

Nationale Dagen voor Arbeidsgeneeskunde
Journées Nationales de Médecine du Travail

12 November 2015, Brussel

Update over beroepsmatige longpathologie

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KU Leuven
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Take home message

Inhalation of “non toxic”
chemicals may lead to (severe)
lung disease ...

Outline

- One recent case
- Some recent examples from the literature

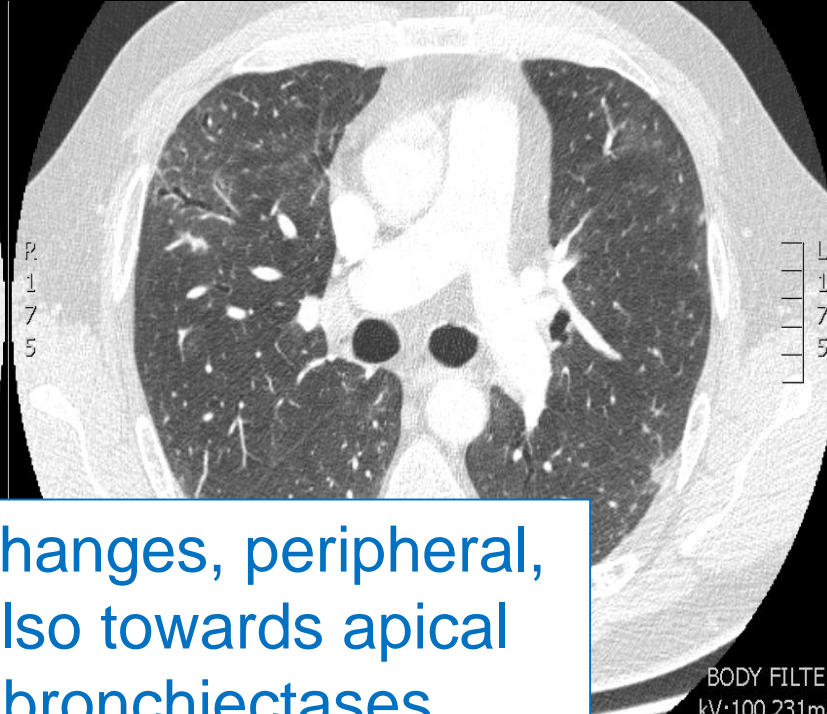
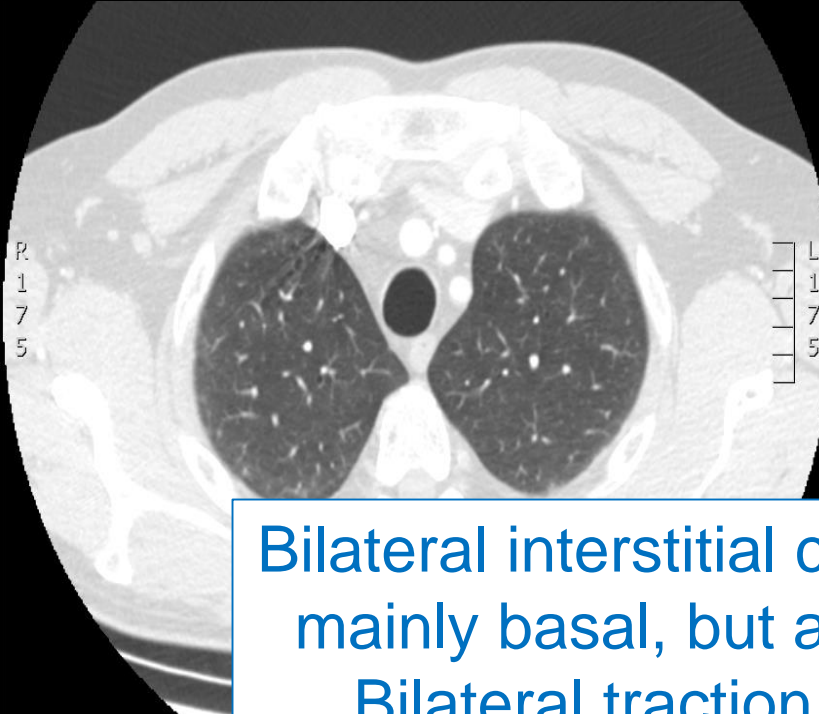
Case

- September/October 2014
 - Male, 46 y, ex-smoker (stop 2 y ago, 2 PY)
 - Allergic rhinitis & asthma since adolescence, well-controlled
 - Mild obstructive sleep apnoea
 - Nasal septum correction; orthopaedic surgery (shoulder)
 - Since early 2014: shortness of breath, fatigue, productive cough, R/ antibiotics for bad “airway infection” (April 2014), no other systemic symptoms
 - Fine basal crepitations, no clubbing, no arthritis, no adenopathies; restrictive impairment + low diffusion; HRCT, bronchoscopy/BAL, surgical lung biopsy
- Referred to clinic of occupational disease UZ Leuven: etiology, management?

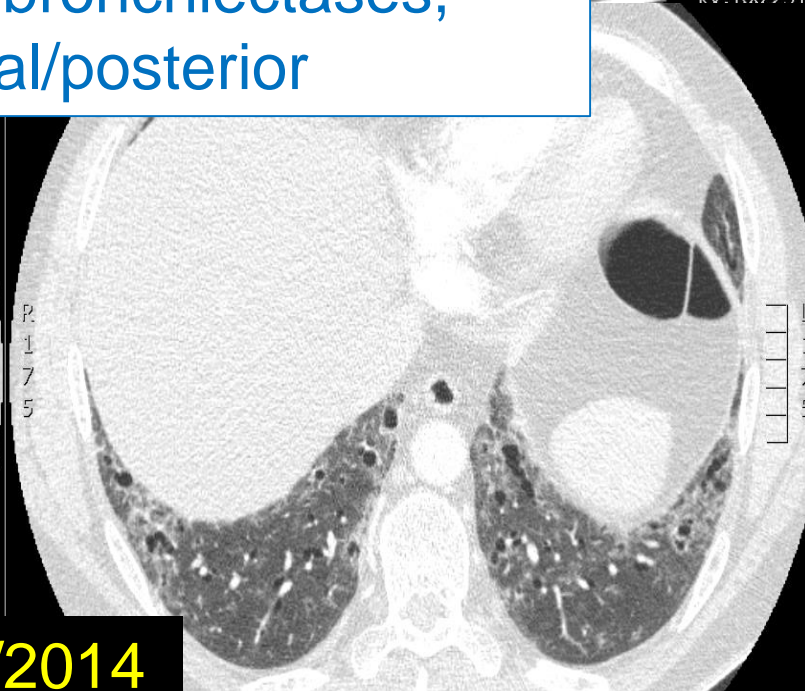
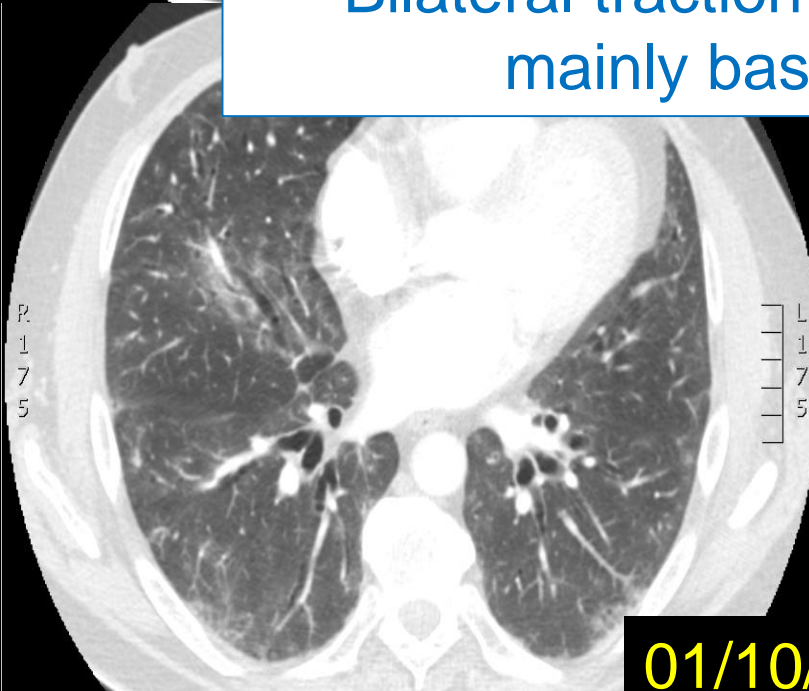
Pulmonary function

30.09.2014

- FVC 3.06 L 64% pred
 - FEV₁ 2.73 L 71% pred (unchanged after β 2)
 - FEV₁/FVC 91% pred
 - PEFR 1.2 L/s 58% pred
 - TLC 4.12 L 58% pred
 - TLco 5.62 U 52% pred
 - Kco 1.41 U 93% pred
- restrictive impairment**
with reduced diffusing capacity



Bilateral interstitial changes, peripheral,
mainly basal, but also towards apical
Bilateral traction bronchiectases,
mainly basal/posterior



01/10/2014

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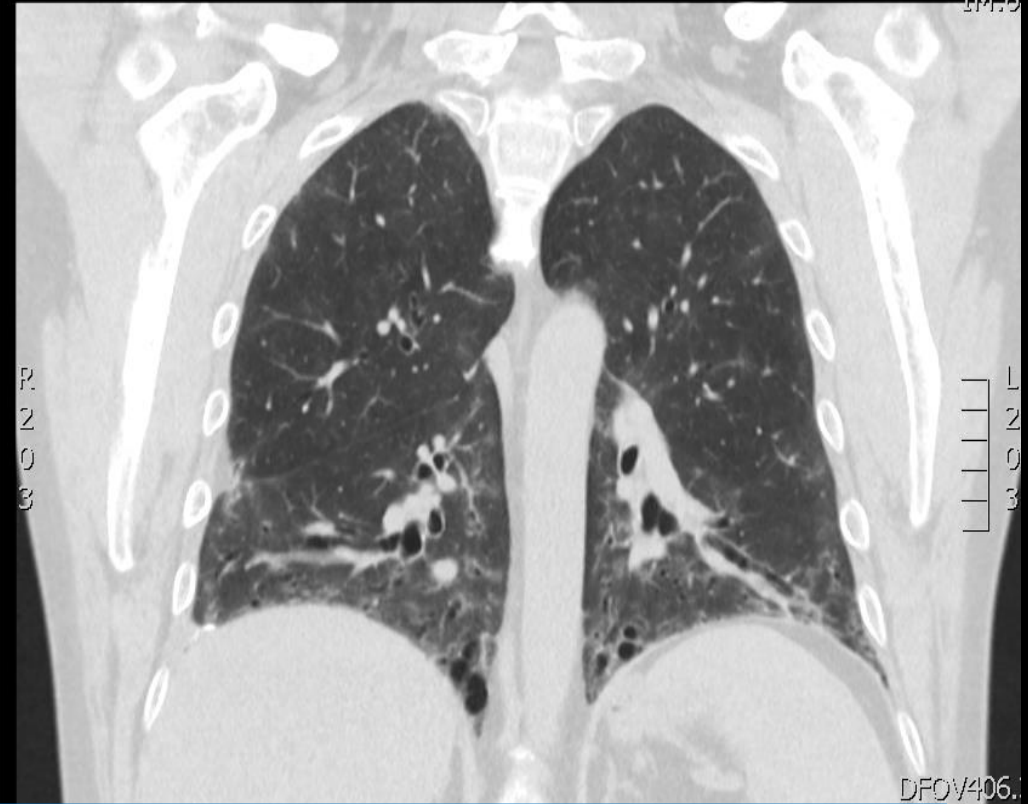
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UZ Leuven Campus Gasthuisberg
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I1027

