

## **DRAFT MEETING SUMMARY**

### **Seventh Meeting of the Health Expert Advisory Committee (HEAC) for Permissible Exposure Limits for Airborne Contaminants in the Workplace California Code of Regulations, Title 8, Section 5155**

**December 16, 2008  
Elihu Harris State Building  
1515 Clay Street  
Oakland, California**

#### **HEAC Members**

Will Forest, Santa Cruz County Public Health Department  
Bob Ku, SafeBridge Consultants  
Linda Morse, Kaiser Permanente Occupational Health  
Mike Kleinman, UC Irvine  
Patrick Owens, Shell Oil Martinez Refinery  
Patty Quinlan, UCSF Occupational Health  
Julia Quint, Independent  
Howard Spielman, California Industrial Hygiene Council  
Mark Stelljes, SLR International  
James Unmack, Unmack Everett Environmental

#### **Staff of Assisting Agencies**

Jim Collins, OEHHA  
Sara Hoover, OEHHA  
Rachel Roisman, OEHHA  
Dennis Shusterman, HESIS

#### **Public and Interested Parties**

Heather Borman, State Compensation Insurance Fund  
Eric Brown, Southern California Edison  
Ken Clark, Willis Risk Consultants  
Steve Derman, MediShare  
Mike Easter, Ensign  
Judi Freyman, ORC  
Ron Hutton, Allergan  
Barbara Kanegsberg, BFK Solutions  
Dan Kim, Arcadis  
Tina Ling, Asian Law Caucus  
Rich Morford, EnviroTech  
Phil Nies, Intel  
Sophie Noero, WorkSafe  
Catherine Porter  
Olivera Radovanovic, Unmack Everett Environmental  
John Sacco, CalPASC, CCMCA, AGC of CA, MIA, CCNSIG  
Michael Smith, WorkSafe

#### **DOSH**

Bob Barish (meeting chair)  
Bob Nakamura  
Mike Horowitz  
Chris Kirkham

Bob Barish welcomed attendees to the meeting and reviewed the agenda for the day. He noted that before discussing specific chemicals, there were agenda items on the draft priority list of substances for the PEL project and for discussion of uncertainty factors.

Time was offered for comments on the minutes of the last meeting September 5, 2008. No comments on the minutes were received.

### **Priority list of substances for PEL work**

The most recent draft priority list of substances posted on the PEL Project website was reviewed. Bob Barish said it was modified primarily in response to an extensive review of the list by Julia Quint which recommended modification of the priority assigned to a number of substances. Many of the suggestions from Julia Quint are reflected in the latest version of the list. Julia Quint suggested that the rationale or basis should be included on the list to explain the inclusion of substances as Priority 1 or 2 substances. Sara Hoover noted errors in the list attributing two substances to the OEHHA December 2007 report but in fact they were not addressed there. Bob Barish explained that these two substances had been addressed by OEHHA but not in the December 2007 report and he said the list would be changed to reflect this.

HEAC member Howard Spielman asked if carbon tetrachloride, which he had volunteered to take on, had sufficient use in California to warrant its classification as Priority 1 in the PEL work list. Bob Barish said his research on California usage for the April 4, 2008 special meeting on this topic had found one location in the EPA EPCRA 313 reporting inventory for California, and one entry in the hazardous materials business plan list for unincorporated Los Angeles County, suggesting at least some likely use and possible exposure in California. However, it was generally agreed that with its continued widespread use in dry cleaning, perchloroethylene, which Howard Spielman had also agreed to review, should be addressed before carbon tetrachloride

### **1-Bromopropane and PEL recommendations from the last committee**

Dennis Shusterman brought up a report of two cases of neurologic effects possibly related to work with 1-bromopropane reported in a recent issue of the Mortality and Morbidity Weekly Reports (MMWR) from the U.S. Centers for Disease Control and Prevention. Bob Barish said that 1-bromopropane was one of a number of substances from the last round of work by the PEL advisory committee for which a proposal package was recently submitted to the Cal/OSHA Standards Board. These substances were held for an advisory committee to take informal public comments on May 18, 2005. (The website and list of substances for that meeting can be found at <http://www.dir.ca.gov/dosh/DoshReg/5155meetings2005.html>). Bob Barish noted that crystalline silica was discussed at that meeting but in light of the comments received was not included in the proposal submitted to the Standards Board. Bob Barish noted that a substantial part of the concern with silica exposure in California had been addressed by the recently promulgated standard for work on concrete and masonry materials (Title 8 section 1530.1).

