Contactgroep Gezondheid en Chemie & NVAB
‘s Hertogenbosch – 09.06.2011

Acute gevolgen van de inhalatie van impregnatiesprays

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Arbeids-, Milieu- en Verzekeringsgeneeskunde

and

Pneumologie

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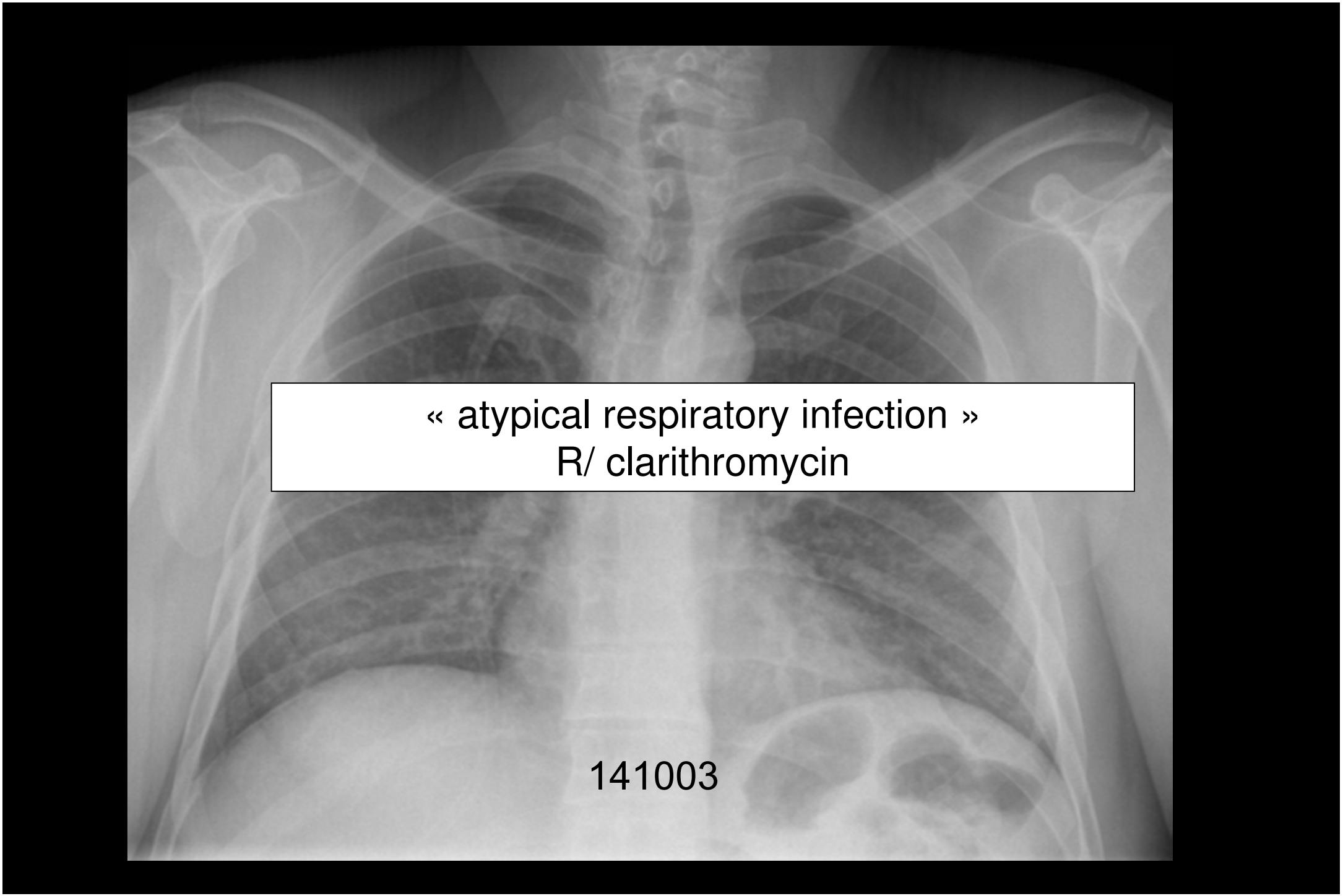
Case 1

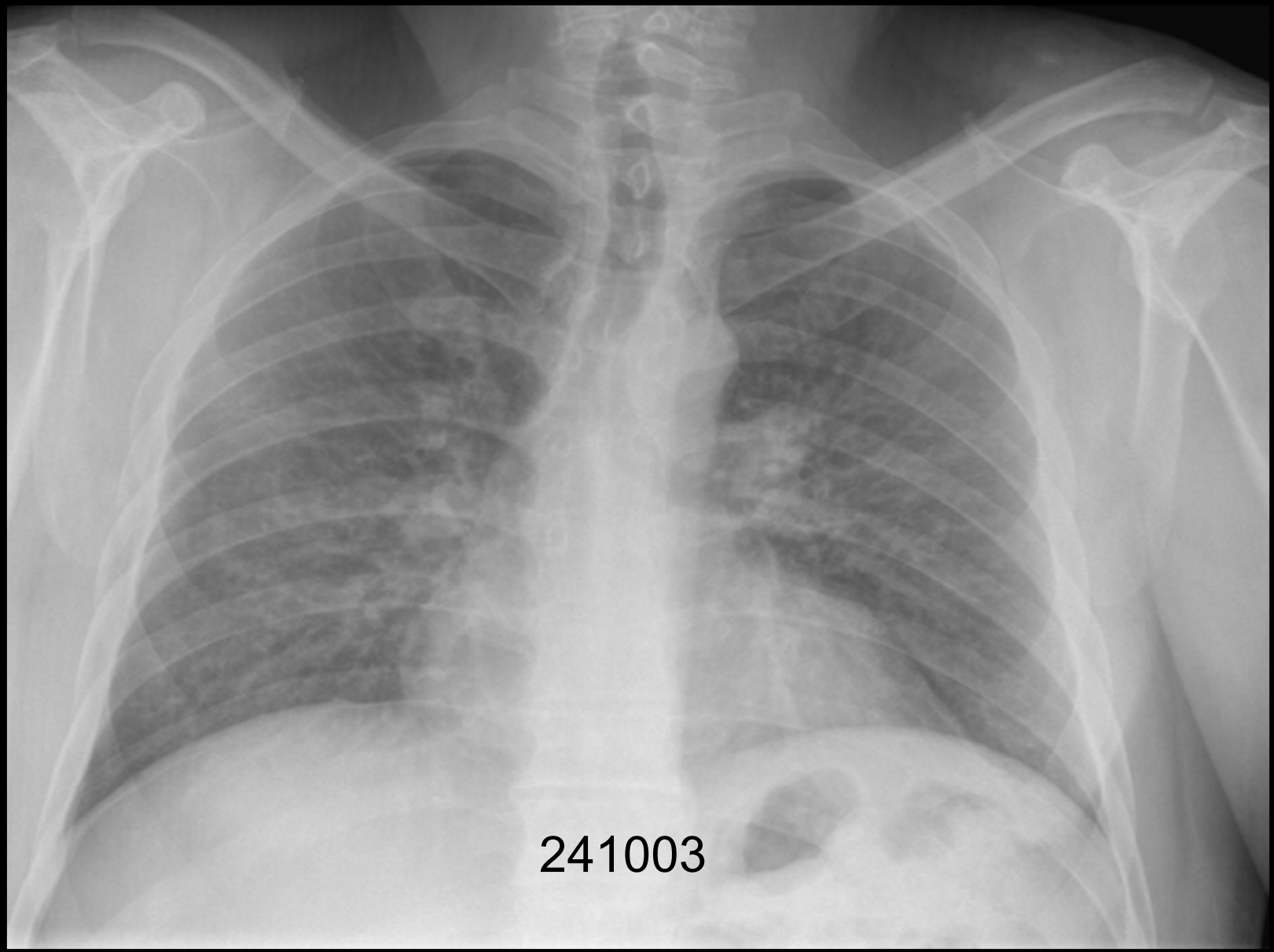
Case 1

- Man, 43 y, smoker, no previous disease
- Visit to Emergency Department:
  - fever, malaise, dry cough, dyspnoea
  - evening: WBC 17,200 (82% pmn), CRP 7 mg/L
  - morning: WBC 11,800 (69% pmn), CRP 53 mg/L, PaO_2 63 mmHg
  - Chest X-ray:


« atypical respiratory infection »
R/ clarithromycin
141003

Case 1

- Second visit to ED 10 days later:
  - similar symptoms
  - WBC 21,400 (81% pmn), CRP 11 mg/L, PaO_2 74 mmHg
  - Chest X-ray and HRCT


