Ninth Meeting of the Health Effects Advisory Committee (HEAC) for Permissible Exposure Limits for Airborne Contaminants in the Workplace California Code of Regulations, Title 8, Section 5155 December 4, 2018 Elihu Harris State Building, 1515 Clay Street Oakland, California

Division of Occupational Safety & Health

Panel: Garrett Keating and Eric Berg
Notes: Kevin Graulich and Keummi Park

HEAC Members Present

Eric N. Brown, Dr PH, CIH, CSP, SCS Engineers (Industrial Hygiene)
Michael Bates, PhD, UC Berkley School of Public Health (Epidemiology)
Michael N. Cooper, MS, MPH, CIH, Principal Scientist, Mcooperconsulting LLC and UC Davis (Industrial Hygiene)
Sarah Janssen, MD, PhD, MPH, Occupational Medicine Department, Kaiser Permanente (Occupational Medicine)
Patrick Owens, MSPH, CIH, Shell Oil Martinez Refinery (Industrial Hygiene)
Kent E. Pinkerton, PhD, UC Davis (Pathology/Inhalation Toxicology)
Howard Spielman, Health Sciences Associates and CA Industrial Hygiene Council (Industrial Hygiene)
James Unmack, CIH, Unmack Corp (Industrial Hygiene)

Public and Interested Parties

Dan Leacox
Bob Nocco, Chevron
Kashyap Thakore, California Department of Public Health, HESIS
Hank McDermott
Jamie Mantzouranis, Alliant
Lauren Scott, ACC
Michael Geyer, KERNTEC Engineering
Michael Horowitz
Jim Kegebein
Conrad Banez, Level 10 Construction
Kevin Buchon
Doug Parker, Worksafe
Emma Wilson, California Department of Pesticide Regulations
Veronica Rojas Munoz
Jennifer McNary, California Department of Public Health, HESIS
David Ross, California Department of Transportation
Rob Neenan, California League of Food Producers
Elisa Koski, Occupational Safety and Health Standards Board

Below are detailed notes of the advisory meeting. These notes do not represent a transcript of the meeting, and are simply a summary of the notes taken by the people conducting the meeting.

Garrett Keating and **Eric Berg** opened the meeting. **Berg** introduced the staff and covered housekeeping items.

Keating, explained the agenda and handouts.
Keating, polled the committee on whether to proceed with MIBK discussion or table it for next meeting because two of three toxicologist members were not present. **Eric Brown** and **Michael Cooper** opined to move forward with MIBK discussion and contact toxicologist members for their input afterwards and **Keating** agreed.

N-, sec-, iso-Butyl Acetates – Final Review

Keating summarized the draft Cal/OSHA PEL recommendation for butyl acetates. Current PEL for n-, sec-, and isobutyl acetate is 150 ppm and the proposal is 50 ppm. There is no change to the draft document from the last meeting and this is the final discussion before closing the review at HEAC. The recommendation follows the ACGIH, which reviewed the irritation data based on 4-hour exposures to 150 ppm n-butyl acetate in volunteers and found evidence of irritation. Factor of 3 reduction is recommended to address the irritation effect and the proposal is 50 ppm. It is common to treat all n-, sec- and isobutyl acetate the same per literature and there is very limited CERS data.

Cooper asked about the factor of 3 reduction and stated that the Division should have the clarity on where it came from.

Keating explained that it was for all four butyl acetates because ACGIH does not consider tert-butyl acetate as a human carcinogen. Iregren et al study was a 4-hour exposure to 150 ppm. Factor of 3 may seem arbitrary but they do not have data at 50 ppm and it seems to be an acceptable reduction. He suggested to review the Iregren study with Cooper.

Howard Spielman stated that the reduction was usually by a log unit and 3 was a half of log unit. **Cooper** stated he just wanted consistency in the methodology.

Michael Bates asked whether it was intentional that the most of the document on tert-butyl acetate and tert-butyl alcohols were the same and **Keating** confirmed, noting tert-butyl acetate rapidly converts to tert-butyl alcohol.

Bates commented on the table on tert-butyl acetate summary document. He asked about * and ** appearing in the Table 2, i.e. 2 year study of female rat nephropathy and **Keating** explained that they apply to the significance of the numbers in the parenthesis. Data for nephropathy and severity of nephropathy are shown and the number in parenthesis is the severity. He added that the severity was in the scale of 1 to 4 and the differences might be significant. **Bates** also mentioned ** in Table 3, i.e. male rat renal tubule adenoma, which denotes significant difference from the control group. In his opinion there is not much difference between 7 and 10 and there should be clarification. **Kashyap Thakore**, **CDPH**, stated that 10 under 2.5 mg/ml column should not have ** according to the NTP table. **Keating** said he would review all tables.

Bates suggested to put * and ** inside the parenthesis to avoid confusion between the occurrence and severity. He opined that these tables are very useful in summarizing the data and makes it easier to read and absorb the information.

Keating asked committee if it confirmed n-, sec-, isobutyl acetate recommendations, other than Cooper's comment on clarifying the factor of 3 on the final document, and committee agreed.

N- Butanol – Second Review

Keating briefed on the n-butanol summary. Current PEL is 50 ppm and the recommendation is 20 ppm with ceiling and skin notation. ACGIH TLV is 20 ppm without a skin notation and the NIOSH REL is 50 ppm with a ceiling and skin notation. The key end-point is irritation in human. Tabershaw study (see table) is an old study from 1940s but it consolidates several worker studies in plants that had butanol where they characterized the

exposures and symptoms from 10-20 ppm and 20-60 ppm. That was the basis for lowering it to 20 ppm. The ceiling notation is for narcosis from the solvent. While the PEL is lowered by a factor of 2 for irritation, there is still a concern for ceiling. ACGIH and MAK eliminated the skin notation based on some old data of *in vitro* human skin data. He added an Appendix of dermal studies to the n-butanol summary document. Subsequent studies by Boman et al. (2000) found significantly higher skin permeability coefficient (K_P) for n-butanol therefore skin notation is appropriate for n-butanol.

Patrick Owens asked is there evidence that n-butanol could absorb sufficiently to cause severe effects because he thought the skin notation was for a substance absorbed in sufficient quantity to cause adverse effect.

Keating said it did not cause narcosis. The Appendix included the calculation of NOAEL for MAK study and they concluded that it did not contribute significantly to the central nervous effects. But they used very old K_P coefficient. He could do the calculation using the new coefficient and compare the results.

Cooper said it is absorbed through the skin so the total exposure of sufficient quantity to cause an adverse effect. **Keating** agreed that it should contribute to total exposure.