### **Uncertainty factors**

Bob Barish started the discussion, noting that uncertainty factors had been an important element in the assessment for PELs for most of the substances considered thus far, particularly the intraspecies uncertainty factor and particularly with toluene as reflected in the minutes of the last meeting September 5. He said the goal of the discussion today was to flesh out issues and try to reach agreement on how to address them.

Bob Barish said he wanted to start the discussion by hearing briefly from each member who wished to comment on the subject. He started with Howard Spielman who had expressed concerns about uncertainty factors in the discussion of toluene at the last meeting.

Howard Spielman said he questioned the scientific basis of uncertainty factors. He said that when applying uncertainty factors to the assessments for specific substances he wanted to see the scientific basis explained.

Patty Quinlan said it would be important for the HEAC members to decide as a group how uncertainty factors would be consistently applied in the health assessments.

Mark Stelljes said that the purpose of uncertainty factors is to address lack of knowledge with respect to risk, and therefore the more scientific data that is available for a substance, the less need there should be to rely on an uncertainty factor in the PEL. He said that uncertainty factors applied should be based on valid scientific data, rather than being default values.

Julia Quint said it was important to have this discussion. She said that in the discussion of toluene at the last meeting the application of an intraspecies uncertainty factor was a point of disagreement. She noted however that the concern had started with the discussion of n-methyl pyrrolidone (NMP). She said that for NMP and for toluene there had been suggestions from some HEAC members and interested parties that reported industrial experience with absence of health effects associated with certain levels of exposure should be included as data in the assessment process. She noted however that, for example, especially for developmental toxicity as in the case of NMP, or chronic neurological effects as in the case of toluene, such effects can be very difficult to detect. She suggested that the benchmark dose assessment process, when it can be used, can reduce reliance on uncertainty factors, especially when toxicokinetic and toxicodynamic information is available for a substance. With regard to comments made on the basis for, and use of, default values for uncertainty factors, she said their use is consistent with what other agencies such as the U.S. Environmental Protection Agency has done for many years. She said that it can be appropriate to use substance-specific data when available to modify default uncertainty factors.

Patrick Owens said he was unsure about the potential for consistent application of uncertainty factors. He said the uncertainty factor applied should depend on the specific data available for the substance. Julia Quint said that what she was talking about was consistency of application given the data available for the substance as Patrick had suggested.

Jim Unmack said he was looking for statistical information to validate uncertainty factors applied.

Bob Ku said that use of uncertainty factors in chemical health risk assessment dates back to safety assessments by the U.S. Food and Drug Administration in 1954. He said that with most default uncertainty factors originating with public health assessments, he said he thought there is a question how to apply them to the occupational situation. He also wondered how the chemical irritant effect as an endpoint would fit into the uncertainty paradigm. He suggested that the concept of “margin of safety” might be better than “uncertainty factors.”

Will Forest noted that there is the example of the 1-in-1000 risk level for cancer suggested by the U.S. Supreme Court’s “benzene decision.” Julia Quint though wondered about the margin of safety for noncancer effects. Will Forest said that he thought generally that uncertainty factors should be used when the data alone was not sufficient to support a particular PEL recommendation, which he thought was most of the time, and that for that default starting point uncertainty factors are relevant. He said what is important is to have good scientific data for whatever uncertainty factor is chosen. He said also that the differences in health status and demographic factors between the general and working populations are not that great, that there are, for example, young people in the workforce who are still growing, and some workers who may be health compromised. He said he thought the same default uncertainty factors should be used as starting points for both public and occupational risk assessments.