10-01-2015
12:16:1
SE:
IM:6



Non-Specific Interstitial Pneumonia (NSIP) (DD atypical UIP, HP)

kV:120
mas:51
inspiratie
W 1500 :

TILT:
L:39.8
T:3mr
121mr
PRI
rugli

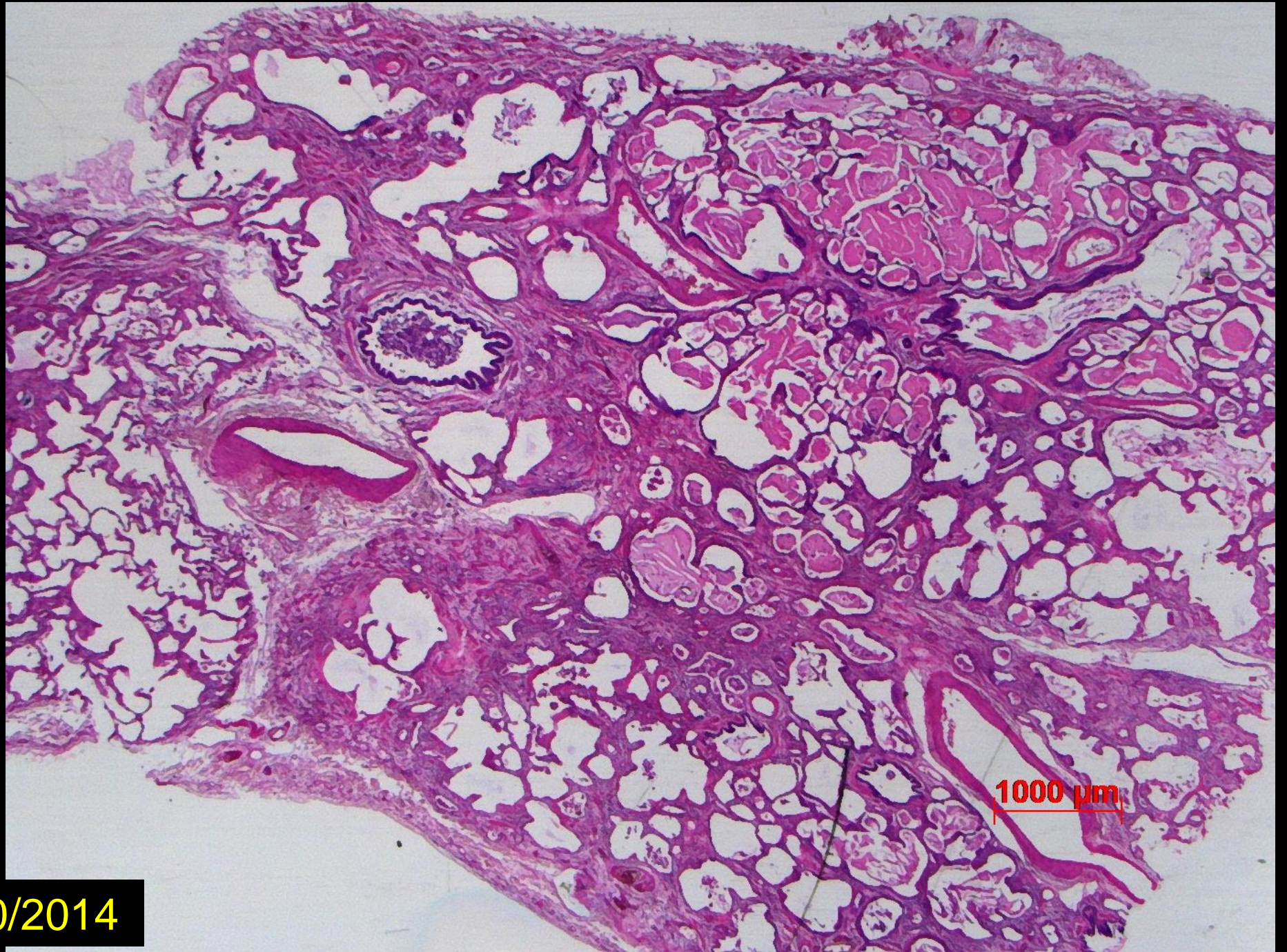
10/01/2015

Laboratory + Bronchoscopy/BAL

- Blood: no abnormalities, incl. auto-immune serology
- No endobronchial abnormalities
- BAL
 - 221 WBC/ μ L (low)
 - 84% macrophages
 - 7.5% lymphocytes
 - 4.5% neutrophils
 - microbiological investigations (bacteria, TB, viruses, fungi): all negative

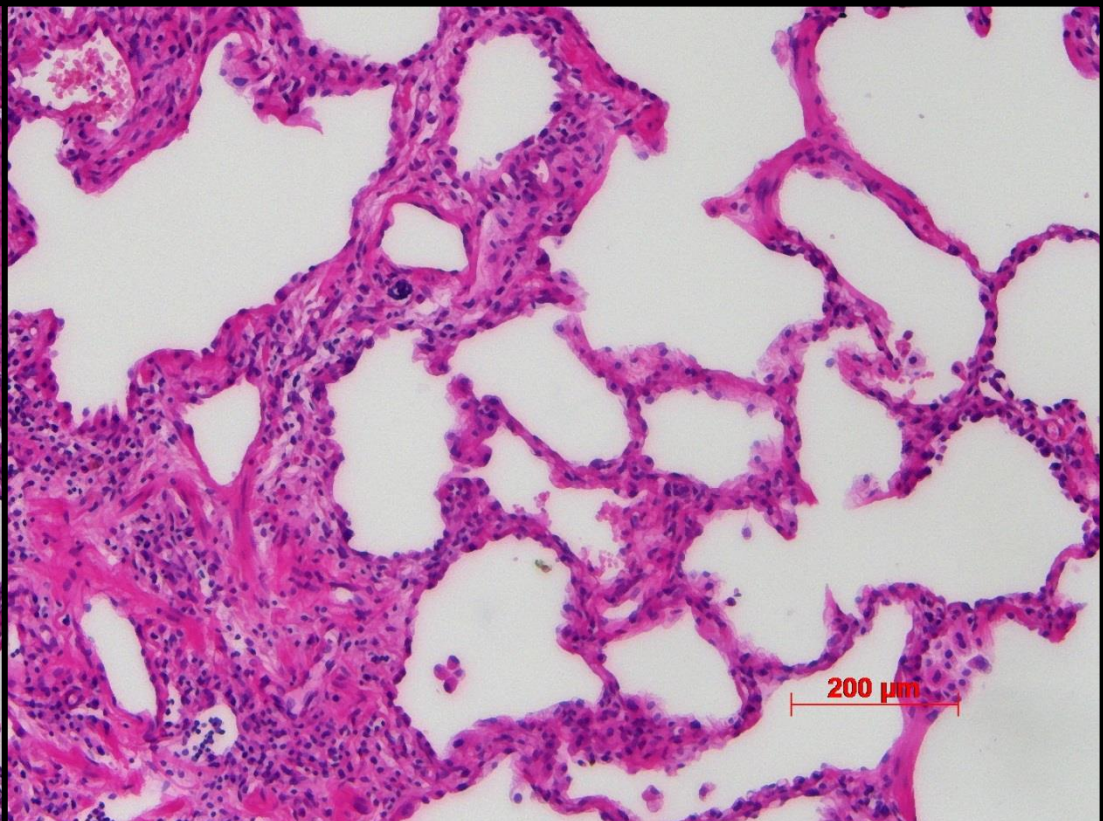
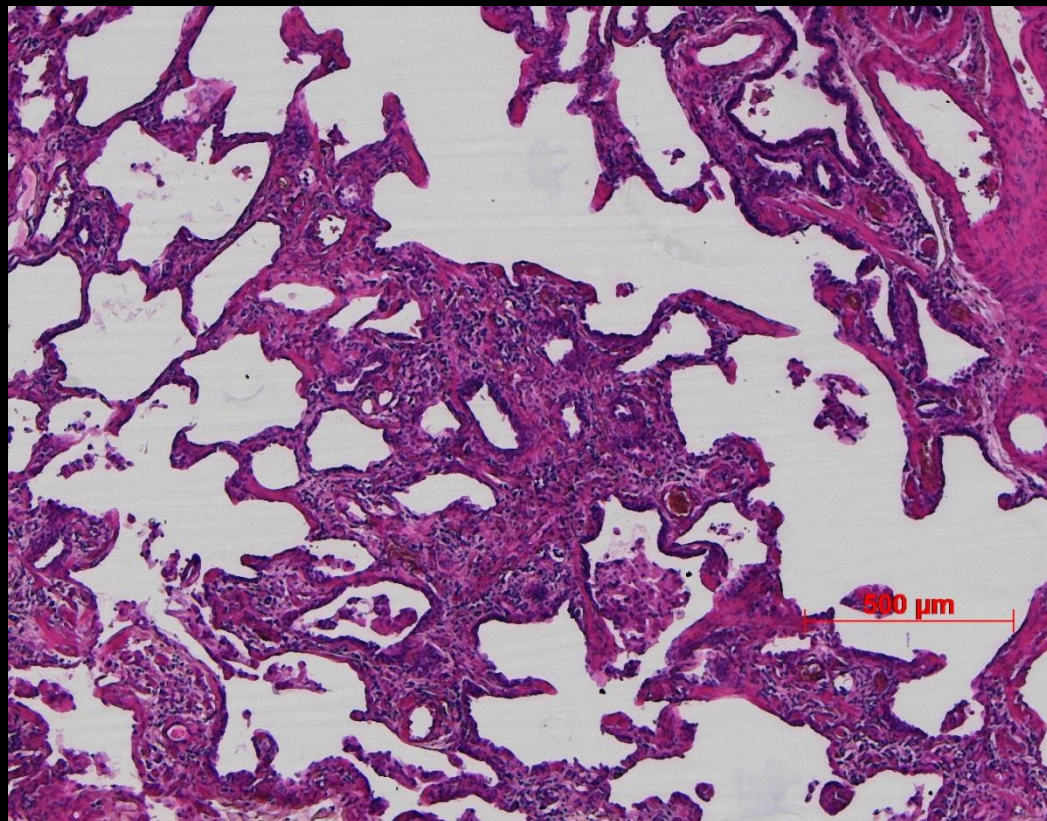
Surgical lung biopsy (Right Lower Lobe)

