European Work Hazrds Network
29.sept. 2006

Personal Protective Equipment (PPE)

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SAFE

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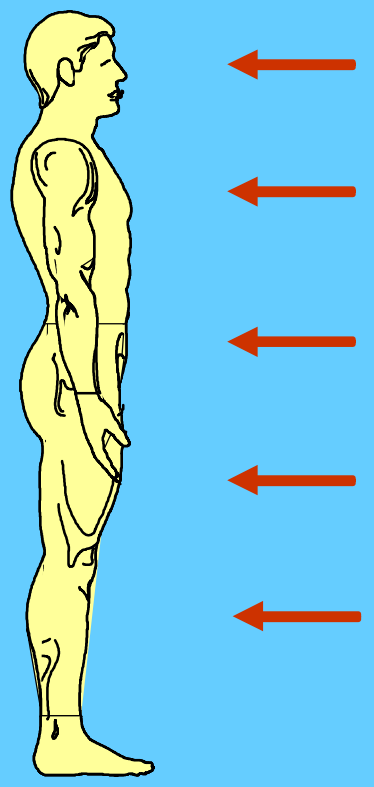
Routes of Exposure



Eyes

Respiratory system

Digestion

Skin uptake

Other routs

Working environment kills

Foto hentet fra boken "The quiet sickness. A phographic chronicle of hazardous work in America"
Earl Dotter. 1998, ISBN 0-932627-85-4. American Industrial Hygiene Association

Chemicals are developed and produced under under safe conditions, but where do they end?

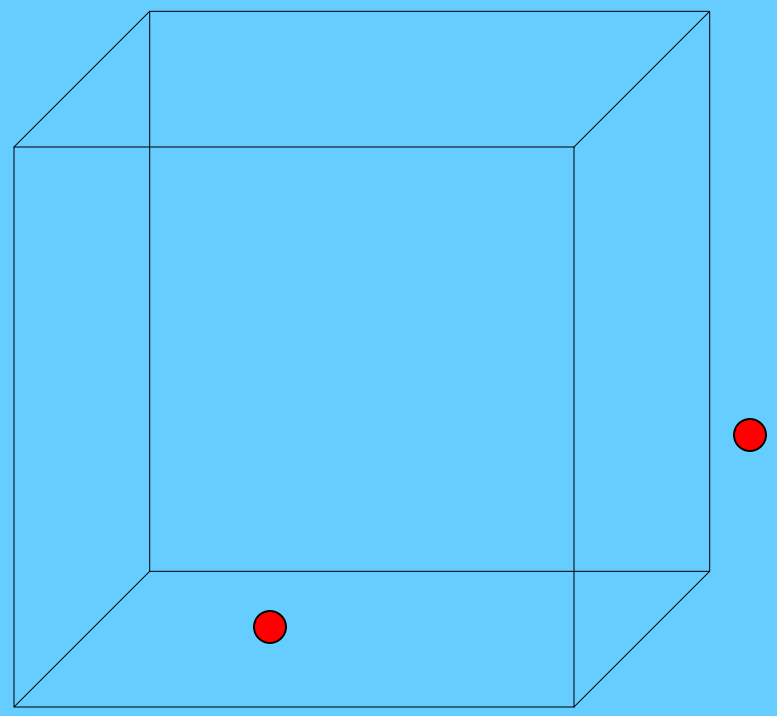
Maybe here?

Or here?

Occupational exposure limets (OEL)

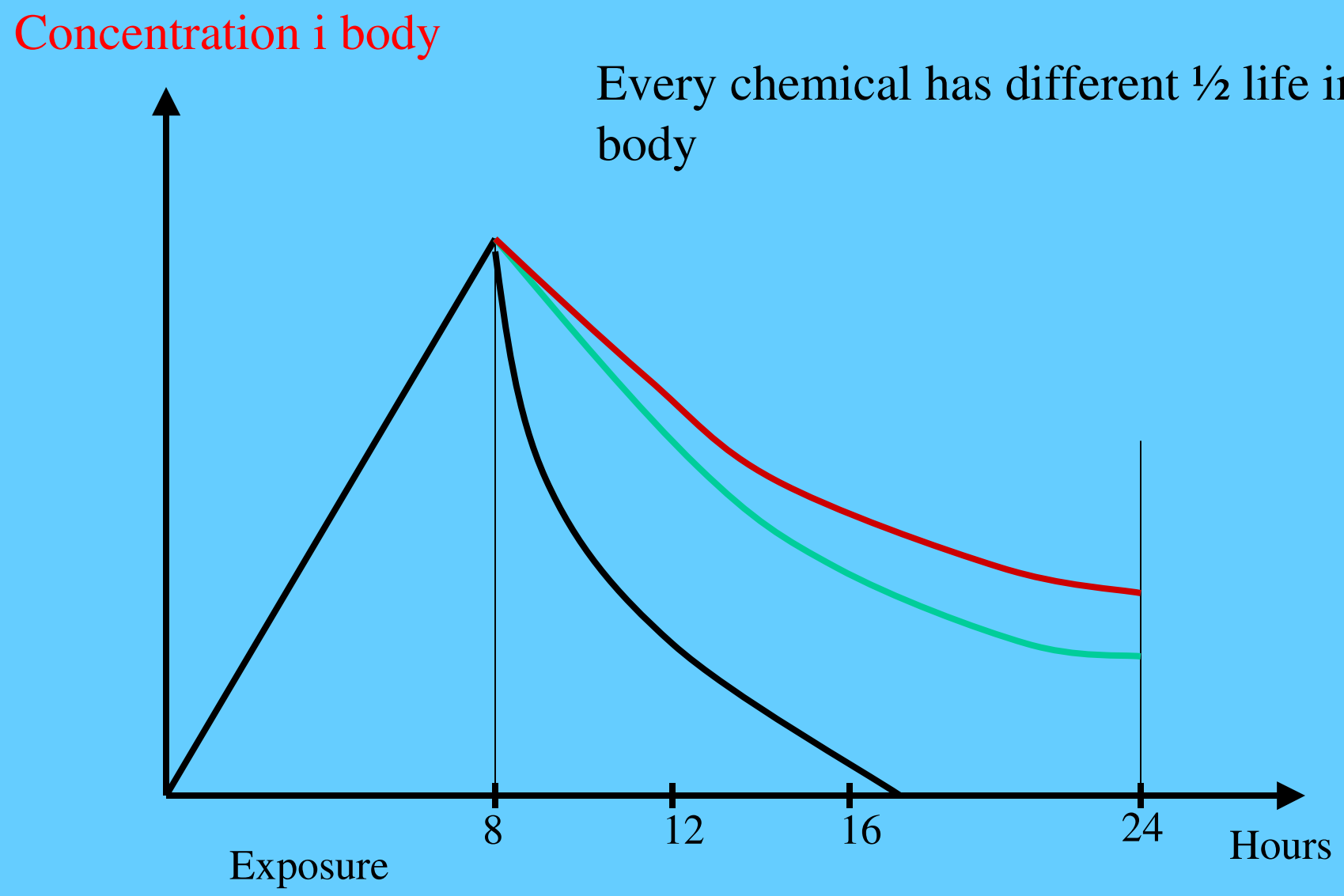
parts pr. million (ppm)

1 m^3 = 1000 litre



1 volume % = 10.000 ppm

1 ppm is 1 cm^3 (1 millilitre) diluted in 1m^3. The weight is in (mg/m^3)


Concentration i body
Every chemical has different ½ life in the body
8
12
16
24
Hours
Exposure

Different Occupational Exposure Level

- TLV (US)
- MAK (Germany)
- OEL (UK)
- Administrative normer (Norway

The Hazard ladder

Concentration		Compound
parts pr. **million** (ppm)	**Volume** %	
1.000.000	100	**UEL, LEL. Upper/Lower Expl. Level**
100.000	10	**Carbon monoxide (74 UEL)**
10.000	1	**Methanol (36 UEL)**
1.000	0,1	**Methane (15,0 UEL)**
100	0,01	**Carbon monoxide (12,5 LEL)**
10	0,001	**Propane (9,5 UEL)**
1	0,0001	**Benzene (7,9 UEL)**
0,1	0,00001	**Xylene (7,0 UEL)**
0,01	0,000001	**Methanol (6,0 LEL)**
0,001	0,0000001	**Methane (5,0 LEL)**
		Propane (2,1 LEL)
		Benzene (1,3 LEL)
		Xylene (1,0 LEL)
		Norwegian OEL
		Methanol (100 ppm) Skin
		Xylene (25 ppm) Skin
		Carbon monoxide (25 ppm)
		Ammonia NH_3 (25 ppm)
		Dichlormethane (15 ppm) Carcinogen
		H_2S (10 ppm) Ceiling
		Hydrochloric acid HCl (5 ppm) Ceiling
		Hydrocyanic acid HCN (5 ppm) Skin,
		Nitrogen dioxide NO_2 (2 ppm) T
		Benzene (1,0 ppm) K
		Hydrofluoric acid HF (0,8 ppm)
		Ozone (0,1 ppm)
		Phosgene (0,05 ppm) Ceiling
		Diisocyanates (0,005 ppm) Allergy

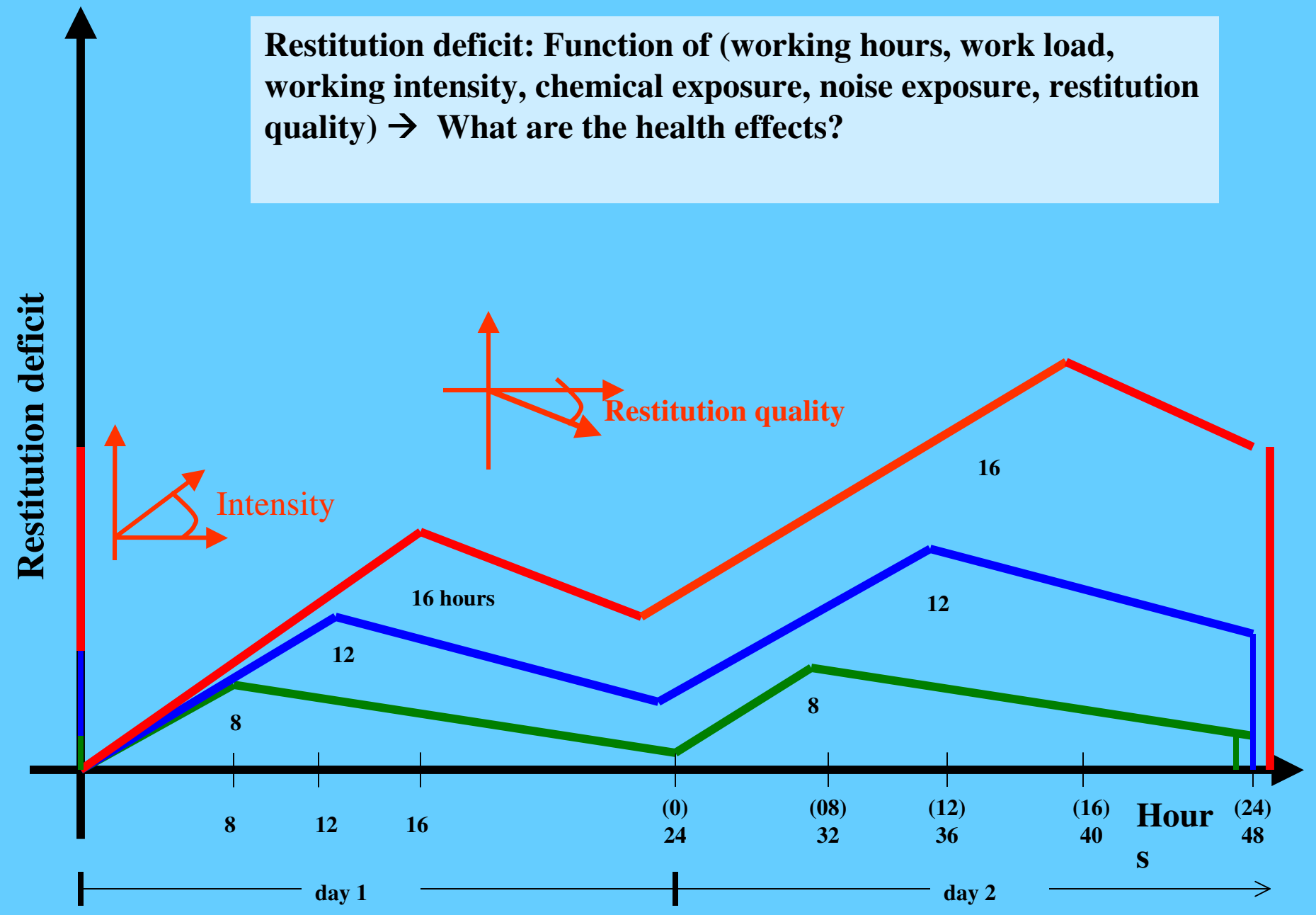
Ref; “Adm.norm” Bestnr. 361 (2001), Eksplosjonsgrenser hentet fra “NIOSH Pocket Guide to Chemical Hazards (1990) og “Sources of Ingition” (J.Bond 1991)

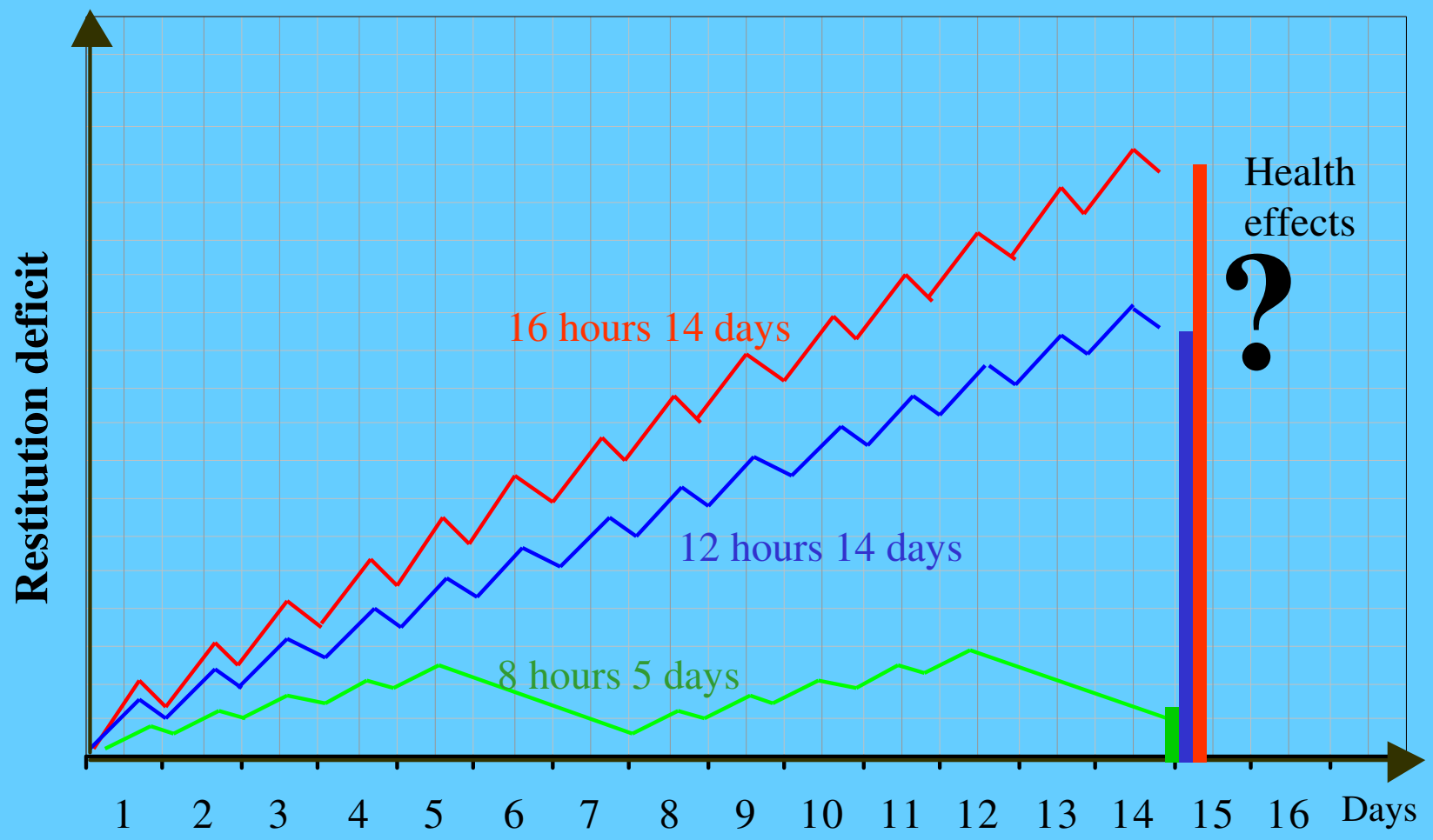
Restitution deficit will be a function of;

- Work length 8 / 12 / 16 / …… hours
- Number of subsequent days of working
- Day/night, circadian rhythme
- Work load
    - Work intensity
    - Work load
    - Psycological factors
    - + + + + + ? ?
- Restitution quality
  - Duration of restitution 8 / 12 / 16/ hours…
  - Sleep quality, sleep length, circadian rhythme
  - + + + + ? ?
- Exposure
  - Chemicals
  - Noise
  - + + + ? ?

And a combination of everything!!