Bob Barish said he thought he heard general agreement among the comments that when they are used uncertainty factors should be based on available data. Howard Spielman reiterated that he wanted to know the scientific basis for the default uncertainty factors. He said his philosophy as an industrial hygienist may be different from some toxicologists in that he believed in the healthy worker effect and that standards should be set to protect most but not necessarily all people if that would include sensitive populations, and that the employer has some responsibility to screen for susceptible individuals. He said this was a better approach than necessarily trying in all cases to set PELs so low that they protected even sensitive population groups. Patty Quinlan said that the law, and ethics, limits screening, as in the U.S. Supreme Court decision in the “Johnson Controls” case where it was decided that screening women out of jobs involving inorganic lead based on potential for reproductive toxicity was not lawful. Howard Spielman brought up the discussion of recommending the PEL for sulfuric acid in part to be able to protect the 20 or 30 percent of the population that may be asthmatic. Dennis Shusterman noted that ACGIH says TLVs are intended to protect

“nearly all workers.” He thought that the seriousness of the health hazard being addressed could affect what uncertainty factor is applied to the data.

Julia Quint reviewed the handout she developed on uncertainty factors considered and applied in HEAC recommendations and discussions to date. The handout is available at <http://www.dir.ca.gov/dosh/doshreg/HEACHandout.doc>.

Julia Quint said that for toluene, as discussed at the September 5, 2008 meeting of the committee she had used a factor of 3 for intraspecies uncertainty, especially in light of indentified deficiencies in metabolism of toluene by Asians, and also the effects of diabetes, and age, on toluene-induced color vision impairment. She noted that OSHA sometimes takes the approach of applying a smaller uncertainty factor when it has good data on health effects from a worker study. There is also the issue of the power of the study, based primarily on the size of the test population. She noted that in the September discussion, Susan Ripple had focused on consideration of study quality. She said that a paper by consultants ICF circulated by Mark Stelljes did a good job of showing that ACGIH used a range of uncertainty factors in work on TLVs, not always applying them consistently between substances. She also said that when appropriate data is available, benchmark dose analysis can eliminate or reduce dependence on uncertainty factors. Mark Stelljes noted that a paper by Kenny Crump had also found inconsistencies in ACGIH use of uncertainty factors.

Will Forest said he wanted to echo Julia Quint’s concern with consistent application of uncertainty factors. He said that default uncertainty factors used by government agencies should be the starting point for these values, and then modify if evidence warrants. Mark Stelljes and Barbara Kanegsberg disagreed, saying that the uncertainty factors used should start from scientific evidence, rather than from default values.

Will Forest said that the default values are not arbitrary, but rather are based on a body of data. He said that, for example, there is a body of evidence supporting 10 as a default value for intraspecies uncertainty. He said that “data quality” was not the issue in using uncertainty factors, but rather where there is evidence in the studies used to help determine an appropriate uncertainty factor.

Julia Quint said that the uncertainty factors in the OEHHA 2008 document on non-cancer risk assessment is a good source for uncertainty factors. Jim Collins of OEHHA noted that this document had been reviewed and adopted by the Science Review Panel.

Julia Quint said she thought it was unlikely that the issue of uncertainty factors could be entirely resolved with a consensus of HEAC members. Bob Barish said his charge has been to convene the HEAC to do an independent assessment of the scientific evidence for the health effects of each substance discussed, and to reach consensus on recommendations where possible. Where there is disagreement, the hope is to be transparent and clear as to what it is. He noted that the Feasibility Advisory phase of the process will also be very important in determining the Division’s proposals for PELs.

Mark Stelljes said there will always be differences in approaches to health assessment between regulators and industry. Julia Quint acknowledged these differences in toxicology cultures. Mark Stelljes said he felt that science used by HEAC to date had been good. He said he thought that uncertainty factors were more of a policy question for the Division.

Will Forest said what is needed is a consistent rational approach to uncertainty factors and chemical hazard assessments generally. He thought the committee’s approach should be consistent with those taken by US EPA and OEHHA.

