

Occupational
Health Clinics
for Ontario Workers



Centre de Santé
des Travailleurs(ses)
de l'Ontario

***OCCUPATIONAL HEALTH CLINICS FOR
ONTARIO WORKERS***

**SUBMISSION TO THE
MINISTRY OF LABOUR
REGARDING:**

**2012 NOTICE OF PROPOSAL TO ADOPT NEW OR REVISED
OCCUPATIONAL EXPOSURE LIMITS OR LISTINGS FOR
HAZARDOUS CHEMICAL SUBSTANCES
MARCH 2012**

***SUBMITTED TO: ONTARIO MINISTRY OF LABOUR
PREPARED BY: OCCUPATIONAL HEALTH CLINICS FOR ONTARIO WORKERS***

1. OEL's, while perhaps necessary as a bare minimum standard, are not the most effective method for reducing workplace exposures. OEL's should be secondary to an **explicit regulatory requirement to identify and control workplace hazards**, so that even if compliance with an OEL is demonstrated, action can be taken to protect workers experiencing symptoms/diseases at exposures below the OEL.
2. Without any regulatory requirement for workplaces to **assess exposures**, nor, any requirement to use **statistically valid sampling strategies** to assess compliance, OEL's may not even be effective in preventing harmful exposure, even in non-compliance situations (i.e. excessive exposures undetected because sampling either wasn't done or not done using an appropriate sampling strategy).
3. Ontario should follow BC's lead (similar as in the EU) in requiring employers using a **carcinogen** (or **sensitizer** or **reproductive hazard**) to demonstrate that there are no practicable substitutes for using the carcinogen in the work process. This would be consistent with the current Ministry of the Environment initiative for toxic use reduction. It would also position Ontario for the closer trade relations with the European Union which will likely result from the upcoming free trade negotiations.
4. We would also repeat our previous endorsements of the **silica** and **wood dust** proposals. Based on our work at OHCOW we perceive a significant need to reduce the OELs for **ozone, manganese, PNOCs, metalworking fluids** and **diesel exhaust** (we have raised this issue in previous submissions). There is also a need to update the Code for Medical Surveillance in the lead designation substance regulation to reduce the **blood lead** biological exposure indices used.

OHCOW Background and Exposure Assessment Experience:

The Occupational Health Clinics for Ontario Workers Inc. is a team of health professionals committed to promoting the highest degree of physical, mental and social well being for workers and their communities. At six clinics in Ontario a team of nurses, hygienists, ergonomists and physicians see patients and identify work-related illness and injuries, promote awareness of health and safety issues, and develop prevention strategies. First established in 1989, the clinics have seen thousands of individual patients and visited hundreds of workplaces helping to identify unhealthy and unsafe conditions, and providing advice to workplace parties on the prevention of occupational diseases.

With respect to occupational exposure limits, OHCOW deals directly with Joint Health and Safety Committees (JHSC's), unions, employers, individual workers and others, helping them to interpret exposure assessments, developing assessment strategies, directly assessing exposures, dealing with issues underlying the requests for assessments (e.g. worker symptoms and health conditions), questions of toxicology and assessment elimination, substitution and/or control measures. OHCOW has a number of trained occupational hygienists throughout the province servicing client workplaces.

OHCOW also has extensive clinical experience with workers who have suffered illness or injury due to exposures in the workplace and have seen the role the OEL's play in prevention (or the lack of prevention when illnesses occur even when exposures comply with the OEL).

Concerns Regarding the ACGIH TLV Committee:

Serious allegations have been leveled in the scientific literature in the past concerning the integrity of the ACGIH TLV's particularly with the role that industry plays in influencing the Committee⁽¹⁻⁵⁾. Reviews have shown that often the level set for the TLV's is more closely related to what industry sees as practically achievable levels, as opposed to health based levels. The ACGIH TLV Committee responded to these criticisms by tightening up its process and documentation of the TLV's. However, a different challenge has been launched against the TLV's in the last few years which also threaten to effect the manner in which they are set. A number of lawsuits were launched against the TLV's from both industry and industrial disease victims. These legal challenges have had a "chilling" effect on the organization and seem to have introduced a hesitancy in reacting to situations where there is limited evidence. Recent history has shown that the ACGIH seems to be retreating from certain standards for which they now feel the evidence is not sufficient. This retreat appears to be associated with the recent legal actions against the ACGIH and therefore may be more out of concern to avoid liability than ensuring workers exposed are protected. The removal of the TLV for particulates not otherwise classified (PNOC) is an example. In this effort to become more scientifically exact, protection for exposed workers is lapsing for the sake of scientific precision and avoidance of lawsuits.