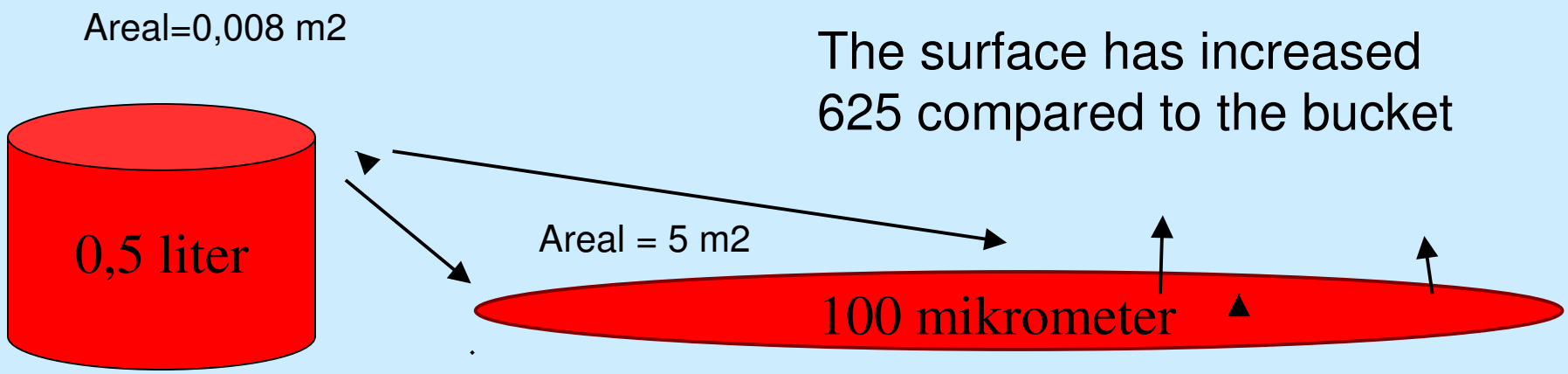
Restitution deficit: Function of (working hours, work load, working intensity, chemical exposure, noise exposure, restitution quality) → What are the health effects?



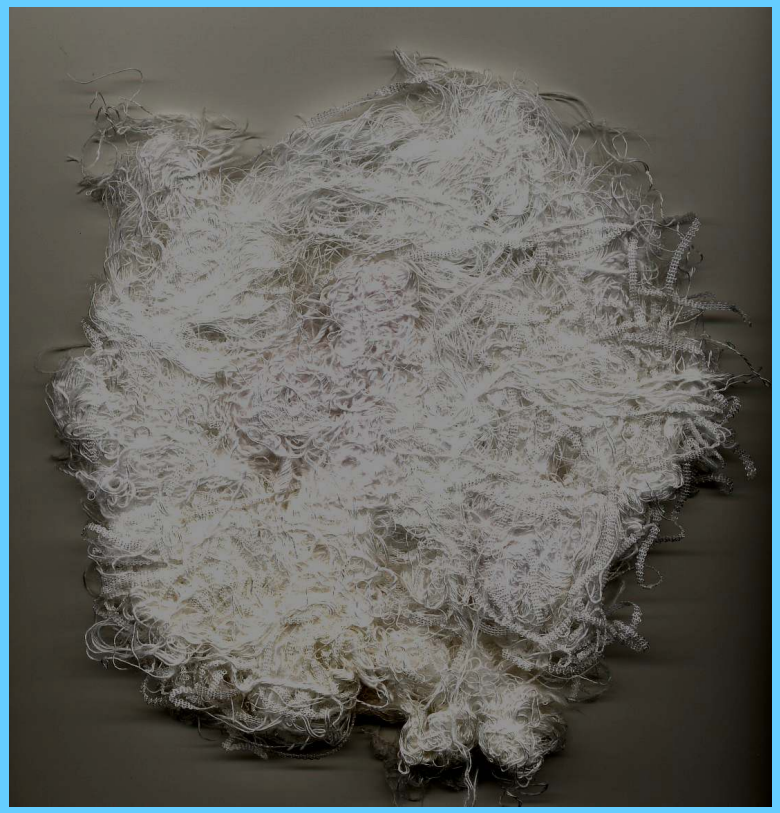

Restitution deficit
16 hours 14 days
12 hours 14 days
8 hours 5 days
Health effects
?
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
Days

Source strength

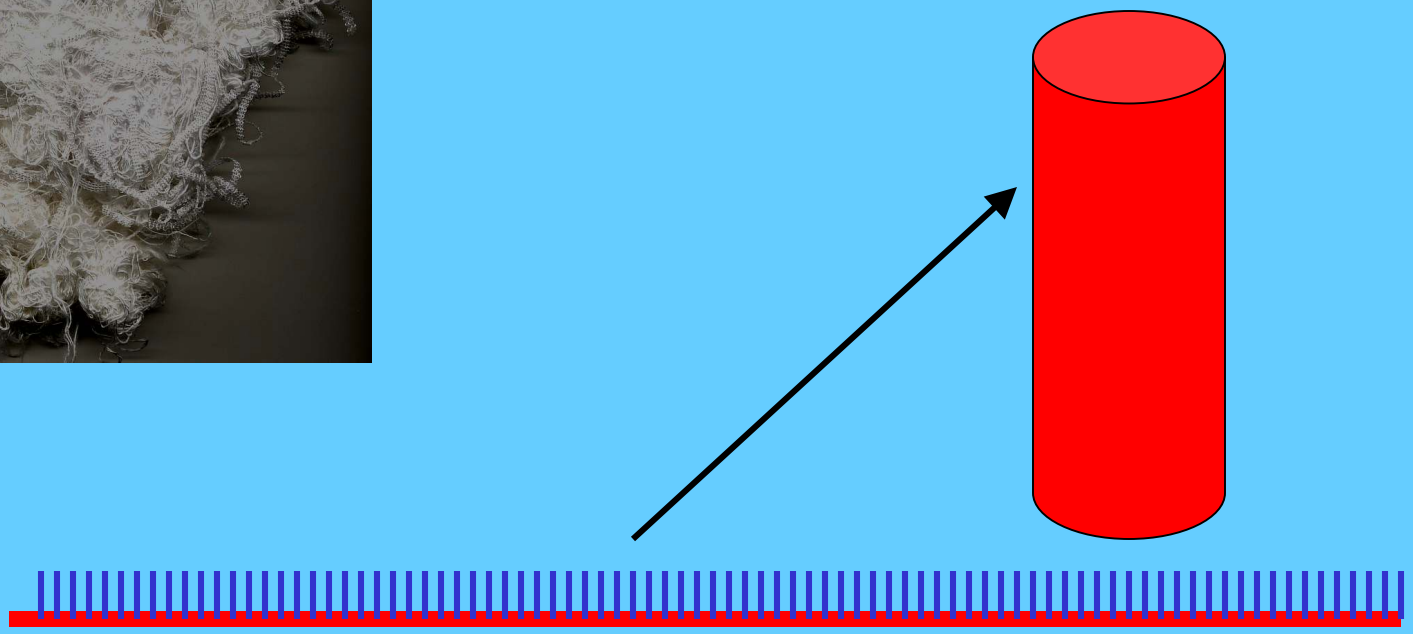
Increace in surface



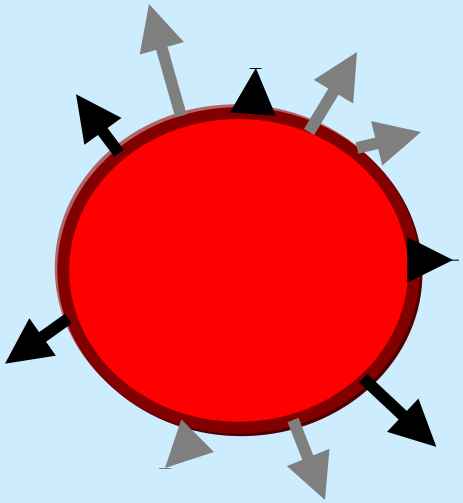
The surface has increased
625 compared to the bucket

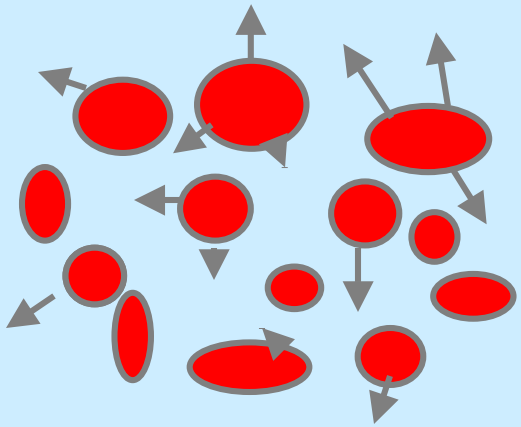


Extreme increase in surface when the chemical is spread on the fibers



Aerosols



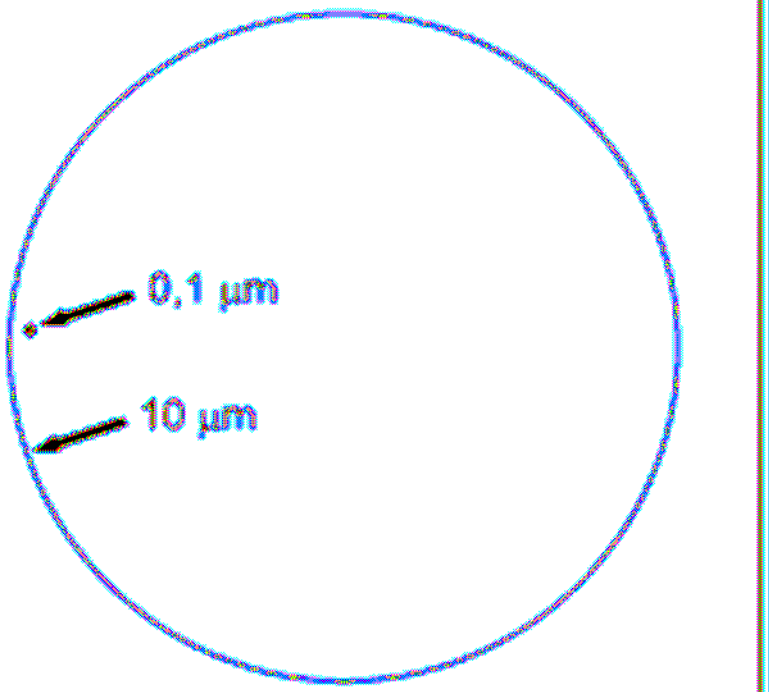


- 1cm^3 split to 2 mikrometer increase the surface 10.000.000 times

Baisbog i teknisk arbejdshygiejne, Thomas Schneider, 1986, side 32

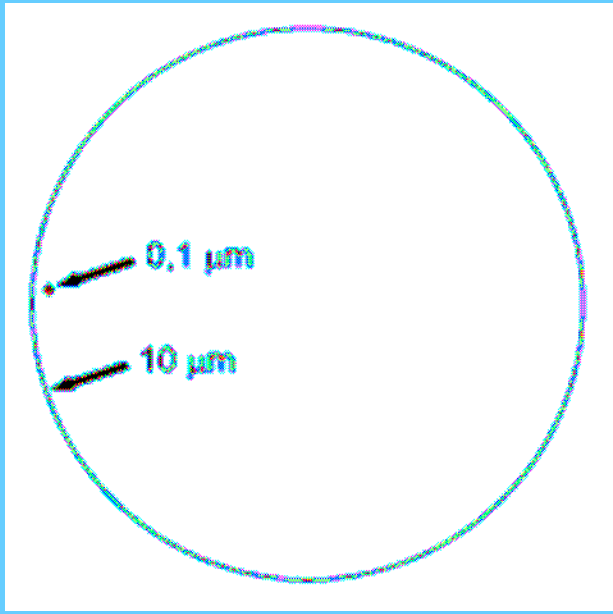
Seize of aerosols

- A person can spot a single particle at about 50 micrometer.
- Smaller particles are only visible in strong light.
- Particles less than 10 micrometer will be seen as fog.

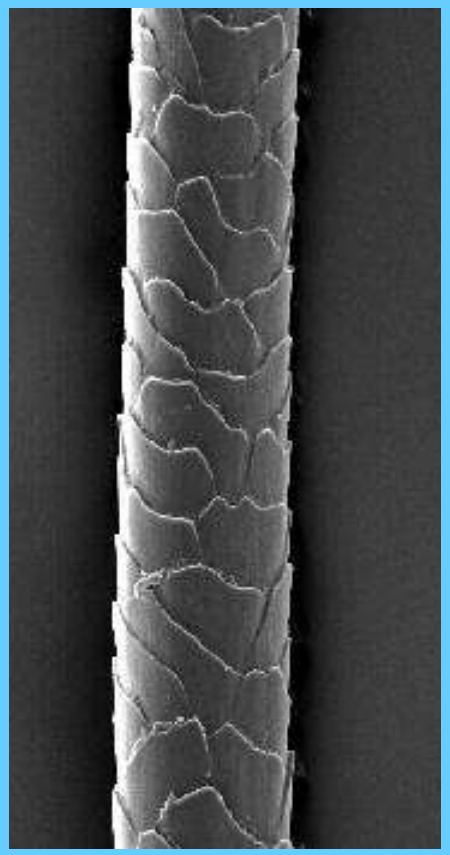


Figur 1 Forholdet mellom en partikkel med diameter på 0,1 µm (om lag som en dieseleksospartikkel) og en partikkel på 10 µm (for eksempel piggdekkstøv)

Relative surface and relative number for a given weight of spherical particles with different diameter		
Diameter Micrometer	Relative surface	Relative number
10	1	1
2,5	4	64
1,0	10	1000
0,1	100	1000.000



Seize of aerosols II



- Hair 60 –100 mikrometer.
- Bacteria 0,3 – 50 mikrometer
- Virus 0,01 - 0,05 mikrometer.

- Particles with aerodynamic diameter less than 10 mikrometer are suspended dust

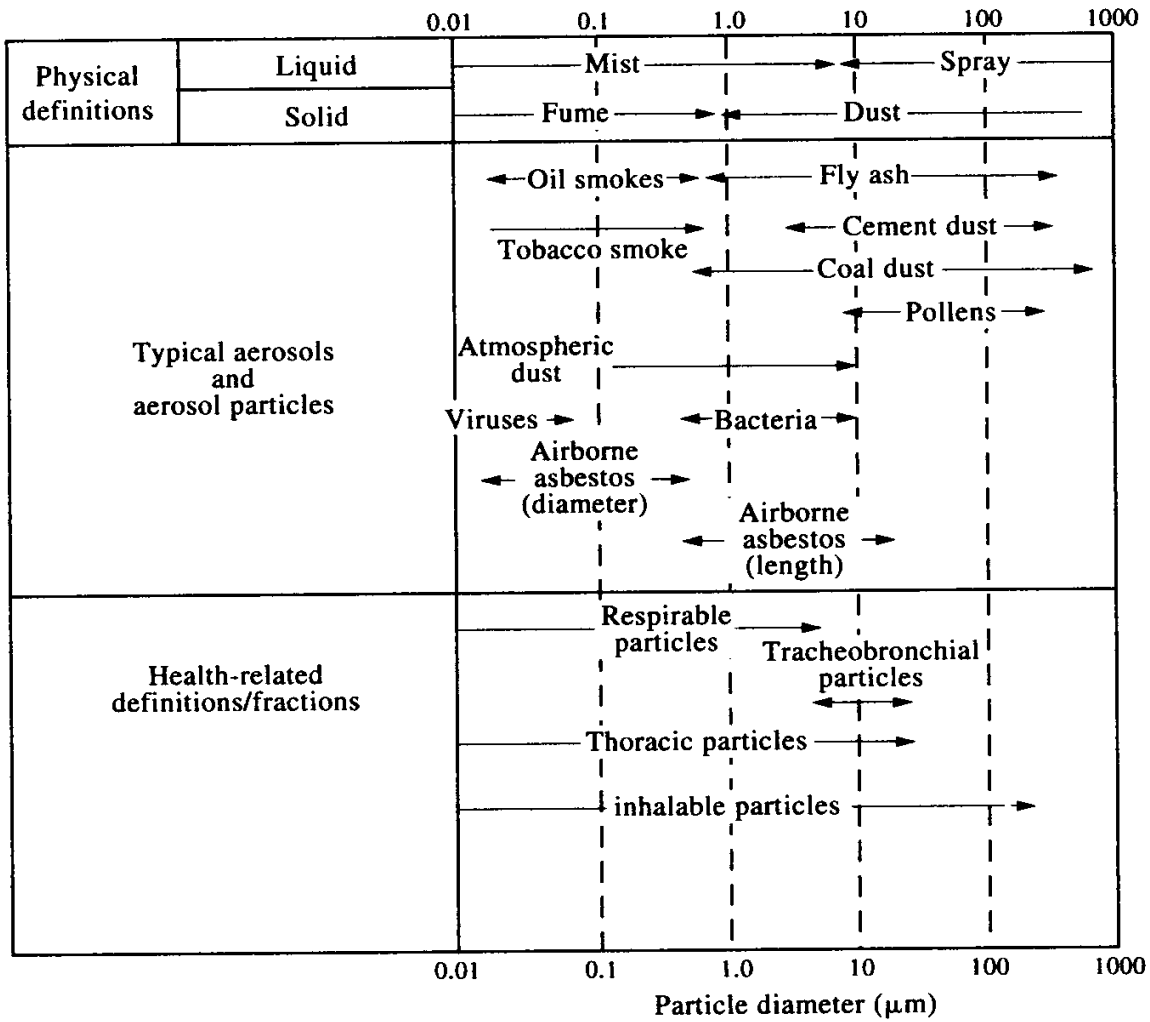


Figure 1.1. Summary classification of aerosols (from Vincent, J.H., *Aerosol Sampling: Science and Practice*, Copyright 1989, adapted by permission of John Wiley and Sons Limited).

