Predict Worker Exposure in Minutes using New Exposure Calculator

The vast majority of worker exposures are never sampled. And who can blame them when you consider the cost of sampling? Most exposures are not assessed because of a lack of a convenient and reliable way to estimate exposure. Most workplaces don't have the training to perform a credible worker assessment and simply don't know where to start.

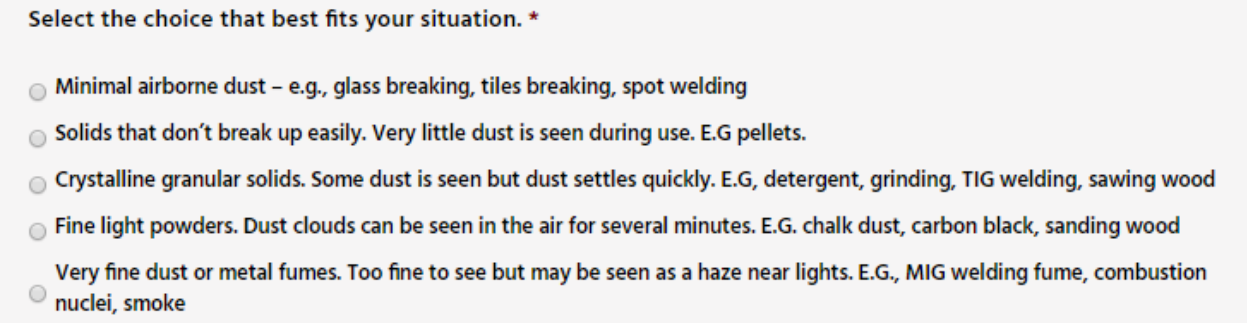
Occupational Hygienists have these skills. But is there a way for companies to perform an assessment themselves? In the same manner that take-home tax program let the average person work through the daunting process of income tax, can an easy to use program that asks the right questions and weights the answers correctly be used to provide an estimate of worker exposure?

Develop by an Occupation Hygienist as part of the Safety in Numbers program (www.safetyinnumbers.ca), Exposure calculators have been developed to estimate worker exposure. Answer 6 questions and the exposure is predicted as falling into a range of exposures relative to the OEL. The exposure bands with recommended actions for each band are shown in the figure below.

Exposure Bands

Exposure Rating	Recommended Action / Follow Up
< 1% of OEL	No Action
1 - 10% of OEL	General WHMIS Training
10 - 20% of OEL	+ Specific training on hazards of product
20 - 100% of OEL	+ periodic exposure monitoring
> 100% of OEL	+ respiratory, engineering or other controls
multiples of OEL	greater respiratory protection or process shutdown, introduce improved engineering controls

There are two Exposure Calculators: one for liquids and one for dusts. The questions vary somewhat to take into account the different physical forms. However, each question comes with help and you simply click on the option. A dust question is shown below.



Real Life Example: Application of isocyanate product

A product containing **Methylene Bisphenyl Isocyanate** is spread out on a surface for a1 - 2 hours over the course of the day. There is no specific ventilation and the worker does not use any respiratory protection. What would the worker's exposure be?

The exposure calculator is used to predict the exposure. You simply answer questions about how long the task performed, workers position, Vapour Hazard Ratio of product, etc. Each question comes with a guide and you simply select the best answer. The options for worker position are shown below.

How close a worker is to any fugitive emission is a significant metric of the magnitude of the worker's exposure.

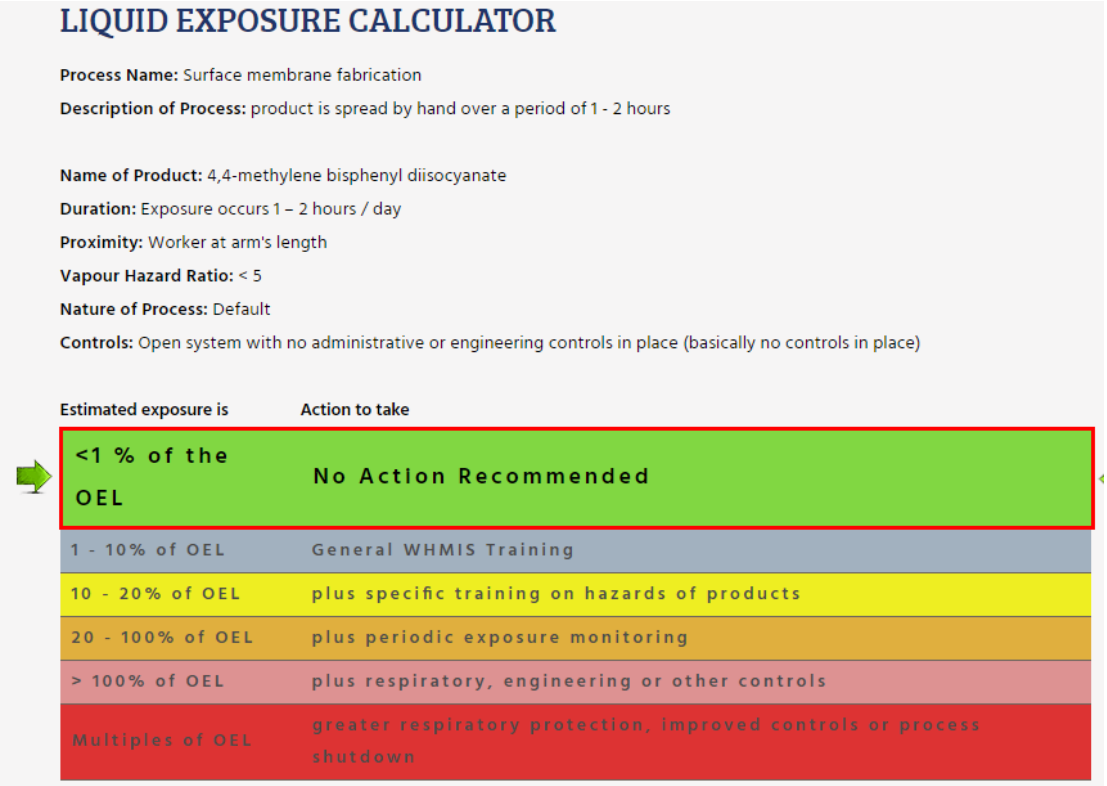
Worker is Nearby | Arm's length | Directly in Emission