Berg read out title 8 section 5155 on skin notation. The substances designated by "S" in the skin notation column of Table AC-1 may be absorbed into the bloodstream through the skin, the mucous membranes and/or the eye, and contribute to the overall exposure.

Owens asked what would be cited if a worker was not wearing adequate protective equipment for using a substance with skin notation. **Berg** said they could be cited under the PPE requirements to prevent skin contact and it would depend on how persons were exposed.

Spielman pointed out a typo in the measurement information. The unit for flow rate for OSHA Method 7 must be liters per minute, not ppm. He stated that the measurement information should address the ability to take direct readings for the ceiling level. He added that it made sense to have a ceiling limit for irritation effect.

Sarah Janssen asked about reproductive and developmental toxicology data because of concerns for womens' exposure in nail salons. She said there was not a lot of data on developmental toxicology and no multi-generational toxicology studies.

Keating stated that developmental toxicity had been looked at but those studies used very high doses. He said n-butanol assessment was in draft in IRIS and had not moved to the formal external review stage. A review article (Bale, 2016) on *in vitro* studies with n-butanol noted its mode of action is similar to ethanol but at this time the data was insufficient to set a standard. There is no quantitative estimate at this time.

Janssen stated that nail salon workers were exposed to n-butanol, xylene, toluene and other developmental and reproductive toxins. HEAC has not looked at multiple exposures but it is something to keep in mind. **Keating** said it could be discussed in moving forward and NIOSH and EPA were developing methods for cumulative risk assessment.

Doug Parker, Worksafe, offered to forward a study from 1994 related to increased risk of miscarriage among cosmetology workers.

Berg stated that the title 8 section 5155 Appendix stated that combined exposures were assumed to be additive in the absence of specific evidence to the contrary. One should take the percentage of PEL for each substance and add them together. If it is over 100% then they are over-exposed.

Keating said that we needed to acknowledge the inadequacy of the data for developmental effects of n-butanol when we moved forward with the standard and declare basis. He referenced these studies in the summary and

hoped that would be adequate record that we were aware of developmental effects although we concluded we could not assess them at this time. He added that there was a lot of irritant potential with nail salons and there is a well-established basis for cumulative additive risk assessment for the irritation.

Keating closed the HEAC review on n-butanol and he would recalculate the dermal absorption using new K_p coefficient.

MIBK – final review

Keating briefed the MIBK summary. Current PEL is 50 ppm and STEL is 75 ppm. HEAC recommendations are PEL of 5 ppm and STEL of 75 ppm, which changed from the previous recommendation of 50 ppm STEL. References to blood-air partition coefficients were added to the summary document. At the last meeting he referenced blood-air partition coefficients for humans and rats as a modifying factor in extrapolation. If a chemical partitions less into human than it does into rat blood, humans can be exposed to higher dose. In the case of MIBK, more MIBK partitions into human blood than rat blood. Humans will absorb more when exposed to the same concentration. Therefore, if you see an effect in rats and use that to extrapolate to humans, the human dose needs to be lowered accordingly.

Cooper asked if the partition was for all compounds and **Keating** replied that it works best for volatile organics. It is a classic method in the pharmacokinetic modeling. He pointed out that the MIBK partition coefficient has not been evaluated by any risk assessment agency and no one has used it to set a standard.

Spielman pointed out two 15-minute exposures during a work shift at 75 ppm STEL would bring the total shift exposure to the 5 ppm PEL. There had been standards where the number of STEL episodes were limited to once or twice per work shift and that discussion might be needed for MIBK.

Keating explained that 5 ppm was based on developmental toxicology in rats. The previous recommendation for the STEL of was 50 ppm based on a human study of limited measurement at 15 minutes but could not determine from that publication whether that was an appropriate use of data. For that reason the current STEL of 75 ppm is maintained. Regarding the 5 ppm PEL, additional information regarding IRIS review was added to the summary document (see Appendix). There were 3 external reviewers and the confidence was low to moderate in the IRIS risk assessment. Reviewers acknowledged that it was a problematic data set but given some evidence of reproductive effects they determined that it was the most relevant end point for hazard assessment.

Spielman could not remember which chemicals had limits on STEL. **Jim Unmack**, said ACGIH TLV handbook talked about four STEL events per work shift. But four STEL events at 75 ppm would exceed the 5 ppm PEL for the work shift.

Cooper asked if it was compelling to have a STEL. **Owens** stated that it caused eye irritation at 200 ppm for subject volunteers. **Brown** opined that the usage period would be extremely limited with the lowered PEL and he questioned the effectiveness of the STEL.

Spielman said there would be responsibility to meet both the PEL and STEL. Someone without an IH background might assume that they are in compliance if they meet STEL and they will only look for the peak usage. He is concerned that this might give a wrong impression to someone who needs to comply with the standard. If there is only a PEL, they will have to comply with it and if there is a peak, it will be reflected in the exposure evaluation. He stated that he was not sure if a STEL was necessary and **Cooper** agreed.

Owens stated that another study by NIH showed mucous membrane irritation at 50 to 100 ppm with substantial skin absorption.

Jennifer McNary, CDPH HESIS, stated that not everyone was exposed all day and a STEL had its value even if a

PEL could be exceeded in an hour.

Keating clarified that the PEL was based on developmental effects and the STEL was on irritation. 5 ppm is based on his interpretation of the partition coefficient and it would be 7.5 ppm without the partition coefficient consideration. MIBK is a developmental toxicant and the EPA approach used area under curve (AUC) and subsequently lowered human effective concentration. Normally, developmental toxicants are modeled based on the critical window during development and they adjust for time, not AUC. He could learn more about it and explain that to the committee and he could get other opinions about the partition coefficients.

Janssen questioned if there was a practical difference between 5 ppm and 7.5 ppm.

Keating stated that current Cal/OSHA PEL was 50 ppm, ACGIH was 20 ppm, NIOSH REL was 50 ppm, and MAK was 20 ppm. None of these levels address this developmental end point. They are based on the irritation. Reviewers had issues with the EPA approach but it was an alternative method for combining data from different studies and using that end point. He mentioned that an NTP study with MIBK might have cancer data, hyperplasia data or kidney effects for NOAEL derivation. However, he did not see any grounds for dismissing the developmental effects.

Brown suggested to keep a PEL of 5 ppm and bring it back for another discussion the STEL of 75 ppm. **Cooper** suggested to close the HEAC review with a 5 ppm PEL and the Division could decide the fate of the STEL. **Berg** stated that it could be further discussed at HEAC. **Keating** mentioned the possibility of eliminating the STEL to address some committee members' concerns.

Bob Nocco, Chevron, stated that the science dictated two different end points – one for reproductive effects and another for irritation. You cannot guard against the IH malpractice by setting a standard.