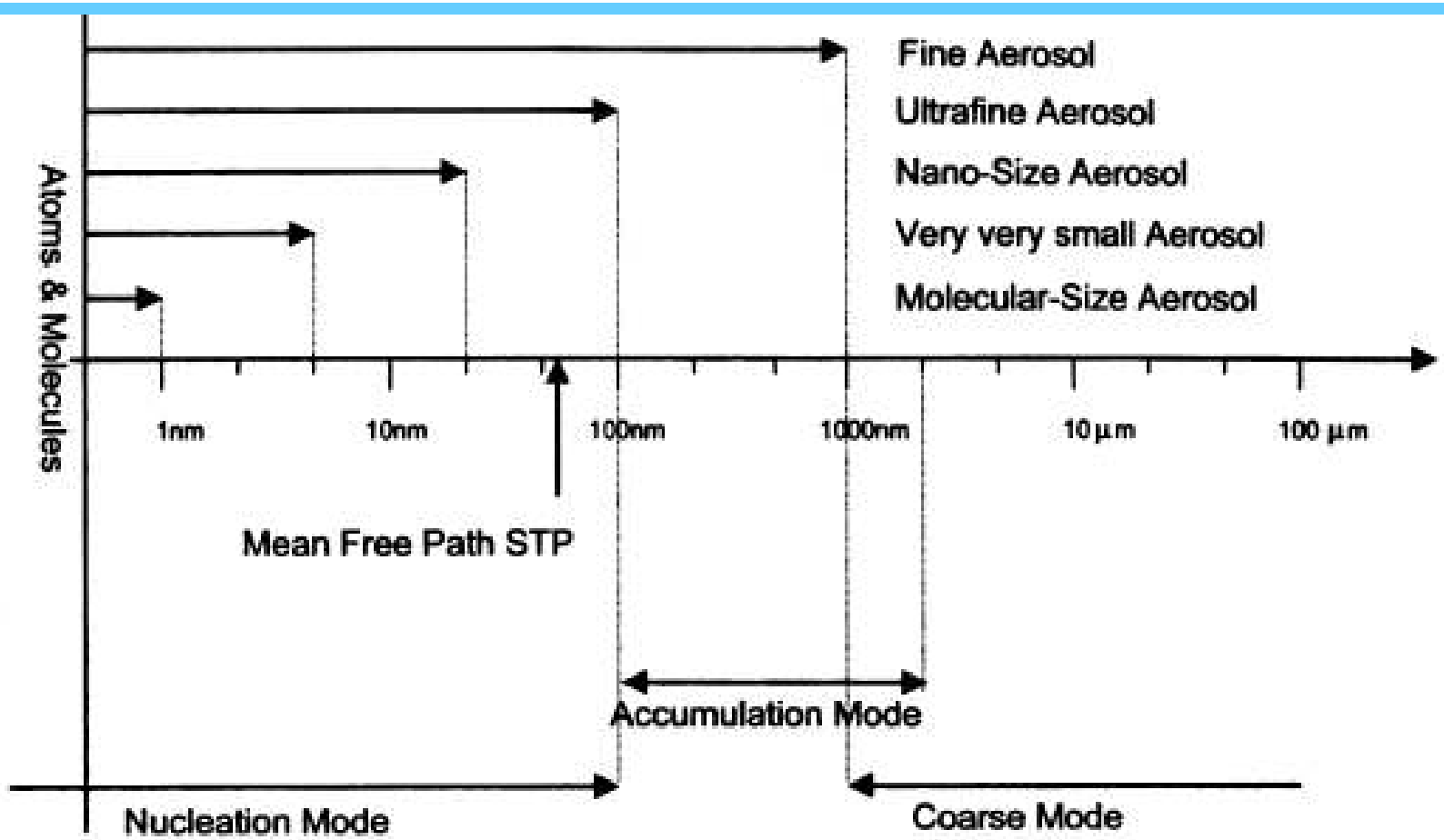


Figure 3.

The particle size classes: **coarse mode**, particles larger than about 1 µm mainly produced by diminution processes; **fine aerosol**, particles smaller than about 1 µm mainly built up by nucleation, condensation and coagulation; **nucleation mode** and **ultrafine aerosol**, particles smaller than about 100 nm; **nanosized aerosol**, particles smaller than about 20 nm; **very very small aerosol**, particles smaller than about 5 nm, particle behaviour dominated by surface effects, total number of molecules less than 500, **molecular size aerosol**, particles smaller than about 1 nm, less than 10 molecules in the particle. Reproduced from Preining (1998).

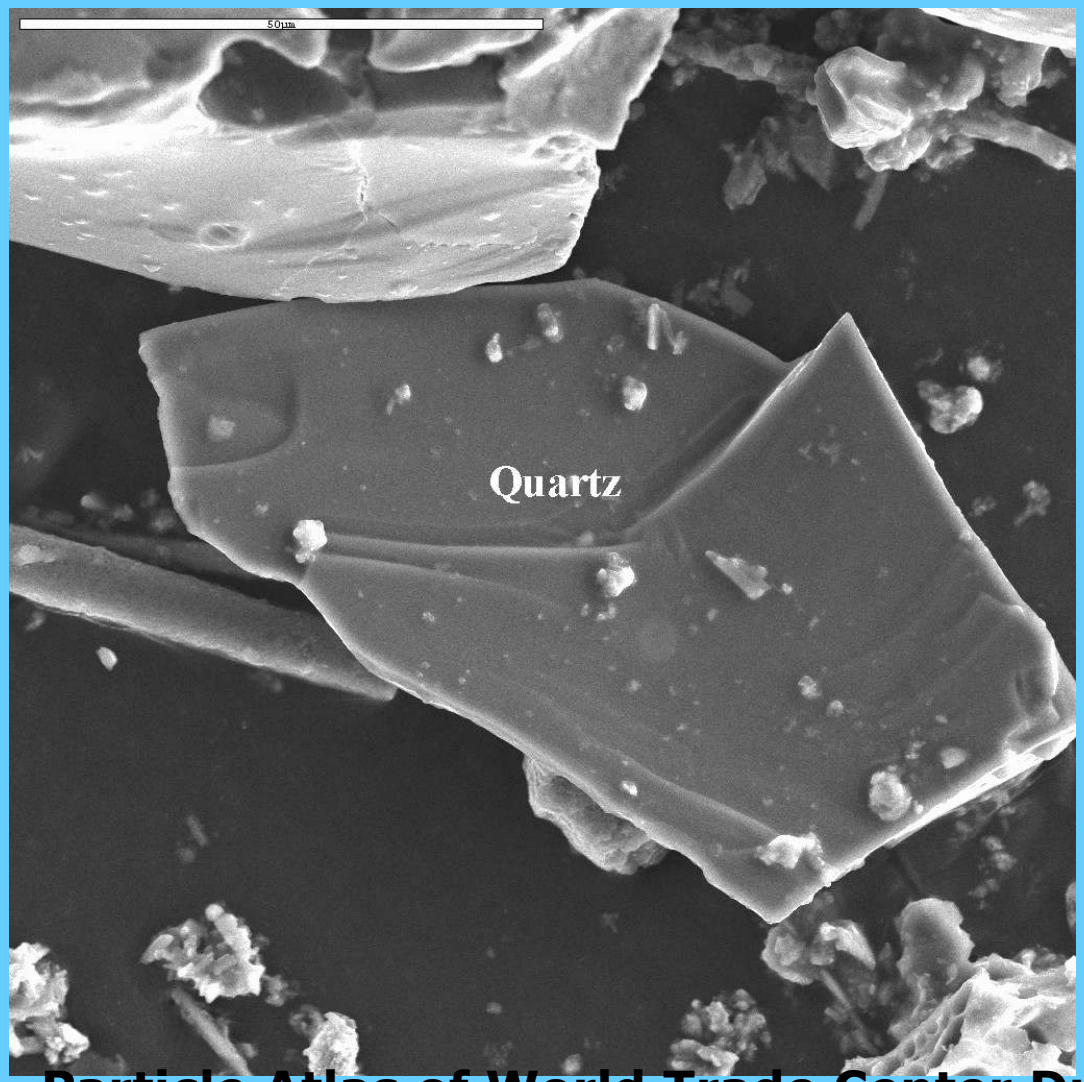
How fast will an aerosol fall in the air?

- Aerodynamic diameter (mikrometer)

Aerodynamic diameter (mikrometer)	Velocity metre/hour
100	1080
40	172
10	11
5	3
1	0,11

Silica dust

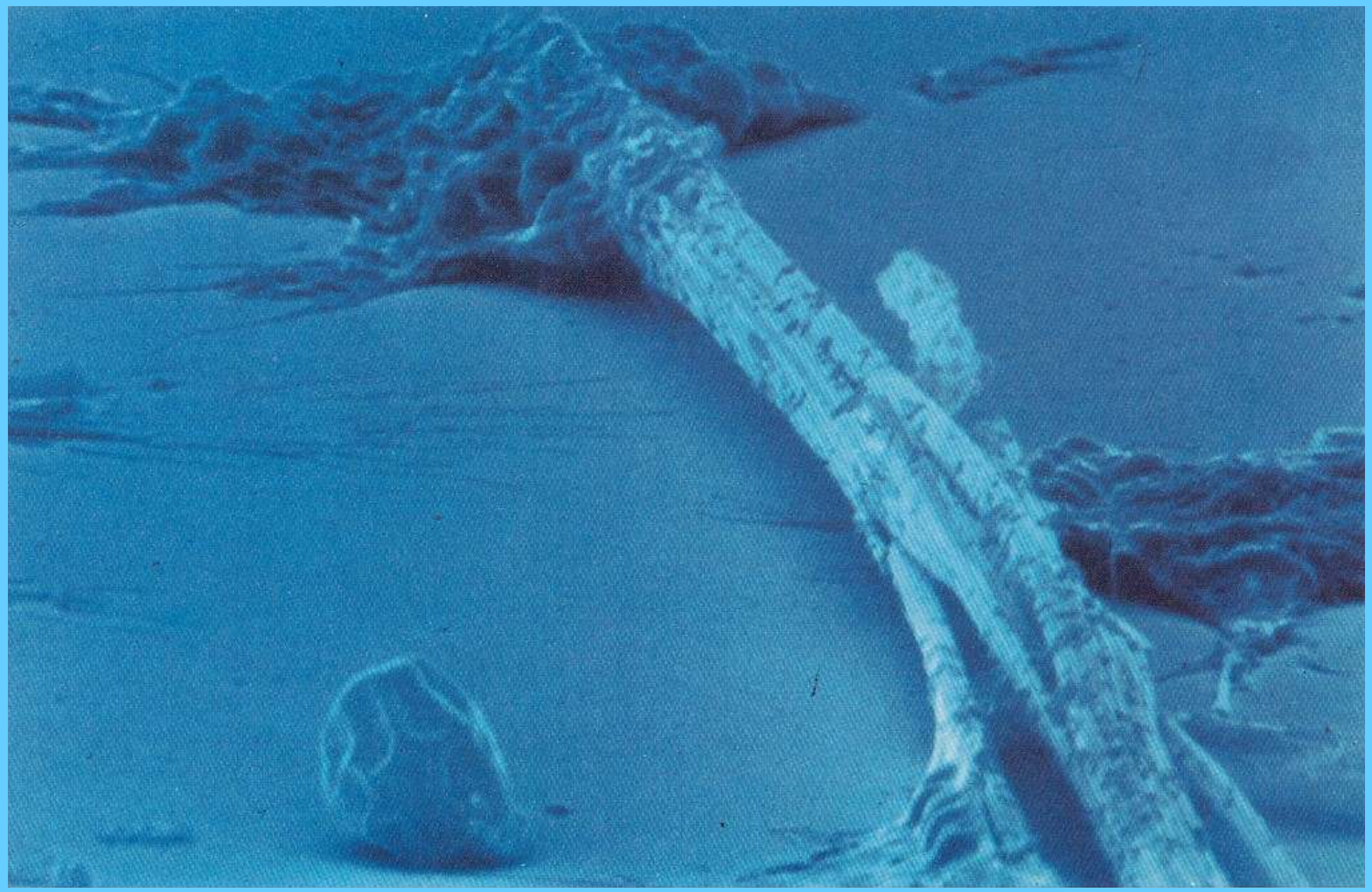
Very dangerous, but forgotten?…



Particle Atlas of World Trade Center Dust

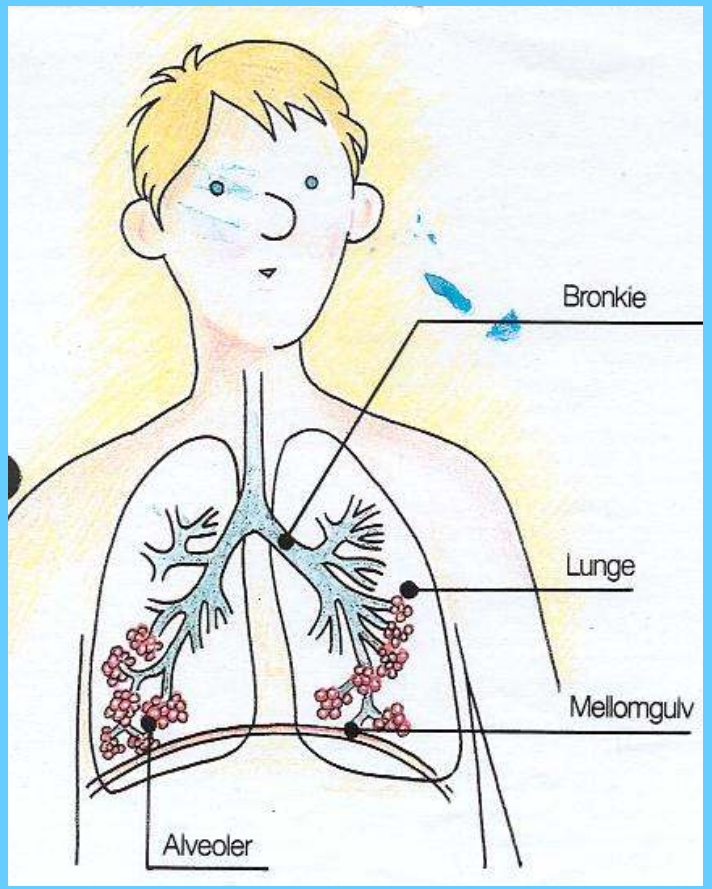
http://pubs.usgs.gov/of/2005/1165/table_1.html

Asbestos – still a major problem



The seize of the particles decies where they ends

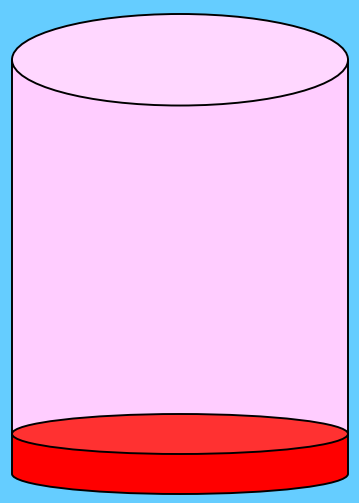
Seize (mikrometer)	
10 - 5	Nose and thraot
5 - 3	Windpipe
3 -2	Bronchus
2 - 1	Bronchus
1 - 0,1	Alveols
< 0,1	Kan pustes ut igjen

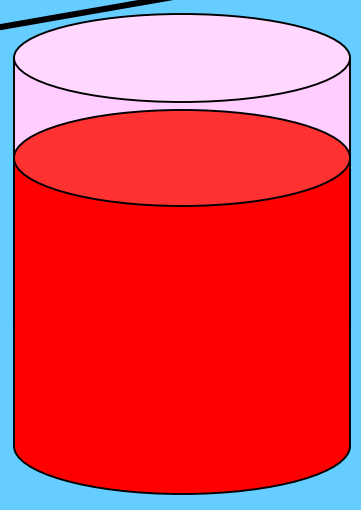


The rule of 1300

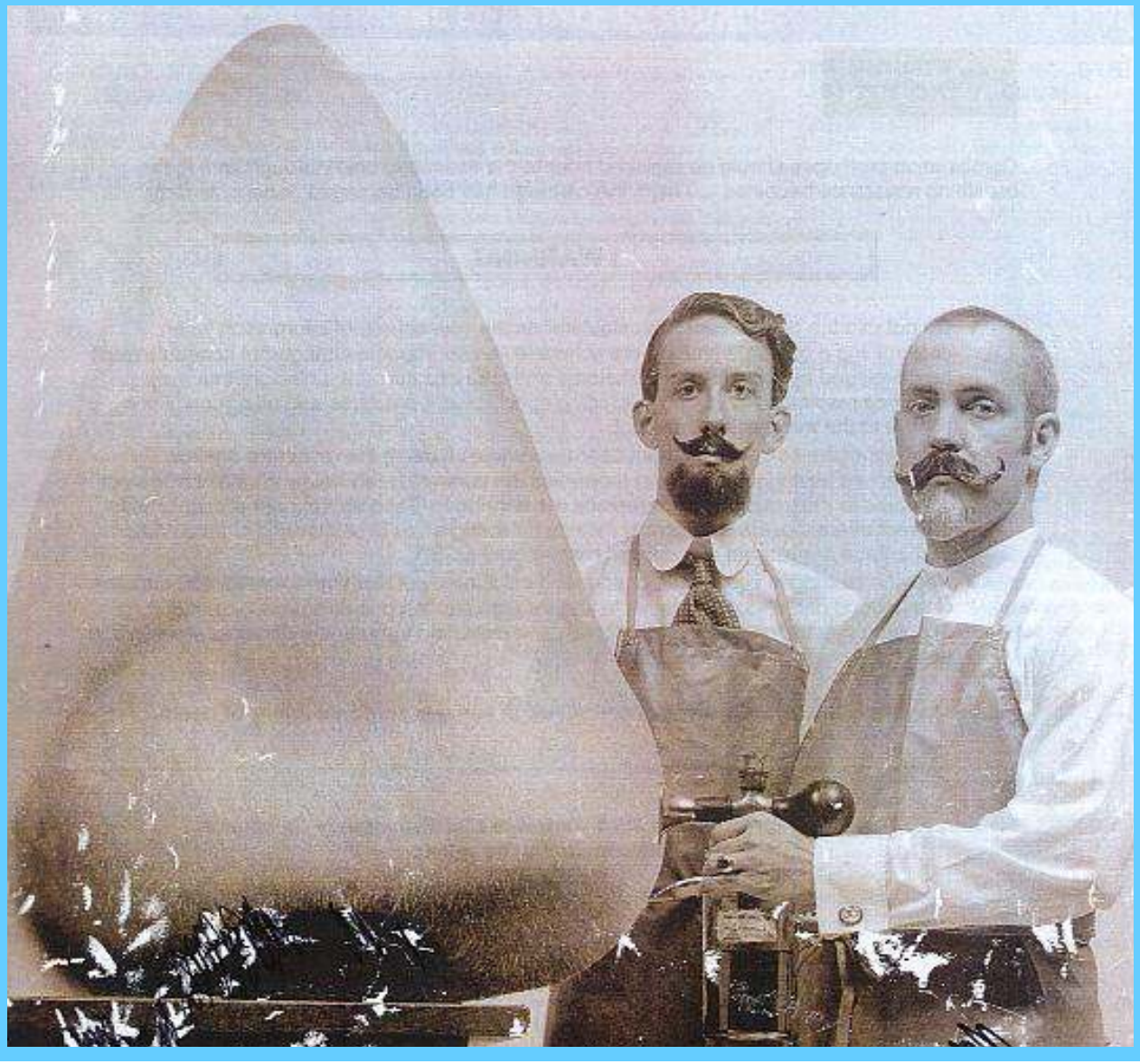
Toluene has a vapor pressure of 20 mmHg.