Howard Spielman said that as a longtime consultant coming from a public health background, but also having worked in industry, he wanted to defend the ACGIH process. He said it is a purely professional effort and they have many of the same type of disagreements as in the HEAC. He said the ACGIH TLV Committee has responded to criticisms, and is starting to use formal risk assessment techniques. He said the TLVs should not be dismissed or discounted out of hand because he was not aware of large scale “failures,” ie. illnesses, associated with TLV level exposures. He said he felt that data showing absence of illness in workers should be given at least the same weight as animal toxicity results. He said that where uncertainty factors can be justified by scientific evidence he would support their use.

Julia Quint said that she, and she suspected other HEAC members, would first start with ACGIH, see if it can be used or not, and then openly develop the basis for different possible PELs.

Howard Spielman reiterated that he hasn't seen the basis for uncertainty factors applied in assessments of substances discussed to date by HEAC. Bob Barish asked him if he can address that by asking the HEAC member presenting their assessment. Sara Hoover said she thought Howard Spielman was asking where uncertainty factors such as 3 or 10 originated, with what scientific evidence. She said that Julia Quint's use of uncertainty factors in the assessments she had prepared to date, for example, did have a valid scientific basis, for example as detailed in the 2008 and prior OEHHA Hot Spots assessment documents. She said that when they first started being used in the 1950s, default uncertainty factors may have sometimes been selected without good basis. But that in more recent times there has been a lot of study with scientific evaluation to determine how to pick uncertainty factor default values. She offered to pull that information together and make it available to the committee.

Julia Quint said she hoped that the information Sara Hoover is offering to put together might help narrow differences in the committee over uncertainty factors.

Will Forest said it's really only possible to identify broad ranges of default uncertainty factor values to apply to chemicals generally, but that for individual substances, it's necessary to look at how the data should be applied specifically.

Mark Stelljes said that pharmacokinetic data can be used to reduce the uncertainty in uncertainty factors. That might help produce more consistency in uncertainty factors.

Dennis Shusterman suggested that DOSH should have a more clear mission statement for the HEAC effort, detailing the goals of the HEAC. A statement of who the PELs are intended to protect, for example possibly "nearly all workers." He said that could help reduce ambiguity. He noted that 25 to 30 percent of the working population is estimated to be atopic and so more susceptible to sensitizing agents. So he asked if PELs would be set to control exacerbation of respiratory symptoms, induction of actual symptoms, or some other level.

Will Forest said he thought there was something in the PEL regulations that addresses this already. Chris Kirkham pointed out that a note to subsection (a) of section 5155 already addresses this and refers to "nearly all." Bob Barish said that Labor Code section 144.6 also details criteria for PELs.

Julia Quint said that if the Division is ultimately going to be deciding on PEL proposals, then there should be a stated policy to guide that process as Dennis Shusterman suggests on who is intended to be protected.

Catherine Porter said she is here as public participant. She said she believes that the main goal of the committee, and PELs generally, has not been clearly stated. She said that the goal should be to protect the health of workers, without qualification. She said the largest uncertainty factor should be used because it would be the most protective of health. She said in considering various possible PEL recommendations, the burden of proof of acceptability should be on those who advocate higher rather than lower PELs.

Howard Spielman responding to Catherine Porter, said taking zero exposure as the starting point for PELs as he thought she seemed to be suggesting would not be a tenable approach.

Sara Hoover said most of the focus on uncertainty factors in HEAC discussions to date has been on intraspecies variability. She said not using an intraspecies uncertainty factor, ie. assuming high levels of homogeneity in the working population, will not protect workers who, for example, are sick, older, etc. She said that an uncertainty factor of 3 is generally applied where homogeneity is assumed in the population to be protected. She said the REACH program in Europe now uses an uncertainty factor of 5 where homogeneity is assumed.

Bob Barish asked Julia Quint if the discussion had clarified what she was trying to elaborate in her handout on uncertainty factors. Julia Quint said it helps, but also said she thought DOSH should develop a document succinctly spelling out policy for HEAC to use as a reference. Bob Barish told HEAC members to send him ideas about what a policy document might say.