Against this trend we would suggest that the precautionary principle (as it was discussed in the context of workplace health and safety in the Campbell Commission http://www.health.gov.on.ca/english/public/pub/ministry_reports/campbell06/campbell06.html) needs to be included in Regulation 833 to address situations where the OEL has been eliminated, or no OEL has been established or the OEL is insufficiently protective. The current provisions in Regulation 833 only provide remedies in such situations if a worker can get medical corroboration for their health concerns, however, a large majority of OEL's are based on preventing irritation which would not be clinically objectively verifiable, thus there is need to address worker health effects which are not clinically measurable.

A Lack of a Legal Requirement to Measure Exposures:

Setting lower OEL's will not necessarily lead to reductions in exposure in Ontario workplaces. (Removing some OEL's will obviously not have such an effect either and may even increase exposures – a very counter-prevention trend!) In order for an OEL to effectively lower workplace exposures, measurements must take place in workplaces particularly where exposures may exceed the new OEL. The proposed changes to the regulation do not require employers to take measurements, so naturally if no measurements are taken, no over-exposures will be detected and there will effectively be no regulatory inducement to reduce or eliminate exposures.

There is thus a need for a regulatory requirement to perform sampling for the purpose of exposure assessments if the changes in OEL's are to impact Ontario workplaces. Without such a legal requirement, employers fearing being found out of compliance may merely decide not to measure at all.

A Lack of a Legal Requirement to Employ Unbiased Sampling Strategies:

Even if measurements are taken, the conditions under which they are taken and the number of measurements taken can be manipulated as to minimize the chances of detecting an over-exposure. This concern is often brought to the attention of OHCOW staff by workers asking for reviews of occupational hygiene reports (e.g. “they should have sampled when ...”). In fact it has been shown⁽⁶⁾ that mathematically modeling exposures⁽⁷⁾ is more accurate than a sampling campaign that covers three or fewer workdays (most sampling campaigns cover only a single day). The Joint Steering Committee on Hazardous Substance Regulations (JSC, 1987-1995) recognized this situation and brought forward a draft regulation on exposure assessment strategies which would require employers to assess exposure using prescribed methods and sampling strategies which would ensure objective assessments. Stephen Rappaport has also written extensively^(8,9) on statistically valid sampling strategies and was used as a consultant for the JSC's draft regulation on sampling strategy. The AIHA Exposure Assessment Strategy Committee has produced a manual⁽¹⁰⁾ on procedures and strategies for managing exposure assessments. This manual has become the standard for properly designing exposure assessment strategies. For regulatory purposes, a regulation could simply refer to this monograph and require that sampling strategies would be devised following the procedures outlined in this manual. This would ensure that appropriate exposure assessment strategies are used addressing the common criticisms of biased sampling strategies.

Concerns Regarding the Effectiveness of the OEL as a Means for Improving Workplace Conditions:

If these changes in the OEL's were accompanied with legal requirements to perform exposure assessments and be required to follow recognized sampling strategies, would workplace exposures be reduced? This question has been addressed by the author Eileen Senn⁽¹¹⁾ who reviewed the US OSHA experience with measurements taken by OSHA representatives in response to workplace exposure complaints. Her findings based on the OSHA database of workplace measurements showed that over 90% of measurements taken in response to complaints were in compliance. What this means is that quantitative exposure assessment essentially had the effect of reinforcing the status quo (i.e. no regulatory onus to reduce

exposures) in situations where workers had lodged complaints regarding exposures. While delivering our services, OHCOW has encountered the general frustration workers have with respect to occupational hygiene exposure assessments. Invariably, exposures are in compliance with current standards, in spite of significant symptoms and concerns experienced by workers. Note as well that most sampling strategies do not follow accepted guidelines as laid out in the AIHA exposure assessment manual. These assessments/reports then become an extra obstacle in the struggle to alleviate symptoms and reduce/eliminate exposures.

Ms. Senn also investigated the effect of updating the US OEL's from 1968 to 1989 would have on the percentage of compliance. Her findings were that such a drastic updating (almost 30 years) would generally only lower the compliance rate by less than 10% (from above 90% compliance to above 80% compliance). Thus the updating of the OEL's would generally have little impact on the level of exposure experienced by most workers. There were some exceptions however, for instance the proposed lowering of the silica OEL's in Ontario would significantly impact those workers working with these chemicals since exposures are often at or over the current exposure limit. But outside a few specific exceptions, it is generally expected that if employers would be obliged to measure exposures and if they used appropriate sampling strategies, the number of workplaces found out of compliance would not change significantly.

Limitations in OEL's in Preventing Occupational Disease:

Even though most workplaces are in compliance with current OEL's and would be expected to be in compliance with the proposed changes (with a few notable exceptions), this does not mean there are little or no hazards due to the exposures among Ontario workers. First of all, the ACGIH in its preamble to the TLV specifically state that not all workers will be protected by complying with these OEL's. In fact if one follows the history of OEL's one will notice a gradual decline in most OEL's over the years as more evidence of workers experience symptoms and diseases are established. What is to say that an exposure which may be legal now, may in the future be considered to be associated with an occupational disease once the evidence (i.e. affected workers) has been collected and assessed. This has been the pattern in the past and there is little reason to suspect it will not continue. This is one of the reasons for the ALARA (as low as reasonably achievable) principle or the precautionary principle, which both suggest that exposures be kept as low as reasonably possible in light of the scientific uncertainty associated with the evidence (or lack of evidence) regarding the association of exposure with disease. Rather than a chemical being assumed to be non-toxic until proven otherwise (thus the absence of evidence supporting non-toxicity), we would adhere to the assumption of a chemical's toxicity until valid evidence is produced to the contrary.

