (the blend) is selected, perhaps for performance reasons, the situation becomes even more complex and problematic in that the blend may exhibit synergistic effects. That is, the impact of the blend on workers may be greater than the sum of the individual components of that blend. Regulatory agencies tend not to be able to be concerned with the impacts of synergy. We would expect, however, that as regulations become increasingly stringent, so will creative formulation.

This means more blends, and more unknowns for workers. Currently, the Material Safety Data Sheet (MSDS) does not have to list every component of the blend. If a non-carcinogen is used at under 1%, it does not have to be listed unless the total of more than one chemical from the same family exceeds 1%. To the best of my understanding, there are many complex blends and the definition of "family" for chemicals has become very narrow. By carefully reading the various sections of the MSDS, you may find blends that have no hazardous chemicals but have a high level of volatile materials.

Unknown: Impact on MSDS
With lower PELs, the significance of small amounts of chemicals in a complex blend could change. While the OEL or PEL of a number of materials has decreased, so far, these decreases have not lead to any changes in the MSDS. However, a decrease of 3 to 5 orders of magnitude in the Cal/OSHA PELs might translate to increased concerns with chemicals comprising, say, 0.5% to 0.8% of a blend.

Would community based Cal/OSHA PELs impel changes to disclosure requirements in the MSDS nationwide? Would the next logical step be for Cal/OSHA to require additional disclosure of toxics for MSDS in California?

While disclosure of lower levels of components of blends could favorably impact worker safety as well as process performance, ever-increasing creative blending of little-used chemicals could make it more difficult to assess the work environment; and, for that matter, the impact on community safety.

Conclusions
We hope you have gained a bit more insight about differences in development of worker safety and community environmental standards. We invite your comments.

Good science, transparency of the PEL process, and analyses based on the individuals exposed to the chemistry are critical to setting protective, enforceable standards. Coordination among agencies is important. However, to achieve the optimal regulations, it would seem reasonable for each agency to perform analyses and to set standards based on the purpose of those standards. For your information we have included the mission statements derived from the websites of some key governmental agencies as well as a few of my own comments about pregnant workers.

Agency summaries:
OSHA
http://www.osha.gov/oshinfo/mission.html

> OSHA's mission is to assure the safety and health of America's workers by setting and enforcing standards; providing training, outreach, and education; establishing partnerships; and encouraging continual improvement in workplace safety and health.

EPA
http://www.epa.gov/epahome/aboutepa.htm

The mission of the Environmental Protection Agency is to protect human health and the environment. Since 1970, EPA has been working for a cleaner, healthier environment for the American people.

OEHHA
http://www.oehha.ca.gov/

OEHHA's overall mission is to protect and enhance public health and the environment by scientific evaluation of risks posed by hazardous substances.

Cal/OSHA (DOSH)
http://www.dir.ca.gov/dosh/doshreg/5155Meetings.htm

Division of Occupational Safety and Health (DOSH)
Protects workers and the public from safety hazards through its Cal/OSHA, elevator, amusement ride, aerial tramway, ski lift and pressure vessel programs, and provides consultative assistance to employers.

An additional comment about pregnant persons: The issue of exposure to chemicals during pregnancy is a real one. As a career mom, I was actively involved in the workplace during my pregnancies. Certainly, since there is a fetus involved, pregnant people would be considered to be a sensitive, working population (no remarks, guys!). During my first pregnancy, one boss ordered me to open a bottle of concentrated di-isopropyl fluorophosphates (This is not Chanel Number 5!); I refused, under threat of dismissal. I was right; my boss was wrong; he grumbled; he didn't fire me. We need to be very cautious about protecting the next generation. In my opinion, however, unrealistic worker exposure levels may lead to a situation where pregnant women are unnecessarily excluded from many if not most jobs. An exploration of this topic is beyond the scope of this article. Given that there are many unknowns in terms of chemicals and chemical blends, I suggest that each pregnant person have an informed, educated decision.

Thanks:

SQRC wishes to thank Ron Hutton, past President of the Orange County Section, AIHA, for providing the table comparing PEL levels and for his review and suggestions. We also appreciate the review and suggestions of James Unmack, President Orange County Section, AIHA.

The comments and interpretation provided in this article are those of the author.