Select one of the choices below that best fits your scenario. *

- ○ Intermittently nearby
- ○ Worker is consistently nearby
- ◉ Worker at arm's length
- ○ Worker is directly in emission

Previous | Next

The predicted exposure is shown as falling into an exposure band. The exposure bands are based on recommended action. A screen shot from the Exposure Calculator is shown below. It lists the assumptions entered into the calculator and the predicted band of exposure.



LIQUID EXPOSURE CALCULATOR

Process Name: Surface membrane fabrication

Description of Process: product is spread by hand over a period of 1 - 2 hours

Name of Product: 4,4-methylene bisphenyl diisocyanate

Duration: Exposure occurs 1 – 2 hours / day

Proximity: Worker at arm's length

Vapour Hazard Ratio: < 5

Nature of Process: Default

Controls: Open system with no administrative or engineering controls in place (basically no controls in place)

Estimated exposure is	Action to take
<1 % of the OEL	No Action Recommended
1 - 10% of OEL	General WHMIS Training
10 - 20% of OEL	plus specific training on hazards of products
20 - 100% of OEL	plus periodic exposure monitoring
> 100% of OEL	plus respiratory, engineering or other controls
Multiples of OEL	greater respiratory protection, improved controls or process shutdown

The laboratory results gave a concentration of 0.3 ug/m3 compared to an OEL of 51 ug/m3. This equates to about 0.5% of the OEL

Lab ID: W145011001 Sample ID: AGUARO CARAKU Media: Treated Glass Fiber Filter (Isoc Sample Date: 5/23/2018 Sampling Time:

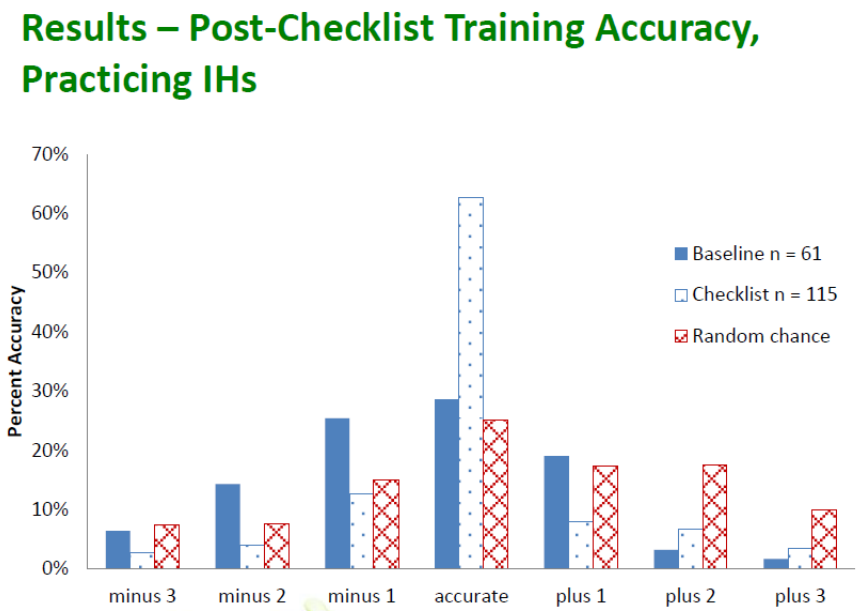
Analyte	Method	Analysis Date	Volume		Reporting Limit	Front	Rear	Total	Concentration	
4,4-Methylene Bisphenyl Diisocyanate	OSHA 47M	06/04/18	470	L	0.12 ug			0.129 ug	0.276 ug/M3	0.027 ppb

How Reliable is it?

This is an example but we do quite a bit of air testing at Winnipeg Air Testing and have been back-checking the Exposure Calculator against actual sampling results. We believe that the process is a credible approach to potential worker assessment and more accurate than professional judgement.

Information from the AIHA Assessment group shows that the use of a checklist (there specific questions are used and weighted accordingly can be much more accurate than professional judgement. A figure taken from the 2017 Exposure Assessment PDC in Seattle is shown below. It shows the accuracy of putting an exposure in the correct

exposure band. Plus 1 means that the predicted exposure band was one higher than the "correct" exposure band based on sampling data.



No process is going to be correct every time. The Exposure Calculator is trying to balance the simplicity of the system against the accuracy. Six simple questions and about 2 minutes to work your way through it and you have a reasonable prediction of worker exposure. Again, we have compared (and to continue to compare) predicted exposures to actual lab results in a wide range of activities and settings and believe that it provides a reasonable estimate of worker exposure. Ideally, we would like to have the system used by a) other Hygienists and b) non-hygienists in a study to see how good it works. This could best be done by simply having Hygienist run the calculator against exposure scenarios that they have sampling results for. No need to know company names or any other information that might identify the company or client. Feedback could be as simple as a copy of the summary page from the Exposure Calculator and the actual sampling data (we don't need a copy of the lab results – just the measured concentration). It would also be interesting to others would predict the exposure band based only on their own professional judgement.

Any questions or comments would be appreciated.

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