Eksempel: 20 mmHg x 1300 = 26000 ppm





Odor Thresholds

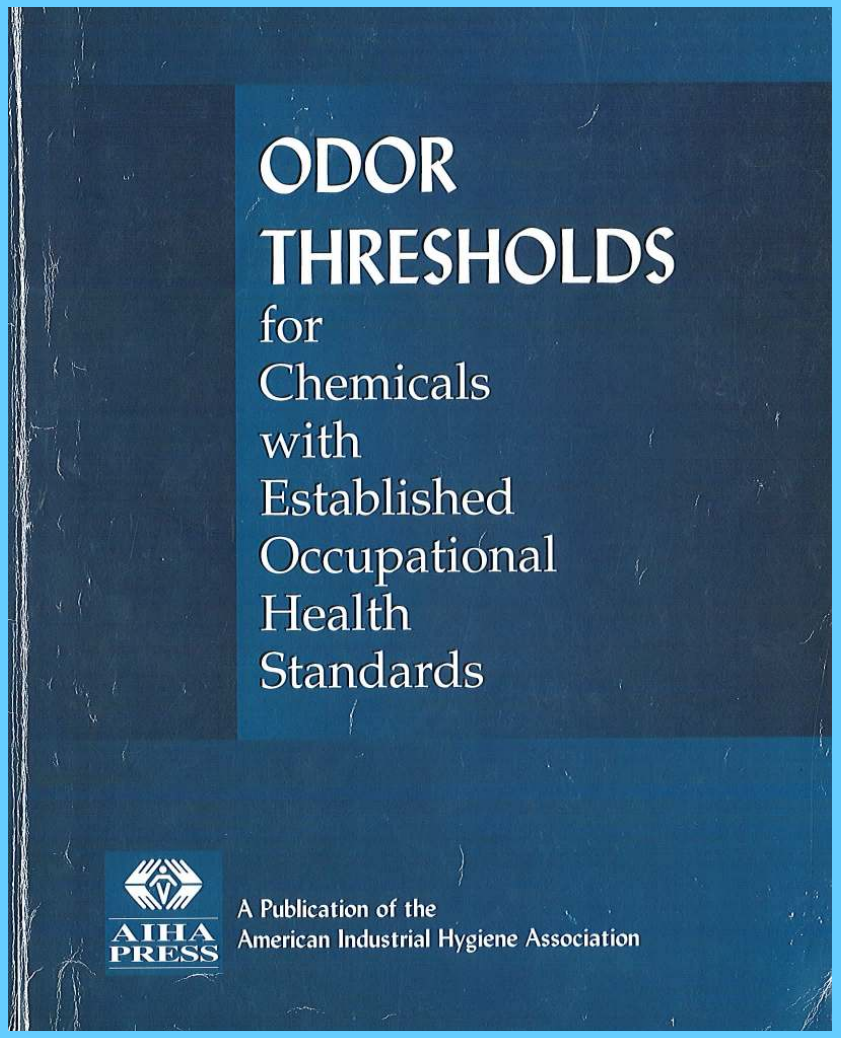


Odor Thresholds

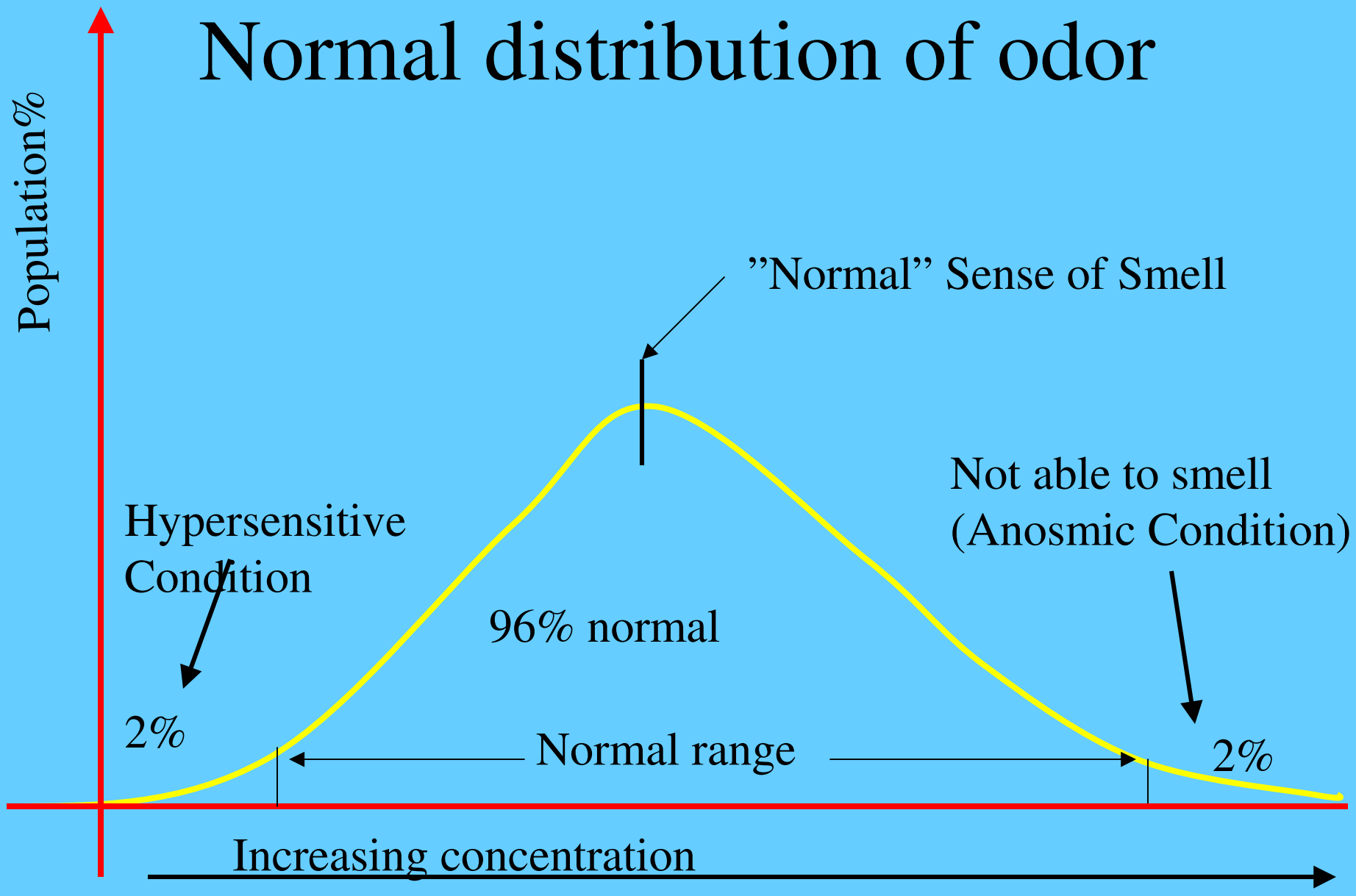
Odor Thresholds for Chemicals with Established Occupational Health Standards.

American Industrial Hygiene Association, 1995.

ISBN 0-932627-34-X



Normal distribution of odor



Some odor thresholds

Chemical OEL* (ppm) *Norwegian	Low	High	Geometric mean
Dichormethane (15)	1,2	440	160 d
Styrene (25)	0,017	1,9	0,14 d
Methanol (100)	4,2	5960	160 (all ref.)
Xylene (25)	0,06	40	20d
Hydrochloric acid (5)	0,256	10,1	Not accepted
Formaldehyde (0,5)	0,027	9770	Not accepted
Isopropyl Alcohol	37	610	43
Ammonia NH_3 (25)	0,04	53	17 d
Acetone (125)	3,6	653	62 d
Toluene diisocyanate TDI (0,005ppm)			0,2-0,4*
Benzene (1)			2,14-12 **
Toluene (25)	**0,16**	**37**	**1,6**

Odor Thresholds for Chemicals with Established Occupational Health Standards. American Industrial Hygiene Association, 1995. ISBN 0-932627-34-X
*http://www.basf.com/businesses/polymers/urethanes/pdfs/chemicals/Other/2000tdihandbook.pdf
** Maslansky and Maslansky, Health and Safety at hazardous waste Sites, 1997, ISBN 0-442-02398-7, side 102

- **Two percent of the population are predictably hypersensitive, and two percent insensitive.**
- **The insensitive range include people who are anosmic (unable to smell) and hyposmic (partially unable to smell).**

The difference between people

- The sensitive range includes people who are hyperosmic (very sensitive) and people who are sensitized to a particular odor through repeated exposure.
- Individual threshold scored can be distributed around the mean value to several orders of magnitude.

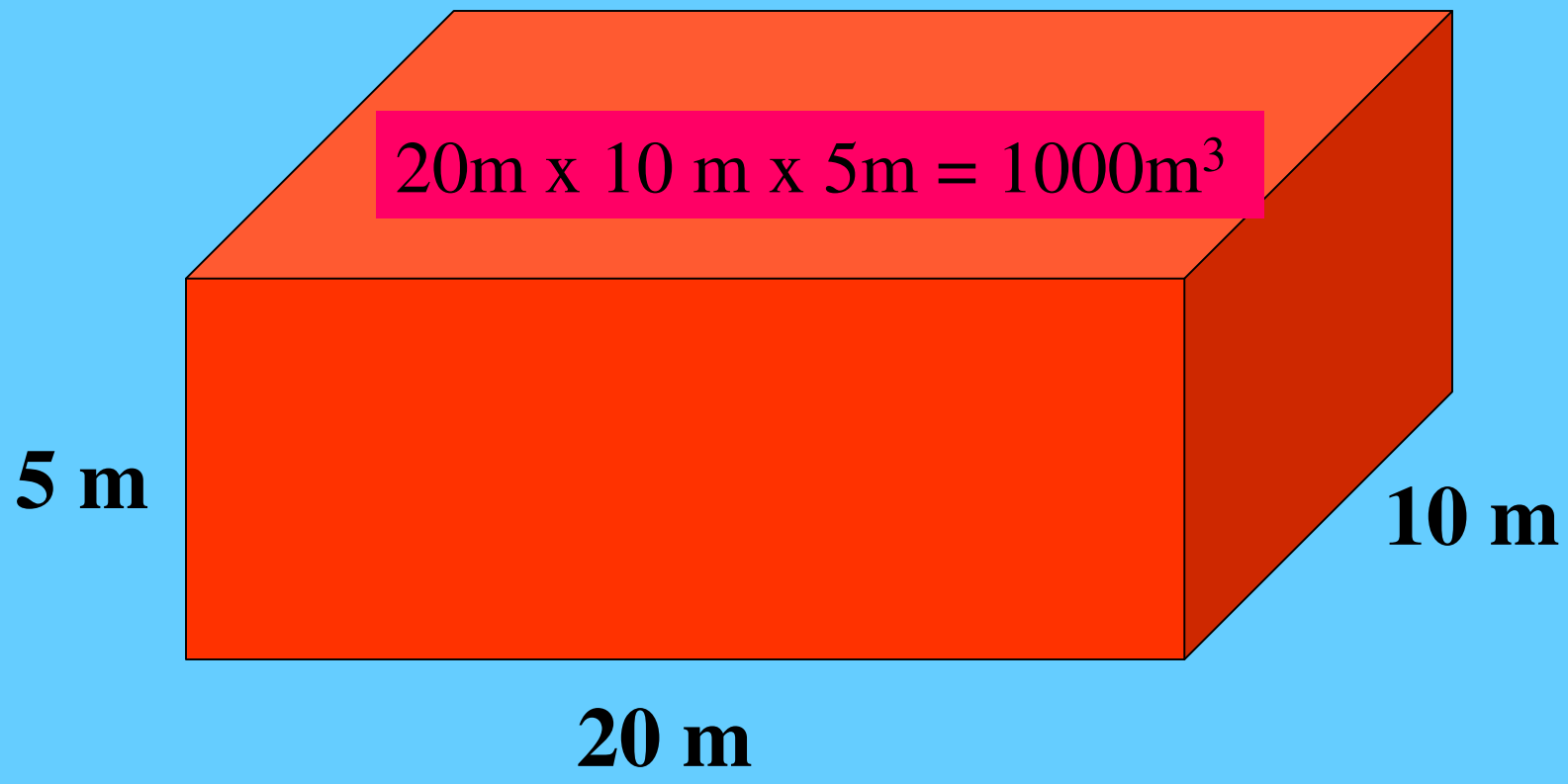
Variation

- A person may be hyposmic to one odorant and hyperosmic to another.
- The variation occurs in specific anosmia and is often caused by repeated exposure to a particular odor. It is not uncommon among chemists or other workers who have had daily exposure to an odorant over a period of years

Odor fatigue

After 3 min of exposure to an odorant, the subject's perceived intensity of the odorant is reduced about 75%

Concentration



Room volume 1000 m^3

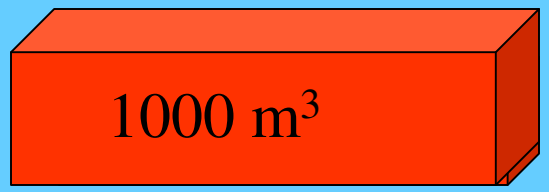
1 kilogram TOLUENE

1 kg = 1000 gram = 1000000 milligram
1 ppm = 3,83 mg/m^3

(1000 mg/m^3).

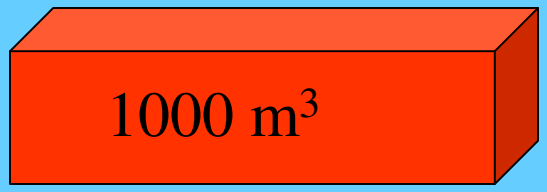
Concentration in the room

1000 mg/m^3/3,83 mg/m^3 = 261 ppm



Air volume necessary to dilute to occupational exposure level

- Norwegian OEL (25 ppm, 94 mg/m^3)?
- **10000000 mg / 94 mg/m^3 = 10640 m3**



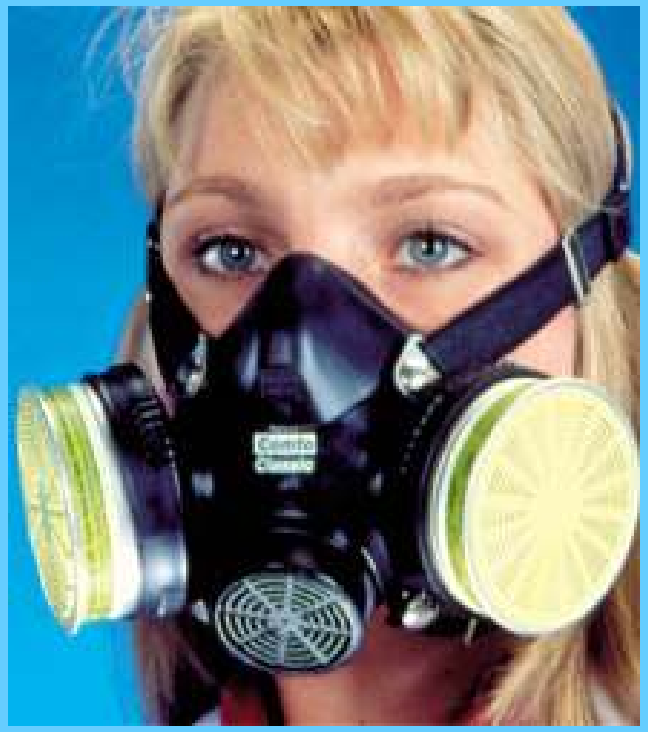
http://www.brown.edu/Administration/EHS/resources/NPG/npgd0619.htm

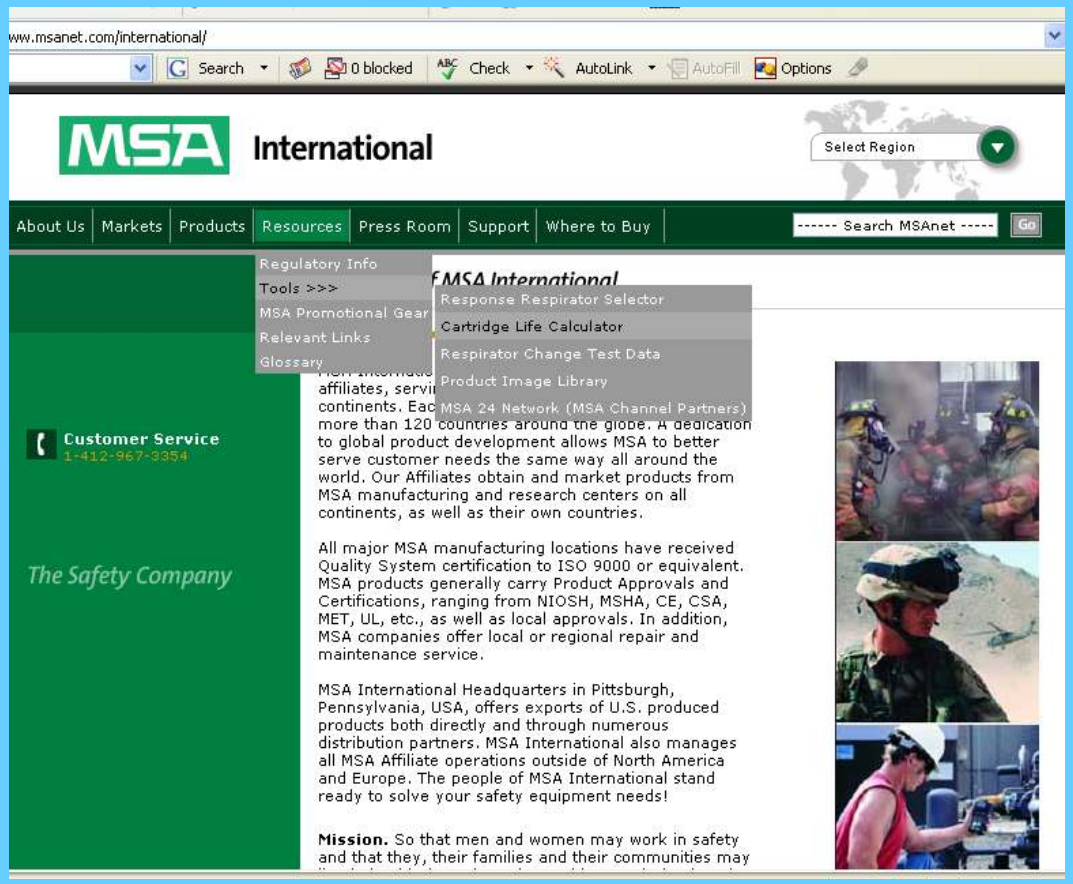
Lower Explosive Level working in confined space

- **1,1 volume % = 11000 ppm**
- **11000 ppm x 3,83 mg/m^3 = 42130 mg/m^3**
- **1000000 mg / 42130 mg/m^3 = 23,7 m^3**

LEL from: NIOSH Pocket Guide to Chemical Hazards
http://www.cdc.gov/Niosh/npg/npgd0619.html

MSA Cartridge Life Calculator





http://www.msanet.com

Gjennombruddstid til 10 ppm ved 261 ppm toluen

MSA Cartridge Life Expectancy Results

Final Breakthrough Time Calculation

When using a ComfoClassic Facepiece with a Comfo GMA Cartridge under the following conditions:

Chemical Name:	Toluene
Chemical PEL (ppm):	200 OSHA PEL
Temperature:	20°C
Relative Humidity:	40 %
Pressure:	760 Torr
Breathing Rate:	60 LPM
Use Concentration:	261 ppm
Breakthrough Concentration:	10 % OSHA PEL
The estimated Breakthrough Time at which cartridges need to be replaced is:	**377 minutes**

40 %RH
Breakthrough Time 377 min

"NaN" = Not A Number
For example, a result cannot be calculated if Use Concentration is less than Breakthrough Concentration.