The MOL has instituted a policy which recognizes that just because exposure assessments demonstrate compliance is no reason to ignore workers symptoms and health problems associated with such exposures. The fact that there are relatively few reported investigations assessing worker health in relation to exposures in consideration of the number of workers actually exposed. The standard of evidence for the basis of many OEL's is extremely poor by general scientific standards; some merely suggesting limits by analogy or based on animal toxicity experiments despite that fact that thousands of workers are exposed daily to such chemicals.

For other OEL's where there is sufficient human evidence, a conscious decision has been made by the committee to tolerate a specified amount of occupational disease in setting the limit. An example of this calculated risk is the noise TLV, where the documentation of the TLV

recognizes that up to 10% of workers exposed to 85 dBA in a working life will suffer noise induced hearing loss. Furthermore, it is well known that workers exposed to sensitizers such as isocyanates are not adequately protected by compliance with the OEL (a certain percentage of exposed workers will go on to develop asthma in spite of maintaining exposures below the OEL). Carcinogens often do not have a threshold and thus OEL's are set at an "acceptable" rate of occupational disease (usually 1 worker in 1000 exposed, despite the environmental standard of risk being 1 citizen in 100,000 to 1,000,000). Taking all these limitations into consideration, it is very clear that compliance with OEL's is in no way a guarantee that no significant health effects may occur among workers exposed!

New Paradigms in Exposure Criteria:

The dose-response relationship is more of a continuum than a straight line with a sudden discontinuity at the OEL. The heat stress OEL is graduated response as the WBGT rises. New paradigms in exposure assessment criteria have surpassed the single digit representation of the dose-response relationship which the OEL represents. In indoor air quality investigations, sampling strategies focus on source identification and measurements are interpreted in terms of ranges instead of a single digit threshold. For example, carbon dioxide is used as a surrogate for ventilation performance and is interpreted in terms of ranges⁽¹²⁾:

< 600 ppm	no problem with the quantity of outdoor air supply
600-800 ppm	possible problem particularly if there are other parameters indicating possible problems (select parameter best suited to intervention)
800-1000 ppm	probable problem with inadequate quantity of outdoor air supply
1000 ppm	definite problem with inadequate quantity of outdoor air supply

Similar graduated ranges have been established for volatile organic compounds (VOC's)⁽¹³⁾, although the main goal of measuring VOC's is more to find the source and eliminate or control it to prevent exposure in the first place. Thus in the overall scheme of prevention, the single digit threshold concept is a gross reduction of a much more complex dose-response relationship and as such the graduated exposure criteria, such as for VOC's, are a more realistic approach.

Sensitizers, Carcinogens and Reproductive Hazards in the Workplace:

Workers' health in Ontario would benefit if exposures to sensitizers and carcinogens was avoided through methods including substitution, engineering controls, isolation, local ventilation and protective equipment to prevent exposure by any route. The ideal place to prevent exposures is at the source⁽¹⁹⁾. Any workplace where sensitizers or carcinogens are used should be required to demonstrate, on a regular basis, that it is actively involved in an ongoing process to identify alternative non-toxic chemicals and/or processes, so that these materials are no longer used in the workplace. Until such time that a substitute chemical and/or process replaces the sensitizer or carcinogen, the workplace must demonstrate, using a valid occupational hygiene sampling strategy⁽¹⁰⁾, that exposures are "as low as possible" and that there is a continuing process of

improvement in engineering and occupational hygiene that will result in a further reduction in exposure and that workers are not experiencing symptoms of exposure or are having to leave due to health effects caused by the product.

Innovative Qualitative Exposure Techniques to Address Small & Medium Sized Business Enterprises:

It has also been recognized that most small or medium sized enterprises (SME's) do not have the resources to conduct the amount of quantitative sampling required by an appropriate quantitative exposure assessment strategy consistent with the procedures outlined in the AIHA exposure assessment manual (not to mention the concern that those resources would be more productively allocated to control once workers have identified an exposure of concern). In response, the AIHA manual and various European organizations have developed qualitative exposure techniques to help SME identify the needs for exposure control without using significant resources to measure exposures. One of the most recognized techniques is the control banding method espoused by the British HSE (<http://www.coshh-essentials.org.uk/>). Other schemes have also been developed in the Netherlands, Germany, Italy and Spain. All these methods attempt to "automate" the decision logic exposure assessors would use to categorize exposures and recommend controls. The Ontario Ministry of Labour had a preliminary meeting with stakeholders a few years ago (1999-2000) introducing the idea, however, nothing appears to have materialized from these efforts.