- Interstitial inflammation (lymphocytes + plasmacytes); some fibrosis; no granulomas
- Translobular and homogenous distribution across all lobules
- Hyaline material (PAS+) and cholesterol crystals + foamy macrophages in some alveoli
- No vasculitis
- Ziehl – / Grocott –; no particles/fibres
 - **Fibrosing NSIP (+ secondary alveolar proteinosis)**

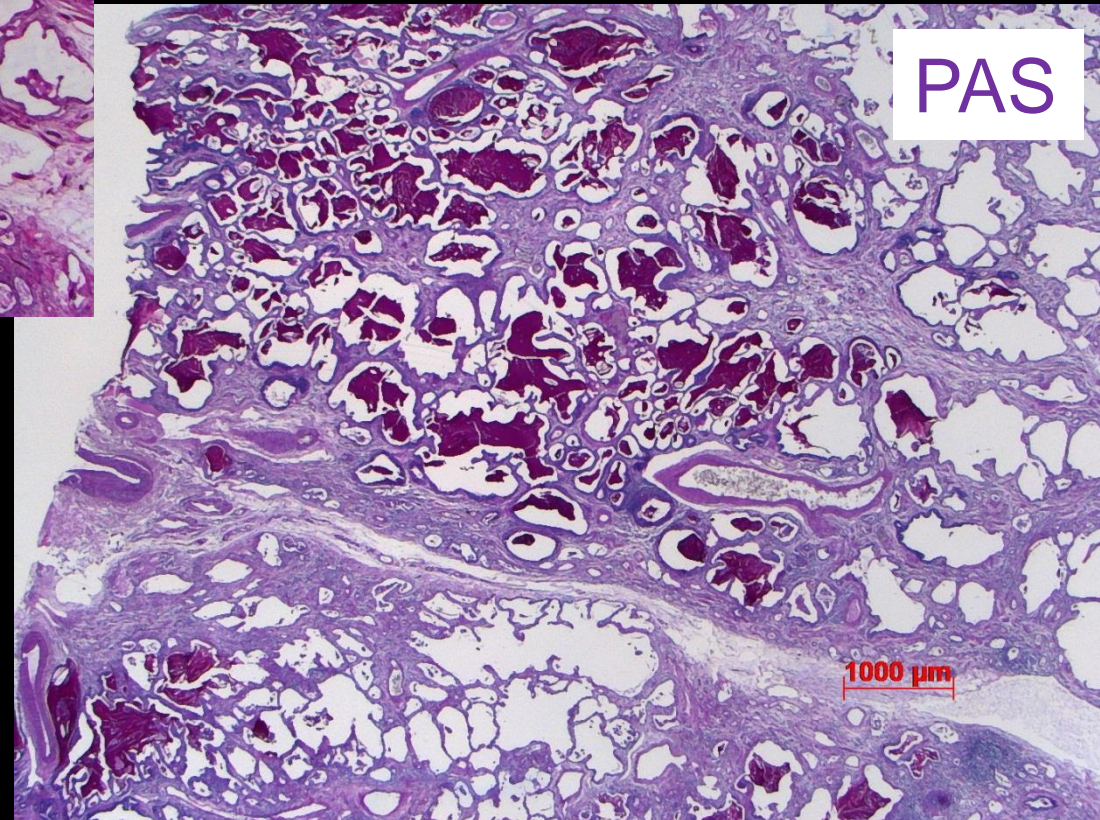
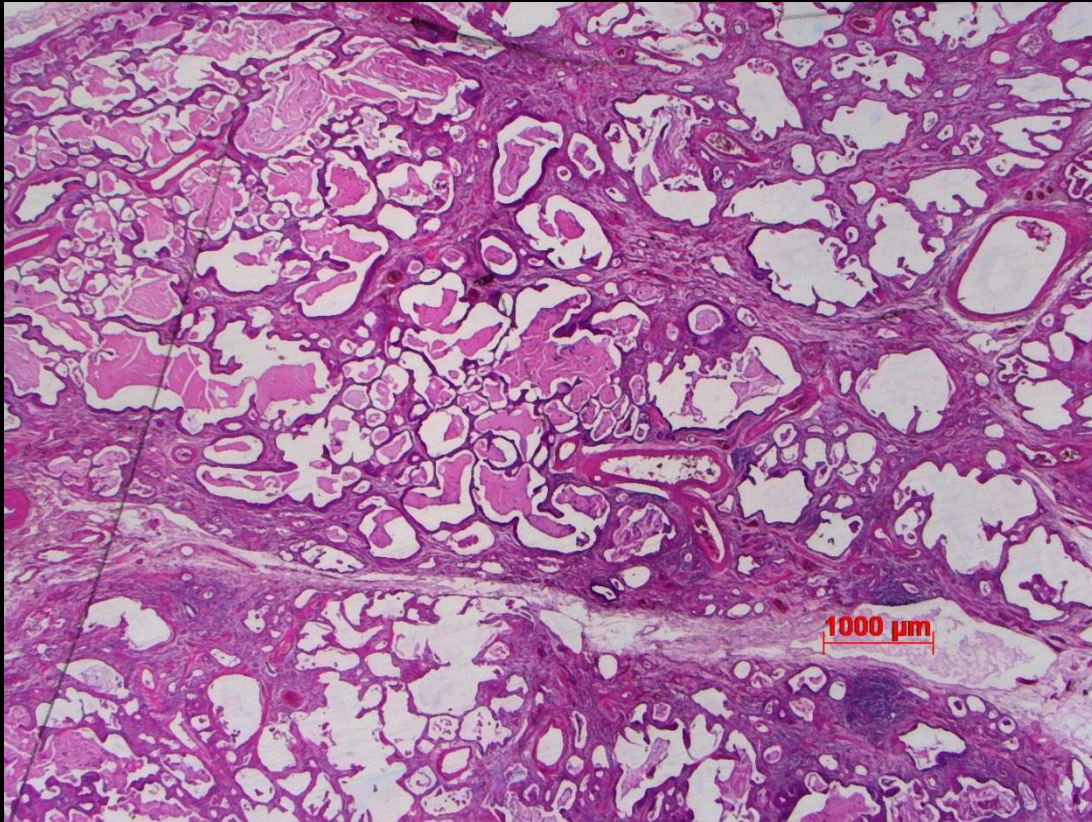


1000 μm

20/10/2014



20/10/2014



20/10/2014

Other findings

- Laboratory:
 - Auto-immune screening: negative
 - GM-CSF antibodies: none detected
 - IgGs (fungi): not increased above normal
 - Serum LDH: minimally increased (266 U/L)
- Capillaroscopy: normal findings

Exposure history

- Electrician
- Various jobs in buildings
- Since age 24 y: work in theater, philharmonic orchestra, ...: operating various machines, stage décor, ...
- Past 8 y: work as **light and sound technician** in a busy cultural centre
- Home: no dampness
- Hobby: bass trombone (2 h/week) since 3 y, no sports

Light technician

- Use of “theatrical haze/fog”
- Since 2 y: new device “ANTARI fog machine”, at least once a week (rehearsals and shows)
- Initial information: “*harmless water-based product*”

Onderwerp: HZ 500 vloeistof JB systems

Hallo,

Ik werk in CC en ben op zoek naar de samenstelling van boven vernoemde vloeistof.

Ik heb geprobeerd om antari zelf te mailen maar krijg daar geen reactie op.

Het zou kunnen dat ik daar allergisch voor ben en zit nu al van oktober thuis met een zware allergische reactie op mijn longen.

De bus die we hebben is dezelfde als die jullie verkopen, om de hazen vloeistof uit te sluiten zoek ik dus de samenstelling.

Deze vloeistof is zeker niet toxisch, ... maar dit wil niet zeggen dat jij er niet allergisch voor kunt zijn.

Een kat is ook niet toxisch, maar er zijn er toch heel wat allergisch aan.

Wat ik weet

- Dit is watergebaseerd, dus geen solventen, geen alcoholen
- Is op basis van diglycolen: is een verbinding die tussen vetten en alcohol ligt.
- Het kan bij inademing wel een olie achtige film nalaten, maar dit alleen bij langdurige en zeer geconcentreerde blootstelling.

ONTVANGEN 20 JAN 2015

Theatrical smoke and fog

From Wikipedia, the free encyclopedia

- Smoke: pyrotechnic materials, smoke cartridges, incense, ...
- Low lying fog effect: liquid or solid CO₂ or N₂
- Fog machine: pumping glycol or glycol/water mixtures into heat exchanger → vapour cloud
- Haze machine: homogeneous cloud (fine mist) intended to reveal lighting beams
 - Glycol/water mixture
 - Mineral oil



HAZE LIQUID HZL-5

HAZER LIQUID

This Haze Liquid is specially designed for Hazer. It contains high quality chemical liquid that can be dispersed into haze for entertainment use. It leaves no residue or contamination and increases the life span of your Hazer considerably. This Haze Liquid is colorless, odorless, non-toxic, non inflammable, oil based liquid that can be dispersed into a long-lasting, non irritating haze with no health hazard.

CAUTION

Keep out of reach of children.
Non-edible. Do not drink it.
Please do not mix it with any other Liquid.

HAZER-FLUID

Dieses Hazer-Fluid wurde speziell für Hazer-Nebelmaschinen entwickelt. Es besteht aus hochwertigen Chemikalien und kann zu Unterhaltungszwecken verdampft werden. Das Fluid hinterläßt keinerlei Rückstände und erhöht die Lebensdauer Ihrer Hazer-Nebelmaschine.

DIFFUSEUR-LIQUIDE

Ce liquide est spécialement développé pour les machines à diffusion de brouillard léger. Il contient une composante chimique de haute qualité diluée dans de l'eau distillée pour être utilisé à la formation de brouillard léger, presque invisible à des fins d'effets spéciaux pour spectacles et animations.