Back to the Calculator

MSA Cartridge Life Expectancy Results

Final Breakthrough Time Calculation

When using a ComfoClassic Facepiece with a Comfo GMA Cartridge under the following conditions:

Chemical Name:	Toluene
Chemical PEL (ppm):	200 OSHA PEL
Temperature:	20°C
Relative Humidity:	60 %
Pressure:	760 Torr
Breathing Rate:	60 LPM
Use Concentration:	261 ppm
Breakthrough Concentration:	10 % OSHA PEL
The estimated Breakthrough Time at which cartridges need to be replaced is:	**303 minutes**

60 %RH
Breakthrough Time 303 min

"NaN" = Not A Number
For example, a result cannot be calculated if Use Concentration is less than Breakthrough Concentration.

Back to the Calculator

MSA Cartridge Life Expectancy Results

Final Breakthrough Time Calculation

When using a ComfoClassic Facepiece with a Comfo GMA Cartridge under the following conditions:

Chemical Name:	Toluene
Chemical PEL (ppm):	200 OSHA PEL
Temperature:	20°C
Relative Humidity:	80 %
Pressure:	760 Torr
Breathing Rate:	60 LPM
Use Concentration:	261 ppm
Breakthrough Concentration:	10 % OSHA PEL
The estimated Breakthrough Time at which cartridges need to be replaced is:	**200 minutes**

80 %RH
Breakthrough Time 200 min

"NaN" = Not A Number
For example, a result cannot be calculated if Use Concentration is less than Breakthrough Concentration.

Back to the Calculator

JANUARY 16, 1999

6-inch growth could qualify him for the Guinness World Recor

Man grows world's longest nose hair!

SWEET SMELL OF SUC
After more than 15 years,
Byrdal has almost reach
goal of getting in
Guinness
Re

BUFFALO, N.Y. — As gross as it might seem, Alan Byrdal is about to make it into *Guinness World Records* — for having the longest nose hair in the world!

By AMY LECHNER
Weekly World News

The 64-year-old former pool table salesman has been pursuing the record "since the mid-1980s," he says. And now that the longest of his nose hairs has reached a staggering 6.12 inches, he's ready to stake his claim to the record.

"I guess everyone wants to be known for something, and this is it for me," he said. "I've heard all the comments — I know some people might say it's disgusting or whatever. But you can bet most of those people will never make it into any kind of record book."

Byrdal said he had to start cutting his nose hairs when he was about 27 years old because they grew so fast.

"My dad and grandfather had the same problem," he said. "Mine started growing when I was fairly young and back then it was pretty gross. Long nose hairs are not really the kind of thing the girls go for."

But when Byrdal reached his 50s, he decided to forget about trimming his nose hairs every day.

"By that time my hairs were growing faster than they ever had," the lifelong bachelor said. "I decided, to heck with it, let's see how long they can grow."

Byrdal now admits he "probably became obsessed" with his bizarre hobby.

"It became the most important thing in my life," he said. "I still remember how surprised I was when I found out there wasn't an official world record for longest nose hairs."

Byrdal said he probably would never have done it if he had the active social life he enjoyed when he was younger.

"Nowadays I live by myself and hang around the same group of guys most of the time," he said. "I guess the girl down at the grocery store has seen me so many times she doesn't even notice anymore.

"But I'm getting ready for that all to change now. I'm going to be famous when people all over the world hear about how long my nose hairs are."

FLASHBACK TO: WEEKLY WORLD NEWS JANUARY 1999

PHOTO © NORTH AMERICAN PR

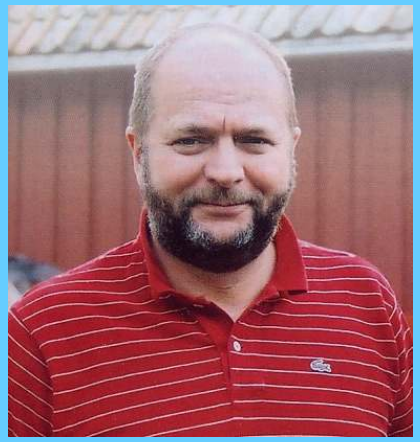
WWN EXTRA

WORLD'S LONGEST EAR HAIR!

Inspired by Alan Byrdal's courage and passion, Arm
Boyd has cultivated the world's longest ear hair in
hopes of gaining his turn in the spotlight.

"At first I just had these monster earfros,"
Boyd says of the experience of developing his hirsu
auricles. "Then I made them into some kicking drea
but that didn't fly so well with the boss—I work in
accounting. So finally I bought myself some beads
had my mother braid them."

Limitations for filter masks: No facial hair



Laboratory testing of beard vs. clean shaven

	x times cleaner inside
• **Clean shaven**	
• Half mask	• 2950
• Full face maske	• > 10.000
• Beard	
• Half mask	• 12 half mask,
• Full face mask	• 30

The test perform in laboratory under perfect conditions. No relevance to normal use, but shows how facial hair are compromising negative pressure filter masks

Effect of Facial Hair on the Face Seal of Negative-Pressure Respirators.
Am. Ind. Hug. Assoc. J. 45(1):63-66 (1984).
O.T. Skredtvedt and J.G. Loschiavo

Assigned Protection Factor

The assigned protection factor (APF) of a respirator reflects the level of protection that a properly functioning respirator would be expected to provide to a population of properly fitted and trained users. For example, an APF of 10 for a respirator means that a user could expect to inhale no more than one tenth of the airborne contaminant present.

Respirator Class and Type	*OSHA* Cadmium Std.	*NIOSH*
Air Purifying		
Filtering Facepiece	10	10
Half-Mask	10	10
Full-Facepiece	50	50
Powered Air Purifying		
Half-Mask	50	50
Full-Facepiece	250	50
Loose Fitting Facepiece	25	25
Hood or Helmet	25	25
Supplied Air		
Half-Mask-Demand	10	10
Half-Mask-Continuous	50	50
Half-Mask-Pressure Demand	1000	1000
Full-Facepiece Demand	50	50
Full-Facepiece Continuous Flow	250	50
Full-Facepiece Pressure Demand	1000	2000
Loose Fitting Facepiece	25	25
Hood or Helmet	25	25
Self Contained Breathing Apparatus (SCBA)		
Demand	50	50
Pressure Demand	>1000	10,000

http://www.ehso.com/RespProtectionSelection.htm

Assigned Protection Factor

- The assigned protection factor (APF) of a respirator reflects the level of protection that a properly functioning respirator would be expected to provide to a population of properly fitted and trained users.
- For example, an APF of 10 for a respirator means that a user could expect to inhale no more than one tenth of the airborne contaminant present.

http://www.ehso.com/RespProtectionSelection.htm

Electrostatic filter

Mechanical filter

Electrostatic versus mechanical filters

- A study conducted by the INRS (National Research and Safety Institute) has found that certain types of particulate filter respirators lose their effectiveness over time.
- Filtration levels for solid and liquid aerosols are currently defined after a 3-minute exposure to test aerosols. This brief exposure period is suitable for “mechanical” filters, which become more effective each time they are used, but proves inappropriate for electrostatic filters made of synthetic unwoven fibres, as their performance may diminish over time.
- In real working conditions, the performance of certain electrostatic filters, even those classed “high-efficiency”, can rapidly deteriorate (from the very first time they are used) as the electric charge is gradually neutralised by the trapped dust particles.

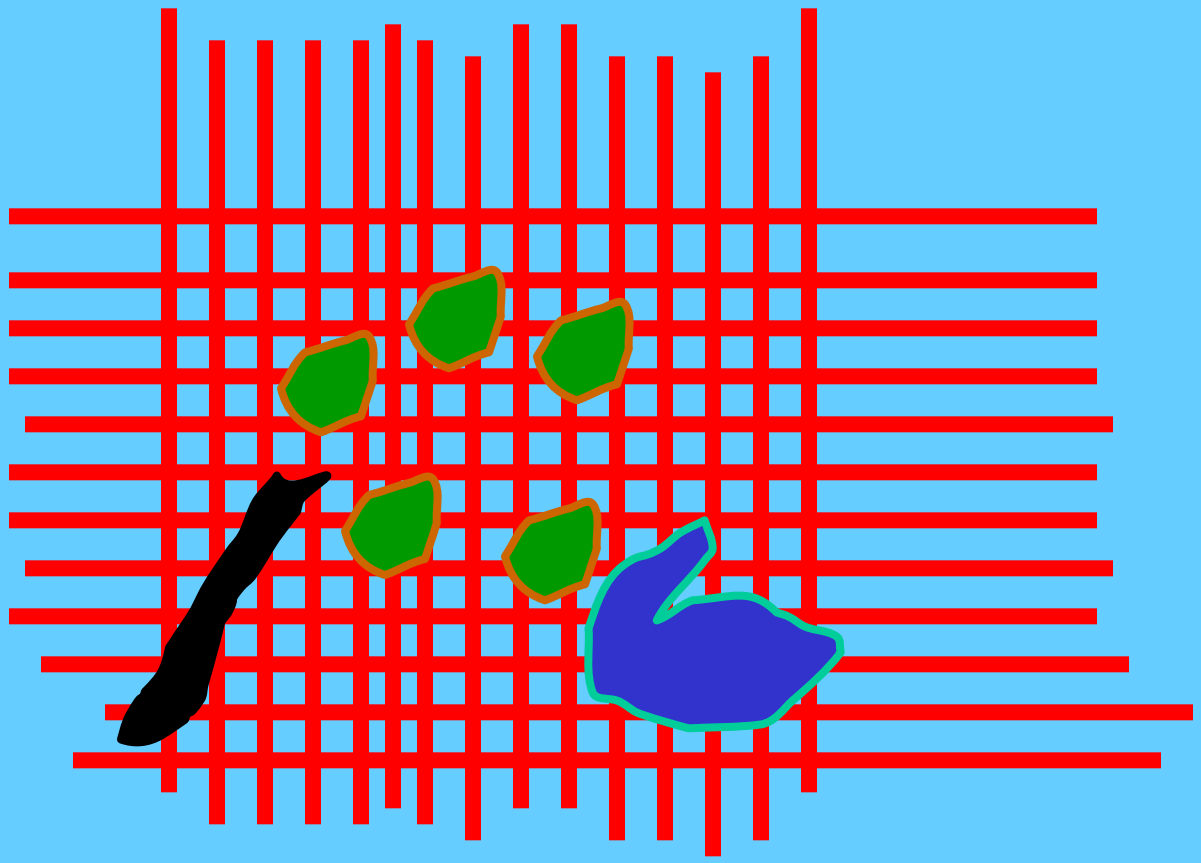
•EUROPEAN SEMINAR ON PERSONAL PROTECTIVE EQUIPMENT

•Saariselkä 19-21 January 2005 Electrostatic filters for respiratory protective devices : an action in progress

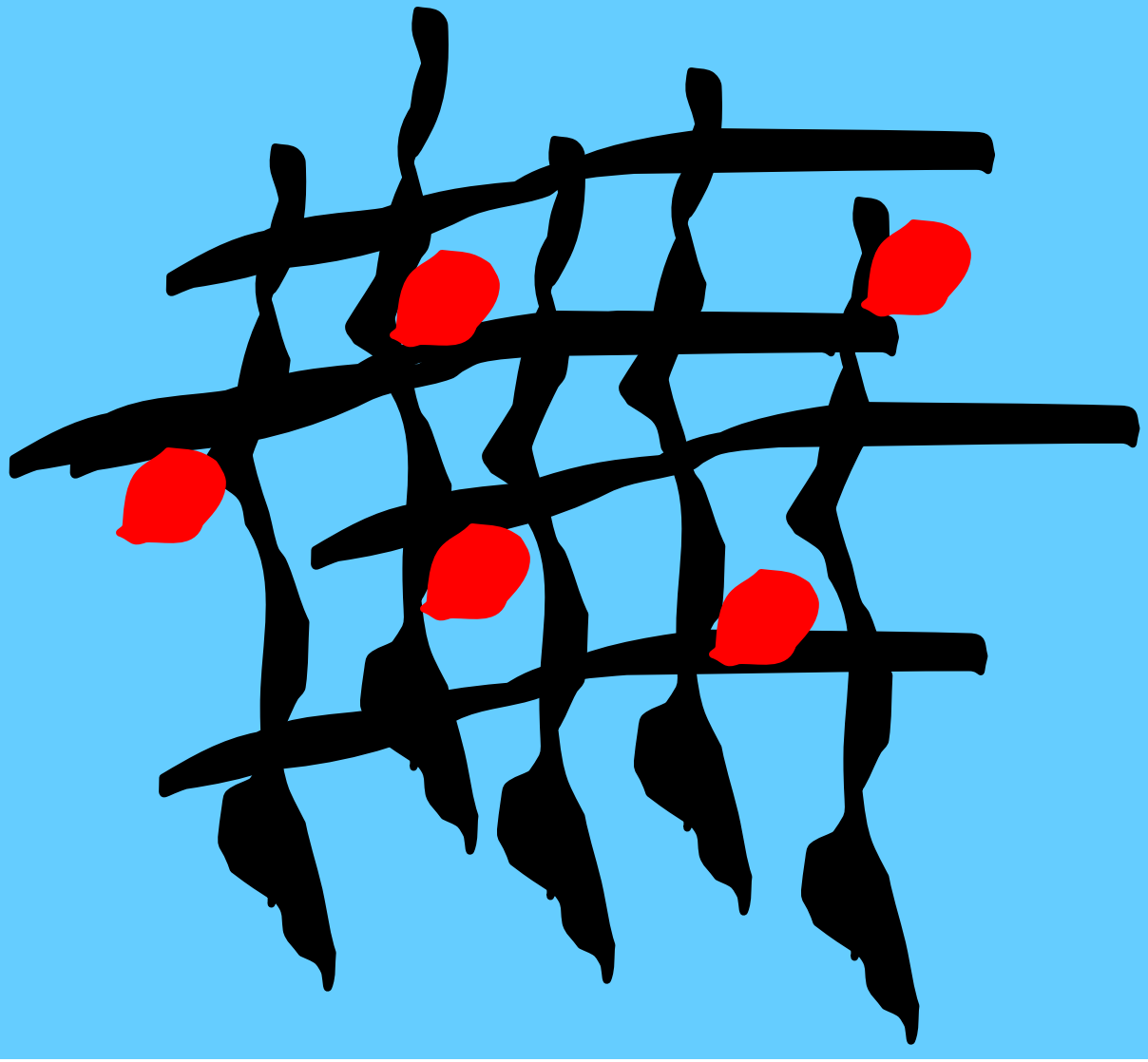
•Pascal Etienne, Patricia Le Frious,French Ministry for Labour, employment and social cohesion