Howard Spielman noted that in human studies, there is generally a range of effects, and someone has to decide a number from that range. He wondered if there is a wide range, should there be more reliance on other data? Will Forest responded to Howard Spielman, said what is important is not just the range of health effects seen but also the power of the study based on the size of the test population.

Linda Morse thanked Sara Hoover for her offer to produce a reference that reviews the scientific basis for uncertainty factors.

Julia Quint noted that even if there is a reference such as Sara Hoover had offered, there is still a need to vote on PEL recommendations and what happens at that point if there are differences among HEAC members. Bob Barish said that at some point, there would be a decision that the discussion is over, that the issues have been explored to the extent they can be. In that situation the Division would take the substance to the FAC, hopefully with only a narrow range of possible recommendations from the HEAC. Bob Barish said he hoped this would be the exceptional situation, rather than the norm.

Patty Quinlan said that the previous PEL committees worked by majority rule vote not consensus.

Bob Barish thanked the HEAC members for the discussion, and Sara Hoover for offering to prepare a reference document on the basis for default uncertainty factor values. He said he anticipated that the discussion of uncertainty factors would almost certainly continue on individual substances, but that he hoped that today's discussion might help narrow differences among committee members in the discussion.

## **12:30 Lunch Resumed 1:30 p.m.**

### **Toluene**

Tina Ling of the Asian Law Caucus made a brief presentation on indications of possible reproductive effects of toluene and the concern with this among nail salon workers. She said that toluene is an ingredient in many nail polishes and that workers cannot normally wear gloves to prevent skin exposure. She noted that hers and several other groups had submitted written comments supporting a health-based PEL recommendation of 3 ppm for toluene based on increased risk of spontaneous abortion reported in the study of Ng et al. (1992) among female workers in an audio speaker factory exposed to toluene as had been reviewed in Julia Quint's draft assessment document for toluene. She noted that the draft health assessment document had indicated that 3 ppm was the PEL derived using the data of Ng et al. based on prevention of spontaneous abortion. Tina Ling also noted that the draft assessment document had cited differences in toluene metabolism among Asian women reported by Kawamoto et al. (1994) as a basis for applying an intraspecies uncertainty factor to data used to support the PEL. Tina Ling also said that during her group's outreach activities to nail salon workers there had been reports of spontaneous abortions occurring among these workers. Bob Barish asked if these had occurred among those known or believed to have had exposure to toluene in their work. Tina Ling responded that this was not known directly, but she reiterated that toluene is a common ingredient in products used in nail salons. Michael Smith of WorkSafe echoed the concerns and recommendations of Tina Ling and said that WorkSafe had also sent a letter supporting a PEL of 3 ppm for toluene based on prevention of spontaneous abortion.

Julia Quint said the endpoint for her recommendation of 10 ppm for the toluene PEL was based on chronic neurological effects. She said that as explained in the draft document she had chosen not to use spontaneous abortion as the endpoint for the PEL because of a potential confounding factor in the findings of Ng et al., which could have affected the study results. She explained that the increased risk of spontaneous abortion may have been due in part to repeated spontaneous abortions among some of the women in the toluene-exposed group. The risk of spontaneous abortion is influenced by the occurrence of previous spontaneous abortions. Julia Quint noted that the letter submitted by the California Healthy Nail Salon Collaborative and a joint letter from several environmental groups had suggested in addition to 3 ppm as noted by Tina Ling, also a possible PEL for toluene of 0.5 ppm based on a formula in Proposition 65 legislation. Specifically the 0.5 ppm level would be arrived at by taking the NOAEL of 500 ppm (presumably from the studies of Roberts et al. 2003 and Saillenfait et al 2007 for reproductive effects as shown in Julia Quint's draft assessment document) and dividing this number by 1,000 as required for establishing a Maximum Adverse Dose Level (MADL) for reproductive and developmental toxicants as specified under Proposition 65 (Title 22, California Code of Regulations, section 12803). However, Julia Quint said she said she did not favor using this method for deriving the toluene PEL since it was not consistent with OEHHA's noncancer risk assessment guidelines

which she used in deriving the HEAC recommended PEL.

