



# Occupational Hygiene Case Study – Industrial Degreasing Operation

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## OUR OBJECTIVE

- Briefly describe the work activities of an R&O operation, specifically the degreasing operation
- History of exposures in the degreasing operation
- Controls put in place by company to reduce exposures
- Impact of those changes
- Company's final solution to control exposure

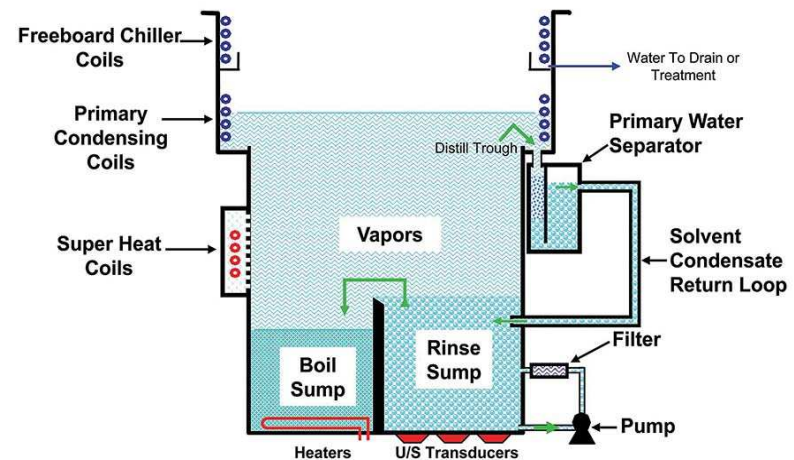


## BACKGROUND INFO

- Company is involved with repair and overhaul of transportation parts
- They receive parts scheduled for regular PM as well as damaged parts from their clients
- They have various operations including disassembly, abrasive blasting, deburr, machining, plating, painting, NDT, assembly, etc.
- Completely strip parts into components, remove paint, test parts, replace parts as needed, re-plate and paint, and then reassemble
- Vapour degreaser is used to clean parts, including disassembled parts from the field and in order to prep for other internal work

# VAPOUR DEGREASER

- The vapour degreaser uses a solvent to dissolve contaminants on a part so that the contaminants will drip off the part
- The solvent is heated with the lid closed to cause the solvent to evaporate and form a vapour
- The solvents are heavy than air so they fill the tank
- The chillers cool the vapour and they condense the solvent back to a liquid, which is collected in the degreaser and re-used
- Typical solvents are halogenated organic solvents