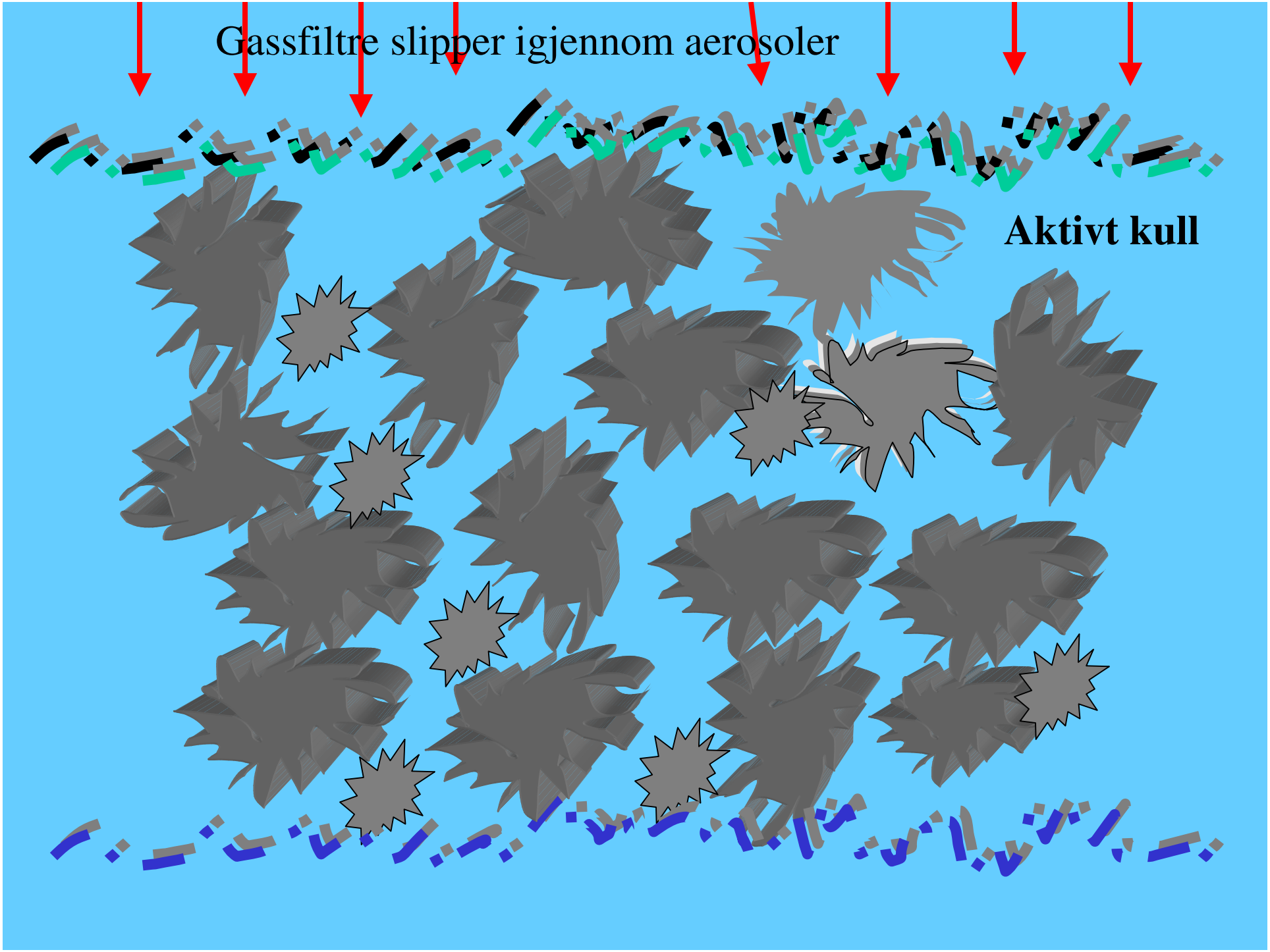
•http://www.ttl.fi/NR/rdonlyres/99175DFD-757A-4AEB-81EB-021934D9DBB0/0/Etienne.pdf

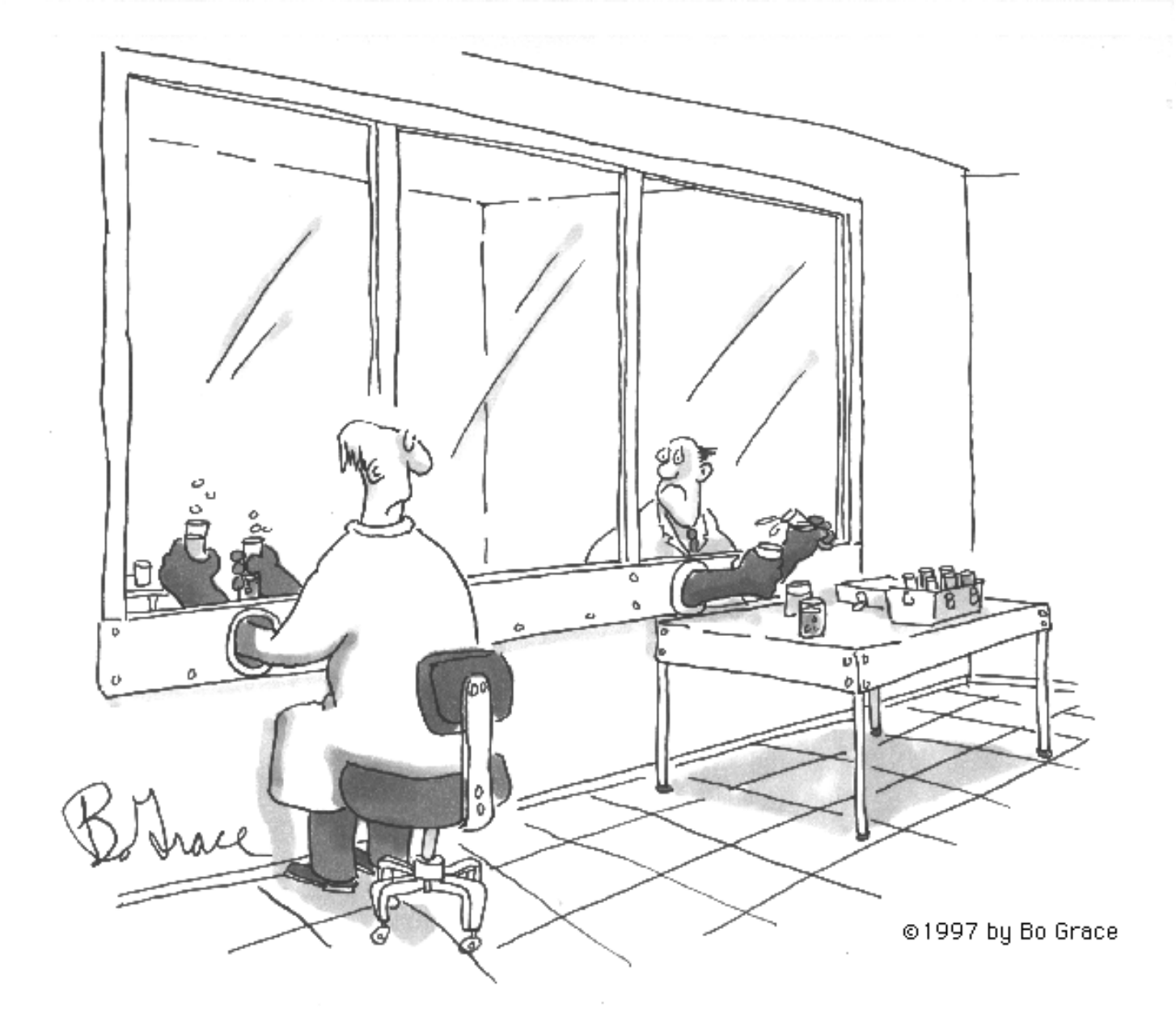
Mechanical filter



Electrostatic filter




Gassfiltre slipper igjennom aerosoler
Aktivt kull

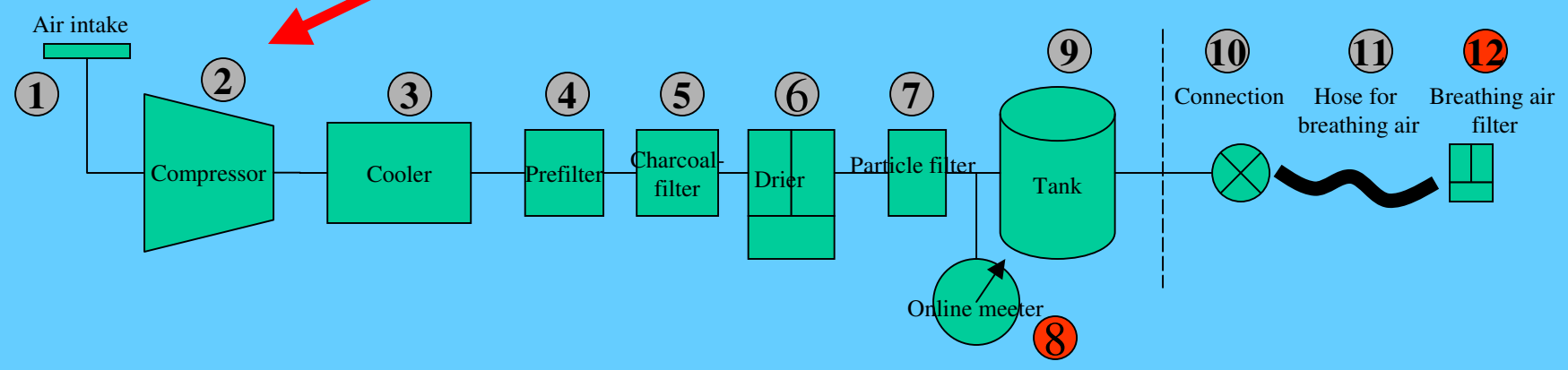

Bo Grace
©1997 by Bo Grace

Supplied air

A—Tunnel. B—Pipe. C—Nozzle of double bellows.

Agricola,
De Re Metallica
1556

The air compressor may be a source for very hazardous exposure from oil leakage and thermal degraded oil



•Review of the breathing system

•http://www.samarbeidforsikkerhet.no/index.html?infoPage=oppslag.html&siteID=4&id=41&siteID=4&frameID=3&fromTopMenuId=199&&languageCode=EN

Kilde; Samarbeid for sikkerhet. www.samarbeidforsikkerhet.no

Anbefaling 09/2003 – Gjennomgang av pusteluftsystemene

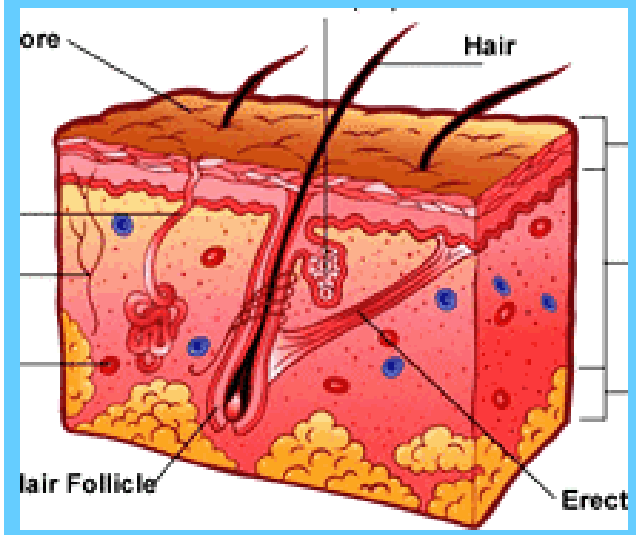
http://www.samarbeidforsikkerhet.no/index.html?infoPage=oppslag.html&id=41&siteID=&frameID=3&languageCode=NO

Hazards

Recommended action

"Hey! Look what Zog do!"

Skin uptake



- For instance, about a teaspoonful of styrene (3 milliliters) splashed on a worker's skin can deliver the same dose as the eight-hour inhalation exposure limit-50 parts per million.
- Just touching a surface contaminated with 1.5 micrograms per square centimeter of the suspected carcinogen acrylamide (a quantity about one-millionth the weight of a paper clip) could equal inhaling one day's permissible exposure limit, 0.03 milligrams per cubic meter.

http://www.okhighered.org/training-center/newsletters/osrhe/under-your-skin.html

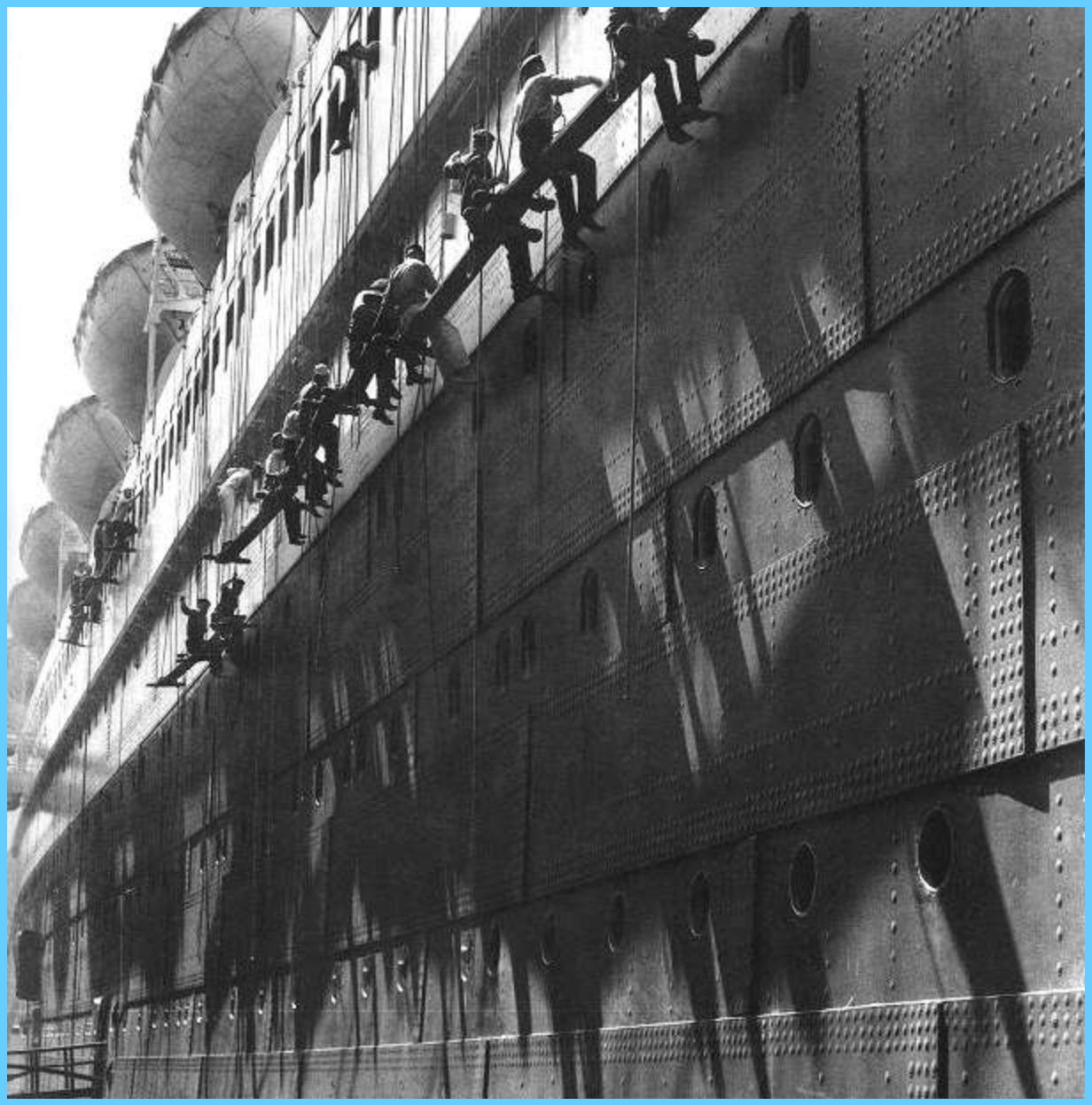
Skin protection, some advices

- **Do:**
- Keep skin clean and healthy. Abraded, irritated, or even sun burnt skin is more susceptible to dermal absorption. Use products tailored to the industrial market, not just cosmetic moisturizers, says Eleanor Fendler, Ph.D., product development manager for skin care company Gojo Industries.
- Keep hands and skin dry. Moisture on the skin, like sweat, can enable permeation, as can high temperatures.
- Choose gloves and protective materials carefully. Some chemicals, like lacquer thinner, can permeate just about any glove when microscopic molecules break through individual molecules of the protective film on the glove. But beware, too, of over protecting. A glove that is too thick or bulky only contributes to exposure risks when workers remove it to perform jobs requiring dexterity or tactility.
- Watch out for glove degradation. Don’t rely on a glove once its physical property changes, says Nelson Schlatter of glove maker Ansell Edmont. "Degradation is easy to spot," he says. "The glove will either swell up and get soft, or shrink and harden." Flexing a glove can increase the permeation rate and breakthrough time by ten, according to NIOSH’s Boeniger. And, of course, chemicals can penetrate visible holes in gloves.

Skin protection, some advices;

- **Don’t:**
- Don’t use solvents to clean chemicals off hands. Solvents can damage the skin, making it more readily permeable, says Fendler.
- Don’t put gloves on contaminated hands. Gloves can force penetration of chemicals already on the hands and increase the likelihood of dermal penetration up to five times, according to Boeniger.
- Don’t apply moisturizer or barrier cream to contaminated skin. "If an auto mechanic puts barrier cream on his hands after he changes the oil, he can be causing himself really serious damage by forcing penetration," Fendler says.
- Don’t use barrier creams in the place of gloves. Barrier creams can be an addition to a skin protection regime, but studies recommend against substituting them for gloves.

Painting in earlier times



Very hazardous way of painting

Status. April 2002

Find five faults

Sikker strategi

[redacted] kjenner seg trygg når han maler rør til Statoils Kvitebjørn-dekk. Han følger selskapenes sikkerhetsrutiner. Statoil har laget en kjemikaliestrategi blant annet for å redusere vedlikeholdskostnader til overflatebehandling. Dessuten videreutvikles god praksis for helse, miljø og sikkerhet.