Parker stated that it seemed a little out of order to strike the STEL at this point. That is not the path of discussion nor what the data represents.

Brown clarified that HEAC was not moving forward with striking the STEL. He stated HEAC was trying to evaluate what the current STEL is based upon and if it was going to make a change, what the basis for it was. There were not enough data at the time.

Keating offered to look into a STEL justification and **Owens** asked if justification was needed for not changing the current STEL, and the committee replied no.

Berg stated that it would be in interest for people who use the chemical for a half hour per day.

Keating said he would look into it more but the recommendation would stay as is.

Owens proposed to add the skin notation and there was no objection from the committee.

Spielman added that one can get the STEL and PEL with one monitoring effort with advancements in technology. He was just questioning whether it was a practical approach to have such a wide spread between the PEL and STEL. The question is how someone will know there are different end points for PEL and STEL.

Brown stated it made sense to have a STEL for short-term usages.

Keating closed the HEAC review on MIBK with addition of a skin notation.

Tert-Butyl Alcohol (Second Review) and tert-Butyl Acetate (Final Review)

Keating stated that the document on tert-butyl acetate and tert-butyl alcohol were very similar because acetates quickly converted to alcohols and the same effects were observed in animals. The health effects of tert-butyl acetate are based on tert-butyl alcohol and minor adjustments are made for absorption and conversion rates. He brought attention to the ERRATA sheet. First, he had stated in the previous drafts that IARC had determined that tert-butyl alcohol was not an alpha-2-globulin (A2G) carcinogen. In fact, IARC had not made that determination and tert-butyl alcohol was on a list for high priority review. Secondly, there was a slight modification to the cancer risk. Essentially it keeps the risk at approximately one in a million for the two substances using male rat kidney data and there is a slight difference due to their molecular weight differences. Next, he added more text to better explain the route-to-route extrapolation based on previous comments from Mark Stelljes. Most of the studies on TBA are oral drinking water studies and EPA undertook route-to-route extrapolation. Otherwise, there is no change in the proposal. The current PEL is 50 ppm and the recommendation is 1 ppm based on the cancer risk that is derived from a TBA oral drinking water study.

Cooper asked if the recommendation was based on one in a million risk. **Keating** stated the risk of one in a thousand was used to derive the 1 ppm recommendation.

Owens asked if an uncertainty factor of 100 was used. **Keating** clarified that there were two PEL calculations in the document – cancer risk and non-cancer risk. That uncertainty factor applies to a non-cancer OEL of 4.4 ppm for nephropathy. EPA considers tert-butyl alcohol to be an animal carcinogen not caused solely by the A2G mechanism but with some evidence for the A2G mechanism. It is EPA policy not to use tumor data for cancer risk assessment if there is some evidence of the A2G mechanism. That is the basis for using the female rat kidney hyperplasia to derive the non-cancer effect level of 5 ppm. The fact that OEHHA and EPA both acknowledge this as an animal carcinogen is a persuasive reason to use the cancer basis.

Cooper asked if there was a skin notation and **Owens** confirmed there was.

Keating closed the HEAC review for tert-butyl acetate and tert-butyl alcohol with a PEL of 1 ppm and a skin notation. He would reach out to Mark Stelljes for additional comments.

Manganese – Final Discussion – a slide presentation was used during the discussion.

Keating commented that there had been a presentation from the Western Steel Council (WSC) about the proposed PEL at the last HEAC meeting. HEAC proposals were 0.02 mg/m^3 respirable and 0.1 mg/m^3 total manganese (Mn). Mn is a natural nutrient under homeostatic control and there is a physiologic level in the brain. The WSC presentation showed a normal physiologic range of between 0.24 and 0.64 µg/g. These were from studies of normal brains analyzed at autopsy for Mn. This was the range from several studies cited in a paper. Keating collected the means from these and additional studies and presented the average mean tissue level in the brain, approximately 0.4 µg/g. For these nine study means, he calculated the standard deviation and a 95% confidence interval of 0.34 to 0.44 µg/g. He took the largest study with ten individuals and calculated the mean, standard deviation and confidence interval. The mean of that study was 0.46 µg/g and the 95% confidence interval 0.37 – 0.55.

Bates commented that the mean of means was going to be statistically narrower and it was not really epresentative of standard distribution. Keating acknowledged this and said he chose the single largest study (n=10) to get an estimate of the true standard distribution. **Keating** explained that his point was to show what should be considered as the normal range because the absolute range does not represent the probability of occurrence of that value in the population.

Keating continued with Mn solubility on slide 5. The pharmacokinetic model is based on Mn sulfate, which is a highly soluble form of Mn, whereas welding and other processes we are concerned about involve Mn oxide, which is insoluble. The handout showed a new solubility data with Mn chloride, another soluble form of Mn, versus oxide. It shows a single intratracheal instillation of equivalent dose and kinetics over 240 hours. The

soluble form quickly enters and leaves the blood in 12 hours whereas the insoluble form shows much slower dissolution into the blood. He interpolated the data to 300 hours to capture the area under the curve and it appears the two forms are roughly equivalent. In terms of exposure, solubility may not be that important as stated. When the single dose is inhaled for two weeks, slightly higher brain levels are found from Mn chloride compared to Mn oxide. Slide 6 shows an inhalation study after 14 consecutive days of exposure for 6 hours per day. It shows the dose level effect and there is not much difference between the concentration of manganese forms in lung and striatal (brain) tissue.

Owens asked if the clearance from rat lung is similar to humans. **Kent Pinkerton** replied it was usually more rapid in rats.

Keating said that there was no difference in solubility in terms of daily exposures to low doses where pharmacokinetics stand.

Owens asked how long the particles stayed in the body if humans inhaled the insoluble form. **Pinkerton** stated that if the deposition was in the tracheobronchial tree, the clearance would be about 48 hours. If it got down to alveoli, it would be weeks. **Keating** added that there was very low clearance from the lung.

Cooper asked about the particle size and **Keating** said that the referenced studies were done with 1 micron particles and everything would get deposited if it got in the lung. **Pinkerton** stated that a 1 micron particle size would definitely deposit in the tracheobronchial tree and clearly reach alveoli as well.

Keating continued with the uncertainty factor. The PEL is based on an uncertainty factor of 3, which is based on the difference in particle size. A lot of epidemiologic studies are done in smelters with particles of 2 and higher microns whereas for welding studies typically have geometric means below 1 micron. These two sizes have different deposition characteristics. The table on slide 7 is from the pharmacokinetic model used to predict the brain levels (Ramoju 2017) that used a standard model for inhalation risk assessment (MPPD). It shows particle deposition based on mass median aerodynamic diameter (MMAD). Head is for upper nasal region, tracheobronchial for branches, and pulmonary for deep lung. It shows different deposition for welders and smelter workers. Welders get significantly more deposition, approximately 3-fold.