Il ne contient aucune matière ou résidu ce qui permet une durée de vie extrême du diffuseur. Ce liquide est incolore, inodore, ininflammable, non toxique à base d'huile. Ce qui le rend non nocif pour la santé.

ATTENTION

Certaines précautions sont tout de même nécessaires, telles que garder hors de portée des enfants.

A ne pas boire.

Ne pas mélanger avec d'autre liquid.

Made in Taiwan by Antari Lighting & Effects Ltd.
www.antari.com



Material Safety Data Sheet



EFFECTIVE DATE: 01/15/2008

I. IDENTIFICATION

PRODUCT NAMES: "HZL-1 Haze Liquid" and "HZL-5 Haze Liquid" Where data differs discretely by product (not over a range) it will be presented in the above product order.

FORMULA: Pure grade Lubricating Base Oil.

III. INGREDIENTS

These products are all "Oil-based" Mineral oil solutions. As such, toxicity is minimal. These products have been shipped internationally for more than 5 years under the Antari name, and are considered "non-hazardous" by most national health and safety regulatory bodies.

Tests conducted by independent laboratories have confirmed the non-hazardous nature of these liquids.

Material Safety Data Sheet

EFFECTIVE DATE: 01/15/2008



V. HEALTH HAZARD DATA

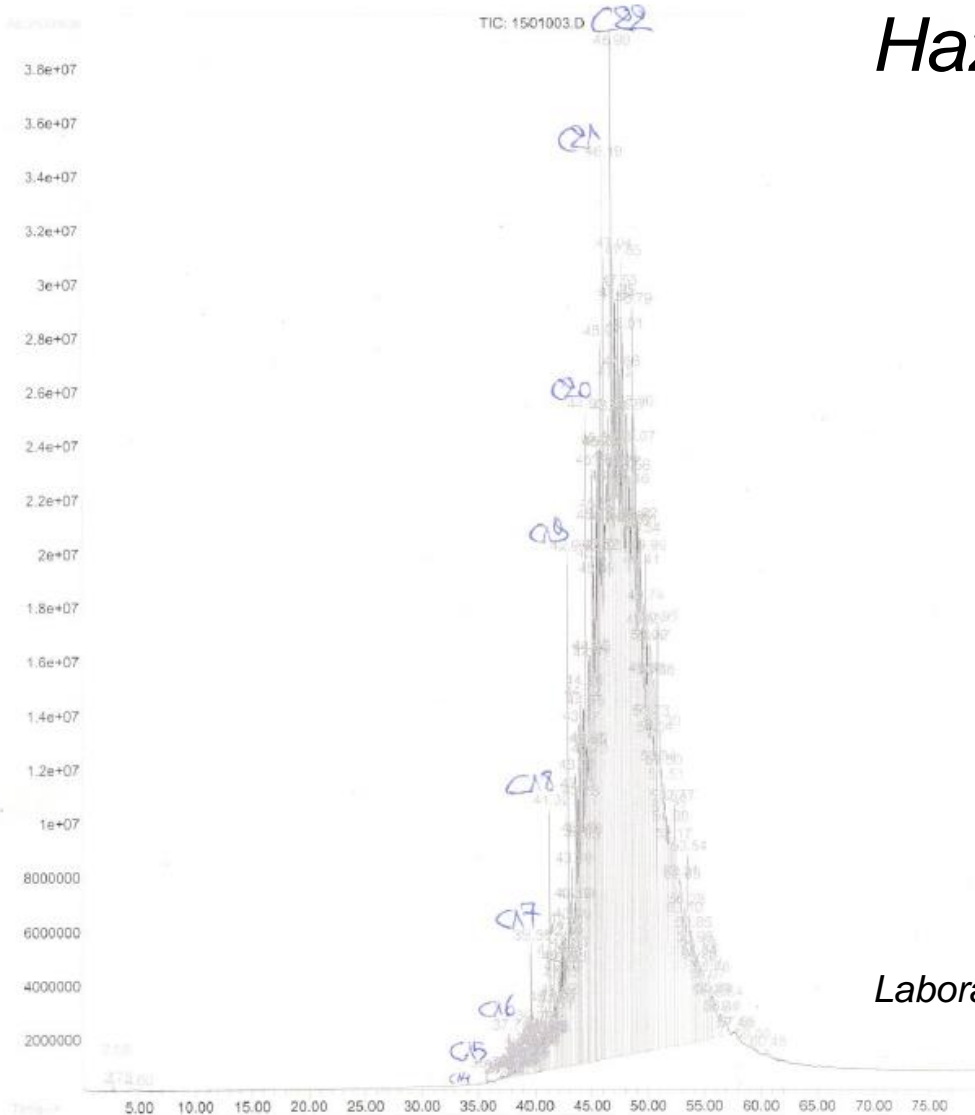
No exposure limits have been determined for these products, nor for any of the ingredients from which they are formulated.

Swallowing has no adverse effects in low doses. Higher doses may induce nausea and vomiting, but with no long-term toxicity. Inhalation produces no adverse effects when used according to standard practices. Continuous exposure to highly concentrated fog may lead to throat/respiratory tract irritation. Under such conditions, irritation should subside immediately upon moving to an area of low fog concentration. The fog produced by these products will be adequately filtered by any 10 - 20 micron filtration system. Contact with the liquid may cause minimal, temporary irritation to exposed skin areas. Eye contact with the liquid may also cause minimal, temporary irritation. In all cases of contact with the liquid, flushing of the exposed area with water is sufficient. No contra-indications may be determined, as the ingredients have no independently toxicological effects, even when considered combinatively with possible pre-existing physical conditions or dietary/medicinal regimens. Treatment of egregious overexposure may be determined by health personnel, with principal attention given to the control of symptoms and overall clinical status.

Area Percent Report

Data File : C:\HPCHEM\1\DATA\sol2301b\1501003.D Vial: 15
Acq On : 23 Jan 2015 18:23 Operator:
Sample : H2500 vloeistof JB Systems Inst : GC/MS Ins
Misc : Multiplr: 1.00
Sample Amount: 0.00

MS Integration Params: EVENTS.E
Method : C:\HPCHEM\1\METHODS\SOLVSPLI.M (Chemstation Integrator)
Title :



*Haze liquid 1% in CS₂
GC-MS*

mineral oil

(no glycols)

*Laboratorium voor Arbeids- en Milieuhygiëne
KU Leuven*

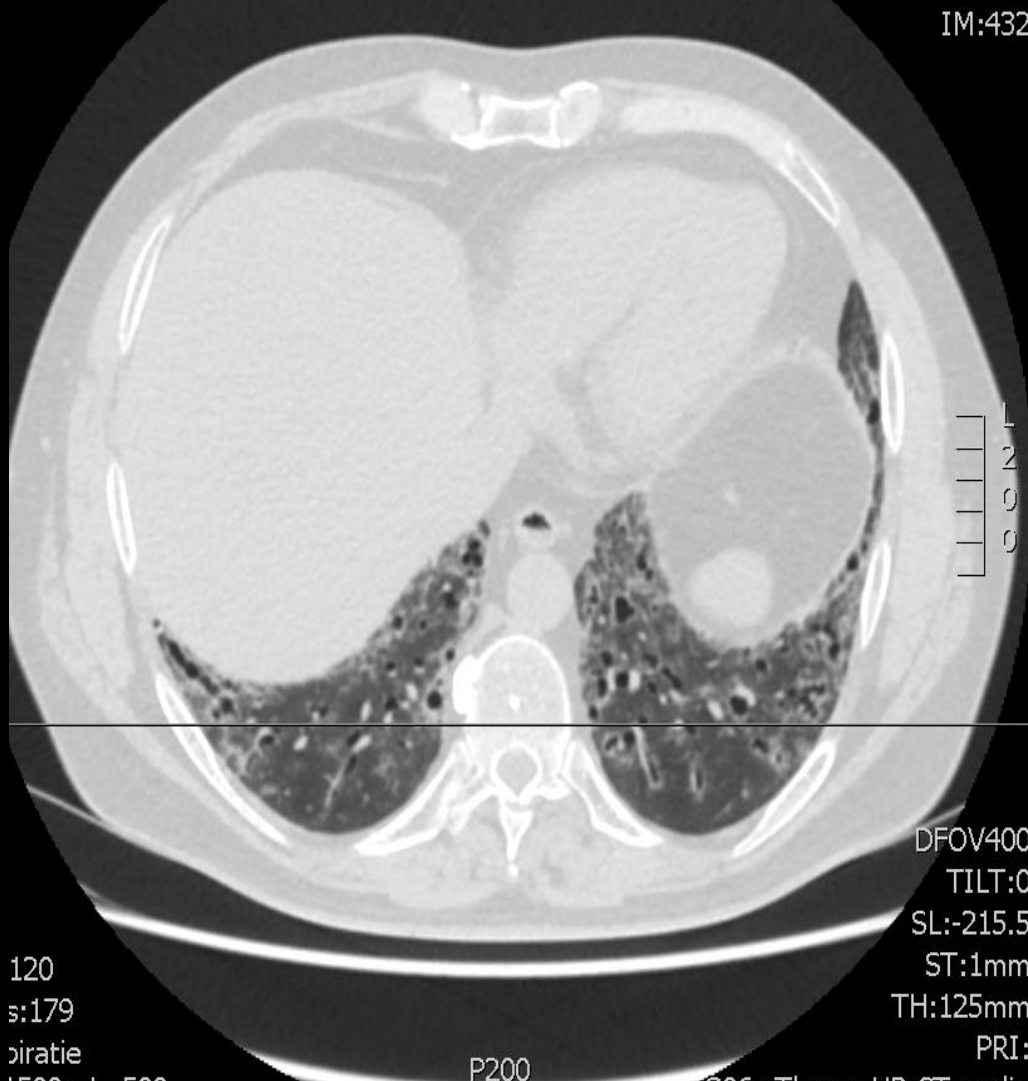
Final diagnosis & management

- Interstitial lung disease: NSIP
- Probably caused by chronic high (?) exposure to mineral oil (theatrical haze)
 - stop exposure
 - reported to FBZ

Follow-up

- Complete work stop
- No specific treatment (except asthma meds)
- Some clinical improvement; still cough +++ (muscle pains) & dyspnoea on exercise
- No functional improvement
- No changes in HRCT (MAY 2015)
- BAL + transbronchial biopsies (MAY 2015): no PAP, “normal tissue”