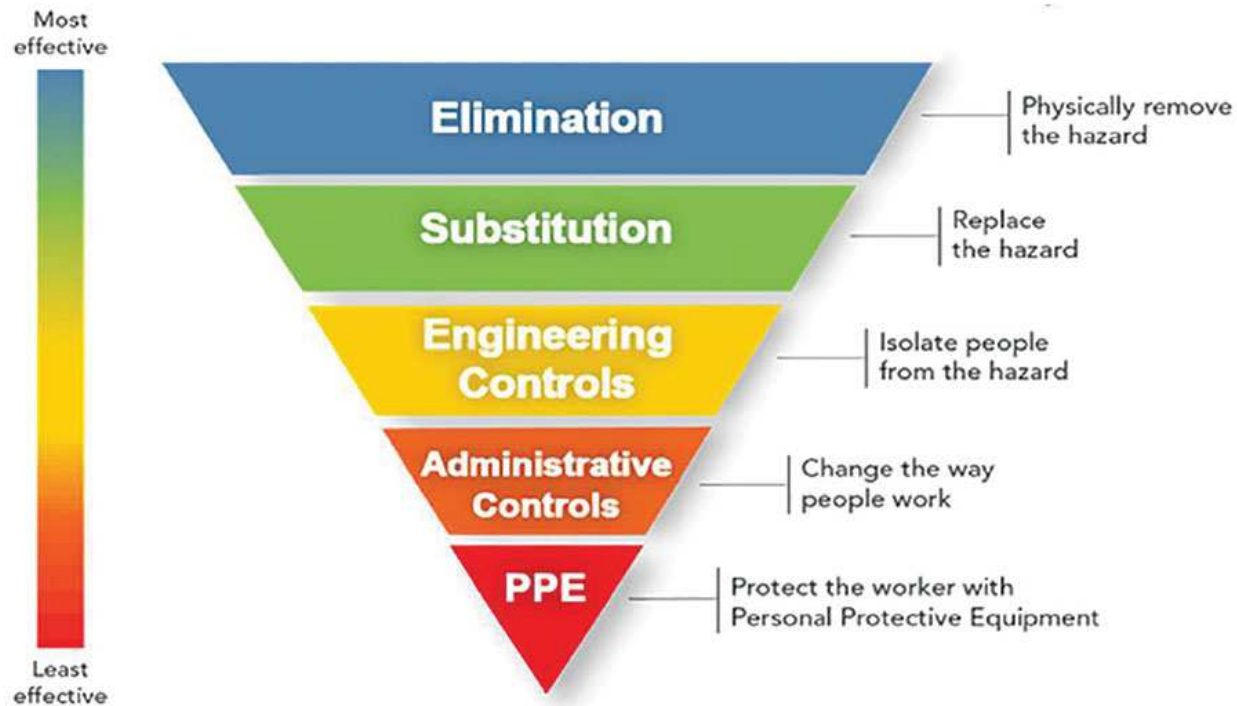
## VAPOUR DEGREASER

- Smaller parts can be placed in a bin and placed in the degreaser with the lid closed to help reduce fugitive emissions.
- Medium sized parts can be suspended inside the degreaser from the overhead crane with the lid close. Only a small gap in the lid for the suspended straps.
- Some parts are too large to entirely place in the degreaser, therefore the lid remained open, allowing for some fugitive emissions.
- Local exhaust ventilation (LEV) present to help reduce fugitive emissions from the degreaser.
- They had some clients that specified that n-propyl bromide has to be used as a degreasing solvent.

## OCCUPATIONAL EXPOSURE LIMITS

- In Ontario, occupational exposure limits (OELs) are established in the regulation, The Control of Exposure to Biological or Chemical Agents (R.R.O. 833/90)
- This regulation establishes 8-hour time-weighted average (TWA) limits for many chemicals
- These represent the average exposure that nearly all workers can be repeatedly exposed to, day after day, over a working lifetime, without adverse health effects
- Many OELs in Ontario are taken from the ACGIH TLV and BEI booklet

# HIERARCHY OF CONTROLS





## NOVEMBER 2008 AIR MONITORING SURVEY

- n-Propyl bromide (nPBr) used as the degreasing solvent in the vapour degreaser.
- The Ontario 8-hour TWA limit was 10 ppm.
- ACGIH 8-hour TWA-TLV was also 10 ppm.
- Degreaser operator's TWA exposure was 10 ppm with an area concentration of 11 ppm.
- Operator wore a half-facepiece respirator with an organic vapour (OV) cartridge.
- This respirator has an assigned protection factor (APF) of 10, meaning it can be worn in environments of up to 100 ppm nPBr.





## AUGUST 2010 AIR MONITORING SURVEY

- Site had switched to trichloroethylene (TCE) as the solvent in the vapour degreaser to trial the solvent.
- The Ontario 8-hour TWA limit was, and currently is, 10 ppm.
- ACGIH 8-hour TWA-TLV was, and currently is, 10 ppm.
- 8-hour TWA exposure of 19 ppm with an area concentration of 12 ppm.
- Degreaser worn half-facepiece respirator with OV cartridges which allows exposures up to 100 ppm of TCE.



## AUGUST 2011 AIR MONITORING SURVEY

- Site had switched back to nPBr as the solvent in the vapour degreaser.
- The Ontario 8-hour TWA limit was 10 ppm.
- ACGIH 8-hour TWA-TLV was 10 ppm, but with a 2011 notice of intended change (NIC) to reduce TWA-TLV to 0.1 ppm.
- 8-hour TWA exposure of 27 ppm with area concentration of 18 ppm.
- Areas adjacent to the degreasing area had nPBr concentrations ranging from 3 ppm to 7.5 ppm.



## DECEMBER 2013 AIR MONITORING SURVEY

- Improvements to the degreaser LEV to help reduce nPBr exposures.
- The Ontario 8-hour TWA limit was 10 ppm.
- ACGIH 8-hour TWA-TLV was reduced to 0.1 ppm.
- 8-hour TWA exposure of 14 ppm with an area concentration of 10 ppm.
- Areas adjacent to the degreasing area had nPBr concentrations ranging from 3.8 to 8.6 ppm.
- Suspected that new LEV was drawing nPBr vapours away from degreasing area and into surrounding areas.