Dan Leacox stated that focusing on the pulmonary ignores other depositions and their contributions, which are a part of the model and there is total deposition. For a battery worker, it is 90.6%, smelter 72.8%, and welders it is 46% and 50%. **Keating** stated the head deposition was cleared through the GI tract and a small fraction entered the blood.

Owens asked if the GI tract would be more important for insoluble forms. **Keating** explained there was very little GI absorption of Mn except during pregnancy. The body needs a certain amount of Mn and controls it through GI absorption and bio-excretion. During pregnancy, the body sequesters and absorbs more Mn. It contributes much less than the pulmonary route.

Pinkerton commented that in terms of head deposition, MMAD gets higher deposition in the head because the nasal cavity creates a turbulent flow through the turbinates and that helps to filter out or deposit larger particles. There would be fairly good deposition within the nose because of the turbulent flow even for particles in 0.3 micron range. Those ultrafine particles will be exhaled when they go down into the deep lung. There is a lot of concern about very tiny particles depositing in the nose. The clearance could be either you blow your nose or particles get into deep nasal cavity where mucous flow will bring them down to the pharynx and you will swallow them. Therefore, it is an important clearance mechanism. There is a lot of concern about ultrafine particles for nose to brain transport. It should be considered that it could be another route. **Keating** stated that the olfactory absorption was included in the pharmacokinetic model and is being looked at with new imaging techniques. **Pinkerton** stated that University of Rochester study showed clear nose to brain transfer of Mn.

Leacox said that they were getting additional data on particle size distribution because Keating had raised a question about nanoparticles during the meeting last Friday. They were collecting data showing that the particle size was not the reason to expect a difference in deposition and they would provide that data.

Keating had a question about how well ultrafine particles were sampled because they require electromobility analyzers and not impactor samplers. **Pinkerton** stated that nanoparticles could be collected by impaction. **Keating** asked about the feasibility to capture particles below 0.05 micron and **Pinkerton** said there was no problem measuring them. **Keating** stated that many welding studies that looked at particle sizes used a cascade approach and reported 50 to 80% of the sample was below 0.4 micron. He asked how to get that fine discrimination below 0.4 micron. **Pinkerton** replied that a cascade impactor could capture ultrafine particles, which were defined as 0.1 microns or less, but it did not differentiate that well.

Keating, moved on to the best science approaches.. There are three best science approaches. Probabilistic - Roels approach used purely mathematical method to their data set and came up with LOAEL for 20 years working lifetime. Several occupational organizations use the weight of evidence approach. They looked at many of the same studies using the same end points. Recommendations vary depending on their interpretation of studies. SCOEL and ACGIH use the weight of evidence approach and they look at multiple studies to come up with their recommendations. ACGIH looked at smelter studies and welding studies to come up with LOAELs which were in close proximation. ACGIH felt that they were confirmatory and subsequently set the standard at 0.02 mg/m^3. They do not express or explain explicit uncertainty factors or judgement call. Then there is bench mark dose model.

Roels study (1992) is unique because it is a strong data set for benchmark dose modeling. Roels determined a cumulative Mn exposure by integrating anywhere from 5 to 20 years of smelter worker exposure at different operations in the plant to give µg/m^3 per year. In the Roels study the best predictor was the cumulative exposure index, which they called the lifetime integrated exposure. Depending on integrated exposure, you can divide that by the number of years worked, to figure out the concentration each worker was exposed to. It is a powerful way to integrate widely variable exposure in welding and smelting operations. There are multiple end-points for neurological effects in Roels and the reduction in eye/hand coordination was significantly greater in workers than controls. The study collected both respirable and total manganese dust. Probabilistic approach was taken by authors of Roels study. They plotted the lifetime-integrated exposure (LIRD and LITD) against hand steadiness. The upper 95% confidence interval corresponding to a 5% probability of abnormal hand steadiness amounts to the integrated exposure shown on the handout. They divided the integrated exposure by 20 to get an average exposure over 20 years – 36.5 µg/m3^3. Effects are seen across all of their workers. They did not determine a NOAEL in the study. No other study used this approach.

Leacox commented that the Roels study used a 5% probability threshold and the EPA model and OEHHA used 10% for their standards.

Keating continued. Other studies with different workplaces, workers, and Mn processes but similar concentrations came to the same end point – 0.03 mg/m^3. Therefore, the weight of evidence suggests that it is valid. Table A-1 is the Roels dataset for benchmark dose modeling. It shows the incidence data for abnormal eye/hand coordination scores. The control group had 5% incidence of abnormal score.

He stated that the weight of evidence was the best science approach to be used. There is considerable variability in welding exposures and the integration of exposure is a good predictor of symptoms of Mn exposure as they are well captured in the Roels study. The approach we took in the document is using the best estimate of effects observed in smelters and applying an uncertainty factor to that for greater particle deposition expected for welders.

Keating asked the committee how to address the uncertainty because one of the WSC points was that we do not need to use the uncertainty factor. WSC had stated that we could use the ASTDR-derived benchmark dose of 140

µg/m3^3 as the standard with an uncertainty factor of 1.2. He reviewed the studies WSC cited as a basis for the uncertainty factor. It was only based on one subchronic study in monkeys and there is no verification outside that one dataset. They do a great deal of scenario modeling of that data. But in terms of chronic long term kinetics of Mn absorption in animals, which could be extrapolated to humans, there is not a dataset for that. Some of the recommended levels by others are LOAELs and some effects are seen at these low concentrations of Mn exposures. He cannot see a justification to use the data without some uncertainty factor.

Cooper asked if the conversion for 20 years was based on 8-hours a day or yearly total exposure. The original value of 730 µg/m^3 was based on a lifetime value as compared to 2000-hours a year. **Keating** explained that it was for the number of working years. Roels's study evaluated 8-hour exposure with 4-hour samples and multiplied by the number of hours worked at that part of the plant. He thought they used 2000-hour work for the calculation since they used the hours and years worked at the plant and integrated the total exposure over the working years. The average working lifetime for the Roels study is 5.3 years and it ranged from 2 to 18 years. Dividing the annual exposure by the number of years at the plant under those conditions gives the average exposure of 36.5 µg /m^3. **Cooper** asked if the interpretation of 36.5 µg /m^3 was over 2000 hours or 365 days. **Keating** said it was a work situation because it was based on work measurements. **Spielman** agreed that a typical work year was 2000 hours and that was how we would interpret the data.