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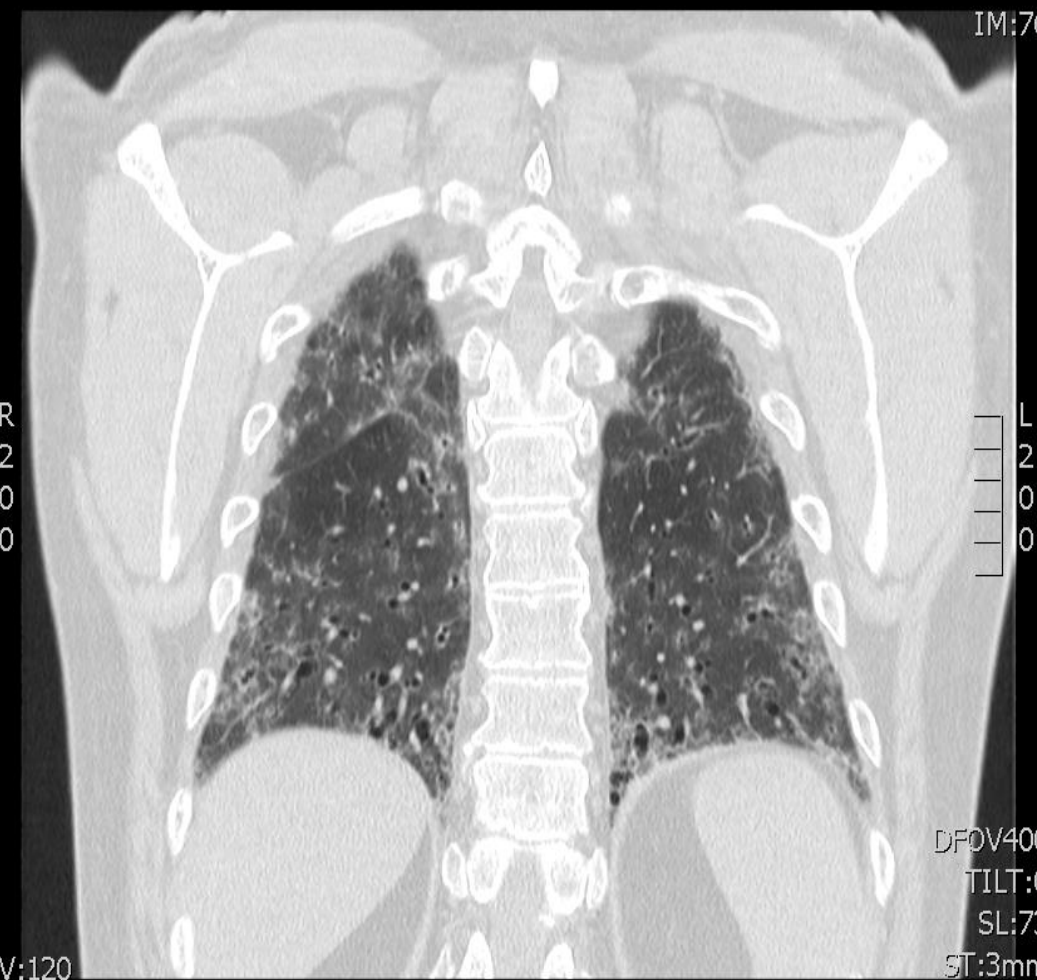


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I268

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DFOV400
TILT:0
SL:-215.5
ST:1mm
TH:125mm
PRI:

kV:120
mas:120
inspiratie\Coronal

I668

DFOV400
TILT:0
SL:77
ST:3mm
TH:125mm
PRI:

120
s:179
piratie

P200

08/05/2015

Follow-up

(stop exposure; no specific treatment)

	2014		2015	
	OCT	JAN	APR/MAY	SEP
FVC	64%	61%	60%	60%
TLC	58%	55%	53%	52%
TLco	52%	54%	46%	44%
Kco	93%	97%	92%	90%
6MWT			82%	
	SaO ₂		99% ↘ 88%	
BAL	M	84%		86%
	Ly	7.5%		2.0%
	N	4.5%		9.5%
	E			2.5%

Other cases?

- Possibly one other case of subacute lung injury in a job student exposed to haze (to be confirmed).
- No similar cases in literature.

Literature

Journal of Occupational and Environmental Hygiene, 2: 277–284

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DOI: 10.1080/15459620590952215

Exposures to Atmospheric Effects in the Entertainment Industry

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Susan M. Kennedy,² and Michael Brauer²**

¹University of British Columbia, Health Care and Epidemiology, Vancouver, BC, Canada

²University of British Columbia, School of Occupational and Environmental Hygiene,
Vancouver, BC, Canada

TABLE I. Summary of Area Inhalable Aerosol Concentrations

	All Fog Fluids	Glycol Only	Mineral Oil Only	Glycol and Mineral Oil	Dry Ice
All productions (n)	32	14	14	3	(1)
Minimum, mg/m ³	0.05	0.05	0.05	0.60	n/a
Maximum, mg/m ³	17.1	3.47	6.56	17.1	n/a
Arithmetic mean, mg/m ³	1.36	0.57	1.21	6.18	0.08
Arithmetic SD, mg/m ³	3.16	0.91	1.74	9.45	n/a
Geometric mean, mg/m ³	0.41	0.24	0.55	2.05	0.08
Geometric SD	4.21	3.37	3.71	6.32	n/a
Movie and TV productions (n)	16	6	9	1	(0)
Minimum, mg/m ³	0.05	0.11	0.05	n/a	
Maximum, mg/m ³	17.07	3.47	2.71	n/a	
Arithmetic mean, mg/m ³	1.86	0.76	0.90	17.09	
Arithmetic SD, mg/m ³	4.20	1.33	1.00	n/a	
Geometric mean, mg/m ³	0.47	0.30	0.43	17.09	
Geometric SD	4.90	3.71	3.96	n/a	
Theater, music, and other productions (n)	16	8	5	2	(1)
Minimum, mg/m ³	0.05	0.05	0.41	0.60	n/a
Maximum, mg/m ³	6.56	1.49	6.56	0.85	n/a
Arithmetic mean, mg/m ³	0.86	0.42	1.77	0.72	0.08
Arithmetic SD, mg/m ³	1.57	0.47	2.69	0.18	n/a
Geometric mean, mg/m ³	0.35	0.20	0.88	0.71	0.08
Geometric SD	3.68	3.32	3.24	1.28	n/a

Notes: Results for all productions and all fluid types in bold. Concentrations measured using the 7-hole sampler. SD = standard deviation; n/a = not applicable.

Effects of Theatrical Smokes and Fogs on Respiratory Health in the Entertainment Industry

Sunil Varughese, MSc,¹ Kay Teschke, PhD,^{1,2} Michael Brauer, ScD,¹ Yat Chow, MSc,¹
Chris van Netten, PhD,^{1,2} and Susan M. Kennedy, PhD^{1,2*}

Background *Theatrical fogs (glycol or mineral oil aerosols) are widely used in the entertainment industry to create special effects and make lighting visible.*

Methods *We studied 101 employees at 19 sites using fogs and measured personal fog exposures, across work shift lung function, and acute and chronic symptoms. Results were also compared to an external control population, studied previously.*

Results *Chronic work-related wheezing and chest tightness were significantly associated with increased cumulative exposure to fogs (mineral oil and glycols) over the previous 2 years. Acute cough and dry throat were associated with acute exposure to glycol-based fogs; increased acute upper airway symptoms were associated with increased fog aerosol overall. Lung function was significantly lower among those working closest to the fog source*

Conclusions *Mineral oil- and glycol-based fogs are associated with acute and chronic adverse effects on respiratory health among employees. Reducing exposure, through controls, substitution, and elimination where possible, is likely to reduce these effects.* Am.