241003

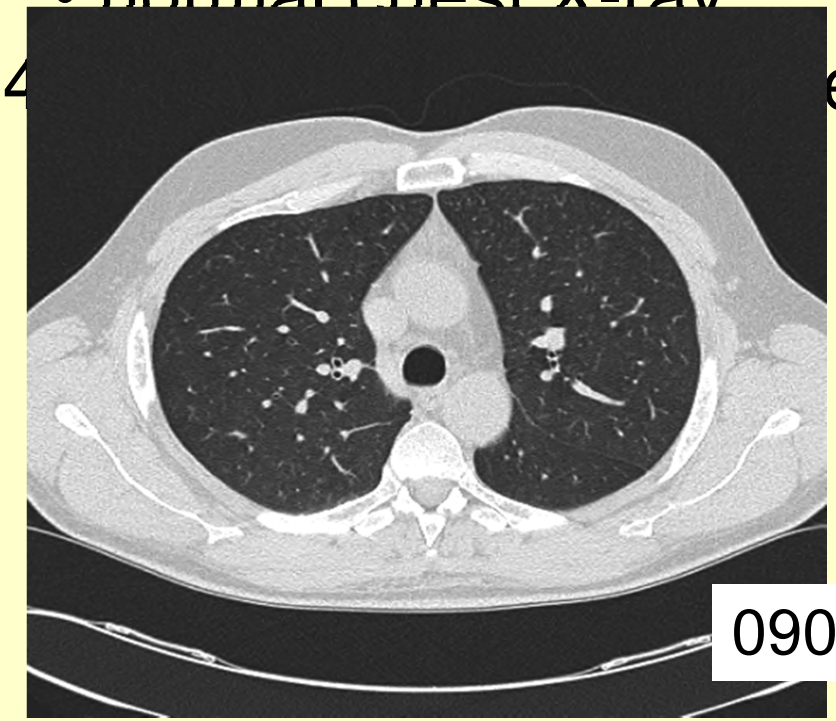
«sprayed an aerosol to prepare new cars (1 can/car)»
Fluorocarbon-containing spray

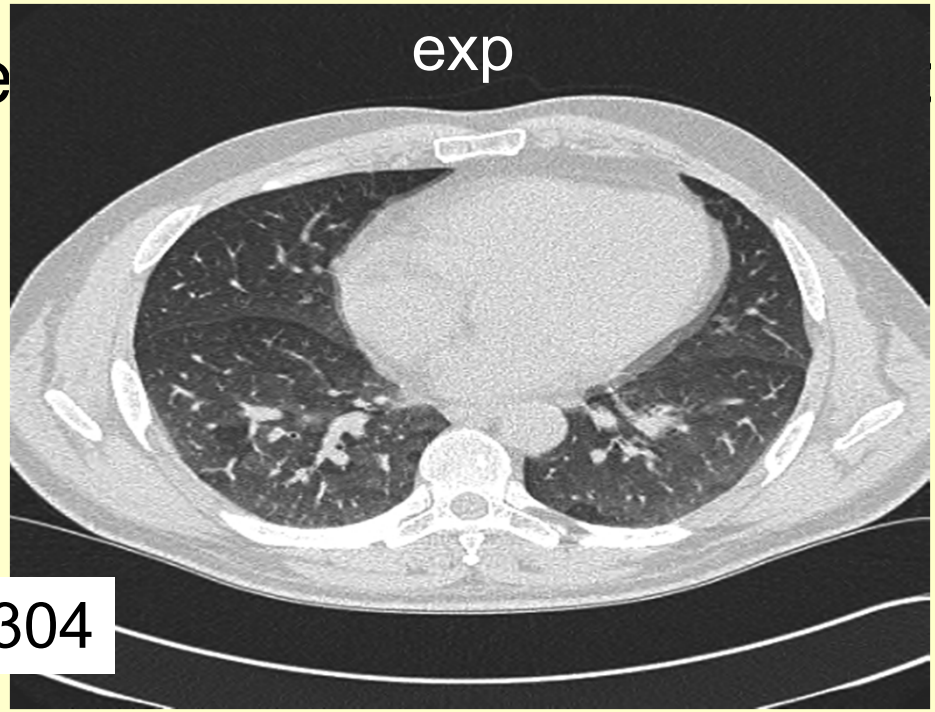
Toxic alveolitis
caused by fabric protection spray

24100

Case 1

- no infectious organisms detected
- R/ methylprednisolone
- rapid improvement, discharged after 5 days
    - normal pulmonary function, including DLco
    - normal chest X-ray
- 4





090304

Fabric protection sprays

- Sprays for impregnation of leather or fabrics (shoes, jackets, furnishings, …) (water/dirt repellant, “anti-rain”)
  - Fluorine-containing hydrocarbons
  - + Solvents

➢ severe pulmonary damage in consumers, domestic animals, workers

- Burkhart *et al*. Pulmonary toxicity following exposure to an aerosolized leather protector. *Clin Toxicol* 1996;**34**:21-24.
- Jinn *et al*. Acute lung injury after inhalation of water-proofing spray while smoking a cigarette. *Respiration* 1998;**65**:486-488.
- Bracco & Favre. Pulmonary injury after ski wax inhalation exposure. *Ann Emerg Med* 1998;**32**:616-619.

Fabric protection sprays

- 2002-2003 reports of (severe) pulmonary injury in users of fabric & leather protection sprays
- The Netherlands

  Bonte *et al*. Ned T Geneesk, 2003, 147, 1185-8
  - Rotterdam, 5 patients [~70 cases reported to PCC]
- Switzerland

  Heinzer *et al*. Thorax, 2004, 59, 541-2
  - Lausanne, 6 patients [153 cases reported to PCC]

  Vernez *et al*. J Occup Environ Hyg 2006, 3, 250-61
  - Switzerland: 102 cases
- Belgium
  - Leuven, 3 men (36-43 y)

Change in propellant
(solvent with more pleasant smell)

“Horse rug lung”

Wallace GMF, Brown PH. Horse rug lung: toxic pneumonitis due to fluorocarbon inhalation. *Occup Environ Med* 2005, 62, 414-6

- Horse rug cleaning firm (14 people)
- Fluorocarbon polymer spray (Rudoguard EPF1619) applied as waterproofing agent (spray gun with air compressor)
- 4 cases of toxic pneumonitis (2 with possible chronic pneumonitis)

“Horse rug lung”

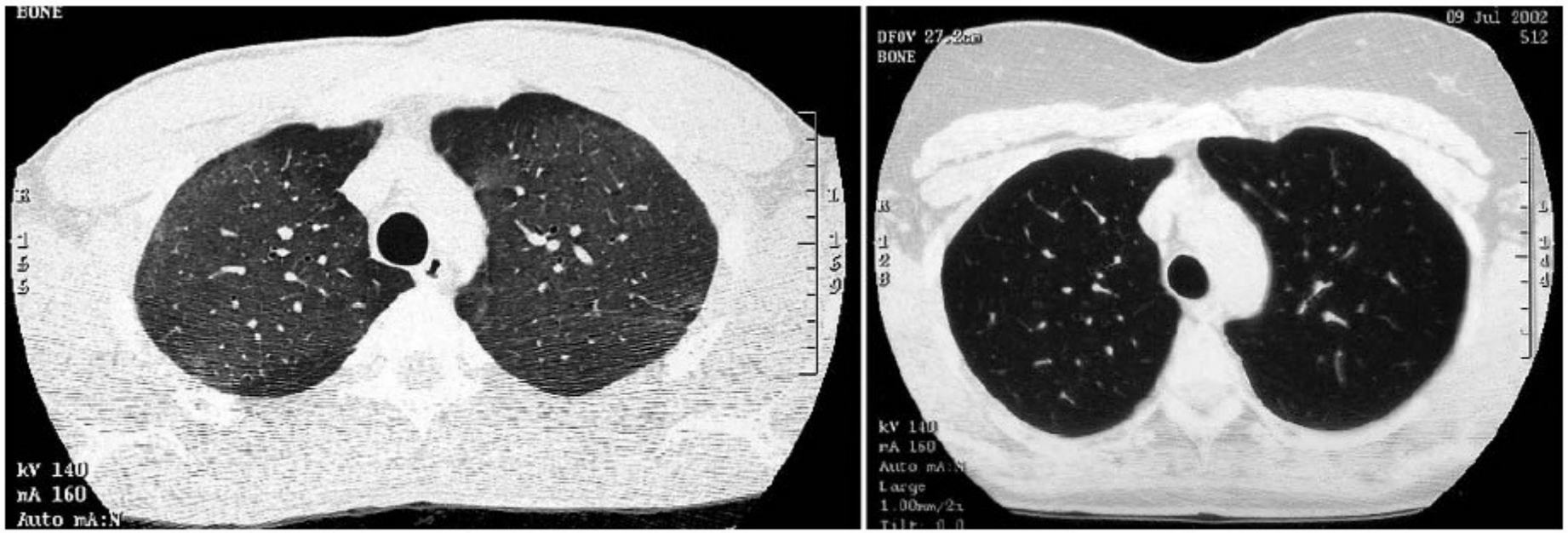


Figure 1 High resolution CT scan (HRCT) of the chest from the first case showing bilateral ground glass opacification (left) alongside a normal HRCT of the chest for comparison (right).