Michael Geyer, KERNTEC Engineering, stated that there was high degree of focus on the Roels study, which was a smelter study and smelters and welding were two different worksites. There is a huge difference between welding and smelting in potential exposure and duration of exposure. **Keating** said that he was not sure if air concentration was different but the working time and particle sizes were different. **Geyer** stated that most welders did not work in the shop - they worked on the field, on high rises and oil platforms, and the duration of exposure was not similar to smelting. He added that the discussion was about 20 years for 2000 hours a year and it was not equivalent to welding. **Brown** stated that that was the nature of PELs and sampling methodologies. The exposure is averaged over a period of time and we have STELs for a short period of exposure.

Conrad Banez, Level 10 Construction, stated that he had been a production welder who worked on high rises, bridge building and underwater welding, and he never worked regular 8-hour shifts. As a production welder he was never given a respirator because they were outside. The information provided is very alarming because he has friends and coworkers in the same boat. As a safety director he is passionate about this topic because he is a welder by trade. He wants to make sure their contractors are provided with the safest worksite possible. They worked on 181 Fremont project and they built everything in cocoons because of rain, wind and to protect the public and other workers. Feasibility and the best practice is possible and attainable. As far as compliance in the field, PAPRs are the best solution; workers love them because they provide cool wind in the face while they are welding. They are not cumbersome and are quite comfortable. His company supports what DOSH is doing and there is a lot of interest in the field. A lot of contractors are doing their own studies and he would be interested to see what WSC came up with as they worked with some bigger fabricators in the Bay Area. He is confused about the Roels study because most production welders work outside.

Keating stated that WSC presentation was on the Ellingsen welder studies and it was cited by others in their derivation of 0.03 to 0.05 mg/m^3. The handout includes his critique of the study. At least for modeling purposes, there are no studies of duration and integration of the Roels study. We need to know the worst case or what is feasible and what could happen in the workplace and protect on that. WSC field study data will be certainly useful.

Brown asked how many welders were in the field and **Banez** replied that they had over 50 welders at 181 Fremont project, and they were full-time workers on 12-14 hour shifts. They were doing full production welding on heavy steels and carbon steels. **Brown** asked what changed in their PPE when hexavalent chromium regulation came out. **Banez** stated that they used half-face negative pressure respirators with welding hoods.

Spielman stated that the Roels study was trying to establish the dose that would cause a certain effect. If

someone accumulates that dose over a certain length of time, this will be the average per day or per year. They may accumulate that dose over ten years if exposures are higher or they might not accumulate that dose for 20 years if the exposure is lower. No matter how the sampling is done, if the study is based on lapel air sampling and the worker wears a face shield for other purposes, the shield itself will give a protection factor of at least two. If the Roels study is lapel-sampling data, you already have a safety factor built into the study and we should consider that. **Brown** disagreed. In his experience reviewing the side-by-side sampling data inside versus outside the hood, he did not see the protective factor that he would assume to be a fact. **Cooper** suggested Spielman submit that data to Keating. He explained that it was a presentation by a local AIHA section on some of types of welding and compared internal and external sampling methods. He would provide it to Keating.

Unmack stated that the human neurological effects are more obvious with fine particles. **Keating** agreed and stated that this study did not account for particle size with a factor that is different with welding. He asked for direction on the health number from the committee. He stated he needed to look feasibility more.

Leacox commented on the health number. Keating had mentioned that the safety factor is based on the expectation of higher rate of exposure based partly on the particle size. It is still an open question that is being debated. Some smaller particle sizes deposit less. Unless you are going to dismiss the deposition model, the way it is used in the studies raises a question. Weight of evidence is not necessarily the weight of conclusions. You have to look at the evidence in these studies and try to draw a conclusion that brings the evidence together. Lisa Bailey did a lot of looking at the data behind these studies and brought them together in her presentation. Because you are getting to numbers that represent the lower ranges of normal, the nutrient factor should be considered. Those do not necessarily comport with that information. Use of means becomes a hidden safety factor in setting the PEL. A PEL is a limit on a whole range of exposures and it is not a mean. A lot of regulatory concentrations are more based on means and they are looking at average dose. PEL is setting a limit on excursion. If you set a PEL at 10 and you are talking about maintaining the range of exposure with mean factor of 3 or less. If you ignore that you are reaching a conclusion based on the mean and set a limit there, you could overlook a big hidden safety factor. You set a PEL of 0.02 mg/m^3 in order to keep all of exposures below that and the mean will be well below that. Hank McDermott had submitted the data last time showing that 0.02 mg/m^3 was well below the means of these studies. So it highlighted the need for respirator and feasibility issues as well.

Thakore mentioned that they developed the benchmark dose concentration of 72 µg/ m^3 and provided some calculation for that regarding the PEL recommendations. **Keating** said that he did not show that data but the ATSDR benchmark dose ranged from 0.07 to 0.14 mg/ m^3. There are assumptions made about the model on benchmark dose and it will be difficult to account for uncertainties in welding. Whatever benchmark dose was used, he would advocate for an uncertainty factor of 3 based on particle sizes and some other factors. Absent any direction, he will stay with the current health number and look into the feasibility issues. As a prelude to the rulemaking, he will more extensively work with stakeholders to learn more about feasibility and bring those issues back to HEAC if there is an interest. He would like to discuss at the HEAC any changes DOSH does or does not make based on the feasibility assessment.

Cooper expressed his interest in the discussion. **Keating** stated that the uncertainty factor of 3 was incorporated in the PEL of 0.02 mg/m^3. There had been an extensive contact with stakeholders and the Division was waiting on the economic data from stakeholders.

Pinkerton expressed a concern about using the end point where 5% of workers would be having neurological effect. **Owens** said that it was for eye/hand coordination, which was a subtle first sign. **Keating** added that it was a hand steadiness and not the full manganism. One of the strengths of the Roels study was that they did a follow up in 1999. After 1992, the Mn air concentration in the smelting plant lowered and in 1999 Roels re-tested workers and individuals who had left the plant. Hand steadiness, eye hand coordination and another symptom were looked at; two reversed and one persisted. Other studies show that some Mn symptoms are reversible and others are not.

Owens asked about Figure 5 in the Mn handout and **Keating** clarified that it was the original figure. 100 µg/ m^3 was the threshold where they started to see the accumulation in the brain using a new imaging technique.

Keating closed the HEAC review on manganese. The Division will work with stakeholders on feasibility assessment and will apprise the HEAC on the process.

This ends the morning agenda.