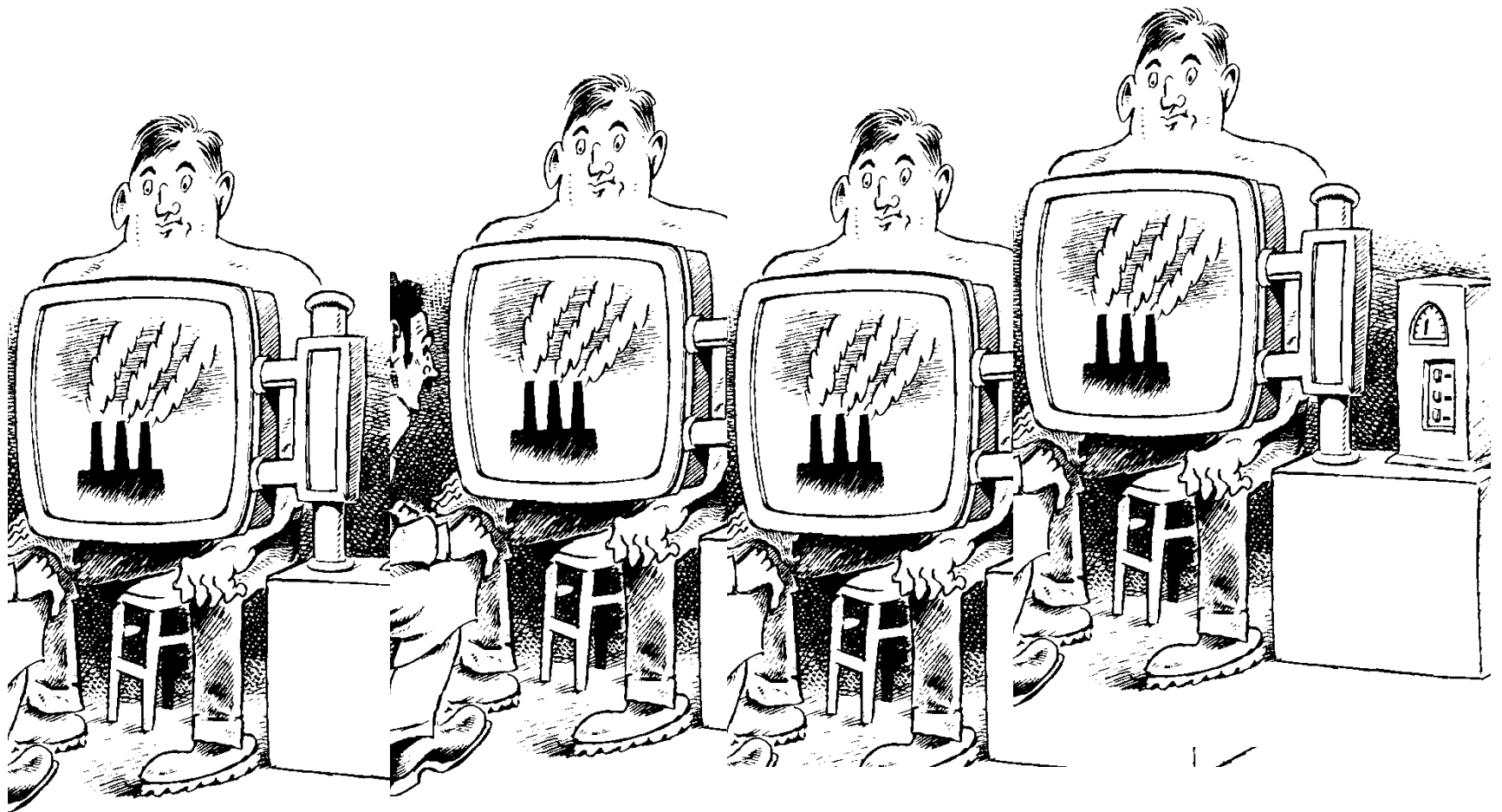
Theatrical smoke and fog

From Wikipedia, the free encyclopedia

Theatrical smoke and fog, also known as **special effect smoke**, **fog** or **haze**, is a category of atmospheric effects used in the entertainment industry. The use of fog can be found throughout motion picture and television productions, live theatre, concerts, at nightclubs and raves, amusement and theme parks and even in video arcades and similar venues. These atmospheric effects are used for creating special effects, to make lighting and lighting effects visible, and to create a specific sense of mood or atmosphere. If an individual is at an entertainment venue and beams of light are visible cutting across the room, that most likely means smoke or fog is being used. Theatrical smoke and fog are indispensable in creating visible mid-air laser effects to entertain audiences. Recently smaller, cheaper fog machines have become available to the general public, and fog effects are becoming more common in residential applications, from small house parties to Halloween and Christmas.

Theatrical fog and theatrical fog machines are also becoming more prevalent in industrial applications outside of the entertainment industry, due to their ease of use, inherent portability and ruggedness. Common popular applications for theatrical fog include environmental testing, such as HVAC inspections, as well as emergency personnel and disaster response training exercises.

Militaries have historically used smoke and fog to mask troop movements in training and combat, and the techniques and technology used for generating smoke and fog in theatre and film are similar.



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

In occupational medicine, n is nearly always >1

Other examples of ILD caused by “non toxic” agents

- Ardystil syndrome: spray paints used in textile industry (Spain, Algeria)
- Flock worker’s lung: nylon flock (USA, Canada) + other polymers (Turkey, Spain)
- Popcorn worker’s lung / Food flavourer’s lung
- Korea : biocides used in domestic humidifiers

- Novel materials

Popcorn worker's lung (Food flavourer's lung)



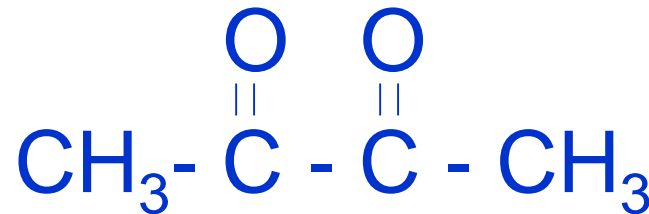
Popcorn worker's lung

- Kreiss *et al.* Clinical bronchiolitis obliterans in workers at a microwave-popcorn plant. *N Engl J Med.* 2002, 347, 330-8.

➤ cause = “butter flavor” (GRAS)

predominant compound:

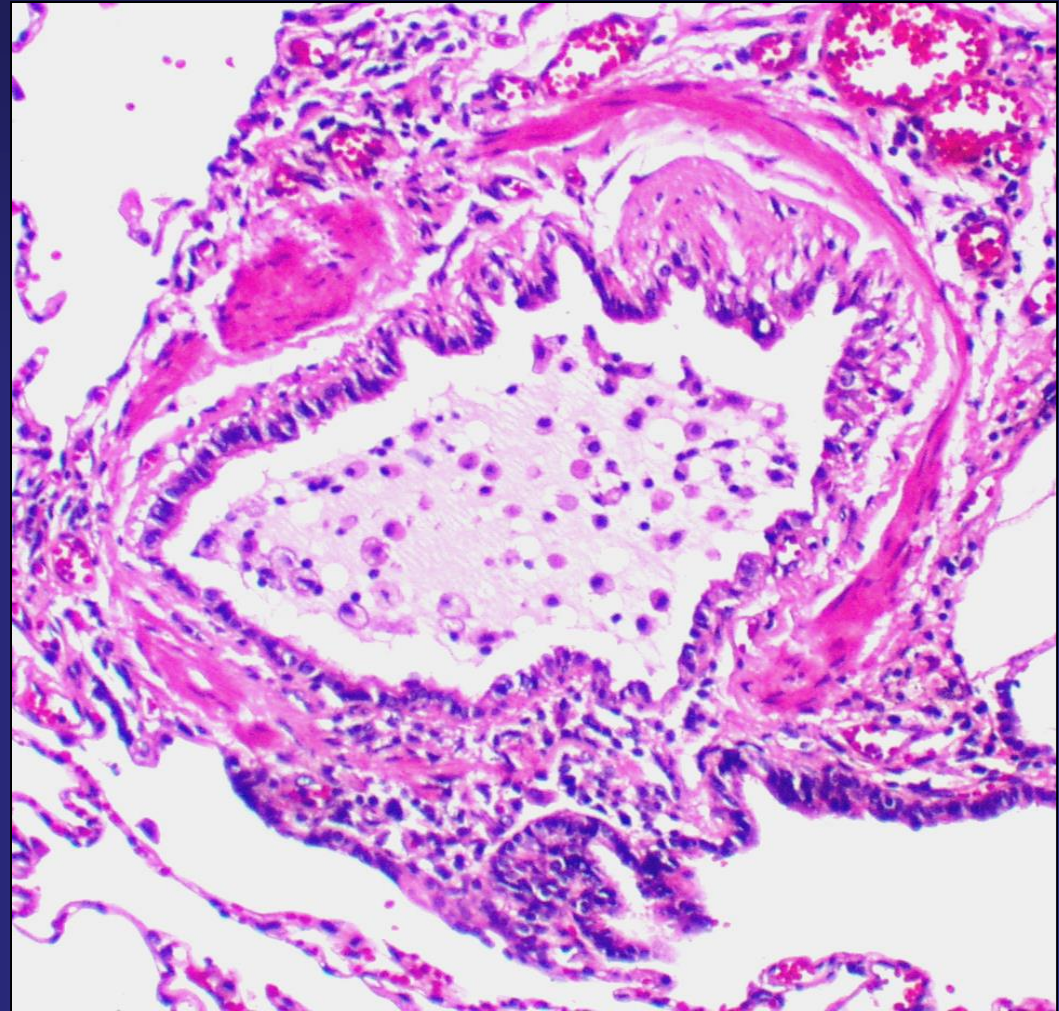
diacetyl = 2,3-butanedione



“POPCORN” LUNG

Proximity to the butter
flavoring increased the
risk of developing disease.

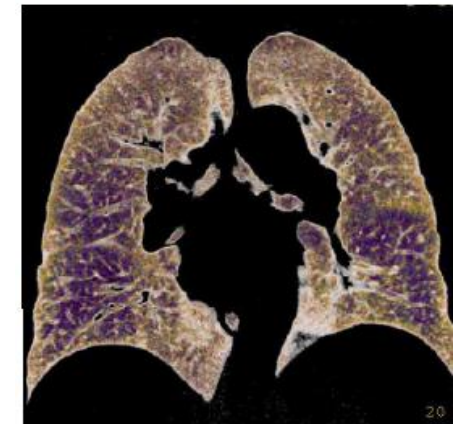
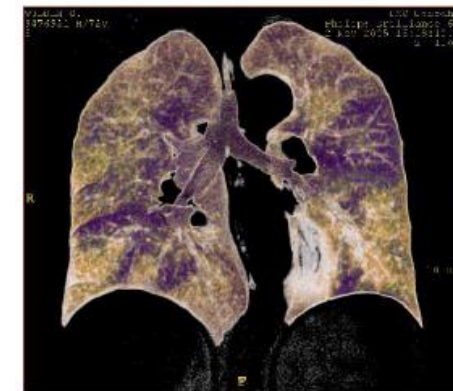
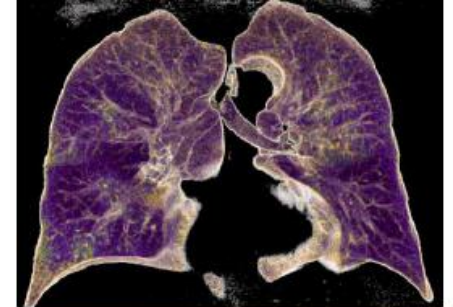
Histologic finding:
Constrictive bronchiolitis



Production of diacetyl

van Rooy FBGJ *et al.* Bronchiolitis obliterans syndrome in chemical workers producing diacetyl for food flavourings. *AJRCCM* 2007,176, 498-504

- Retrospective study among 102 process operators in a Dutch chemical plant producing diacetyl (1960-2003)
- 3 (4) cases consistent with Bronchiolitis Obliterans



“Food flavourer’s lung”

Hendrick D.J. “Popcorn worker’s lung” in Britain in a man making potato crisp flavouring.

Thorax 2008, 63, 267-8

- Man, 36 y, nonsmoker
- Exposed to diacetyl in factory producing food flavouring for potato crisps/chips
- Rapidly evolving fixed airways obstruction

**Obliterative Bronchiolitis in Workers in a Coffee-Processing Facility —
Texas, 2008–2012**

- Two nonsmoking workers (W 34 y, M 39 y)
- Respiratory symptoms < 18 months of working in flavoring room
- Severe obstructive impairment ($FEV_1 < 35\%$ pred.)
- Diacetyl present in facility

- More cases ? (ATS 2013)

Article first published online: 2 NOV 2015 | DOI: 10.1002/ajim.22533

Respiratory Morbidity in a Coffee Processing Workplace With Sentinel Obliterative Bronchiolitis Cases

**Rachel L. Bailey, DO, MPH,^{1*} Jean M. Cox-Ganser, PhD,¹ Matthew G. Duling, MS,¹
Ryan F. LeBouf, PhD,¹ Stephen B. Martin Jr., PhD,¹ Toni A. Bledsoe, MS,²
Brett J. Green, PhD,² and Kathleen Kreiss, MD¹**

- Bronchiolitis Obliterans in 5/13 former workers
- Possible Bronchiolitis Obliterans or Occupational Asthma in 11/75 current workers

SiO₂ in “novel” materials

“New materials”

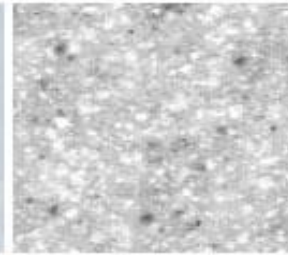
Kitchen and bathroom countertops, ...