Other countries, Italy and Brazil in particular, have established mandatory risk mapping exercises, where workers are asked to identify exposure concerns in a diagram format and these become the basis of an exposure control program^(15,16). Also, Malchaire⁽¹⁸⁾ in Belgium has developed an approach to risk assessment and control which recognizes four levels of assessment and problem solving (screening (shop floor), observation (JH&SC), analysis (OH&S professional) and expert) which goes by the acronym of SOBANE. The screening and observation risk assessment and problem solving tools are ideal for the SME and the analysis protocols ensure that the work done by hygienists co-ordinates with the preliminary risk assessments done on the shop floor and JH&SC levels.

OEL Update Process (substances not acted upon):

Having participated in a number of rounds of update consultations, we have some concerns about the process, particularly with substances not adopted and seem to have "fallen through the cracks". There appears to be no communication process that allows those who submit comments to get any feed-back from the Ministry other than the regulation stipulating which OEL's have been adopted. No official communications dealt with the substances which were not adopted. On contacting the branch of the MOL which deals with the OEL updates, one is generally told that matter is still "under consideration". One particular substance which has been "under consideration" for more than five years, is silica.

Silica: In 2004 the MOL proposed lowering the silica OEL (or TWael as it is called in the designated substance reg for silica) to 0.05 mg/m³, however it was not adopted. In 2006 (after the ACGIH lowered its TLV again), the MOL again listed silica in its annual OEL update

but this time proposing to lower the TWAEL to 0.025 mg/m³, but again, it has not been adopted and is said to be “under consideration”. The ACGIH has provided extensive documentation for their TLV of 0.025 mg/m³. As silicosis is still a disease that affects Ontario workers (http://www.cbc.ca/sunday/2009/02/022209_1.html) despite the fact that the knowledge and technology have long been available to prevent silicosis, it speaks to the urgency needed to implement this change. It is also noted that in the current silica designated substance regulation that the ALARA is incorporated:

“Every employer shall take all necessary measures and procedures by means of engineering controls, work practices and hygiene practices and facilities to ensure that the time-weighted average exposure of a worker to silica is reduced to the lowest practical level and in any event shall not exceed” (Section 4(1))

Furthermore as a carcinogen, we would also invoke the comments made above pertaining to the need to substitute workplace carcinogens out of the workplace where practicable.

We realize that quartz is ubiquitous in the Ontario environment (particularly in the Canadian Shield) however, workers are still vulnerable to silicosis if exposed. We do not agree that simply because our environment has more quartz in it than other jurisdictions that therefore Ontario workers should endure inferior protections. Other jurisdictions have other exposures more frequently than northern Ontario (e.g. heat stress and ozone). Thus while Ontario businesses may have to devote funds to control a particular hazard of environmental origin more often than similar enterprises in other jurisdictions, other environmental hazards may be less prevalent in the natural Ontario environment. Asbestos is another natural hazard which needs to be regulated despite the fact that it occurs naturally in the environment.

We can see no environmental justification to deprive Ontario workers from adequate protection against silicosis.

As noted earlier and as reported by the CBC (http://www.cbc.ca/sunday/2009/02/022209_1.html) silicosis is still an issue in Ontario and it behooves the Ministry of Labour to bring their “considerations” to a conclusion after 5 years of “consideration”.

Blood Lead: Another issue that appears to have “dropped through the cracks” is the blood lead criteria for review and removal found in the Code for Medical Surveillance associated with the Lead designated substance regulation. When the OEL for lead was reduced, no changes were made to the Code for Medical Surveillance, thus it would appear that Ontario’s blood lead removal concentration is 70 µg/dL (or 0.70 mg/L or 3.4 µmol/L). The ACGIH Biological Exposure Index (BEI) for lead is 30 µg/dL with a caveat that women of child bearing potential should not exceed 10 µg/dL. The Ontario Designated Substance Lead Regulation Code for Medical Surveillance specifies the following responses to blood lead levels:

<u>Blood Lead</u>		<u>Action</u>
40 µg/dL	(1.95 µmol/L)	pregnant workers to be removed
50 µg/dL	(2.4 µmol/L)	return to exposure after medical removal
60 µg/dL	(2.9 µmol/L)	exposure review (alert level)
70 µg/dL	(3.4 µmol/L)	medical removal

Philip Landrigan was asked by the Ministry of Labour to compile evidence for a list of health effects and their corresponding threshold blood-lead levels for the Joint Steering Committee's Biomedical Task Force. He came up with the following list:

<u>Toxic Effect</u>	<u>Lowest Blood-Lead Levels Associated with Toxic Effect</u>	
inhibition of heme biosynthesis (ALA-d inhibition)	10 to 20 µg/dL	(0.48-0.97 µmol/L)
renal impairment (inhibition of vitamin D hydroxylation)	25 µg/dL	(1.21 µmol/L)
hypertension	10 to 20 µg/dL	(0.48-0.97 µmol/L)
peripheral neuropathy	30 to 40 µg/dL	(1.45-1.93 µmol/L)
central neuropathy (sub-clinical encephalopathy)	40 to 70 µg/dL	(1.93-3.38 µmol/L)
male reproductive dysfunction	50 to 60 µg/dL	(2.41-2.89 µmol/L)
fetal neurological impairment	10 to 20 µg/dL	(0.48-1.21 µmol/L)

* this table was copied from "Medical Surveillance of Workers Exposed to Lead: A Report to the Biomedical Surveillance Task Force, Ontario Ministry of Labour", by P.J. Landrigan (January 1992).

Based on this review, Landrigan recommended that the blood-lead removal concentration be 20 µg/dL (1.0 µmol/L) and the re-entry concentration be 10 µg/dL (0.5µmol/L). Therefore, for a lead assessment where blood-lead concentrations have been determined, if the levels exceed 10 µg/dL (0.5 µmol/L), it can be argued that the health of the worker could be affected. It should be noted that the Ministry of Labour received this recommendation in 1992 and no changes have been made to the Code for Medical Surveillance.

Substances Under Review

The Ministry of Labour is calling for discussion on the following proposed changes:

1. Acetic anhydride- TWA of 1 ppm and STEL of 3 ppm added, C deleted. Acetic anhydride is used in the manufacture of acetyl compounds, cellulose acetates, synthetic fibres and plastics. It is a severe eye and skin irritant at concentrations above 5 ppm. Prolonged exposure can lead to pulmonary oedema.
2. Allyl chloride- adding a skin notation. According to the literature the skin notation seems appropriate. Allyl chloride used as an intermediate for manufacture of polymers, resins, plastics, varnishes, plastic adhesives, pharmaceuticals such as barbituates and hypnotics. Health effects are demonstrated at different levels including eye irritation at 50 – 100 ppm, nasal irritation at 25 ppm, risk of kidney/liver damage at concentrations at or close to allowable level (2.04 ppm) and it has poor warning properties at OEL of 1 ppm Therefore OHCOW questions whether this is low enough.
3. Carbon Black- OEL developed for inhalable fraction, 3 mg/m³.

- Uses pigment, tires, printing, plastics stabilizer from UV radiation, high temperature insulating material
 - Causes cough, phlegm and pneumoconiosis
 - OHCOW doesn't know if the level is low enough but supports level of the inhalable fraction.
4. Ethyl Benzene- TWA reduced from 100 ppm to 20 ppm, STEL withdrawn
 - Uses precursor to styrene
 - Causes eye, skin and mucous membrane irritation
 - At high concentrations causes lacrimation, conjunctivitis, nasal and respiratory tract irritation, chest constriction, vertigo, ataxia, headache, irritability, chronic sleepiness, fatigue
 - IDLH 800 ppm
 - OHCOW could not find levels at which these occur and wonder why the OEL has been reduced so dramatically?
 5. Maleic anhydride- OEL developed for inhalable fraction and vapor at 0.01 mg/m³
 - Uses copolymer production intermediate, manufacture of alkyd type resins, dyes, pharmaceuticals and agricultural chemicals
 - Causes bronchitis, dermatitis, possible contact and respiratory sensitization and asthmatagen
 - Odour threshold of 0.05ppm
 - OHCOW supports measurement of inhalable fraction
 6. Methyl isopropyl ketone- TWA reduced from 200 ppm to 20 ppm
 - Used as a solvent for nitrocellulose lacquers
 - Causes skin, eye and respiratory tract irritation and CNS depression
 - Odour threshold 1.9-4.8 ppm
 - Why the dramatic drop in TWA?
 7. 2,4- Pentanedione- (AKA- Acetyl acetone)
 - Not previously listed, addition of substance to regulations at 25 ppm
 - Uses fungicide, bactericide
 - Health effects ataxia, drowsiness, dizziness, headache, laboured breathing, nausea, vomiting, contact dermatitis
 - possible skin absorption
 - Why no skin notation?
 - Health impacts have been recognized at 2-14 ppm (Patty's)
 - Why is the OEL set at 25?
 8. Soapstone- separate listing withdrawn and substance to be regulated under listing for talc.
 - OHCOW agrees with this decision.
 9. 4,4-Thiobis (6-tert-butyl-m-cresol)- OEL developed for inhalable fraction 1mg/m³
 - Uses, production of phenolic antioxidants, added to polymers and rubbers
 - Eye, skin, respiratory irritant and asthma
 - Very little data available on health effects

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Previous Submission (2004): Wood dust

Regulation 833 classifies wood dust into two categories:

- 1) certain hard woods as beech and oak with an eight hour exposure limit of 1 mg/m^3 ;
- 2) soft woods with an eight hour exposure limit of 5 mg/m^3 and a short-term exposure limit (STEL) of 10 mg/m^3 .