LUNCH BREAK

Sulfur Dioxide - Discussion

Keating stated that the ACGIH recommendation was to change its 2 ppm TLV to a 15 min STEL of 0.25 ppm to address asthmatic workers. Some human studies show asthmatics are susceptible at 0.25 ppm after 10-15 min at heavy breathing. The current Cal/OSHA PEL is 2 ppm for 8 hours. At the last meeting, committee members requested more usage data and it is included in the handout. There are only 20 entries on the CERS database with a limited number of users - a couple of refineries, federal, municipal, and sewer treatment. There are many users in the food and agricultural industries in California, where it is used in the wine industry to fumigate wine barrels and other tanks, and for fruit and grape fumigation. This data is maintained by Department of Pesticide Regulations (DPR) who regulates pesticidal applications of SO_2. Fumigation is the biggest such use. There is a mix of closed fumigation chambers with some tenting and wine barrels are barrel by barrel. Large fumigation centers are industrial with controlled settings and protocols where they load the tank or room, close and seal it, inject SO_2 and scrub the exhaust air with a water system at the end to make sure the level is below 2 ppm before re-entry. Some stakeholders maintain SO_2 at a constant low level for product storage.

Bates asked about "Fumigation, Other" in the table. **Emma Wilson**, **CDPR**, stated that it represented the wine barrels and corks. Licensees of restricted materials who have the licenses to purchase and utilize the pesticide are reporting how much they are using and number of sites they are using it on. So it might be one building and number of barrels in one building. The number of reported use is the number of location or instances the chemical is used.

Unmack mentioned that glass makers use more than 3 pounds of SO_2 for flat glass and glass bottle manufacturing and **Keating** stated that there was no glass makers on the CERS database. **Wilson** clarified that the summary table of DPR data only represented the pesticide usage and would not include any other usages.

Keating stated that SO_2 had been on the Priority 1 list for past two years and it had factor of 10 from 2 ppm to 0.25 ppm. SCOEL is recommending 0.5 ppm and EPA established a LOAEL at 0.25 ppm based on studies with human volunteers who were asthmatics. They looked at concentration, duration, and ventilation (breathing rate, L/min). Ventilation was the key factor and subjects were tested under different ventilation. They looked at sRaw and FEV1 as two end points. **Brown** said there were small number of subjects and **Keating** commented that the most of human volunteer studies were this size.

Owens commented that the percentage of subjects did not add up to 100 percent. When you add number of subjects in each group, it ends up being more than the total number of subjects for that study. **Janssen** and **Brown** said that it was counted twice and if you are in $\geq$20% group, you are automatically included in $\geq$15% group. **Janssen** stated that if there is more than 20% decrease in FEV1, they would need help in breathing such as an inhaler. **Keating** clarified that these were controlled exposures for volunteers and were not worker studies.

Cooper questioned if HEAC would consider lowering the PEL not for normal healthy population of workers but for a subset of workers who were asthmatic. **Berg** clarified that it was a STEL and not PEL. **Cooper** asked if he would need a lower level of PEL when he hired someone who had a cancer. **Berg** disagreed and said that this population would be made sick because of these exposures. **Owens** asked for a clarity whether this was only for

asthmatics or for everyone. **Pinkerton** stated that it was problematic because it was just based on asthmatics without seeing people who do not classify themselves asthmatics responding at these levels. The general population covers a whole lot more than just asthmatics who would be responding to these levels. **Berg** stated that we were supposed to protect all workers not just the healthiest workers.

Pinkerton commented that this was an EPA document and they have to look at the most susceptible individuals when they establish a standard for the EPA. **Keating** stated that he did not remember if ACGIH called out asthmatic workers although they mention it in the overall summary in the beginning. **Spielman** stated that HEAC had established the precedent of looking into asthmatics for the sulfuric acid standard. HEAC had looked at the studies that were done on asthmatic people and used that as a justification for lowering a standard.

Janssen asked if there was data that showed the exposure not just exacerbate the existing asthma but actually cause asthma. **Keating** replied that there was workplace-acquired asthma. There was a question about the concentration that caused the asthma. **Cooper** asked for the date when the current PEL had been established.

Brown stated that this was a temporary single stage impairment where someone would experience shortness of breath at 15% decrease of FEV1. He asked what would be considered as a material impairment versus a normal biological effect. **Keating** stated that he would look into that and there might be an explanation in the paper on why they selected these values. **Janssen** stated the difference was whether the body would recover by itself or it might need a medication or inhaler to recover their lung function. The definition of asthma is a reversible change in FEV1. You can measure with spirometry so you can challenge people and cause FEV1 to drop and you give them the clenbuterol, which is the medication in the inhaler, and it usually goes back up. Some asthmatics may recover on their own with rest and removal from the irritant but some may require medication to recover or they may continue to lose FEV1 because they are producing mucous, depending on the severity of their asthma.

Owens asked what the normal respiratory rate of a worker was. **Keating** stated that 40 L/min was considered moderate when they conduct these studies on the treadmill. **Pinkerton** stated that at rest you breathe 12-14 breaths per minute and at 500 cc and it would be 6-7 L/min. **Keating** stated that one of the key questions was about ventilation – at what level of exertion should we regulate as some of the ventilation levels are pretty high in the human studies. The studies included the baseline where subjects exercised at the ventilation rate without SO_2 exposures.

Leacox when we looked at the sensitizers there was a discussion about what we were protecting against. There was a distinction made between protecting against sensitization and protecting the sensitized. We protect against sensitization and if someone is already sensitized, it could be almost at any level and we have to do other things about that. **Berg** commented these individuals were not sensitized to SO_2 and someone sensitized could not have any exposure.

Cooper thought he heard that SO_2 could cause asthma although not quite sure what level that was. **Keating** stated that there was acquired workplace asthma from acute SO_2 gassing incidents at higher levels.

Geyer stated that HEAC was discussing to potentially lower the limit for SO_2 based on adults that had asthma. Going back to Mn in welding, if those adults with asthma were welding, they will have hard time clearing it from the lung. He asked why SO_2 was cherry picked with asthmatic adults and whether they were already sensitized.

Keating stated that the ACGIH was recommending the change and their basis was the asthmatics in the workplaces. **Geyer** asked if we were moving toward sensitized individuals irrespective of what they were sensitized for and looking to lower the limit. Committee members commented that these were not sensitized individuals. **Keating** stated that sensitization was triggered at much lower levels and these were more of the ambient conditions.

Janssen and **Cooper** requested to see the ACGIH document on SO_2 and **Keating** replied he would provide it.

Spielman mentioned that about 10% of the new work population already had asthma and it was reasonable to use that research on asthmatics as a foundation for changing the sulfuric limit. He asked whether we should look at SO_2 as primarily an acute exposure issue as opposed to chronic exposure and if there was an acute number that could be established for short-term exposure that would satisfy the chronic question.

Cooper asked if they looked at the same level of exercise with and without SO_2 and we could extract that information. If they did not do that, he would have a hard time understanding how these numbers were related to SO_2 exposure.