Wallace GMF, Brown PH. Occup Environ Med 2005, 62, 414-6

“Horse rug lung”

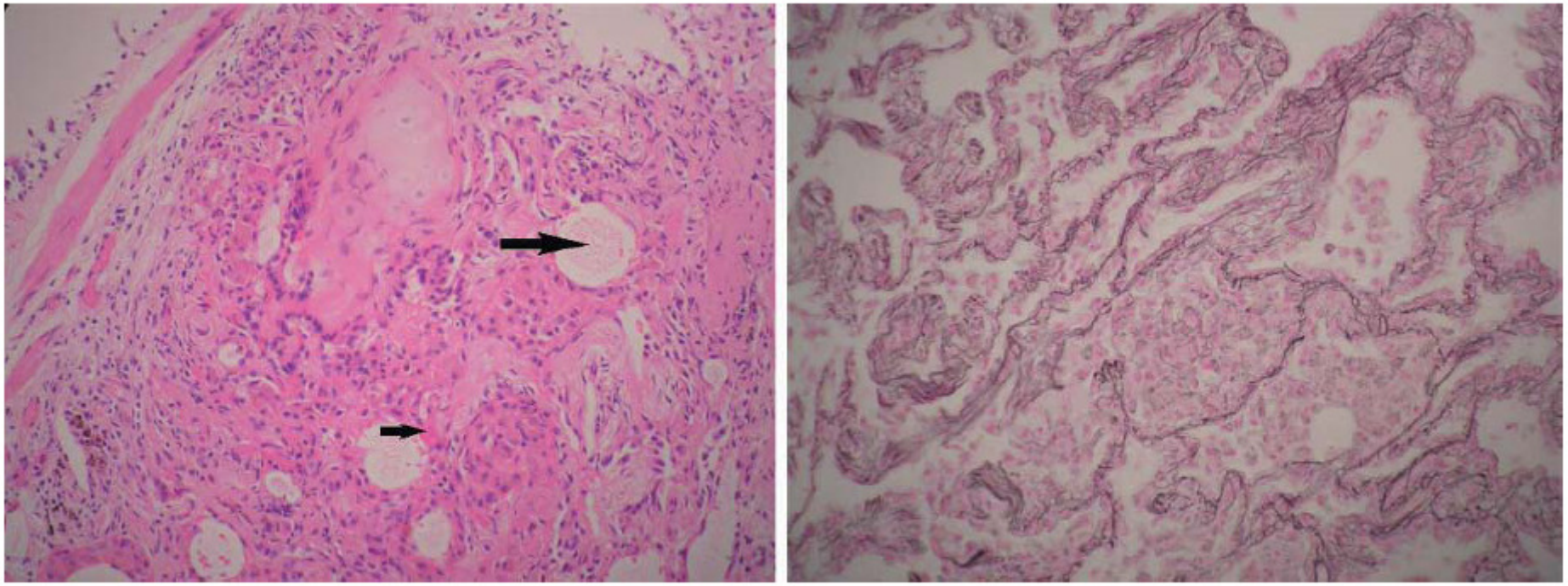


Figure 2 Haematoxylin and eosin stain (left) of lung parenchyma from the first case showing mildly inflamed pulmonary parenchyma, interstitial thickening, foci of organising exudate (large arrow), and striking proliferation of type 2 alveolar lining cells (small arrow) in keeping with toxic alveolar injury. The reticulin stain (right) from the same case confirms that there is no fibrosis. We acknowledge Dr Jenny Dhundee for her help with this.

Wallace GMF, Brown PH. Occup Environ Med 2005, 62, 414-6

Case 2

Case 2

- Man,
- “sales manager” in small company making and testing “fire retardants” for various applications
- 28.06.2010:
  - Air-sprayed new product (Pelicoat Pro-Wood+) on wooden structure (statue)
  - No exhaust ventilation, no personal protection

➢ evening: emergency admission:

- “acute bronchospasm”, wheezing
- FEV_1 56% pred; T_{Lco} 36% pred; desaturation
- R/ steroids (iv + inhaled); discharged after 4 d

- Gradual improvement over 3 months

PRO-Wood +

Hydrofuge,Oleofuge incolore à base de composés fluorés avec action anti-graffiti.
Pro Wood + est inodore et écologique
Pro Wood + est liquide, transparent, prêt à l'emploi et destiné à l'hydrofugation de différents supports de bois.
Pro Wood + a été test par le Centre Scientifique et Technique de la Construction, rapport C.S.T.C. n° : HD 340/133-71.

Pro Wood + is een complexe vochtwerende, pollutieafstotende formule, met anti-graffiti werking
Pro Wood + is reukloos en milieuvriendelijk
Pro Wood + is vloeibaar, transparant en gebruiksklaar
Pro Wood + is geschikt voor alle houtmaterialen
Getest door het W.T.C.B. Wetenschappelijk en Technisch Centrum voor het Bouwbedrijf n°: HD 340/133-71

Propriétés :

- Pro Wood + respecte l'environnement
- S'applique facilement, sans diluer sur tous les supports poreux
- Incolore et inodore, il conserve l'aspect et la texture d'origine des matériaux
- Augmente l'isolation thermique
- Ralentit l'encrassement du bois et réduit le coût de l'entretien
- Protège durablement contre l'eau, les effets du gel, la pollution
- N'altère pas le polystyrène expansé, ni la laine de roche ou de verre, ni les vitres
- Retarde le développement des mousses et moisissures
- Améliore l'hygiène des pièces d'habitation en supprimant les taches d'humidité

Eigenschappen:

- Pro Wood + is een milieuvriendelijk product
- Makkelijk aan te brengen, zonder verdunning, op alle poreuze onderlagen
- Reukloos en kleurloos, het originele uitzicht en de textuur van het materiaal blijven bewaard
- Verbetert de thermische isolatie
- Hout wordt minder snel vuil, wat resulteert in minder onderhoudskosten
- Biedt duurzame bescherming tegen water, vorst en vervuiling
- Tast noch polystyreenschuim, glas, rotswol of ruiten aan
- Gaat mos- en schimmelvorming tegen
- Verbetert de hygiëne in leefruimten door de vorming van vochtvlekken en schimmel tegen te gaan

Application :

- Pro Wood + s'applique à la brosse ou par pulvérisation sur matériaux propres et secs ou légèrement humides, en une ou deux couches de manière à saturer le support
- Pro Wood + est destiné aux applications extérieures et intérieures
- Un masque de respiration approprié doit être porté si le produit est manipulé en grandes quantités, dans des espaces confinés ou dans des circonstances ou l'OEL peut être atteint ou dépassé.
- Lors d'une application à l'intérieur, ventiler les locaux
- Les vitres ne doivent pas être protégées (Essuyer avec un chiffon)

Gebruiksaanwijzing:

- De te behandelen materialen moeten schoon en droog zijn (of weinig vochtig)
- Pro Wood + aanbrengen door middel van een kwast of een pulverisator in één of twee lagen totdat de materialen verzadigd zijn
- De ramen moeten niet afgedekt worden (het volstaat er met een doek over te wrijven)
- Aangepaste maskers dragen, zeker bij gebruik van grote hoeveelheden, gebruik in enge ruimtes, of in andere omstandigheden waarin de blootstellingslimieten benaderd of overschreden kunnen worden.
- Pro Wood + kan zowel binnen als buiten gebruikt worden. Wanneer men het product binnen aanbrengt is het aangeraden het lokaal te ventileren

VEILIGHEIDSINFORMATIEBLAD

Voldoet aan EEG directieven en amendementen

1. IDENTIFICATIE VAN HET PRODUCT EN DE PRODUCENT

HANDELSNAAM : **PELICOAT PRO WOOD PLUS**

Toepassing : Beschermende coating (zie technische fiche)

2. SAMENSTELLING EN INFORMATIE BETREFFENDE DE BESTANDDELEN

Chemische benaming : PTFE in organisch oplosmiddel

Gevaarlijke bestanddelen :

Naam :	CAS N° :	Concentratie :	Gevaarsymbolen/ zinnen:
Gedeshydrateerde Naphta	64742-48-9	+/- 90 %	Xn (schadelijk) R10-65-66
PTFE in naphtaoplosmiddel	nvt	+/- 5 %	Zie onder

3. GEVAREN

De gevaren van het product zoals hier geleverd :
CE-R : 10-20-36-37
Brandbaar
Irriterend voor de ogen
Schadelijk bij inademing

7. HANTERING EN OPSLAG

Voorzorgsmaatregelen voor het veilig hanteren :
Goede plaatselijke ventilatie en aan de deeltjesgrootte aangepaste ademmaskers zijn vereist. Vermijd huid- en oogcontact. Dampen niet inademen. Vermijd eten, drinken of roken tijdens het gebruik van het product. Respecteer regels en procedures betreffende beschermende kleding.

8. MAATREGELEN BEHEERSING BLOOTSTELLING – PERSOONLIJKE BESCHERMING

Maatregelen beheersing blootstelling :

Ventilatie. Gelieve sectie 7 te raadplegen.

Maatregelen beheersing blootstelling aan gevaarlijke stoffen :

Naam : nvt CAS N° : nvt Blootstellingslimieten : nvt

Persoonlijke beschermingsmiddelen :

Ademhaling :

Gelieve sectie 7 te raadplegen betreffende ventilatie. Aangepaste maskers dragen, zeker bij gebruik van grote hoeveelheden, gebruik in enge ruimtes, of in andere omstandigheden waarin de blootstellingslimieten benaderd of overschreden kunnen worden.

11. TOXICOLOGISCHE INFORMATIE

Contact met de ogen :

Irriterend.

Contact met de huid :

Herhaald of langdurig gebruik kan uitdroging van de huid veroorzaken, wat leidt tot huidonsteking. Kan irriteren bij langdurig of herhaaldelijk gebruik.