## SEPTEMBER 2014 AIR MONITORING SURVEY

- Degreasing area enclosed with plastic sheeting from floor to ceiling (not air tight or completely sealed) and adjustments to LEV of Degreaser and surrounding areas were made.
- 8-hour TWA exposure of 25 ppm with an area concentration of 35 ppm.
- Operator wore a full-facepiece supplied air respirator (SAR).
- This respirator has an APF of 1,000, meaning it can be worn in environments of up to 10,000 ppm nPBr (compared to MOL TWA limit) or 100 ppm (compared to ACGIH TLV-TWA).
- Areas adjacent to the degreasing area had nPBr concentrations ranging from 0.56 to 3.6 ppm.
- Changes increased concentration in the degreasing area and lowered concentration in the adjacent areas.



## NOVEMBER 2015 AIR MONITORING SURVEY

- The enclosure around the degreasing area was improved and time was limited inside degreasing area.
- 8-hour TWA exposure of 72 ppm with an area concentration of 160 ppm.
- Operator wore a full-facepiece SAR.
- Areas adjacent to the degreasing area had nPBr concentrations ranging from 0.64 to 1.8 ppm.
- Changes significantly increased concentration in the degreasing area and further lowered concentration in the adjacent areas.



## MARCH 2016 AIR MONITORING SURVEY

- Adjustments to LEV of Degreaser (more than double exhaust rate). Time in degreasing area continue to be limited.
- 8-hour TWA exposure of 44 ppm with an area concentration of 58 ppm.
- Operator wore a full-facepiece supplied air respirator.
- Areas adjacent to the degreasing area had nPBr concentrations ranging from 3.1 to 26 ppm.
- New LEV system in adjacent area significantly increased the concentration in this area. Respirators were implemented in the adjacent area.



## MAY 2016 AIR MONITORING SURVEY

- LEV in degreasing area lowered to 2015 levels. Time in degreasing area continue to be limited. Changes to the LEV system of the adjacent work area.
- 8-hour TWA exposure of 21 ppm with an area concentration of 57 ppm.
- Operator wore a full-facepiece supplied air respirator.
- Areas adjacent to the degreasing area had nPBr concentrations ranging from 0.12 to 0.17 ppm.
- Changes in LEV reduced exposures in adjacent areas.



## NOVEMBER 2017 AIR MONITORING SURVEY

- Changes to the adjacent operations, which moved some of the LEV systems away from the degreasing operation.
- MOL had proposed adopting the ACGIH TLV-TWA of 0.1 ppm.
- 8-hour TWA exposure of 46 ppm with an area concentration of 31 ppm.
- Operator wore a Powered-air purifying respirator with an OV cartridge, which has an APF of 1,000.
- Areas adjacent to the degreasing area had nPBr concentrations ranging below 0.1 ppm.
- Change of plant layout reduced nPBr concentrations in adjacent areas to acceptable levels.





## DECEMBER 2017 AIR MONITORING SURVEY

- Site had switched to dichloroethylene (DCE) as the solvent in the vapour degreaser to trial the solvent.
- The Ontario 8-hour TWA limit was, and currently is, 200 ppm.
- ACGIH 8-hour TWA-TLV was, and currently is, 200 ppm.
- 8-hour TWA exposure of 38 ppm with an area concentration of 46 ppm.
- Degreaser worn PAPR with OV cartridges.
- Areas adjacent to the degreasing area had DCE concentrations that were below detectable levels (less than 0.06 ppm).



## MAY 2018 AIR MONITORING SURVEY

- DCE was still used as the solvent in the vapour degreaser and they installed a smaller degreasing unit with DCE so the large degreaser didn't need to be used for smaller parts.
- nPBr still used for client required specific parts. Used a drum of this solvent instead of the solvent degreasers.
- Ontario had adopted the ACGIH 8-hour TWA-TLV of 0.1 ppm for nPBr.
- 8-hour TWA exposure of DCE was 15 ppm with an area concentration of 11 ppm.
- 8-hour TWA exposure of nPBr was 0.21 ppm with an area concentration of 0.18 ppm (only one part used).



## MAY 2018 AIR MONITORING SURVEY

- Degreaser worn SAR with loose fitting hood.
- This respirator has an APF of 1000, meaning it can be worn in environments of up 20,000 ppm DCE and 100 ppm nPBr.
- Areas adjacent to the degreasing area had DCE concentrations that were below detectable levels (less than 0.06 ppm).
- Areas adjacent to the degreasing area had nPBr concentrations below detectable limits (less than 0.03 ppm)
- End of story??

# QUESTIONS?



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