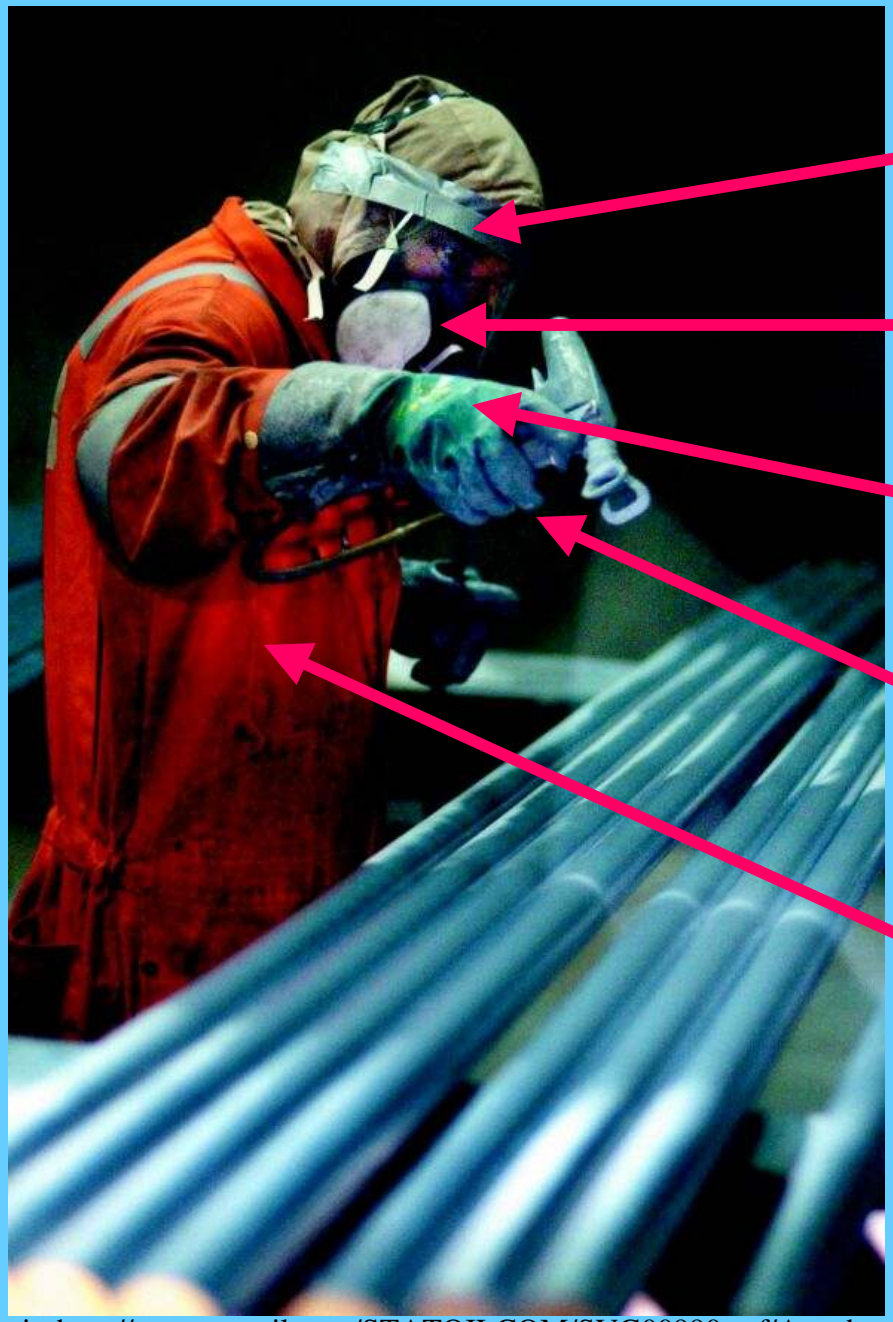
Side 8-9

Jakter på leteområder

Side 2-3

Investeringer bærer frukter

Side 7



Eye protection

Filter mask use when spaypainting

Not the right gloves

Safety guards on the spaying gun missing

Not using a chemical resistant suit

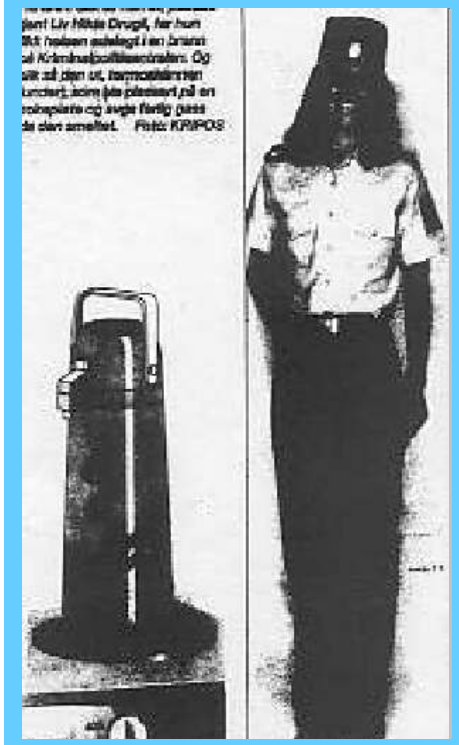
Bildeutsnitt http://www.statoil.com/STATOILCOM/SVG00990.nsf/Attachments/bilde1.jpg/$FILE/bilde7.jpg

When careers and allergies collide

When careers and allergies collide

Epoxy allergy or asthma

- Two conditions that can be developed in a very short time



Får 1,7 millioner i erstatning etter røykforgiftning

– En stor lettelse, sier tidligere Kripos-betjent Liv Hilde Drugli. Staten må betale henne 1,7 millioner i erstatning etter at hun ble ny forgiftet på jobben.

KARIN BØHM-PEDERSEN

Oslo byrett har også pålagt staten å dekke deler av Druglis økonomiske-ninger med 117 000 kroner. Byrettsdommer Lotv Robberstad kritiserer hilde arbeidsgiveren, Kripos, og staten for at det er gjort så lite for å fastslå klarhet i om det er sammenheng mellom brannen for åtte år siden og de alvorlige helseplagene Liv Hilde Drugli fortsatt

VANT FREM: Liv Hilde Drugli

FOTO: KÅRE M. HANSEN

- Brannrøyk og branngass
- Kortvarig høy eksponering for kjemikalier
  - Maling, sveising, kjemikalieuhelluhell, søl, hudkontakt, ulykker….. unormale driftsforhold, feil verneutstyr

http://tux1.aftenposten.no/nyheter/iriks/d36682.htm

Immediately Dangerous to Life and Health (IDLH)

Short term high exposure.

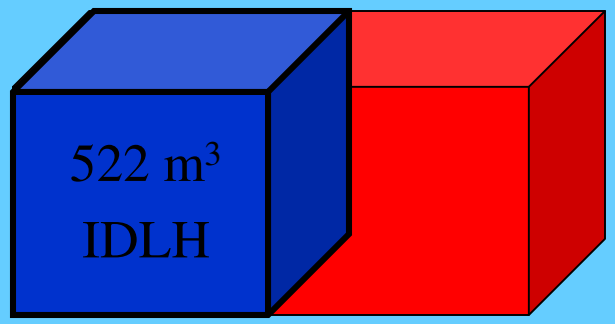
- National Institute of Occupational Safety and Health (NIOSH) has developed a parameter (IDLH) for use to do risk assessment of high level of chemical exposure.
- *NIOSH Definition*
- Immediately Dangerous to Life or Health (IDLH): Acute respiratory exposure that poses an immediate threat of loss of life, immediate or delayed irreversible adverse effects on health, or acute eye exposure that would prevent escape from a hazardous atmosphere.
- *OSHA Definition*
- Immediately Dangerous to Life or Health (IDLH): An atmosphere that poses an immediate threat to life, would cause irreversible adverse health effects, or would impair an individual's ability to escape from a dangerous atmosphere.

- http://www.cdc.gov/niosh/idlh/intridl4.html

How much air to dilute 1 kilogram of toluene to IDLH level?

- The IDLH for toluene is 500 ppm
- 500 ppm x 3,83 = 1915 milligram/m^3
- **1000000 mg/ 1915 mg/m^3 = 522 m^3**

About half the volume of a room of 1000 m^3



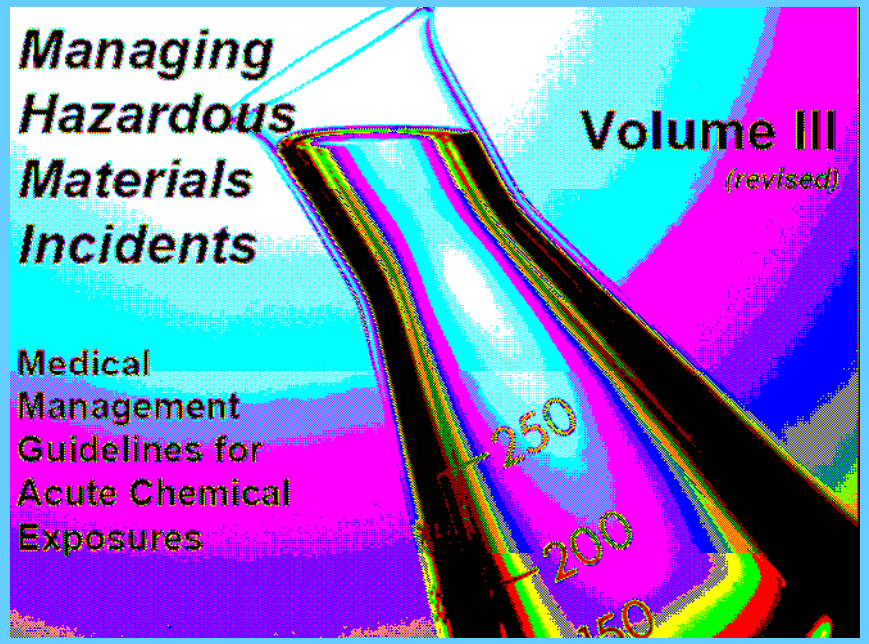
http://www.brown.edu/Administration/EHS/resources/NPG/npgd0619.htm

Comparision between IDLH, OEL, and UEL og LEL

Immediately Dangerous to Life And Health (IDLH) ppm		Occupational Exposure Level		Explosion Level UEL/LEL Vol%
6.000	Methanol	100	Methanol (100 ppm) S	100 Carbon monoxide (74 UEL)
900	Xylene	50	Toluene 25 ppm S	50
500	Benzene TOLUENE	25	Xylene (25 ppm) H	
100	Hydrogen sulfide H_2S (100)	10	Carbon monoxide (25 ppm)	30 Methanol (36 UEL)
50	Hydrocyanic acid HCN (50) Hydrochloric acid HCl (50)	5	Ammonia NH_3 (25 ppm) H_2S (10 ppm) T	15
30		2	HCl (5 ppm) T HCN (5 ppm) HT	10 Methane (15,0 UEL) Carbon monoxide (12,5 LEL) Propane (9,5 UEL)
20	Nitrogen dioxide (NO_2) (20) Formaldehyde (20)	1	NO_2 (2 ppm) T	5 Benzene (7,9 UEL) Xylene (7,0 UEL) Methanol (6,0 LEL)
10	Ozone (5)	0,5	Benzene (1 ppm) K Hydrofluoric acid (0,8 ppm)	2 Methane (5,0 LEL) Propane (2,1 LEL)
3	Methyl isocyanat (3)	0,05	Ozone (0,1 ppm) Phosgene (0,05 ppm) T	1 Benzene (1,3 LEL) Toluene 1,1 LEL Xylene (1,0 LEL)
2	Toluene diisocyanate (2,5) Phosgen (2)	005	Isocyanates (0,005 ppm) A	

Ref; "Adm.norm" Bestnr. 361 (1996), Eksp.grenser"NIOSH Pocket Guide to Chemical Hazards (1990) og "Sources of Ingition" (J.Bond 1991). NIOSH IDLH doc. 1999. Halvor Erikstein des.1999

Short term high exposure



- http://www.atsdr.cdc.gov/MHMI/mhmi-v3-p.pdf#search=%22erpg%20tocp%22

Emergency Response Planning Guideline (ERPG)

- The Emergency Response Planning Guideline (ERPG) values are intended to provide estimates of concentration ranges where one reasonably might anticipate observing adverse effects as described in the definitions for ERPG-1, ERPG-2, and ERPG-3 as a consequence of exposure to the specific substance.

http://www.orau.gov/emi/scapa/erpgdefinitions.htm

Emergency Response Planning Guideline (ERPG) **1**

- The ERPG-1 is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hr without experiencing other than mild transient adverse health effects or perceiving a clearly defined, objectionable odor.

Emergency Response Planning Guideline (ERPG) **2**

The ERPG-2 is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hr without experiencing or developing irreversible or other serious health effects or symptoms which could impair an individual's ability to take protective action.

Emergency Response Planning Guideline (ERPG) **3**

- The ERPG-3 is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hr without experiencing or developing life-threatening health effects.

Chemical (CAS Number)	ERPG–1	ERPG–2	ERPG–3
Dimethyl Disulfide (624-92-0)	0.01 ppm	50 ppm	250 ppm
Dimethylformamide (68-12-2)	2 ppm	100 ppm	200 ppm
Dimethyl Sulfide (75-18-3)	0.5 ppm	1000 ppm	5000 ppm
Epichlorohydrin (106-89-8)	2 ppm	20 ppm	100 ppm
Ethyl Acrylate (140-88-5)	0.01 ppm	30 ppm	300 ppm
Ethylene Oxide* (75-21-8)	**NA†**	**50 ppm**	**500 ppm**
Ethylidene Norbornene (16219-75-3)	0.2 ppm	100 ppm	500 ppm
Fluorine (7782-41-4)	0.5 ppm	5 ppm	20 ppm
Formaldehyde (50-00-0)	1 ppm	10 ppm	25 ppm
Furfural (98-01-1)	2 ppm	10 ppm	100 ppm
Gluteraldehyde (111-30-8)	0.2 ppm	1 ppm	5 ppm
Hexachlorobutadiene (87-68-3)	1 ppm	3 ppm	10 ppm
Hexafluoroacetone* (684-16-2)	**NA†**	**1 ppm**	**50 ppm**
Hexafluoropropylene (116-15-4)	10 ppm	50 ppm	500 ppm
Hydrazine (302-01-2)	0.5 ppm	5 ppm	30 ppm
Hydrogen Chloride (7647-01-0)	3 ppm	20 ppm	150 ppm
Hydrogen Cyanide (74-90-8)	NA†	10 ppm	25 ppm
Hydrogen Fluoride (7664-39-3)**	2 ppm	20 ppm	50 ppm
Hydrogen Peroxide (7722-84-1)	10 ppm	50 ppm	100 ppm
Hydrogen Selenide (7783-07-5)	N/A	0.2 ppm	2 ppm
Hydrogen Sulfide (7783-06-4)	0.1 ppm	30 ppm	100 ppm

Blåsyre
Saltsyre
Hydrogensulfid

http://www.aiha.org/Committees/documents/erpglevels.pdf

Chemical (CAS Number)	ERPG–1	ERPG–2	ERPG–3
Phenol (108-95-2)	10 ppm	50 ppm	200 ppm
Phosgene (75-44-5)	N/A	0.2 ppm	1 ppm
Phosphine (7803-51-2)	NA†	0.5 ppm	5 ppm
Phosphorus Pentoxide (1314-56-3)	1 mg/m^3	10 mg/m^3	50 mg/m^3
Phosphorus Trichloride (7719-12-2)	0.5 ppm	3 ppm	15 ppm
Propylene Oxide (75-56-9)	50 ppm	250 ppm	750 ppm
Sodium Hydroxide (1310-73-2)	0.5 mg/m^3	5 mg/m^3	50 mg/m^3
Stibine (7803-52-3)	ID‡	0.5 ppm	1.5 ppm
Styrene (100-42-5)	50 ppm	250 ppm	1000 ppm
Sulfur Dioxide (7446-09-5)	0.3 ppm	3 ppm	15 ppm
Sulfuric Acid (Oleum [8014-95-7], Sulfur Trioxide [7446-11-9], and Sulfuric Acid [7664-93-9])	2 mg/m^3	10 mg/m^3	30 mg/m^3
Tetrachlorosilane (10026-04-7)	0.75 ppm	5 ppm	37 ppm
Tetraethoxysilane (78-10-4)	25 ppm	100 ppm	300 ppm
Tetrafluoroethylene (116-14-3)	200 ppm	1000 ppm	10,000 ppm
Tetrahydrofuran (109-99-9)	**100 ppm**	**500 ppm**	**5000 ppm**
Tetramethoxysilane (681-84-5)	NA†	10 ppm	20 ppm
Thionyl Chloride (7719-09-7)	0.2 ppm	2 ppm	10 ppm
Titanium Tetrachloride (7550-45-0)	5 mg/m^3	20 mg/m^3	100 mg/m^3
Toluene (108-88-3)	50 ppm	300 ppm	1000 ppm
Toluene 2,4- (2,6-) Diisocyanate (TDI) (584-84-9)	0.01 ppm	0.15 ppm	0.6 ppm
1,1,1-Trichloroethane (71-55-6)	350 ppm	700 ppm	3500 ppm

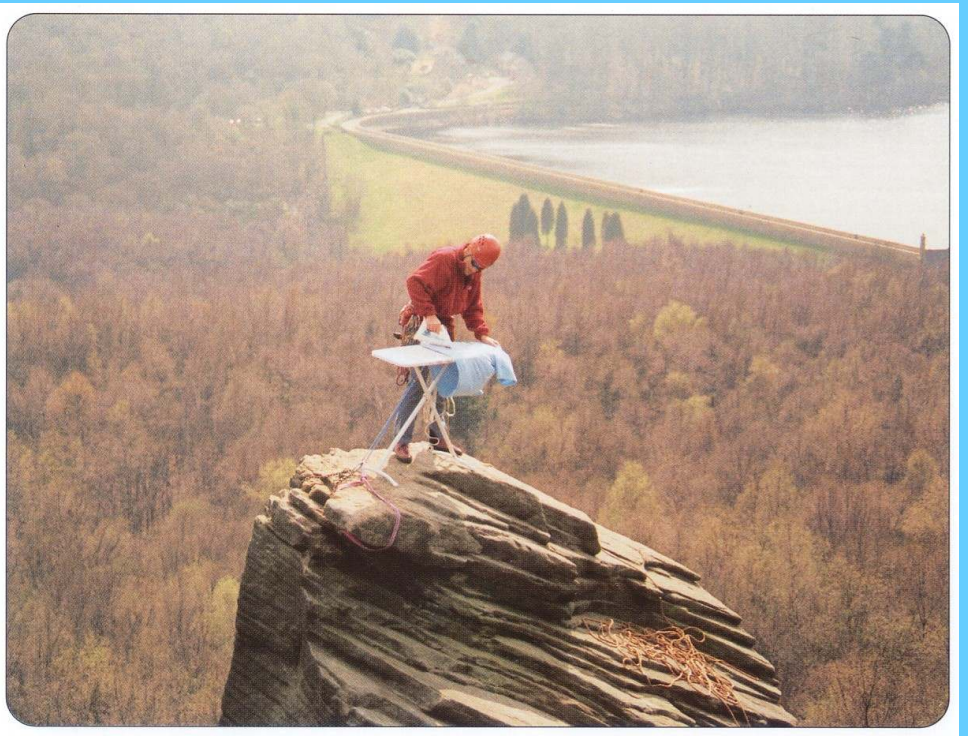
Fosgen

Svoveldioksid

Toluendiisocyanat
0,01 , 0,15 0,6

http://www.aiha.org/Committees/documents/erpglevels.pdf

Hot Work



Rivelin edge in the Peak district is an ideal training ground for extreme ironing