Bij inademing :

Kan duizeligheid, verwarring en coordinatieverlies veroorzaken bij hoge concentraties. Kan brandwonden veroorzaken in de hogere luchtwegen.

15. WETTELIJK VERPLICHTE INFORMATIE

Volgens de EU richtlijn :

Bevat siliconen in naphta (petroleum) oplosmiddel, sterk gehydrotraiteerd.

Symbols CE :

Xn	Schadelijk	Xi	Irriterend

R-zinnen :

R10	Brandbaar
R36	Irriterend voor de ogen
R38	Irriterend voor de ogen
R65	Schadelijk : kan longschade veroorzaken bij opname
R66	Herhaalde blootstelling kan een droge of een gebarste huid veroorzaken

S-zinnen :

S23	Damp niet inademen
S24/25	Aanraking met de huid vermijden
S28	Na aanraking met de huid onmiddellijk met overvloedig water afspoelen
S36	Draag aangepaste kleding
S62	Bij inslikken niet het braken opwekken; direct een arts raadplegen en de verpakking of het etiket tonen
S2	Buiten het bereik van kinderen houden

Nationale wetgeving - reglementering : NVT

Stoffen die de ozonlaag aantasten :

Er zijn geen stoffen die de ozonlaag aantasten aanwezig in dit product en worden ook niet gebruikt voor de productie ervan.

Status :

EINECS :

Alle substanties zijn in het register opgenomen of vereisen geen vermelding.

Impregnation sprays and lung toxicity

- Issues
  - Role of solvents?
  - Fluorocarbons and “Polymer fume fever”?
  - Mechanisms? Nanoparticles?

Solvents

- Solvents rarely cause lung disease, except in massive quantities
- Solvents mainly cause neurologic symptoms
  → acute or chronic solvent encephalopathy
- Solvents may cause mucosal irritation (trigger for bronchospastic reaction if NSBHR)
- Solvents are used as carriers for many (pneumotoxic) agents
  - paints, including spray-paints (isocyanates, …)
  - leather impregnation aerosols

Polymer fume fever

Inhalation fevers

- metal fume fever
  - heating Zn, Cu, ...
- organic dust toxic syndrome (ODTS)
  - bio-aerosols, organic dusts + fungi, ...
- polymer fume fever
  - fumes of heated fluorine-containing polymers (polytetrafluoroethylene = PTFE = Teflon®)

Inhalation fevers

- flu-like symptom complex
  - fever, chills, myalgias, malaise
  - minor respiratory symptoms:

    dry throat, cough, chest tightness
- non allergic, non infectious
- release of cytokines by lung cells + influx of pmn in alveoli (“toxic alveolitis”)
- usually self-limited
- DD: infection, (occupational) asthma, acute HP

Polymer fume fever

- Exposure to heated F-containing polymers,
  typically: polytetrafluoroethylene (PTFE) > 300 ℃
  - PTFE resin moulding & extrusion
  - welding of PTFE-coated metal
  - high-speed machining of PTFE
  - smoking cigarettes contaminated with PTFE
- also heated Cl-containing polymers (PVC) ?
- also heated polymers containing Br-based flame retardants ?

! May be severe (pulmonary oedema → †)

- No tolerance, possible sequelae (fibrosis)

Reference

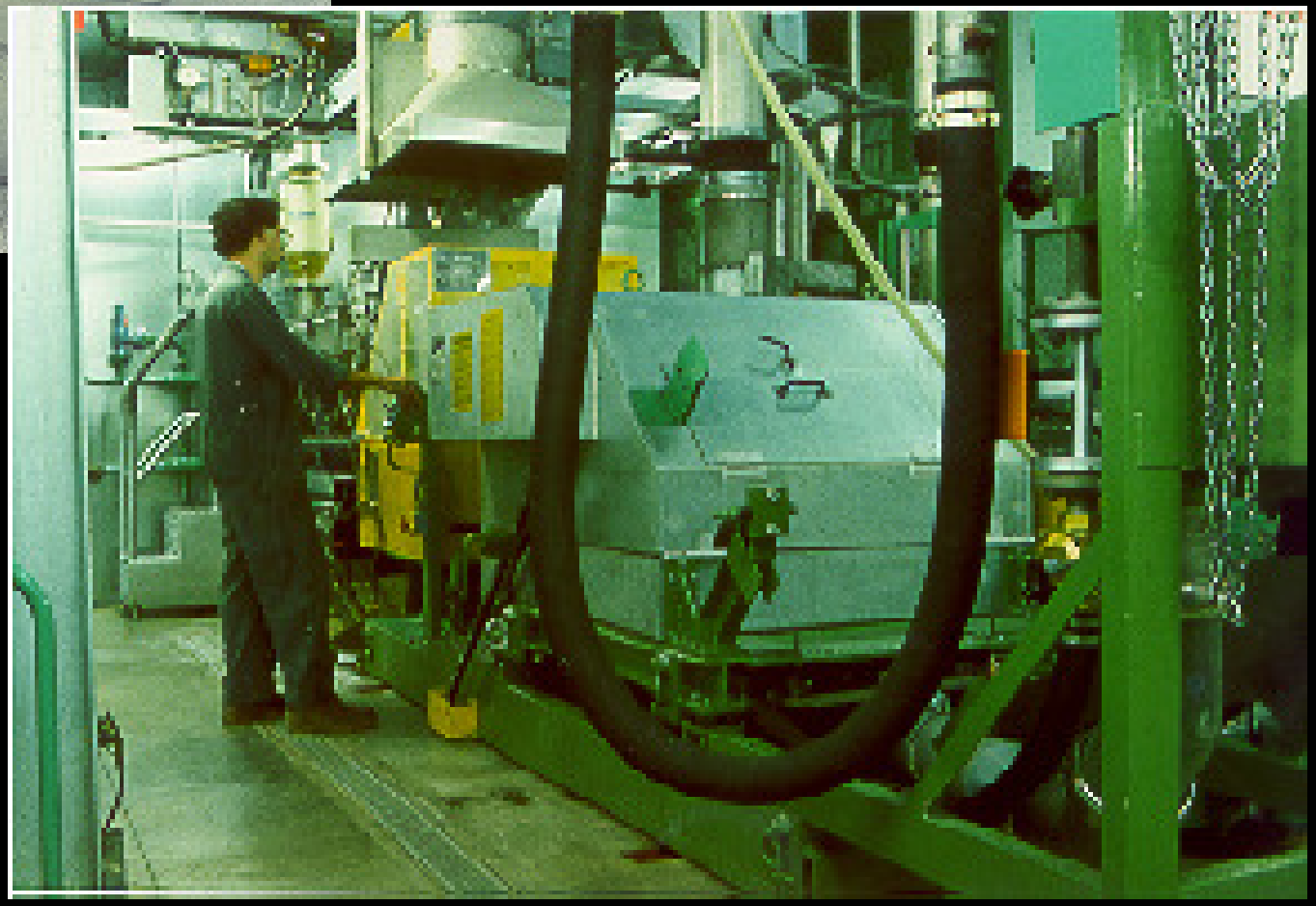
- SHUSTERMAN D.J. Polymer fume fever and other fluorocarbon pyrolysis-related syndromes. ***Occup Med*** 1993, 8, 519-31

Case 3

Case

- male, 30 y, never smoker, atopic (rhinitis)
- operator in polyester extrusion plant

primary polymer
+ additives
(pigments & dyes, stabilizers,
flame retardants, fillers, …)



Case

- male, 30 y, never smoker, atopic (rhinitis)
- operator in polyester extrusion plant
  - ➢ when malfunction (“plop”) → release of fumes
    - sore throat & chest tightness (less if respirator)
    - evening: nausea, chills, headache, myalgias & arthralgias (no asthma)
  - ➢ only if polymers contain bromine-containing flame-retardant
- normal lung function (FVC 123%, FEV_1 108%, D_{LCO} 98%)
- histamine PC_{20} 1.3 and 4.5 mg/ml

Challenge tests

- in cabin, heating approx. 500 g pellets of
  - polybutyleneterephthalate (PBT)
  - PBT + polybrominated polystyrene

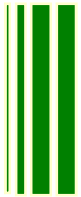
  to approx. **300 °C** (not blind)

  exposure for 5+10+15+(30+30) min
- monitoring symptoms, temperature
  pulmonary function
  blood leukocytosis