ACGIH however lists wood dust two categories: Western Red Cedar, a softwood species but allergenic, with a TWA of 0.5 mg/m^3 ; and all other species having a TWA 1 mg/m^3 and removing (adopted 2004).

Wood dust can result from the process of cutting, milling, sawing, sanding and so forth of natural or processed wood. Wood is composed of polymeric compounds such as cellulose, polyoses, lignin, and a variety of smaller molecules know as extractives. These extractives are often defense mechanisms for trees to survive; however, some are toxic and allergenic to humans.

Exposure to wood dust can often be in combination with a variety of other hazards such as fungi, bacteria and pesticides. In other wood-related industries, workers can also be exposed to formaldehyde from adhesives and resins. Although the focus is on wood dust exposure, it is important to consider other exposures that may have potential ill health effects.

In 1965, an excess of sino-nasal adenocarcinoma was observed among furniture workers exposed to wood dust. This prompted further research which found an excess risk among other workers employed in wood-related industries such as logging, sawmills, furniture making, and carpentry. The highest risk of sino-nasal adenocarcinoma was observed in workers who were exposed to hardwoods such as beech and oak. However, a majority of the research, although examining the risk of cancer, did not specify the type of wood. Furthermore, wood workers are often exposed to mixed woods – not just one. Based on this information, IARC classifies wood dust as a Group 1 human carcinogen. IARC further states that this evaluation was based on workers exposed to hardwood dusts.

Several case-control studies indicate that there may be an excess risk of cancer of sino-nasal adenocarcinoma among workers exposed to softwood dusts. Unfortunately, in some cases there was confounding exposure to hard wood dusts. At this time, studies examining the exposure of softwood dusts and the risk of cancer are inadequate to estimate an OEL. There is however, sufficient data regarding nonmalignant respiratory effects of wood dust.

Upper and lower respiratory symptoms, airflow obstruction (other than asthma), and asthma have been reported in workers exposed to softwood species – particularly Western Red Cedar. Several studies found eye, upper and lower respiratory tract irritation, and altered lung function in sawmill workers exposed to concentrations of softwood dust at levels as low as 0.5 mg/m^3 up to a high of 32 mg/m^3 . One other study of 315 sawmill workers exposed to other softwood dust (such as Douglas fir, Western hemlock, spruce, and balsam) experienced pulmonary function abnormalities and respiratory symptoms at dust levels ranging from 0.1 to 2.7 mg/m^3 . Other studies have demonstrated that the risk of developing asthma to cedar dust increases as wood dust exposure levels increase. For the workers who developed asthma, the levels of exposure were on average less then 2 mg/m^3 .

Based on these studies, workers exposed to softwood dust are still experiencing ill health effects at levels below the recommended TWAEV. It appears the changes to the TLV adopted by the ACGIH in 2004 are well founded. In addition, exposures levels to allergenic species of wood dust should be kept as low as reasonably achievable.

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Additional Substances Recommended for Improved OEL's:

Ozone

The ACGIH has adopted a lower standard for ozone which is based on the degree of physical activity the worker is engaged in:

Heavy work	0.05 ppm
Moderate work	0.08 ppm
Light work	0.10 ppm
All workloads for <2 hrs	0.20 ppm

While we are not convinced of the scientific evidence for the raising of the OEL for periods of less than 2 hours (a modified STEL?), we agree with the need for a more protective OEL for ozone that is graduated for the level of physical activity. We understand that the MOL is reluctant to adopt this ACGIH OEL due to the fact that ambient levels of ozone in Ontario can exceed these levels (particularly on hot summer days when the winds come from the south). It should be noted that the effects of ozone on the health of workers is the same whether the source of exposure is ambient as opposed to originating in the workplace. Despite the ambient source of ozone, employers are still able to take reasonable precautions in the circumstance for the protection of workers. For instance, during high ambient ozone conditions, employers can reduce workloads of outdoor workers to ameliorate the effect of ozone on the lungs (a similar approach is taken for the heat stress/strain TLV). Such a reduction in workload may also be required to address heat stress since high ozone episodes often coincide with hot weather. For indoor workplaces, there are simple adjustments that can be made to outdoor intake (a thin layer of activated charcoal filter) to remove or reduce ozone levels coming into enclosed workplaces. Thus we would challenge the MOL suggestion that an OEL should not be adopted if the ambient air quality conditions might on occasion exceed the OEL. Heat stress would also serve as an example of another exposure which is related to environmental conditions external to the workplace and yet exposure limits are enforced

(http://www.labour.gov.on.ca/english/hs/guidelines/gl_heat.html).