Owens noted there were some significant differences in the sRaw when the exposure duration increased from 5 minutes to 10 minutes. [29:45]

Spielman stated that if you had people with existing asthma and created an environment they needed to breathe that hard without SO_2, many would experience these effects as well. **Keating** commented that exercise-induced asthma in asthmatics was well known.

Geyer mentioned that he heard two work related incidents involving wineries and SO_2. Workers in their mid-20's were exposed to small dose of SO_2 and it took them out. Later they found out that they were both asthmatics. There are a lot of respiratory compromised people in workplaces and SO_2 is one of irritants that triggers it.

Keating stated that he would come back with more information on the data presented and workplace incidents. He was looking for guidance on what toxicology to look for. He went over the summary table of EPA assessment on health effect categories – cardiovascular, reproductive, respiratory and cancer. SO_2 is a major air pollutant and linked to a number of other effects. One causal relationship is short-term exposure and respiratory effects. The Clean Air Program has been reviewing SO_2 for years as it is an ambient air pollutant. They are at 0.25 ppm for asthmatics in the population.

Spielman stated there did not seem to be a lot of data on the causal relationship for chronic levels. **Cooper** added that not for cardiovascular or cancer category. **Keating** stated that a lot of research was from China where they had a lot of SO_2 exposures from coal burning and other processes. At the last meeting, the committee requested more usage data to proceed and he would come back with a summary of asthmatic effects for further discussion.

Rob Neenan, California League of Food Producers, stated that SO_2 was used very extensively in the dry fruit operation as a preservative. He asked if there was any study for these SIC codes on what the typical ambient concentrations were. Keating replied no. He will try to find that out but he was wondering if Keating had that information for other industries. **Wilson** stated that she had not seen any workplace monitoring data and she would forward the information if she finds anything. **Keating** re-stated that we are considering a short-term standard. **Neenan** stated there might be some data because in some cases where it was used to preserve they kept it at a certain level for periods of time and he would try to find out.

Cooper stated that HEAC did some work on SO_2 at prior HEAC. **Keating** stated that Bob Barish had some preliminary work on this and he would look it up. **Owens** added that he might have the document in a word version.

Owens asked if there were data on the reproductive effect and **Keating** explained these were EPA assessments and each end point had lots of data. He added that Prop 65 has acceptable daily dose not related to asthma and it is 32 ppm. It is based on the reduced birth weight in mice.

Process for 2019 PEL Prioritization

Keating stated that we liked to have a list with 10 or more Priority 1 chemicals for the coming year and the current list was down to a few. One of the criteria for selection is if the PEL is tenfold greater than the TLV.. One of the columns is the ratio of PEL to TLV. The ratio for phthalic anhydride is 500 and it is a sensitizer. In March we will be looking for candidate chemicals to take under review. Usage is a factor. Another factor is chemicals for which there is no PEL and they are noted NEW. Peracetic acid is an example that HEAC had worked on in the past two years. There was no PEL and there were reports of usage and problems in California. Priority 2* list is for chemicals that require special committees which includes phthalates, silica, styrene and titanium dioxide. ACGIH is looking at titanium dioxide for a TLV probably because it is nano-materialized. The current Cal/OSHA PEL is 10 mg/m^3. **Spielman** stated NIOSH has recommended a nanoparticle standard for titanium dioxide. **Cooper** added that there is a huge usage. **Keating** said the current Priority 1 list was down to benzophenone, sulfur dioxide and turpentine. Benzophenone is based on a HESIS recommendation for cancer risk and turpentine is a carryover from the previous HEAC.

Cooper suggested the list to include CERS data. **Thakore** stated that he had developed CERS data for about 60 chemicals that had a PEL to TLV ratio of 5 or more and he thought he had provided this information already. He had also considered the Prop 65 list. Sometimes the TLV is based on non-cancer or non-reproductive developmental effects and Prop 65 list should be considered as well.

Keating stated that there were a lot of pesticides on the list. **Berg** stated there was no jurisdiction in the agricultural setting but Cal/OSHA might have jurisdiction in other settings so not necessarily taken off. **Brown** provided an example of a warehouse storage setting.

Spielman stated there was an AIHA committee that put forward the WEELs recommendations for compounds with no TLVs and that could be another resource for priority potential. **Cooper** stated OARS-TERA was the organization doing that work these days and **Owens** added that the AIHA did not have people updating the WEELs list. **Cooper** mentioned that OARS-TERA can be funded to to conduct OEL development if there is interest in developing a more scientific-based OEL. .

Keating went over the flowchart for prioritization. New chemicals will be placed on the Priority 2 list first and will be evaluated. If a PEL exists, we look at the ratio. If other agencies recommend a lower limit than Cal/OSHA or it is a significant new hazard, which may be true for a lot of chemicals as PELs had not been reviewed for a long time and there is a fair amount of new toxicology data. Then we move on to the usage category. For example, 1,2,3-trichloropropane had a significant cancer risk but there was no usage in California and we did not change the existing PEL because it was not worth the effort to go through the rulemaking process. He will utilize the flowchart when he goes through the list for March HEAC.

Cooper said he had the updated version of the flowchart. If members of public are interested in providing chemicals to the Priority List for HEAC, they could reference this flowchart to determine whether it meets the general criteria. The last time we asked the public for a list we got hundreds of chemicals.

McNary commented that it would be helpful but it did not take into account the severity of health effects. For a chemical with no PEL, there is no priority for a chemical that may cause cancer or other permanent health effects. **Cooper** disagreed and stated the severity was addressed in the green box i.e. reversible, irreversible, cancer etc. **Keating** explained that it starts with the usage and exposure and then moves onto the severity. **Owens** said that if there is no PEL and no use, it goes to the Priority 3 and you are assuming a highly hazardous substance will not be used in the next year and usage can change. **Keating** agreed and said we should track it better. However, chemicals without PELs may not be well tracked or inventoried.

Owens asked what "O" and "P" stood for in the priority list and **Keating** replied "P" might be for a pesticide but he would look them up.

Cooper asked for status on chemicals on the priority special list. **Berg** stated that there would be a separate

committee for the wildfire smoke next year. **Cooper** asked if there was a prioritization on the special committee and Keating replied no. **Owens** asked if people would be cited for wildfire smoke exposure. **Berg** stated that Cal/OSHA already said that it would cite for harmful exposures if people were outdoors without taking any precautions. Definition of harmful exposure is already there if it causes illness or incapacitates. There are epidemiology and toxicology data from EPA.

Keating said titanium dioxide caught his attention. It was a nano-material and it was categorized as a special committee substance.

Owens pointed out hexavalent chromium was included in the Priority 2 list. **Janssen** commented that it was because the PEL to TLV ratio was 25.