#1

PBT 300 ℃

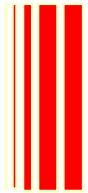
5+10+15+30+30 min



no symptoms

PBT + flame retardant 300 ℃

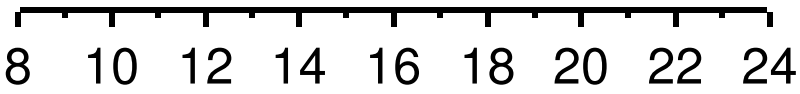
5+10+15+30+20 min



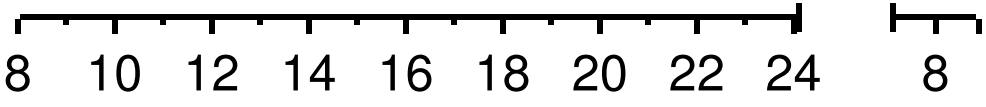
malaise

chills, myalgias

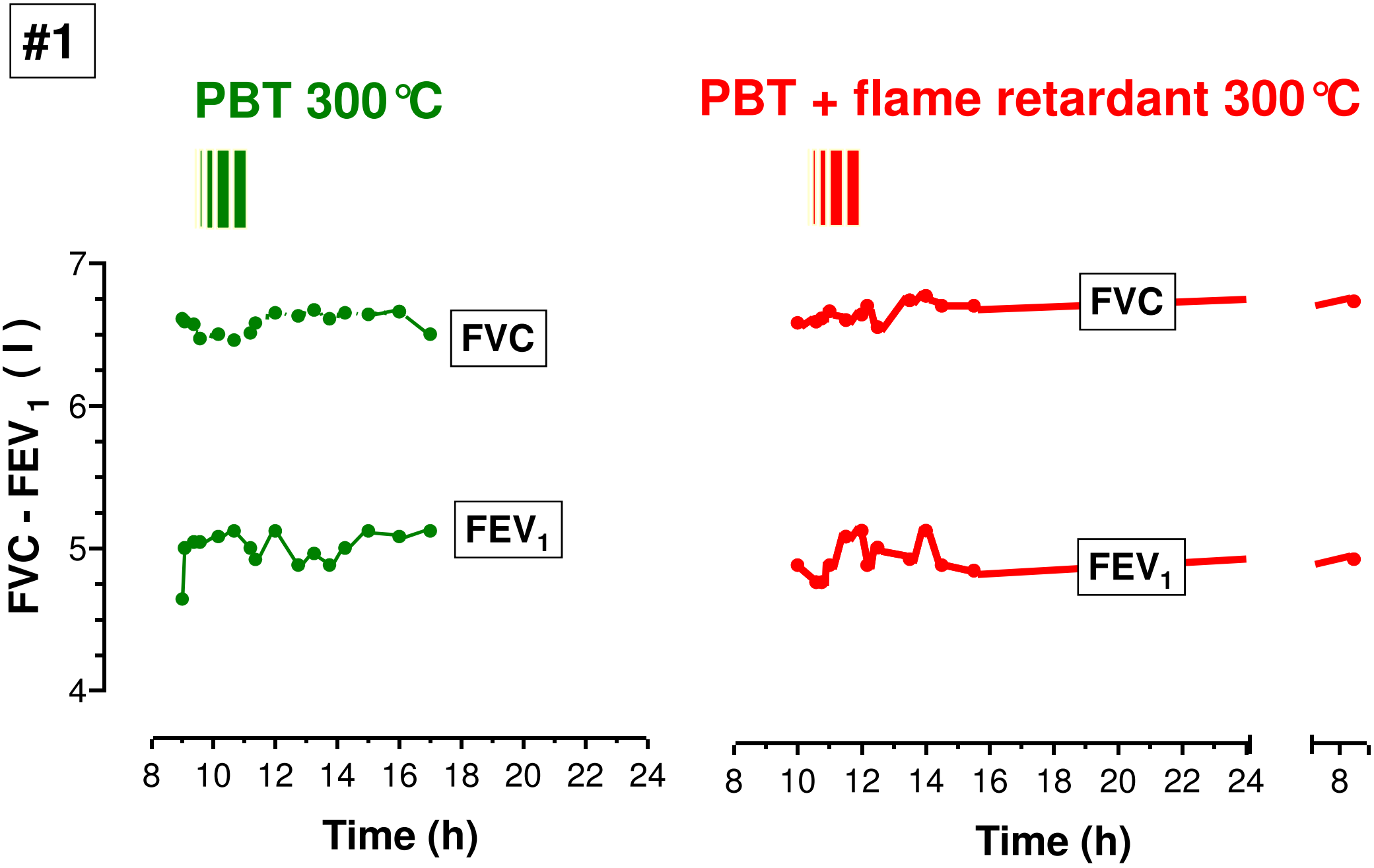
no fever (36.0 - 36.6 ℃)



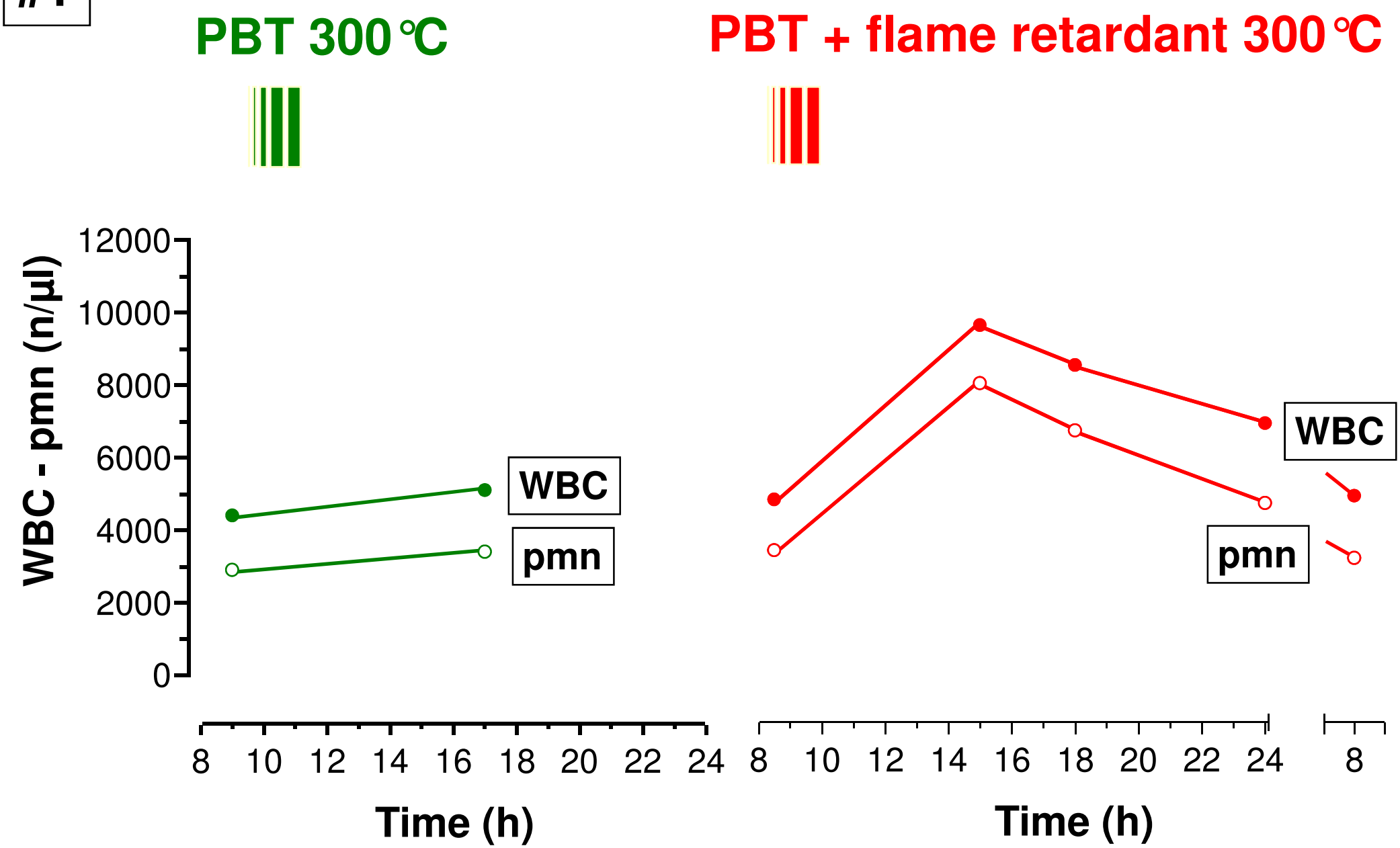
Time (h)



Time (h)


#1
PBT 300℃
PBT + flame retardant 300℃
FVC
FEV1
FVC
FEV1
FVC - FEV1 (l)
7
6
5
4
8
10
12
14
16
18
20
22
24
Time (h)
8
10
12
14
16
18
20
22
24
8
Time (h)

#1


PBT 300℃
PBT + flame retardant 300℃
WBC - pmn (n/µl)
12000
10000
8000
6000
4000
2000
0
WBC
pmn
8 10 12 14 16 18 20 22 24
Time (h)
8 10 12 14 16 18 20 22 24 8
Time (h)

Case 4

Case 4

- Man, 30 y, no previous respiratory disease, smoker
- Since 5 y: window cleaner (+ occasionally cleaning and polishing natural stone)
- 22.05.2008:
  - polished stone floor on which stain repellent had been applied previously (normally: wet polishing)
  - small unventilated room, very dusty job, no respiratory protection
  - ➢ evening: fever (> 38 °C) + malaise
  - ➢ next day: hospital admission

Case 4

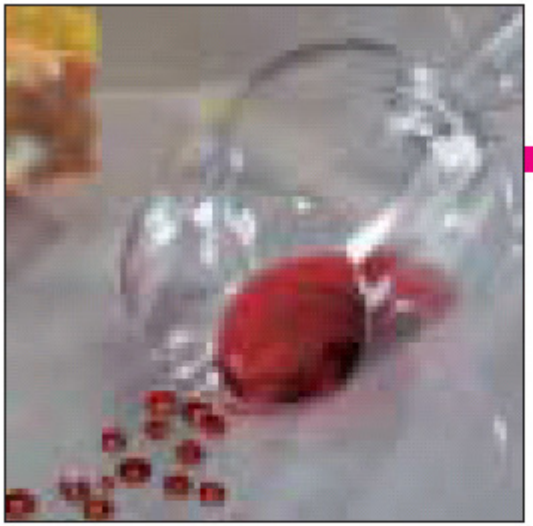
- R/ antibiotics, corticosteroids (systemic & inhaled)
- Favourable evolution, discharged after 4 d
- Stopped smoking