#290*
White on Navy



#295
White on Glacier



#210
Accent



#230
Storm Clouds



#300
Desert



#305
White Sand



#310
Snow II



#315
Pickwick



#320
Aggregate



#325
Bamboo



#330
Walnut Toffee



#335
Riverstone



#340
Mahogany Mist



#345
Terracotta

 caesarstone®





Artificial Stone Silicosis

Disease Resurgence Among Artificial Stone Workers

*Mordechai R. Kramer, MD, FCCP; Paul D. Blanc, MD, MSPH, FCCP;
Elizabeth Fireman, PhD; Anat Amital, MD, FCCP; Alexander Guber, MD, FCCP;
Nader Abdul Rhahman, MD; and David Shitrit, MD*

- Israel, 1997-2010: retrospective analysis of 25 cases of silicosis referred for lung transplantation (n=10)
- Dry cutting of **synthetic decorative stone** “Caesarstone®” >85% quartz (+ resin + pigments) → kitchen & bathroom countertops

“Artificial marble”

Pascual *et al.* Prevalence of silicosis in a marble factory after exposure to quartz conglomerates. *Arch Bronconeumol.* 2011, 47, 50-1.

- Galdakao, Bizkaia, Spain: 6 cases of silicosis among 11 workers of family-run “marble” workshop (“innovative silica product” = quartz)

Pérez-Alonso *et al.* Outbreak of silicosis in Spanish quartz conglomerate workers. *Int J Occup Environ Health.* 2014, 20, 26-32.

- Cadiz, Spain, 2009-2012: 46 cases of silicosis in men making kitchen countertops (quartz countertops)

Friedman *et al.* Silicosis in a countertop fabricator – Texas, 2014. *MMWR* 2015, 64, 129-30

Silicosis and autoimmune disease

Straichman et al. Occup Med 2015, 65, 444-50

- Israel: institute for pulmonary transplantation
- “advanced silicosis databank” 9/40 patients with various autoimmune diseases [7.5 x expected] [3 with features of PAP]

Case	Symptoms	Physical findings	Relevant serologies	Clinical diagnosis
1	Raynaud's; Dysphagia	Sclerodactyly; Telangiectasia; Serositis	Anti-Scl-70 (+); SSA (anti-Ro) (+)	SSc
2	Raynaud's; Arthritis	Digital pitting; Arthritis; Serositis; Fever	ANA > 1:160; RNP (+); SSA (anti-Ro) (+)	MCD
3	Raynaud's; Dysphagia	Sclerodactyly; Digital pitting	ANCA (+)	SSc
4	Raynaud's	Digital pitting; Arthritis; Serositis	Anti-Scl-70 (+); RNP (+); SSA (anti-Ro) (+); SSB (anti-La) (+)	SSc
5	Arthritis, Xerostomia	Arthritis	ANA > 1:160; SSA (anti-Ro) (+)	Sjogren's syndrome
6	Arthritis	Arthritis; Fever; Rash	ANA 1:80; RNP (+); SSA (anti-Ro) (+)	MCD
7	Arthritis	Arthritis; Serositis	ANA > 1:160; RF (+)	RA
8	Arthritis	Arthritis	RF (+)	RA
9	Arthritis, Myalgia	Arthritis; Myositis	ANA (+); SSA (anti-Ro) (+); SSB (anti-La) (+); anti-JO-1 (+)	Polymyositis—anti-synthetase syndrome

Humidifier disinfectants and ILD

South Korea

ORIGINAL ARTICLE

Pediatrics

JKMS

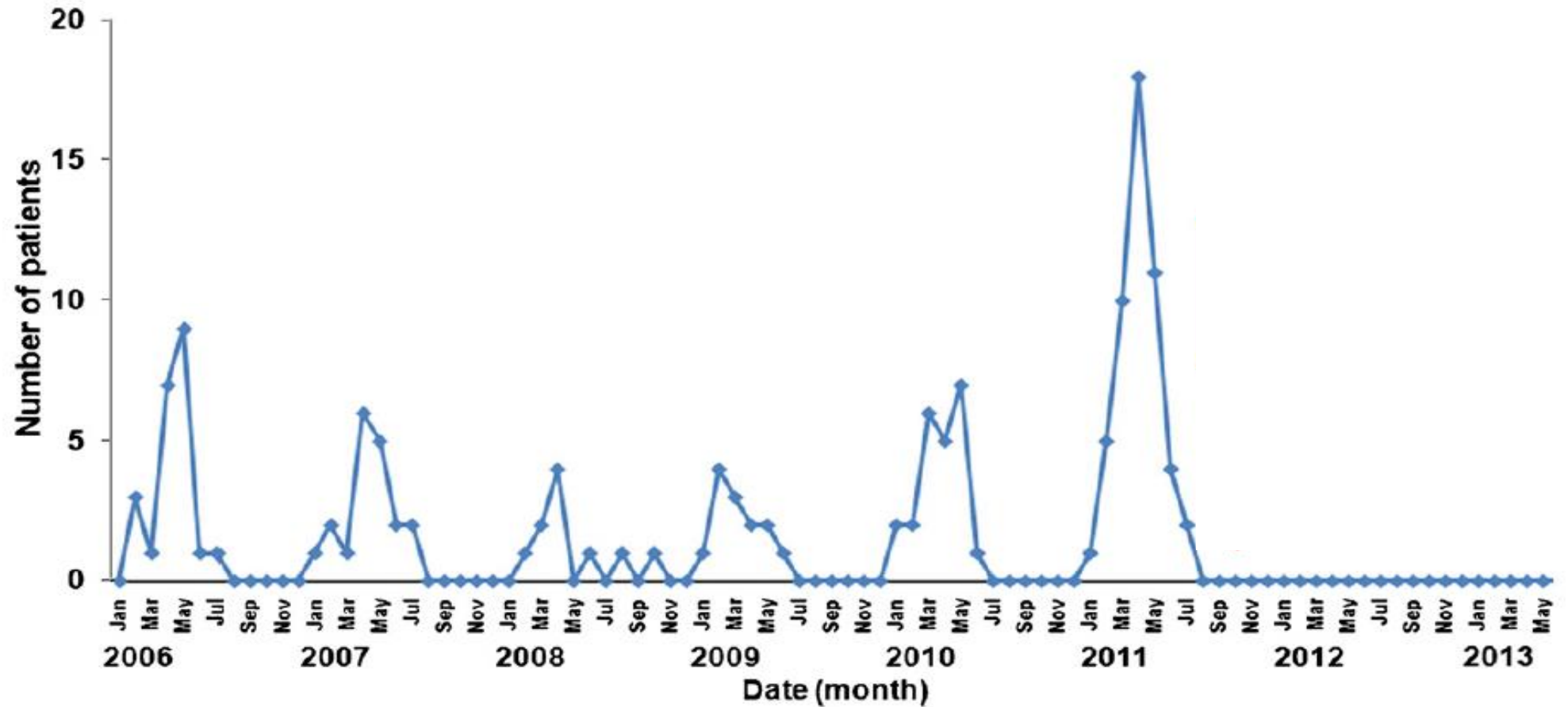
<http://dx.doi.org/10.3346/jkms.2013.28.6.915> • *J Korean Med Sci* 2013; 28: 915-923

Toxic Inhalational Injury-Associated Interstitial Lung Disease in Children

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Hyung Young Kim,⁵ Jinho Yu,^{1,2}
Won-Kyoung Jhang,¹ Seong-Jong Park,¹
Ji-Won Kwon,⁶ Byoung-Ju Kim,⁷
Kyung-Hyun Do,⁸ Young Ah Cho,⁸
Sun-A Kim,⁹ Se Jin Jang,⁹
and Soo-Jong Hong^{1,2,3}

Interstitial lung disease in children (chILD) is a group of disorders characterized by lung inflammation and interstitial fibrosis. In the past recent years, we noted an outbreak of child in Korea, which is possibly associated with inhalation toxicity. Here, we report a series of cases involving toxic inhalational injury-associated chILD with bronchiolitis obliterans pattern in Korean children. This study included 16 pediatric patients confirmed by lung biopsy and chest computed tomography, between February 2006 and May 2011 at Asan Medical Center Children's Hospital. The most common presenting symptoms were cough

- Nationwide retrospective study



Inhalation Toxicity of Humidifier Disinfectants as a Risk Factor of Children's Interstitial Lung Disease in Korea: A Case-Control Study

Hyeon-Jong Yang¹, Hwa-Jung Kim², Jinho Yu³, Eun Lee^{3,4}, Young-Ho Jung^{3,4}, Hyung-Young Kim^{3,4}, Ju-Hee Seo⁵, Geun-Yong Kwon⁶, Ji-Hyuk Park⁶, Jin Gwack⁶, Seung-Ki Youn⁶, Jun-Wook Kwon⁷, Byung-Yool Jun^{6,7}, Kyung Won Kim⁸, Kangmo Ahn⁹, Soo-Young Lee¹⁰, June-Dong Park¹¹, Ji-Won Kwon¹², Byoung-Ju Kim¹³, Moo-Song Lee¹⁴, Kyung-Hyun Do¹⁵, Se-Jin Jang¹⁶, Bok-Yang Pyun^{1*}, Soo-Jong Hong^{3,4*}

2013

PLoS ONE 8(6): e64430. doi:10.1371/journal.pone.0064430

Yang H.-J., Kim H.-J. *et al.* Inhalation toxicity of humidifier disinfectants as a risk factor of children's interstitial lung disease in Korea: a case-control study. *PLoS One* 2013, 8(6), e64430

- 16 pediatric patients matched 1:3 with controls (lobar pneumonia, asthma, healthy)
- Questionnaire (with photographs) on humidifiers + many other indoor & outdoor environmental factors
- use of humidifier disinfectants only significant risk factor (16/16 vs 11/47)

웅진코웨이



① CHP-08AL



② CP-07BLO



③ P-220L

청호나이스



④ 얼음정수기 mini



⑤ 냉온정수기 500 플러스
교원L&C - 웰스정수기



⑥ 디지털 냉정수기



⑦ KWW-5100



⑧ KW-P03W1



⑨ KW-P01W1

동양매직



⑩ WPU-8230C



⑪ WPU-6212C



⑫ WPU-8201C

① 옥시썩썩



② 와이즐렉



③ 세퓨



④ 세퓨 파우치



⑤ 가슴기메이트



⑥ 홈플러스가슴기청정제



⑦ 이마트 가슴기살균제



⑧ 아토세이프



⑨ 아토오가닉 가슴기살균제



⑩ 에코후레쉬 가슴기용항균볼



⑪ 엔워드 가슴기 전용 살균제



⑫ 기타

Yang H.-J., Kim H.-J. *et al. PLOS One* 2013, 8(6), e64430

- Humidifier disinfectants
 - PGH = oligo [2-(2-ethoxy) ethoxyethyl] guanidinium chloride
 - PHMG = polyhexamethyleneguanidine
 - DDAC = didecyldimethylammonium chloride
- widely used biocides for water systems and consumer products
- “non toxic” by oral or dermal route
- little or no data on toxicity by inhalation !