Manganese

The major concern in relation to exposure to manganese is the development of neurological symptoms of hand tremour, reproductive effects, and psychological changes. A review of recent studies over the last 15 years including one conducted in Canada have indicated CNS effects below 0.2 mg/m^3 ⁽¹⁾. A key study which the ACGIH have relied upon for their determination of the TLV has been the study by Roels, et al.⁽²⁾. In this study the authors found that the upper 95th confidence limit of the lifetime integrated exposure metric corresponded to $3.575 \text{ mg/m}^3\text{-yrs}$ of total Mn dust exposure and $0.73 \text{ mg/m}^3\text{-yrs}$ of respirable Mn exposure. Assuming 40 years working life, these values would translate into 0.09 mg/m^3 for total Mn dust and 0.02 mg/m^3 of respirable Mn dust. If one uses the midpoint of the integrated exposure metric instead of the upper 95th confidence limit (as would be more appropriate) these levels would be even lower! In 2003, the ACGIH proposed to further lower the Mn exposure limit to 0.03 mg/m^3 in light of a

calculated LOAEL of between 0.15 and 0.035 mg/m³, however, they specified that this was only applicable to respirable dust. Upon strong objections to the respirable designation (it was considered that non-respirable range particles should be included), they pulled back the recommendation and are in the process of revising it. Despite these ongoing considerations it is quite clear that pre-clinical neurological symptoms can be detected below the current 0.2 mg/m³ TLV, and therefore it is recommended that this level be lowered to at least 0.03 mg/m³ of total Mn dust to prevent the development of such symptoms.

A more recent development concerning the prevention of manganese health effects is the Brescia Declaration:

“On 17-18 June 2006, the Scientific Committee on Neurotoxicology and Psychophysiology and the Scientific Committee on the Toxicology of Metals of the International Commission on Occupational Health (ICOH) convened an International Workshop on *Neurotoxic Metals: Lead, Mercury and Manganese – From Research to Prevention (NTOXMET)* at the University of Brescia. Scientists and physicians from 27 nations participated. Data were presented for each of the three metals on environmental sources, fate and distribution; human exposure; clinical, subclinical and developmental neurotoxicity; epidemiology; risk assessment; and prospects for prevention. Ongoing and future studies were described and discussed.

...
The current occupational exposure standard may not protect workers against subclinical neurotoxicity. The value for air manganese concentration in inhalable/total dust of 100 µg/m³ should be adopted to protect the workers from prolonged exposure and consequent long-term effects.” (www.ntoxmet.it/declaration.pdf)

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Particulates Not Otherwise Classified (PNOC's)

An unpublished paper by Mermelstein and Kilpper titled "Xerox Exposure Limit for Respirable Dust (N.O.S.)" suggests that in order to prevent this overloading of the lung's defences, the exposure level to "nuisance" dust should be kept below 0.4 mg/m³ of respirable dust^(1,2).

In another paper⁽³⁾, the researchers retained by Xerox, calculated a 1 mg/m³ respirable dust OEL but then suggested lowering this value by applying a safety factor since the calculation is conservative and leaves no allowance for errors in the assumptions. This would result in a greater than 10 fold reduction in the present OEL (occupational exposure limit). This paper also references Xerox's exposure limit for respirable dust of 0.4 mg/m³. While Xerox internally experienced much apprehension when it stated its intent to implement this much reduced OEL for respirable PNOC's, they have largely been successful in implementing it and have even

noticed a side benefit of improved morale due to the stringent housekeeping and exposure control needed to achieve this limit. There have been reports however, of workers who still experience symptoms even when this lower exposure limit is achieved.

Susan Woskie⁽⁴⁾ reviewed the issues around the exposure standards for particulate in an article. In this review she suggests that using established models, 4 years of exposure to 0.25 mg/m³ would lead to an accumulated dust burden in the lungs equivalent to the amount causing a 50% decline in lung clearance. Similarly, J. N. Pritchard⁽⁵⁾ suggested the TLV of 10 mg/m³ is two orders of magnitude (i.e. 100 X) too large.

An article by Chestnut et al.⁽⁶⁾ provides some environmental epidemiological support for the recommendations to lower the nuisance dust OEL. This paper suggests that a significant decrease in forced vital capacity (FVC) is associated with exposures to total suspended particulate 121 µg/m³ (i.e. 0.121 mg/m³) and suggested the threshold for this health effect was at a level of 60 µg/m³ (i.e. 0.06 mg/m³). It should be emphasized that these dust measurements include materials other than insoluble mineral dust. It should also be noted that these levels are total dust concentrations. These findings have since been corroborated by numerous other studies⁽⁷⁾ of ambient particulate and various health parameters.