Case 4

- 22.07.2008
  - FVC 5.58 L (106%)
  - FEV_1 3.99 L (91%)
  - RV (pleth) 1.38 L (75%)
  - TLC 6.98 L (95%)
  - TLco 8.40 (70%)
  - Kco 1.26 (78%)
  - Histamine PC_{20} 1.4 mg/ml
  - FENO 5.6 ppb

AKEMI
Anti-Fleck
Anti-Taches
Anti-Vlek
NANO-EFFECT
mit Nano-Abperleffekt,
schnelle Schutzwirkung, überwiegend keine
Farbtonvertiefung, lebensmittelverträglich

NANO-EFFECT



No. 1 09 31	250 ml
No. 1 09 32	1000 ml
No. 1 09 33	5000 ml

Stain Repellent Nano-Effect

Even stronger water-, grease and oil-repellent effect as Stain Repellent (see above) which already begins after some minutes and is fully effective after 2-3 hours. As a rule the colour of the stone remains unchanged. Nano-based substances work against a laminar wetting through liquid drops. Ball-shaped liquid pearls which lie only selectively on top of the stone surface, run off the surface. Food safe (tested by LGA Nuremberg).

Consumption: approx. 1-15 m^2/liter depending on the absorbency and the composition of the stone.

http://www.akemi.de/cmsupload/support/bilder/Steinpflegekatalog_kn0212_GB-E-I_aktuell_Apr07(1).pdf

AKEMI®

Material Safety Data Sheet
According to 91/155 EEC

Printing date 08.06.2006 Reviewed on 08.06.2006

*

1 Identification of the substance/preparation and of the company/undertaking

· Product details

· Trade name: **Stain Repellent Nano Effect**

· Article number: 10849; 10850;, 10851

· Application of the substance / the preparation: Protective impregnation

2 Composition/information on ingredients

· Chemical characterization

· Description: Mixture of substances listed below with nonhazardous additions.

· Dangerous components:

CAS: 64742-47-8 EINECS: 265-149-8 EU Number: 649-422-00-2	Distillates (petroleum), hydrotreated light	Xn; R 65	50-100%
CAS: 123-86-4 EINECS: 204-658-1 EU Number: 607-025-00-1	n-butyl acetate	R 10-66-67	<12.5%
CAS: 64742-48-9 EINECS: 265-150-3 EU Number: 649-327-00-6	Naphtha (petroleum), hydrotreated heavy	Xn; R 10-65-66	<12.5%

· Additional information: For the wording of the listed risk phrases refer to section 16.

Material Safety Data Sheet
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· Product details

· Trade name: **Stain Repellent Nano Effect**

· Article number: 10849; 10850;, 10851

· Application of the substance / the preparation: Protective impregnation

3 Hazards identification

· Hazard description:

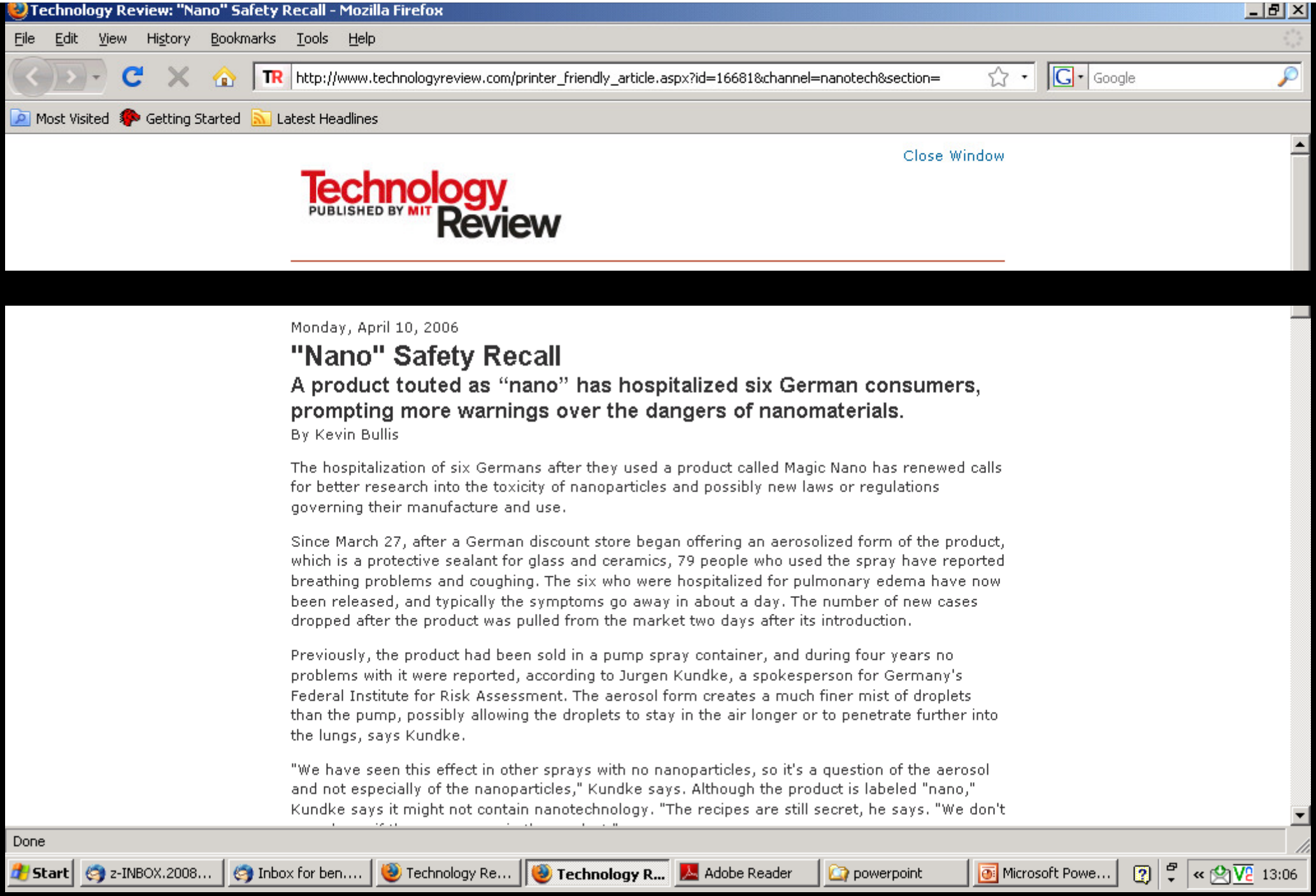
Xn Harmful

· Information concerning particular hazards for human and environment:

The product has to be labelled due to the calculation procedure of the "General Classification guideline for preparations of the EU" in the latest valid version.
At long or repeated contact with skin it may cause dermatitis due to the degreasing effect of the solvent.
R 65 Harmful: may cause lung damage if swallowed.
R 66 Repeated exposure may cause skin dryness or cracking.

· Classification system: The classification is according to the latest editions of the EU-lists, and extended by company and literature data.

· Additional information: The product does not contain any organic halogen compounds (AOX), nitrates, heavy metal compounds or formaldehydes.


Technology Review: "Nano" Safety Recall - Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://www.technologyreview.com/printer_friendly_article.aspx?id=16681&channel=nanotech&section=
Google
Most Visited Getting Started Latest Headlines
Close Window
Technology Review
PUBLISHED BY MIT
Monday, April 10, 2006
"Nano" Safety Recall
A product touted as "nano" has hospitalized six German consumers, prompting more warnings over the dangers of nanomaterials.
By Kevin Bullis
The hospitalization of six Germans after they used a product called Magic Nano has renewed calls for better research into the toxicity of nanoparticles and possibly new laws or regulations governing their manufacture and use.
Since March 27, after a German discount store began offering an aerosolized form of the product, which is a protective sealant for glass and ceramics, 79 people who used the spray have reported breathing problems and coughing. The six who were hospitalized for pulmonary edema have now been released, and typically the symptoms go away in about a day. The number of new cases dropped after the product was pulled from the market two days after its introduction.
Previously, the product had been sold in a pump spray container, and during four years no problems with it were reported, according to Jurgen Kundke, a spokesperson for Germany's Federal Institute for Risk Assessment. The aerosol form creates a much finer mist of droplets than the pump, possibly allowing the droplets to stay in the air longer or to penetrate further into the lungs, says Kundke.
"We have seen this effect in other sprays with no nanoparticles, so it's a question of the aerosol and not especially of the nanoparticles," Kundke says. Although the product is labeled "nano," Kundke says it might not contain nanotechnology. "The recipes are still secret, he says. "We don't
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Engineered nanomaterials

“A cause in search of a disease”

Eur Respir J 2009; 34: 559–567
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Exposure to nanoparticles is related to pleural effusion, pulmonary fibrosis and granuloma