Thakore suggested to ask the usage question first on the flow chart and then ask whether a PEL exists or not. **Cooper** commented that the revised flow chart already reflected that. He recommended to revise the priority list with a level CERS data. Keating said he would try. CERS data is the total number of users.

HEAC 2016 -2018 Proceedings Review

Keating stated that this December meeting was the ninth meeting and it had been two years since HEAC reconvened under the new format. The handout summarized the HEAC process and proposed possible topics for discussion. Should the format be to review all potential toxic effects or focus on consensus endpoint. This is something that he had come across frequently where we have not done a review for a while and some other body has and they have an exhaustive summary. He can summarize and validate all studies or focus on animal studies. He had linked references to articles and identified a LOAEL/NOAEL when possible.

Bates requested to have a more common format for the reviews. Particularly by separating animal studies from human studies within particular end points categories because they get mixed up. Summary tables are really useful because it is hard to read through descriptions of studies and relate one to the other. He would be happy to contribute to come up with a format. **Keating** stated that if the studies had been done by EPA, they have a standard approach for identifying LOAEL/NOAEL and they put them in a tabulated format. He said he would try but typically for chemicals without that kind of study, it would not be possible. **Berg** suggested to make our own table. **Bates** suggested that the committee could produce generic tables, one for animal studies and one for human studies, and then it could bat them around between members to add or delete studies.

Cooper stated that it would be helpful to put the basis for the PEL in the front. So anyone can get the information on the current level, proposed level and the basis for the recommendation without reading the entire document. He added that this would help associating an upper respiratory effect in one chemical with another chemical when determining an additive effect because there is a way to quickly find that information.

Keating continued with the topic of the conduct of meetings. There used to be two committees and the Division chose to make it one. He wants more explicit separation of health effects and feasibility discussions.

The HEAC guideline does not require voting but it would be helpful to formally assess consensus to determine closure of review because stakeholders are often surprised to find out that a certain review process had been closed. To that end he started to put on the agenda first, second or third review. If the agenda says “for discussion” it means it is still under review and a final recommendation will not be made at the meeting or like SO_2 where a draft summary has not been prepared, it is not under review yet. If a PEL is drafted, it will be under review and by guidelines it has a least two reviews before closure. He would put “final review” as a way of indicating that staff considers it has addressed committee suggestions and the summary is ready for completion at HEAC. **Cooper** stated that the committee used to vote and were told it could not vote. He concurred with Keating’s recommendation.

Keating continued with staff response to HEAC questions. He tried to address questions and suggestions in his comments at the meeting when he made revisions to the draft.

A lot of committee members have come to him and offered to help and he wants to follow up on that. Members have offered to help outside the committee structure and he is figuring out how he could do that. He suggested a mid-point call in at day 45 between meetings. People can call in to find out what he is doing and see if they have time to help him or just find out where the process stands.

Brown proposed to streamline the system by assigning people to prepopulate the summary document with the template Keating created and keep things moving quicker. He suggested to create a drive or shared folder that committee members could access and place documents. **Keating** stated that one of the issues that had been coming up was that draft summaries were piling up for formal rulemaking and we did not want to compile a backlog where we could not get to the formal rulemaking until 4 to 6 years out.

Brown pointed out that feasibility was not mentioned on the list. He suggested re-addressing it in a categorical or systematical approach, a checklist of items to review in terms of the feasibility will be great. The economic feasibility on whether the impact is over 5 or 50 million in the industry is all we have now. **Berg** stated that we have to include the best estimate of cost and that is challenging. It includes technical feasibility and benefits as well.

Spielman suggested to put the feasibility discussion on the agenda for the third review and interested people could come in and talk about it. **Leacox** stated that they have to know the third date and the opportunity is coming otherwise they cannot let the first one go by. If you do not want it on the first one, you have to provide a great deal of assurance that you are not bypassing your only opportunity to weigh in. If that is not clear you are not giving that person what they need to give their comments. **Berg** added that we could put that on the agenda if the feasibility issue would be discussed.

Cooper stated that a list of items we were looking for in feasibility discussion would be helpful i.e. measurement and impact. **Spielman** stated the number of entities that know where they are compared to new numbers are extremely small.

Cooper stated that what has worked in the past was to have committee member assigned or volunteer for a chemical, take the format as suggested, populate it to come up with recommended PEL. That becomes the material provided back to the Division. It made a huge difference in number involved. Decades ago we were producing 30 recommendations a year, ready for the Division to promote to the Board.

Cooper asked whether peracetic acid was going to the Board at some point. **Keating** said it was waiting to be assigned to a staff as Michael Horowitz had retired. **Cooper** commented that it created an interesting vacuum where the State knew the hazard associated with a particular chemical and it was not out in the workforce. He asked how many chemicals the committee had approved that were waiting to go to the Board. **Kevin Graulich** stated there were about ten chemicals. **Cooper** asked if there was anything the committee could do that would be helpful to move things to the Board. **Keating** said he did not know.

Spielman offered to review the studies if they were provided to him. **Brown** suggested three members in a group and one of them could do research, the second do the review and the third does the writing. **Cooper** stated that Keating could help with providing documentation or put them in Dropbox and the committee could go to one source for literature. **Keating** said he would take it up with Chris Kirkham about involving committee members more. **Spielman** added that there could be a subcommittee. **Bates** commented that he would like to help but he did not have time. It takes huge amount of time reviewing a chemical and he does not have time these days. **Keating** said experts were great resources in the current format and it helped him.

Thakore commented that in terms of the PEL development recommendation, HESIS recommended the current

NIOSH policy of 1 in 10,000 workers for cancer risk and he would like to know if that would be considered as an agenda item for the next meeting. **Keating** said he told Chris Kirkham that the committee needed clarity on this and it needed the discussion. As an agenda item it would be a part of policy and procedures and that would be a bigger discussion. **Cooper** commented that it would be a huge change and there would be a number of stakeholders having difficulty with that approach because you are essentially saying all the PELs that had been set over multiple decades based on 1 in 1000 will have to be reviewed. **Keating** stated it was a policy question for the committee and if the Division wanted to have HEAC evaluate this, they could.

Brown asked if there was a document that defined the HEAC structure and member responsibilities better. **Keating** stated there was a policy and procedures document and he created a one page summary guide of that document when the committee was reconvened 2 years. **Brown** stated that the committee members did not have much work and proposed the Division to reevaluate the time and commitment it asks of its members and provide the feedback to the committee. This committee is important enough to warrant more commitment and should demand more from its members. **Cooper** said he would rather use Keating in his area of expertise and editing the document was not the best use of his time. **Brown** also suggested a closed group meeting for the committee members before the public meeting and **Spielman** said there could be an issue with transparency.

Next meeting will be March 5th, 2019.

Meeting adjourned.