Humidifier Disinfectant–associated Children’s Interstitial Lung Disease

Kyung Won Kim^{1*}, Kangmo Ahn^{2*}, Hyeon Jong Yang³, Sooyoung Lee⁴, June Dong Park⁵, Woo Kyung Kim⁶, Jin-Tack Kim⁷, Hyun Hee Kim⁸, Yeong Ho Rha⁹, Yong Mean Park¹⁰, Myung Hyun Sohn¹, Jae-Won Oh¹¹, Hae Ran Lee¹², Dae Hyun Lim¹³, Ji Tae Choung¹⁴, Man Yong Han¹⁵, Eun Lee¹⁶, Hyung-Young Kim¹⁷, Ju-Hee Seo¹⁸, Byoung-Ju Kim¹⁹, Young Ah Cho²⁰, Kyung-Hyun Do²⁰, Sun-A Kim²¹, Se-Jin Jang²¹, Moo-Song Lee²², Hwa-Jung Kim²³, Geun-Yong Kwon²⁴, Ji-Hyuk Park²⁴, Jin Gwack²⁴, Seung-Ki Youn²⁴, Jun-Wook Kwon²⁵, Byung-Yool Jun²⁶, Bok Yang Pyun^{3‡}, and Soo-Jong Hong^{16‡}

Am J Respir Crit Care Med Vol 189, Iss 1, pp 48–56, Jan 1, 2014

Deterding R.R., White C.W. Humidifier and environmental “chILD” risks (Editorial). *AJRCCM* 2014, 189, 10-2

Kim K.W., Ahn K. *et al.* *AJRCCM* 2014, 189, 48-56

- Nationwide retrospective study
- 138 children with chILD; 80 (58%) died
- some household clustering

- epidemic stopped after suspension of sale of humidifier disinfectants in 2011

Thorax 2014, 69, 694-702

A cluster of lung injury associated with home humidifier use: clinical, radiological and pathological description of a new syndrome

Sang-Bum Hong,¹ Hwa Jung Kim,² Jin Won Huh,¹ Kyung-Hyun Do,³ Se Jin Jang,⁴ Joon Seon Song,⁴ Seong-Jin Choi,⁵ Yongju Heo,⁵ Yong-Bum Kim,⁶ Chae-Man Lim,¹ Eun Jin Chae,³ Hanyi Lee,⁷ Miran Jung,⁸ Kyuhong Lee,⁵ Moo-Song Lee,² Younsuck Koh,¹ Korean Unknown Severe Respiratory Failure Collaborative, the Korean Study Group of Respiratory Failure

Thorax 2014, 69, 703-8

A cluster of lung injury cases associated with home humidifier use: an epidemiological investigation

Hwa Jung Kim,¹ Moo-Song Lee,^{1,2} Sang-Bum Hong,³ Jin Won Huh,³ Kyung-Hyun Do,⁴ Se Jin Jang,⁵ Chae-Man Lim,³ Eun Jin Chae,⁴ Hanyi Lee,⁶ Miran Jung,⁷ Young-Joon Park,⁸ Ji-Hyuk Park,⁹ Geun-Yong Kwon,⁹ Jin Gwack,⁹ Seung-Ki Youn,⁹ Jun-Wook Kwon,¹⁰ Byung-Guk Yang,¹¹ Byung-Yool Jun,¹² Yangho Kim,¹³ Hae-Kwan Cheong,¹⁴ Byung Chul Chun,¹⁵ Heon Kim,¹⁶ Kyuhong Lee,¹⁷ Younsuck Koh³

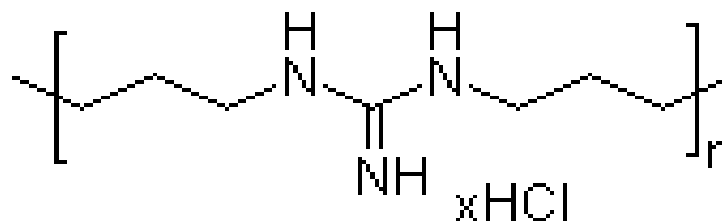
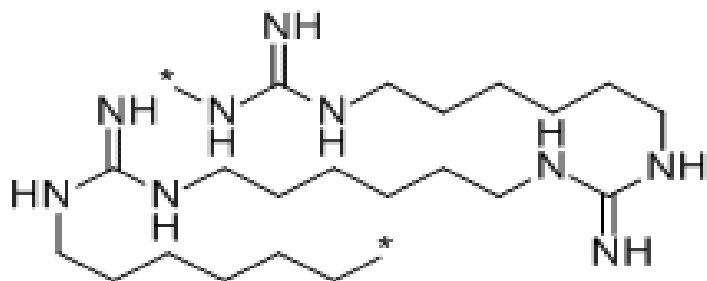
Hong S.-B. *et al. Thorax* 2014, 69, 694-702

- 2011 (spring)
- 17 adults, 28-49 y, 15 women
- 6 pregnant, 4 delivery < 2 weeks
- 13/17 admitted to hospital
- 10/13 severe respiratory distress → ICU
- 5 deaths, 5 lung transplants
- Viral infection (avian flu, SARS, ...)?
- Yellow dust ?
- Some familial clustering
- Humidifier disinfectants

Kim H.J. *et al. Thorax* 2014, 69, 703-8

- 2004-2011 (spring)
- Detailed environmental questionnaire of 18/28 confirmed cases (15 women / 3 men) vs 121 matched controls
- Significantly more use of humidifier disinfectants (detergents) in cases (17/18) than controls (32/121): aOR = 53 [6-444]
- Majority (~80%) used PHMG
- Inhalation of PHMG (100 nm) caused acute pulmonary injury in experimental animals

Polyhexamethyleneguanidine (phosphate, hydrochloride)



Material Safety Data Sheet

SKYBIO 1100

www.skybio.co.kr

www.skchemicals.com

HEALTH : 3 FLAMMABILITY : 1 REACTIVITY : 0

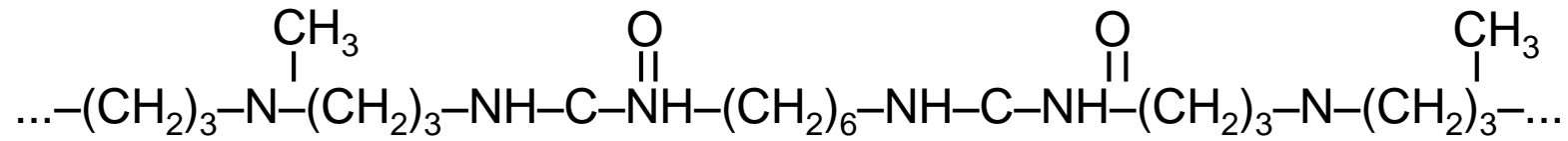
DATE ISSUED DEC 02, 2002

SUPERSEDES FEB 27, 1995

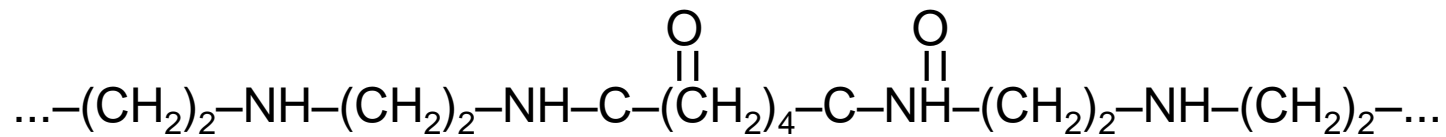
IX. TOXICOLOGY INFORMATION

ACUTE/CHRONIC TOXICITY TEST DATA

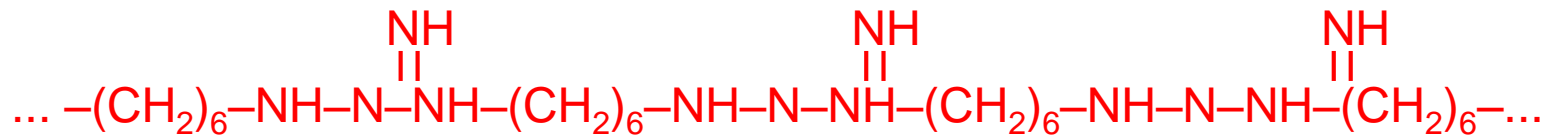
- oral LD₅₀ (rat) : 857mg/kg
- dermal LD₅₀ (rat) : 2000mg/kg
- eye irritation (rabbit) : Mild irritation to the eyes
- skin irritation (rabbit) : No Irritation
- skin sensitization (Guinea-Pig) : No Sensitization



Acramin FWR (Polyurea)



Acramin FWN (Polyamideamine)



PHMG (Polyhexamethylene guanidine)

Nemery B, Hoet PH. Humidifier Disinfectant-associated Interstitial Lung Disease and the Ardystil Syndrome. *AJRCCM* 2015, 191, 116-7

Take home message

Inhalation of “non toxic”
chemicals may lead to (severe)
lung disease ...

Thank you for your
attention

ben.nemery@med.kuleuven.be

Obliterative bronchiolitis in fibreglass workers: a new occupational disease?

Paul Cullinan,^{1,2} Clive R McGavin,³ *Occup Environ Med* 2013;**70**:357–359,²
Toby M Maher,¹ Tim Howell,⁵ John Banks,⁶ Anthony J Newman Taylor,⁷
Chi-Hsien Chen,⁸ Perng-Jy Tsai,⁹ Tung-Sheng Shih,¹⁰ P Sherwood Burge¹¹

- 6 workers [1987-2007, UK & Taiwan]
 - preparing fibreglass-reinforced plastic (5 boatbuilders)
 - 34 y (25-51y); onset of symptoms < 12 months
- obliterative (constrictive) bronchiolitis
 - well documented, severe (1 death, 2 lung Tx)

- exact cause?

- styrene-based resin
- accelerator (methylethylketoneperoxide, dimethylphthalate)
- other chemicals, solvents

Chen *et al.* OEM Sept 2013
+ 2 patients (MEKPO?)