Bob Barish noted that committee members present at the last meeting September 5, 2008 had been divided on the toluene PEL, particularly with regard to application of an intraspecies uncertainty factor as had been suggested in Julia Quint's assessment document to account for variability in toluene metabolism among individuals and groups reported in several scientific papers.

Patrick Owen asked if the metabolic variations found tended to increase toluene toxicity, ie., is the hazard posed by toluene or the resulting metabolites. Dennis Shusterman said genetic variations in the metabolism of toluene could either increase or decrease toxicity. He said the metabolic variation reported by Kawamoto would more likely increase the toxic effect of toluene. Julia Quint said that any disruption of ability to excrete a toxic substance could increase resident or contact time and thus likely increase the health effect. Since the neurological effects of toluene are due to the parent compound, and not the metabolites, decreases in metabolism would increase adverse health effects.

Mark Stelljes asked about the populations in the ten studies that were discussed from the EPA review cited by Julia Quint in the draft assessment document. He wondered if some of the metabolic differences noted might have been accounted for by the study populations. Julia Quint said she did not recall the populations in the 10 studies. Julia Quint said that color blindness is the specific endpoint that is the neurotoxic affect. Linda Morse noted that color blindness is normally genetic, but that the effect from toluene is a different type of color blindness. She noted that in addition to the metabolic differences, pre-existing disease could also have an effect, ie. that color blindness, the particular endpoint of concern indicating neurologic effect, could have a lower threshold in diabetics. Bob Ku asked Julia Quint if the neurological effects being protected against were of a short term or long term nature. Julia Quint said the effects were chronic, though it was unclear to her from the studies if they are irreversible. Dennis Shusterman noted that another reason discussed at the last meeting for use of an intraspecies uncertainty factor besides metabolic variability, was that the LOAEL and NOAEL results in the assessment document were not very far apart.

Julia Quint said that before deciding on a number for the PEL recommendation the committee needed to decide what endpoint should be used. Bob Ku said that if you look at the NOAEL and LOAEL values in the summary table in the draft assessment document, they vary by factors of just 2-4. but if you just use the Zavalic et al. study and apply an intraspecies uncertainty factor of 3 as shown in the summary table of the assessment document you get a PEL of 11. And if you apply an intraspecies uncertainty factor of 3 to the results of the group of studies in the document, it brings the PEL to 9 or 10.

Mark Stelljes noted that the reproductive studies are limited to animal studies except one, the Ng et al. study noted earlier. Patty Quinlan said that she thinks that as shown in the summary table in the draft assessment document the ranges come pretty close together for the different effects.

Will Forest said that this is kind of a difficult assessment to make, but he feels that the neurological effects seems to be the appropriate endpoint as recommended in the draft assessment document, and he supported the document's recommendation of 11 ppm 8-hour time-weighted average.

There was general support for this position, and no disagreement among HEAC members present. It was also agreed to round the number to 10 ppm.

### **Carbon disulfide**

Patrick Owens who drafted the assessment document for carbon disulfide said his recommendation is a PEL of 1 ppm 8-hour time-weighted average, the same as the ACGIH TLV, with retention of the STEL of 12 ppm and the existing skin notation. He said the recommendation of 1 ppm was based on the assessments of other agencies and organizations including the U.S. EPA, OEEHA, OSHA, NIOSH, and ATSDR. He said they were all close together in their conclusions, based primarily on the study of Johnson et al. (1983). He noted he had also included in the draft document an assessment of the study of Godderis et al. (2006) completed after the assessments by the other organizations. He said the Godderis study could be viewed as supporting a slightly lower recommendation, but he felt that the Johnson study and its use by the other organizations made it the choice for the basis for the PEL

recommendation at the present time. He said that Sara Hoover of OEHHA had assisted him with the assessment of the Godderis study as presented in the draft assessment document.

Bob Barish asked if the conclusions of Godderis et al. supported those of Johnson et al. Sara Hoover said no, that the Godderis study showed the same effects at lower levels of exposure. Patrick Owens said that with regard to using Godderis for the PEL basis, it seemed to him that the effects seen at lower levels of exposure were not very convincing.