Bilde; Extreme Ironing. www.extremeironing.com

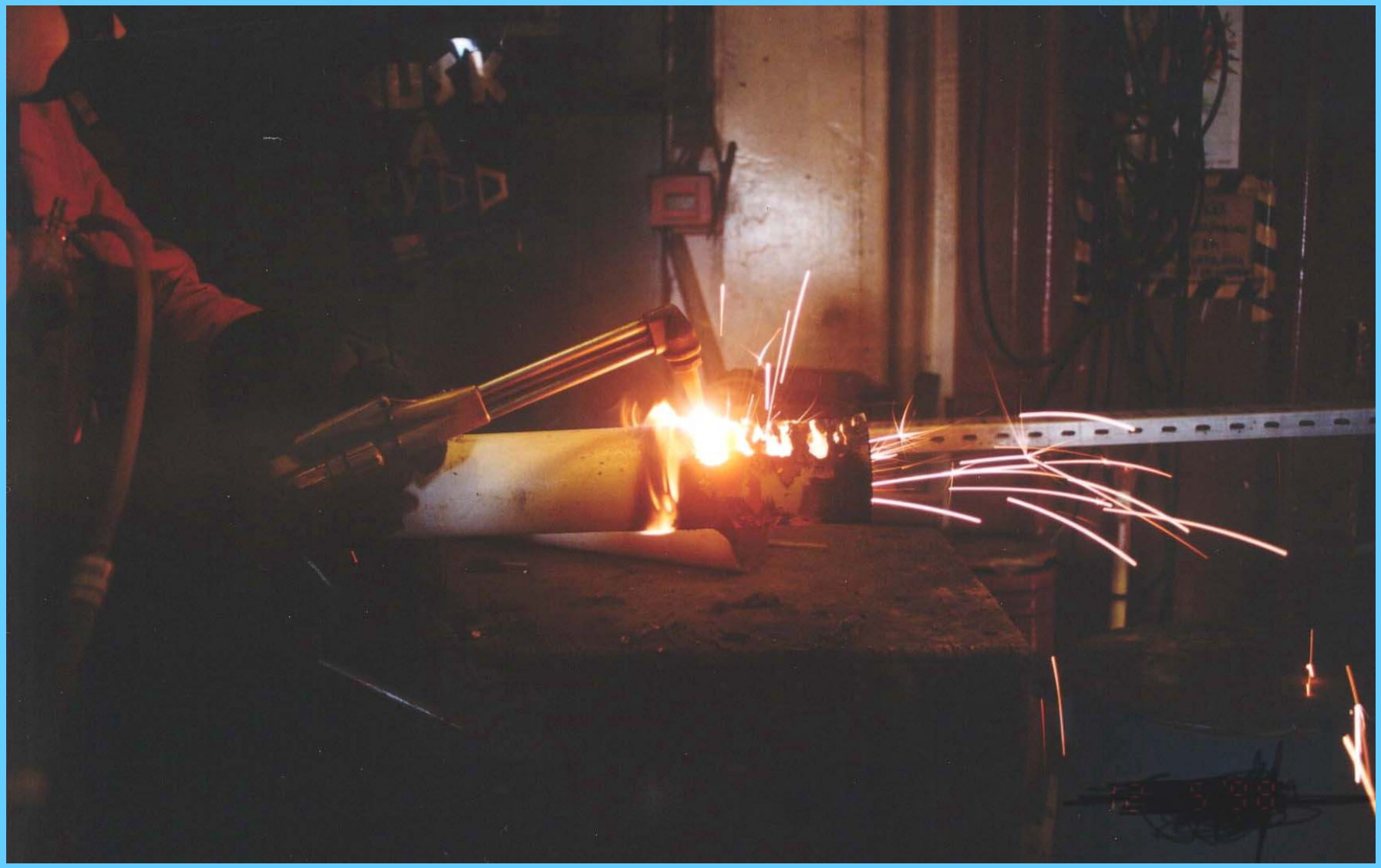
Hot work. Welding, grinding, flame cutting creates many very toxic compounds

Do you work with ISOCYANATES and POLYURETHANE?
http://www.prevent.se/doc_pdf/verktyg/pdf/isoeng_broschyr.pdf
http://www.prevent.se/doc_pdf/verktyg/pdf/isoeng_diagnos.pdf

NIOSH Safety and Health Topic: Isocyanates
http://www.cdc.gov/niosh/topics/isocyanates/

Foto: Halvor Erikstein

Before



- Cutting and heating of painted surfaces, what can happen?

Thermal degradation of polyurethane – general mechanism

Polyurethane ⇨ **isocyanate** ⇨ **amine** ⇨ **nitrils** ⇨ **nitrous oxides (NOx)**

R-NH-CO-O-R2 R-NCO R-NHR R-CN NO2/NO

Example HDI based

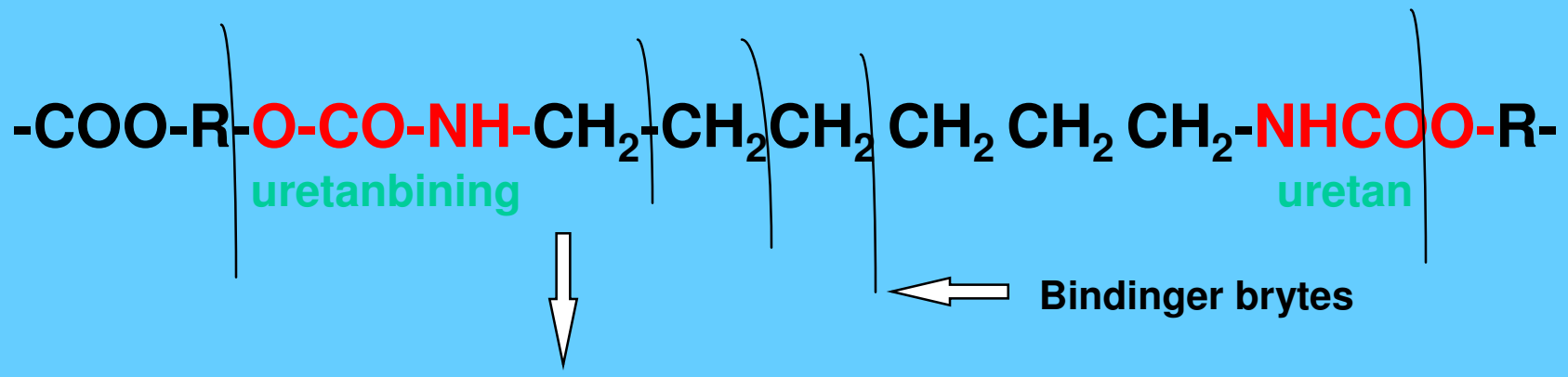
HDI-dekomp. ⇨ Methyl isocyanat ⇨ Methyl amine ⇨ Acetonitril Hydrogen cyanidr

CH_3NCO CH_3-NH2 CH_3-CN / HCN

Fremstilling og bruk av polyuretanprodukter (Isocyanater)
http://www.arbeidstilsynet.no/publikasjoner/brosjyrer/bros536.html

Les mer om isocyanater på;
http://www.arbeidstilsynet.no/sok.html?q=isocyanater

Thermal degradation of HDI-based polyurethane



CH_3-NCO	Methyl isocyanate
CH_3Ch_2-NCO	Ethyl isocyanat
$CH_3CH_2CH_2$-NCO	Propy lisocyanat
OCN-$(CH_2)_6$-NCO	Hexamethylene diisocyanate (HDI)

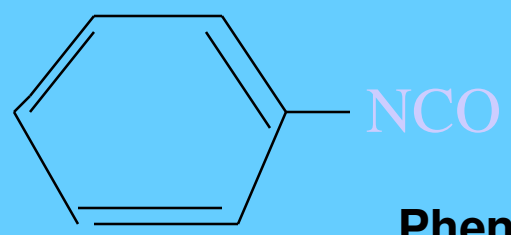
+

Combinations of isocyanates and amins

And other groups. Very complex chemistry

Compounds identified in the smoke from heated polyurethane top coat

	OEL	mikrogram/m3 Measured
CH3-NCO	12	470
CH3CH2-NCO	15	400
CH3CH2CH2-NCO	20	140
OCN-CH2CH2CH2CH2CH2-NCO	30	340



Phenyl isocyanate

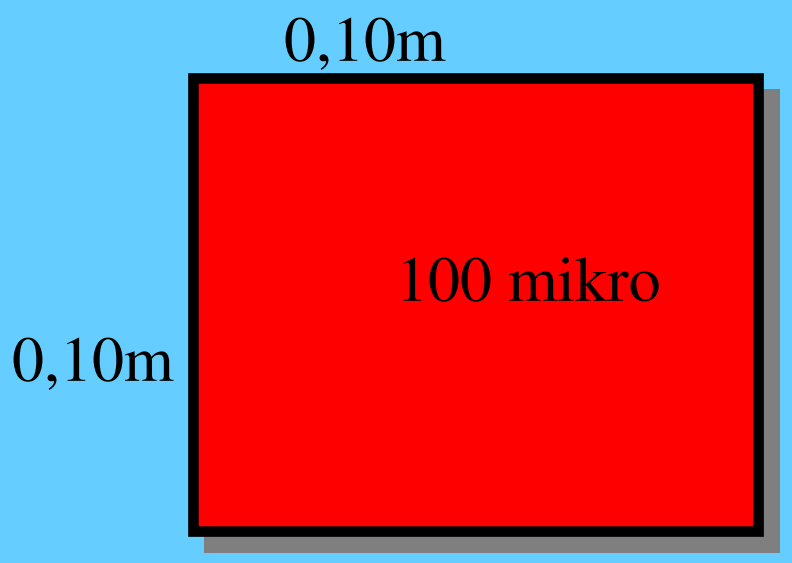
Occupational exposure level (OEL) and times exceeding the OEL

	OEL	Measured	Times
MIC	12	470	39
EIC	15	400	27
PIC	20	140	7
HDI	30	340	11
		Total	84

OEL 0,005 ppm

- UK OEL (0,02 mg(-NCO)/m^3

Example on amounts of isocyanate from heating polyurethane based paint



Thickness 100 mikrometer

Density =1 mg/m^3

0,10m x 0,10m x 0,000001m x1mg/m^3

= 1000 mg

OEL MDI 0,05mg/m^3.

<u>1% of the paint is degraded back to isocyanate</u>

A degrading rate of 1% from 1000 mg gives (1000mgx1%)=10mg.

Air dilution needed for the 10mg/0,05mg/m^3 =

200 m^3

DAGBLADSERIEN
”Den livsfarlige jobben”

Norges oljeeventyr går mot slutten. Dette betyr begynnelsen for en ny bransje: skroting av utrangerte oljeplattformer. Dagbladet setter gjennom en serie artikler fokus på arbeidstakernes sikkerhet og kampen om milliardkontraktene i den nye vekstbransjen. Arbeidstilsynet hevder oljeindustrien fraskriver seg ansvaret for skrotingen av sine gamle oljeplattformer. Tilsynet slår alarm om det de karakteriserer som en farlig og risikofylt bransje.

Søk på Leiv Gunnar Lie og Thomas Ergo i
www.dagbladet.no

12 NYHET SØNDAG 3. APRIL 2005 Dagbladet

Krangelen om Terri fortsetter

Terri Schiavos (41) etterlatte klarer ikke å bli enige om begravelsen hennes. Dermed planlegger foreldrene og mannen hennes hver sine begravelser. Terri Schiavo døde torsdag, 13 dager etter at næringssonden ble fjernet etter en rettsbeordring mannen Michael Schiavo hadde skaffet. Schiavos foreldre ønsket derimot sonden tilkoblet igjen. (ANB)

DØD: Terri Schiavo.

Pressen slår tilbake mot prins Charles

Pressen lar prins Charles gjennomgå etter at han dummet seg ut torsdag. Prins Charles karakteriserte pressekobbelet som fulgte etter ham på et skisted i Sveits som «dette helvetes pakke». Uttalelsen ble mumlet og var ment for sønnene prins Harry og prins William da de tre stilte opp for fotografene. Men mikrofoner plukket opp kommentarer.

The Sun kaller Charles en helvetes surpomp.

Daily Mail kaller prinsens mumlende indre tanker for bitre og furtne, og ber Charles ta et grep om sine kongelige forpliktelser. (ANB)

VISKER: Prins Charles

Dagbladet onsdag 30. mars. Hannu Tiempo ble alvorlig skadd i en eksplosjon på Aker Stord.

Dagbladet torsdag 31. mars. En gnist kunne vært nok til å utløse en stor eksplosjon på Eldøyane.

Dagbladet fredag 1. april. Odd Helge Stormoen døde under arbeid med på «Maureen»-feltet.

Dagbladet i går. Arbeidstilsynet refser oljeindustrien for ikke å ta ansvar.

FÅR NEI: Oljebransjen vil ikke støtte Tor B. Aasens forskningsprosjekt som kan kartlegge den kjemiske risikoen ved å hogge opp gamle plattformer. Foto: Oddmund Lunde

Forskerne kan redde liv - oljeindustrien sier nei

Oljeindustrien bruker millioner på å få kontoransatte til å gå i trapper og kjøre tryggere. Men de vil ikke gi penger til et prosjekt som kan redde liv og helse blant gutta på golvet.

Tips oss!
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BERGEN (Dagbladet): Enorme mengder farlige stoffer og kjemikalier venner arbeiderne som skal rive, hogge og brenne i Norges utrangerte oljeplattformer. Bare på Ekofisk I fins der 980 tonn maling, 1300 tonn elektronisk avfall og 260 tonn asbest, i tillegg til en rekke ukjente stoffer.

Helserisikoen og hvor mange som kan bli rammet er ikke endelig kartlagt. Problemet er at oljebransjen heller ikke viser særlig interesse for å undersøke det.

Ved Haukeland universitetssykehus har forskerne lenge vært klare med et prosjekt for å kartlegge farene. De er ikke i tvil om at slik kunnskap kan redde helsa til mange arbeidsfolk som skal hogge opp oljeplattformer.

Serie
DEN LIVSFARLIGE JOBBEN

Norges oljeeventyr går mot slutten. Dette betyr begynnelsen for en ny bransje: skroting av utrangerte oljeplattformer. Dagbladet setter gjennom en serie artikler fokus på arbeidstakernes sikkerhet og kampen om milliardkontraktene i den nye vekstbransjen.

Farlige giftgasser

– Når man skjærer på maling, frigjøres en del aktive stoffer som kan gi astma, allergier, eksem og lungeemfysem. Problemet i dag er at risikoen er for dårlig kartlagt. Verken de ansatte eller legene deres ve hva slags stoffer dette dreier seg om, sier Tor B. Aasen ved yrkesmedisinsk avdeling.

Lungelegen var oss med inn på et laboratorium. I et glassbur pumpes det inn utsmå mengder giftgasser til en forsøksperson. Så blir det sjekket på en rygg måte om det gir negative utslag på kroppen. Forskerne vil også studere helsa til en rekke arbeidere over tid.

Prosjektet er flere ganger blitt presentert på oljeindustriens årlige sikkerhetskonferanse.

Foreløpig har bare oljeselskapet Total latt seg overtale til å støtte prosjektet. Aasen er overrasket.

– Jeg tror at selskapene vil se seg tjent med å kunne å garantere en sikkerhet i dette arbeidet. Jeg har tilbudt meg å møte oljeindustrien for å prøve om dette problemet, men har ikke fått noen respons, sier Aasen.

Jobb og helse

Uten kunnskap frykter Aasen at et ukjent antall arbeidere vil miste jobb og helse, og kanskje dø, på grunn av kjemisk eksponering.

Først tror man gjerne at det skyldes bronkitt, røykehoste eller liknende. Når legen begynner å mistenke noe mer alvorlig, er arbeidstakeren allerede uhelbredelig syk.

– Ofte blir folk henvist hit når det er for seine. Alt vi kan gjøre, er å hjelpe dem til en rygg eller uførepensjon. Det er trist, sier Aasen.

Uønsket kunnskap

Oljeindustrien bruker mye penger på å få ned antall skader. Blant annet leres ansatte opp i hvordan de skal holde i gelendre når de går i trapper, og hvordan de skal parkere bilen ryggr. At de da ikke avser noen millioner til rygging av platform-hoggernes liv og helse, provoserer Oljearbeidernes fellessammenslutning (OFS).

– **Det er nærliggende å tro at arbeidsgiverne ser på dette som uønsket kunnskap. Hvis vi ikke vet hva man blir utsatt for, er det også umulig å beskytte seg, sier yrkeshygienieker Halvor Erikstein i OFS.**

> « Det er nærliggende å tro at arbeidsgiverne ser på dette som uønsket kunnskap.»
> **Halvor Erikstein,** Oljearbeidernes fellessammenslutning

Har ikke sagt nei

Teknologibedriftenes landsforening (TBL) undersøker at de ikke har avslått prosjekter.

– Dette ser interessante ut, men det finnes flere gode prosjekter enn vi har råd til å støtte. Hvis ikke bedriftshelserjenesten på Aker mener at dette er et viktig prosjekt, kan vi ikke støtte det, sier Knut Aaneland, daglig leder i TBL Offshore.

– Vi tar ansvar når vi skal ta ansvar

Oljeindustriens Landsforening (OLF) vil undersøke forskningsprosjektet ved Haukeland sykehus nærmere.

Interessen fra oljeindustrien skal ha vært lunken de gangene Haukeland-prosjekter har vært presenteret på oljeindustriens årlige Sikkerhetsforum.

– Vi stiller oss ikke avvisende i utgangspunktet. Vi tar ansvar når vi skal ta ansvar. Men dette ser ut som et grenseland, sier OLFs kommunikasjonsdirektør Elin Kleven. Hun peker på at forskerne ser på risikoen ved riving av plattformene. Den jobben utføres for oljeindustrien av leverandørindustrien.

– Formelt kan det se ut som prosjektet derfor gjelder leverandørindustrien, og dermed Teknologibedriftenes landsforening (TBL). Men vi skal nå sjekke ut prosjektet nøye, sier Kleven.

– Ønsker ikke oljeindustrien kunnskap om farene ved riving av plattformer?

– Nei, det vil jeg avvise. All kunnskap om arbeidernes helse er interessant for oss, sier Kleven.

– Har ikke oljeindustrien ansvar for sikkerheten under riving av deres egne plattformer?

– Det kommer an på om du mener moralsk eller formelt. I og med at vi har et overordnet ansvar, vil vi være med på å kartlegge helsekonsekvenser, uten at vi automatisk går inn i alle mulige prosjekter, sier Kleven.

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Kjemisk eksponering skal reduseres ved hjelp av tekniske tiltak