Y. Song*, X. Li# and X. Du*

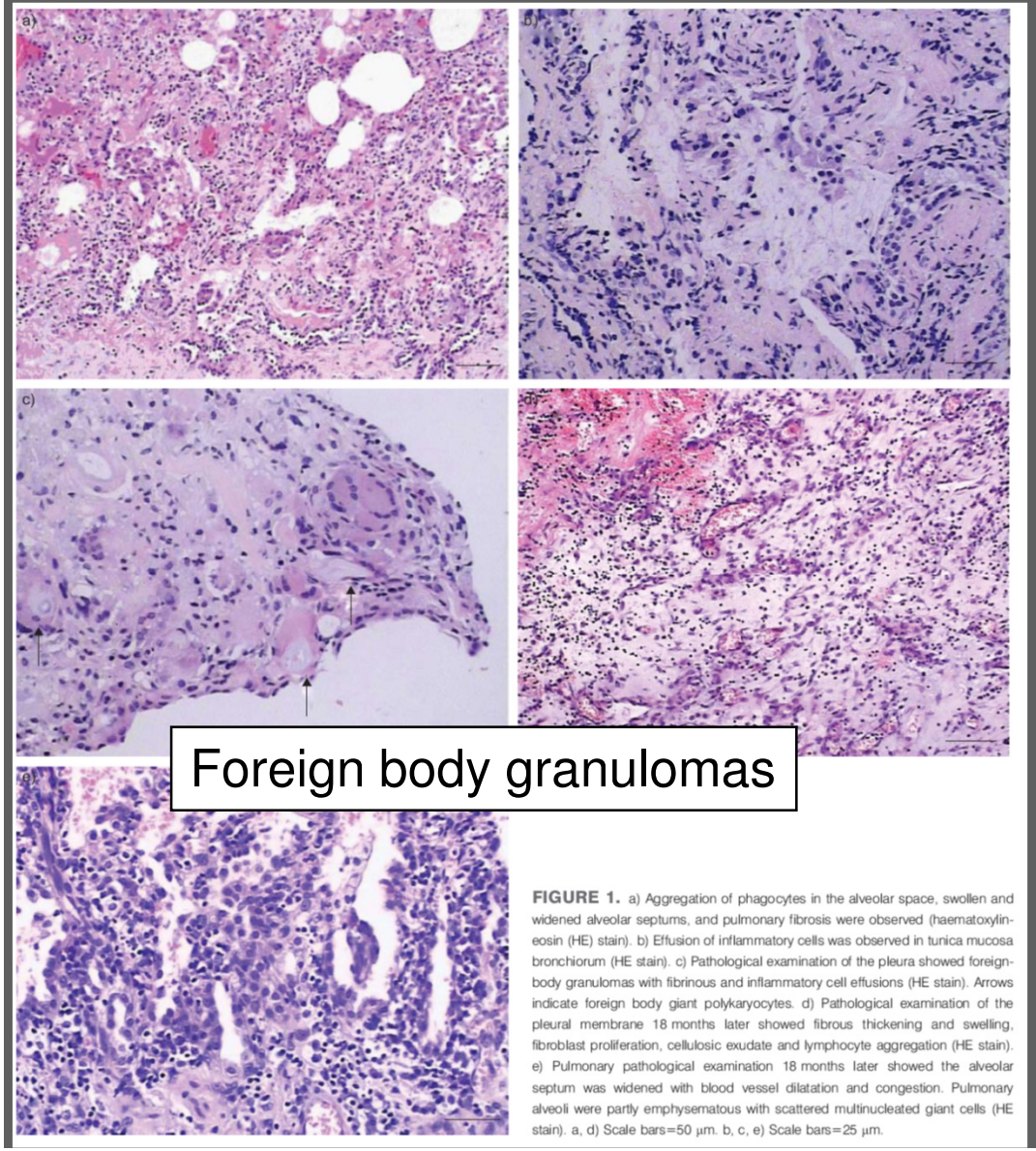
- Beijing
- 7 women (18-47 y) working in small print plant (5-13 months)
- Workplace 70 m^2, no windows, exhaust broken down, no PPE
- 1 machine to airspray coating material onto polystyrene boards
  - Coating material = “mixture of polyacrylic ester”: GC/MS “butanoic acid, butyl ester, N-butyl ether, acetic acid, toluene, di-tert-butylperoxide, 1-butanol, acetic acid ethenyl ester, isopropyl alcohol, ethylene dioxide”
  - Electron microscopy of paste and accumulated dust: “nanoparticles ~ 30 nm”

Song *et al. ERJ* 2009, 34,559-67

- Dyspnoea
- Itching rash on face & hands + forearms
- Mild to severe restrictive impairment
- Hypoxaemia (4/7)
- Pleural fluid: exudate (amber); pericardial effusion
- Chest CT: interstitial disease + fibrosis (rapid progression in 2)
- No infectious agents detected

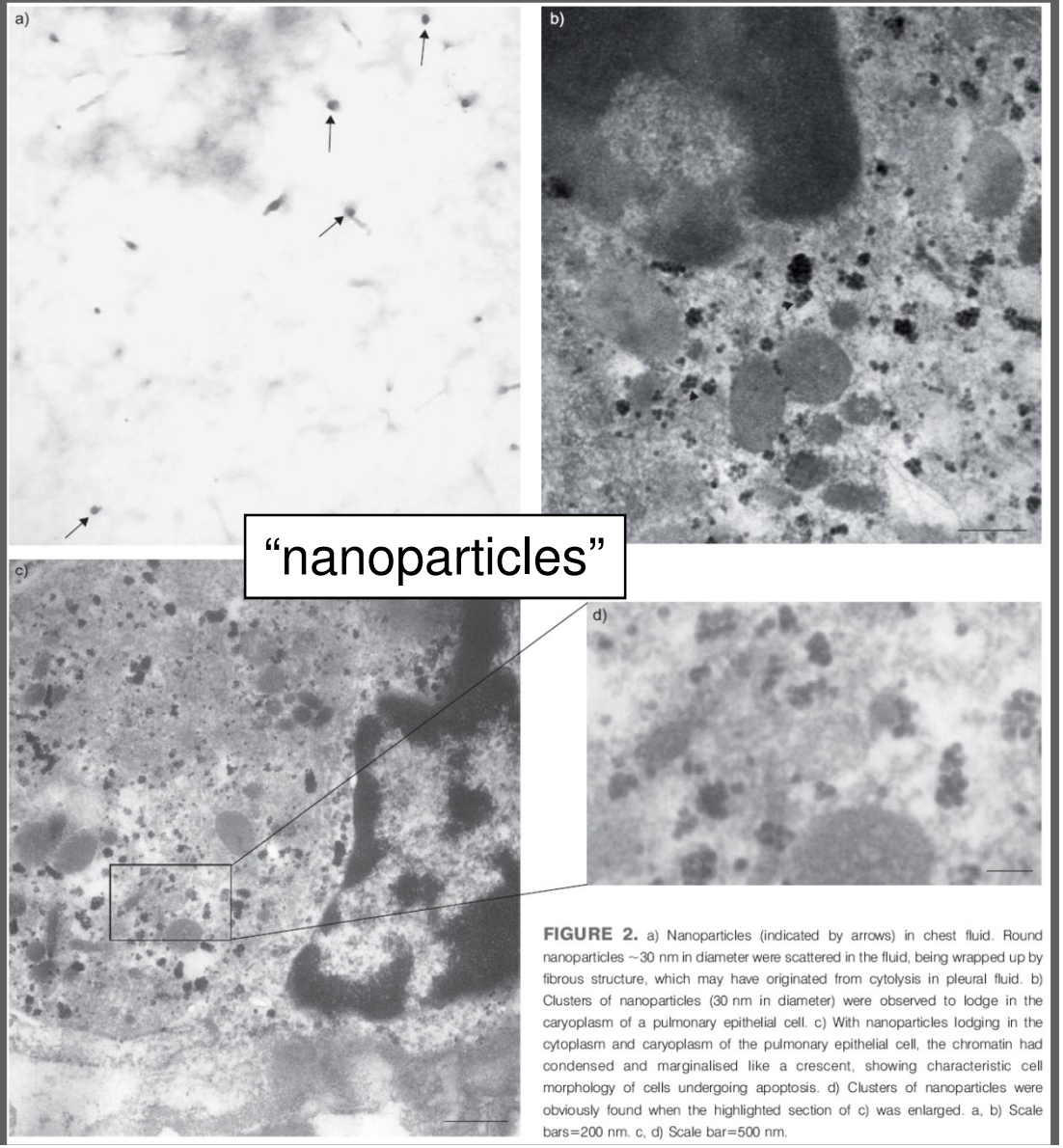
- Two died in respiratory failure

Song *et al. ERJ* 2009, 34,559-67



Foreign body granulomas

FIGURE 1. a) Aggregation of phagocytes in the alveolar space, swollen and widened alveolar septums, and pulmonary fibrosis were observed (haematoxylin-eosin (HE) stain). b) Effusion of inflammatory cells was observed in tunica mucosa bronchiorum (HE stain). c) Pathological examination of the pleura showed foreign-body granulomas with fibrinous and inflammatory cell effusions (HE stain). Arrows indicate foreign body giant polykaryocytes. d) Pathological examination of the pleural membrane 18 months later showed fibrous thickening and swelling, fibroblast proliferation, cellulosic exudate and lymphocyte aggregation (HE stain). e) Pulmonary pathological examination 18 months later showed the alveolar septum was widened with blood vessel dilatation and congestion. Pulmonary alveoli were partly emphysematous with scattered multinucleated giant cells (HE stain). a, d) Scale bars=50 μm. b, c, e) Scale bars=25 μm.