An occupational epidemiological study related to this issue was published by N.S. Seixas et al.⁽⁸⁾, in which they reviewed the exposure of coal miners to respirable coal dust since 1970. The authors found a significant association of obstructive lung disease with cumulative respirable dust exposures of 20 mg/m³-years or more. Assuming a 45 year working life this cumulative respirable dust exposure would translate into a 0.44 mg/m³ average lifetime exposure after which a significant health effect would be expected. Again it should be noted that coal dust is not considered a “nuisance” dust due to its silica content. However, it does seem to corroborate well with the animal study-based OEL recommendations. As a note of interest, the ACGIH in 1997 adopted a change to its TLV for coal dust lowering it from 2.0 mg/m³ to 0.4 mg/m³ for anthracite, and, to 0.9 mg/m³ for bituminous coal (assuming less than 5% silica content).

A more recent review⁽⁹⁾ has focussed in on the increased toxicity associated with ultrafine particulate, reinforcing previous recommendations for reductions in the PNOC exposure limits.

Given the evidence highlighted, the Ministry of Labour should seriously consider the need to lower the PNOC respirable dust OEL for the protection of the health of Ontario workers.

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Metalworking Fluids

Metalworking fluids were not on the list for updating, however, OHCOW's experience with workers affected by MWF and our own participation in MWF research has brought the need for a new OEL to our attention.

There have been three main published studies of cross-shift decrements of FEV₁ among metalworking exposed workers. Kennedy et al. found effects (5% cross-shift decrement) above a threshold of 0.2 mg/m³⁽¹⁾. Kriebel et al., found effects (5% cross-shift decrement) at exposures above 0.15 mg/m³⁽²⁾. Robbins et al. found effects (10% cross-shift decrement) among a group of workers exposed to an average of 0.41 mg/m³⁽³⁾.

With respect to occupational asthma, Kennedy et al. found significant new bronchial hyper-reactivity among apprentices after two years of exposure to an average exposure of 0.46 mg/m³⁽⁴⁾. Rosenman et al. reporting from data from an occupational asthma surveillance system in Michigan found metalworking fluids to be one of the major causes of reported occupational asthma⁽⁵⁾. Follow-up sampling showed all workplaces were below the 5 mg/m³ exposure limit. Eisen et al.⁽⁶⁾ found that exposure to 1 mg/m³ of mineral oil mist had the same impact as smoking on FVC.

Our own work has shown similar comparisons with respect to respiratory symptoms⁽⁷⁾. NIOSH has recommended an exposure limit of 0.5 mg/m³⁽⁸⁾ recognizing that health effects have been confirmed below this level. GM Canada has an agreement with the CAW that all new metalworking process installed will meet a 0.5 mg/m³ exposure standard and that exposures related to existing processes will not exceed 1 mg/m³. Given the current Ontario OEL of 5 mg/m³, and given the large number of Ontario workers exposed to metalworking fluids, furthermore, given the OHCOW clinics experience with patients with lung problems due to metalworking fluids, we would strongly recommend adopting the new proposed ACGIH TLV of 0.2 mg/m³ for mineral oil in metalworking fluids.

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Diesel Exhaust

The ACGIH⁽¹⁾ in 2002 proposed a TLV (TWAEV) of 20 µg/m³ measured as elemental carbon (the proposal was withdrawn⁽²⁾ in 2003 and never replaced). NIOSH⁽¹⁾ in 1988 recommended that diesel exhaust be treated as a human carcinogen. NIOSH suggests⁽²⁾ that occupational exposures be controlled to as low as feasible. In essence, they require that sampling be done in unexposed areas, for example, the air outside the building, and that levels inside the building not exceed those of outside. The US EPA estimates that the ambient outdoor level of diesel exhaust (<10 µm particle size measured by elemental carbon) would be up to 1-3 µg/m³⁽⁴⁾. Thus, NIOSH effectively recommends a level below 1 µg/m³.

NIOSH has published a method⁽⁵⁾ which they recommend to be used to measure the elemental carbon associated with diesel exhaust so as to distinguish it from other carbon sources such as cigarette smoke. In their analysis of exposures in the trucking industry NIOSH⁽⁶⁾ estimated that a 13 µg/m³ working life exposure was associated with a 1-2% (10-20/1000) excess risk of lung cancer above the 5% background lung cancer risk.

The EPA⁽⁴⁾ has developed a reference concentration (RfC) for diesel exhaust of 5 µg/m³ of DPM (roughly equivalent to 3.1-6.6 µg/m³ of diesel exhaust as determined by elemental carbon) which was derived on the basis of dose-response data on inflammatory and histopathological changes in the lung from rat inhalation studies. .

Finally, there is the question of exposure to other gases (sulphur compounds, other nitrogen oxides, VOC's, etc.). The EPA⁽⁴⁾ states "Effects of DE exposure could be additive to or synergistic with concurrent exposures to many other air pollutants. ... (e.g., potentiation of

allergenicity effects, potentiation of DPM toxicity by ambient ozone and oxides of nitrogen)” (page 1-7).

Given the ubiquitous exposure to diesel exhaust among Ontario workers, we would strongly recommend the Ministry of Labour adopt at minimum the 2002 ACGIH proposed TLV if not the NIOSH Recommended Exposure Limit.

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