Julia Quint said she had thought that the PEL recommendation of 1 ppm was based on the Godderis study and that it had not included an adjustment for the carbon disulfide sensitivity issues discussed in the document, thus possibly justifying an additional uncertainty factor of 3. However, if the PEL recommendation is based on the study of Johnson then that may not be necessary.

Howard Spielman asked Patrick Owens if his assessment document had considered or addressed the letter sent by the Carbon Disulfide Coalition which suggested that the TLV of 1ppm, also the level recommended in the draft assessment document, was based on studies of exposed workers which had underestimated or understated the levels of exposure to carbon disulfide. Patrick Owens said he did address that issue in his assessment of the Godderis study which was published since the release of the TLV. Bob Barish noted that the TLV documentation, and the various agency assessments noted in Patrick's assessment which generally supported the TLV of 1 ppm, all had acknowledged the same type of exposure measurement issue raised in the Carbon Disulfide Coalition letter, but had nonetheless based their recommendations on the study of Johnson et al. which led to the recommendation of 1ppm.

Sara Hoover noted that Patrick Owen's write up should be corrected with regard to the agency evaluations. She said the values reported in the draft assessment document are actually what Patrick had calculated from their assessments with adjustment for worker exposure. Patrick Owens said he would work with Sara Hoover to clarify this in the assessment document.

Will Forest asked if the health end-point/target organ is nerve conduction velocity in both the Johnson and Godderis studies. Patrick Owens said yes. Patrick Owens said Godderis determined the-effects on nerve conduction velocities to be only borderline statistically significant at 3.3 ppm. Will Forest said he thought the nerve conduction velocity values show there is a dose response curve. Julia Quint agreed with this point. Will Forest said that the small differences may make it harder to find the effect, but the effect is still there.

Patrick Owens said he just wasn't confident that the Godderis et al. study by itself justified 0.3 ppm for the PEL, especially given the apparent borderline significance of the effects found at 3.3. ppm.

Bob Ku thought that the borderline effect discussion for exposure at 3.3 ppm in Godderis et al. suggests that level may be a NOAEL rather than a LOAEL. So he questioned applying a LOAEL to NOAEL uncertainty factor of 3 to this result. Sara Hoover said that if 10 ppm in Godderis is taken as a LOAEL as suggested by Bob Ku, and uncertainty factors of 3 for LOAEL to NOAEL and 3 for intraspecies variability are used for a total of uncertainty factor 10, this would yield a PEL of 1 ppm, whereas if 3.3 is taken as a LOAEL, using the same approach to the uncertainty factors yields a PEL of 0.3 ppm. With regard to taking 10 ppm as the LOAEL from the Godderis et al. study, Sara Hoover noted that the ATSDR assessment had identified 7.6 ppm as a LOAEL from the Johnson et al. study.

Heather Borman asked about the consistency of retaining the existing STEL of 12 with the note in section 5155 for excursion limits. She said she thought the STEL was high in relation to the note in 5155. Bob Barish read the excursion limit note in section 5155. Patty wanted to verify that the STEL was adopted from the previous TLV.

Will Forest said he is okay with the 1 ppm TWA recommendation, though he preferred recommending 0.3 ppm based on his earlier statements in the discussion.

There was general concurrence with a recommendation for a PEL of 1 ppm, subject to revisions to the draft assessment document as noted in the discussion above to clarify the basis for the recommendation and developing a chart to summarize the results of the risk assessments used.

## **Sulfuric acid**

Revisiting the addendum of 10/23/08 which he prepared for the draft health assessment document on sulfuric acid, Bob Ku noted, for reasons he detailed at the start of the document, he had applied a LOAEL to NOAEL uncertainty factor of 2, rather than the default of 3, to the primate data in the Alarie 1973 study which is the basis of the recommended PEL, and which was also the basis for the OEHHA REL.