"nanoparticles"

FIGURE 2. a) Nanoparticles (indicated by arrows) in chest fluid. Round nanoparticles ~30 nm in diameter were scattered in the fluid, being wrapped up by fibrous structure, which may have originated from cytolysis in pleural fluid. b) Clusters of nanoparticles (30 nm in diameter) were observed to lodge in the caryoplasm of a pulmonary epithelial cell. c) With nanoparticles lodging in the cytoplasm and caryoplasm of the pulmonary epithelial cell, the chromatin had condensed and marginalised like a crescent, showing characteristic cell morphology of cells undergoing apoptosis. d) Clusters of nanoparticles were obviously found when the highlighted section of c) was enlarged. a, b) Scale bars=200 nm. c, d) Scale bar=500 nm.

Engineered nanomaterials

“A cause waiting for a disease”

“Take home messages”

- Fluorocarbon polymers
  - Heating / pyrolysis
  - Machining
  - Aerosolizing (impregnation sprays, water repellants, anti-stain sprays, …)

➢ “polymer fume fever”

➢ toxic alveolitis / chemical pneumonitis

“Take home messages”

- A clinical picture of respiratory infection or pneumonia does not necessarily imply the condition was caused by an infectious agent

➢ Take occupational & environmental history!

- Some common household products may cause severe lung injury:
  - Beware of “old” materials in new formulations !
  - Beware of sprayed “impregnation” products !
- “Polymer fume fever” is not always mild

Dank voor uw aandacht

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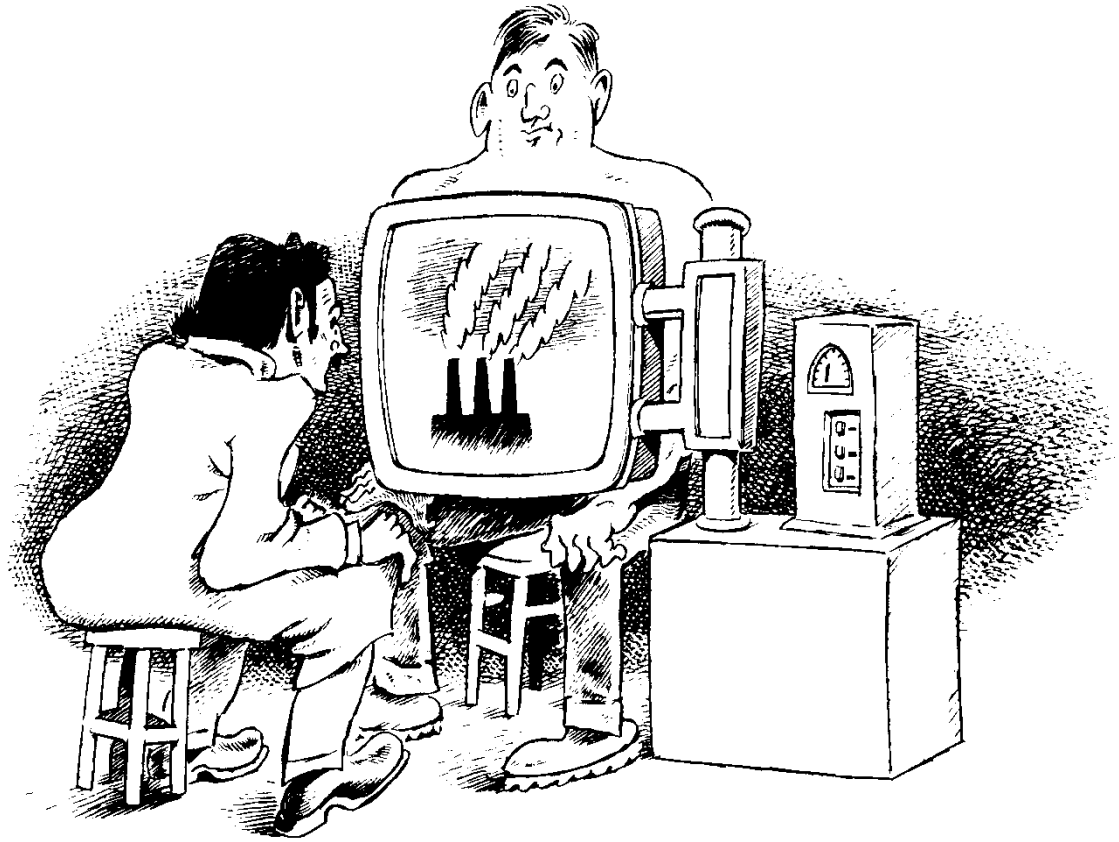
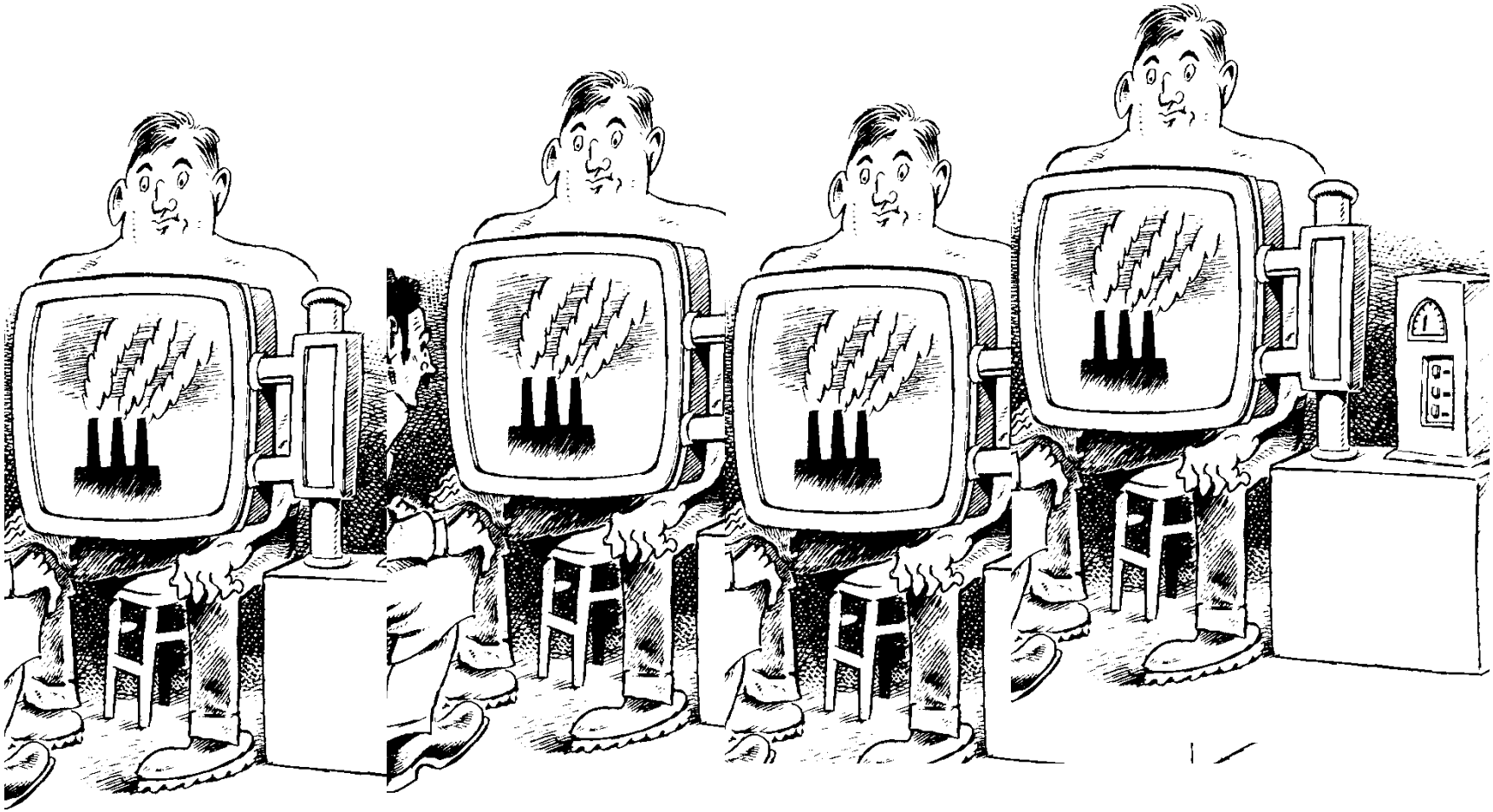


Contrary to this drawing, there is no simple test.
The suspicion and the determination of work-relatedness depend primarily on a careful occupational history

From LEVY BS, WEGMAN DH. Occupational health (3d ed), p.60



However, when you find one case of occupational disease, there are likely more around ...

In occupational medicine, n is nearly always >1

Modified From LEVY BS, WEGMAN DH. Occupational health (3d ed), p.60