Julia Quint said she appreciated Bob's 10/23/08 addendum to the draft assessment document clarifying a number of issues from the previous discussion at the September 5, 2008 meeting. She expressed concern however that the addendum seemed to make respiratory irritation the primary effect that the recommended PEL is intended to prevent.

Will Forest noted that since chronic respiratory irritation can contribute to cancer risk it may be important to adjust the 78 week primate exposure in Alarie 1973 for subchronic to chronic uncertainty. Mark Stelljes said that while the 78 weeks primate exposure in Alarie 1973 may not be long enough to qualify as a "chronic" study in a test animal with such a long lifespan, this is compensated for by the fact that the test exposures were continuous over the 78 week period with no recovery period.

Responding to the addendum of 10/23/08, Sara Hoover said she had been unable to locate the rationale for the OEHHA REL assessment applying an uncertainty factor of 3 rather than 10 for subchronic to chronic in the Alarie 1973 study. She suggested that if the Alarie study had been longer it might have resulted in evidence of carcinogenic effect, thus justifying the importance of applying a subchronic to chronic uncertainty factor of at least 3.

Bob Ku responded that early on in his assessment he had grappled with the question of carcinogenicity. He said he had concluded that the data was not sufficient to enable him to recommend a PEL for sulfuric acid based on that effect.

Julia Quint reiterated her concern that the effects of exposure are not only acute irritation. She said that something was unclear. She requested that the addendum to the assessment document be revised to clarify that the primary effect of concern is not respiratory irritation but rather chronic deleterious effects on the respiratory system. Bob Ku said that in the summary for the basis of the recommendation on page one of the assessment document he indicated that the effect to be protected against was "non-cancer respiratory system effects," not just irritation. He noted additionally with regard to which effect is being addressed, that it is from longterm deleterious effects on the respiratory tract which after all of the adjustments are made, also protects against short term acute irritation. Bob Ku concluded that a by-product of protecting against longterm respiratory effects is that the same level also protects against irritation, and that the converse is true as well.

Bob Ku said that Alarie 1973 had exposed the test primates to sulfuric acid particles in the respirable size range, with the result that more particles reached the upper and lower airways than would be the case in most workplaces, and more than would be reflected with collection of a "total particulate" air sample.

Sara Hoover suggested that the respirable size range and thus increased effectiveness of the dose in Alarie 1973, the study upon which the recommended PEL is suggested to be based, could be viewed as balancing out the absence of application of a subchronic to chronic uncertainty factor to the same study data. Julia Quint agreed that Alarie's use of respirable size particles should be considered in the assessment. Will Forest suggested noting also that most actual workplace exposures to sulfuric acid are not primarily limited to the respirable size range.

There were no other objections or discussion on the PEL of 0.1 mg/M<sup>3</sup> recommended by Bob Ku, subject to revision of the draft assessment document to specify the basis for resolution of the issue of not applying a subchronic to chronic uncertainty factor to the Alarie data as noted in the paragraph immediately above, and clarifying that the effects to be prevented by the PEL are both respiratory irritation and longer term respiratory damage from chronic exposure.

### **Hydrogen chloride**

There was brief discussion of HEAC member Jim Unmack's draft assessment document and recommended PEL for hydrogen chloride. The discussion focused on whether there should be an 8-hour TWA PEL for chronic exposure. The draft assessment document said that the effects of hyperplasia of the nasal mucosa, larynx and trachea nasal metaplasia probably did not constitute an adverse health effect and would not be an appropriate endpoint for a PEL. Some HEAC members disagreed with this assessment and asked for discussion of this question at the next meeting. Julia Quint said that there should also be discussion of the need for an intraspecies uncertainty factor for asthmatics.

Dennis Shusterman agreed. The discussion concluded with Dennis Shusterman saying that the draft assessment document had noted that the hygroscopic nature of hydrogen chloride meant that there may be additional deposition, and therefore additional sensitivity to effects in, the head and upper airway. Jim Unmack said the nose cannot differentiate between hydrogen chloride and chlorine gas, but he was not sure if this was potentially significant. It was agreed that there would be additional discussion of hydrogen chloride at the next meeting March 25, 2009 and the meeting adjourned.

**END**