

**BOHRF**

**2005**

**Evidence-based guidelines OEM 2005;62:290**



**BTS/SIGN asthma guidelines Thorax 2014;69 Suppl 1**

**GORDS**

**Audit of practice Occ Med 2008;58:71**



**BTS Standards of care Thorax 2008;63:240**



**Guidelines for the management of work-related asthma  
Eur Respir J 2012;39:529**



**Specific inhalation challenge in the diagnosis of  
occupational asthma Eur Respir J 2014;43:1573**

# What to expect

- A very little on occupational asthma
- Two stories, one good one bad, incorporating making a diagnosis of occupational asthma
- Surveillance for occupational asthma
- What we can offer

# SIGN/BTS Guidelines 2012

## INCIDENCE

Occupational asthma may account for about 9-15% of adult onset asthma. It is now the commonest industrial lung disease in the developed world with over 400 reported causes.



# If you expose workers to isocyanates some will develop occupational asthma

- The higher the exposures the more will be sensitised
- Some will be sensitised at levels well below current exposure standards
- Your risk assessment will have identified the risk of sensitisation
- You should have respiratory surveillance in place to identify OA early when prognosis is better (MS25)
- You should have an agreed plan for managing workers who develop occupational asthma

- Isocyanate sensitisation is much the most likely cause of adult-onset asthma in a worker with isocyanate exposure

28 year old man developed coughing and chest tightness for the last 9 months and improved on days off work. His GP diagnosed asthma

All patients with airflow obstruction should be asked whether their symptoms improve on days off work or on holiday (BTS/SIGN asthma guidelines). Those that do should be investigated for occupational asthma, the diagnosis can be confirmed in around 50% who do.

## Clinic visit 1

- New onset asthma November 2009
  - Fibreglass constructor
  - Often but not always better days off
  - Better over Christmas break
  - Worse with larger and exercise
- Never smoked
- No family history of asthma



# Occupational history

- 1999-2000 Patisserie warehouse with bagged flour
- 2000-2003 Welder mild steel and aluminium fabrication, paint spraying, no 2 packs
- 2003-2009 Patisserie maintenance fitter, plumbing, welding, brick laying
- Feb 2009- Dormer window fabrication

CB 3/6/2011

	<b>Predicted</b>	<b>Pre</b>	<b>% predicted</b>	<b>Post</b>
FEV1	3.98	4.42	111	4.44
FVC	4.7	5.43	116	5.43
FEV1/FVC	82	81		82

# What would you do next?

- Believe the worker and relocate him away from exposure? (avoiding what?)
- Disbelieve the worker and leave him in the same job?
- Measure some workplace exposures (what?) and reassure the worker if the levels are within the occupational exposure standards
- Do something else?

# How do you prove that this is occupational asthma?

Depends on how certain you need to be

- Surveillance failures may not have asthma, require further proof

When new onset asthma validated

- If loosing job a possibility,
  - good proof required
- If relocation possible with equivalent job
  - Trial of relocation often best with monitoring

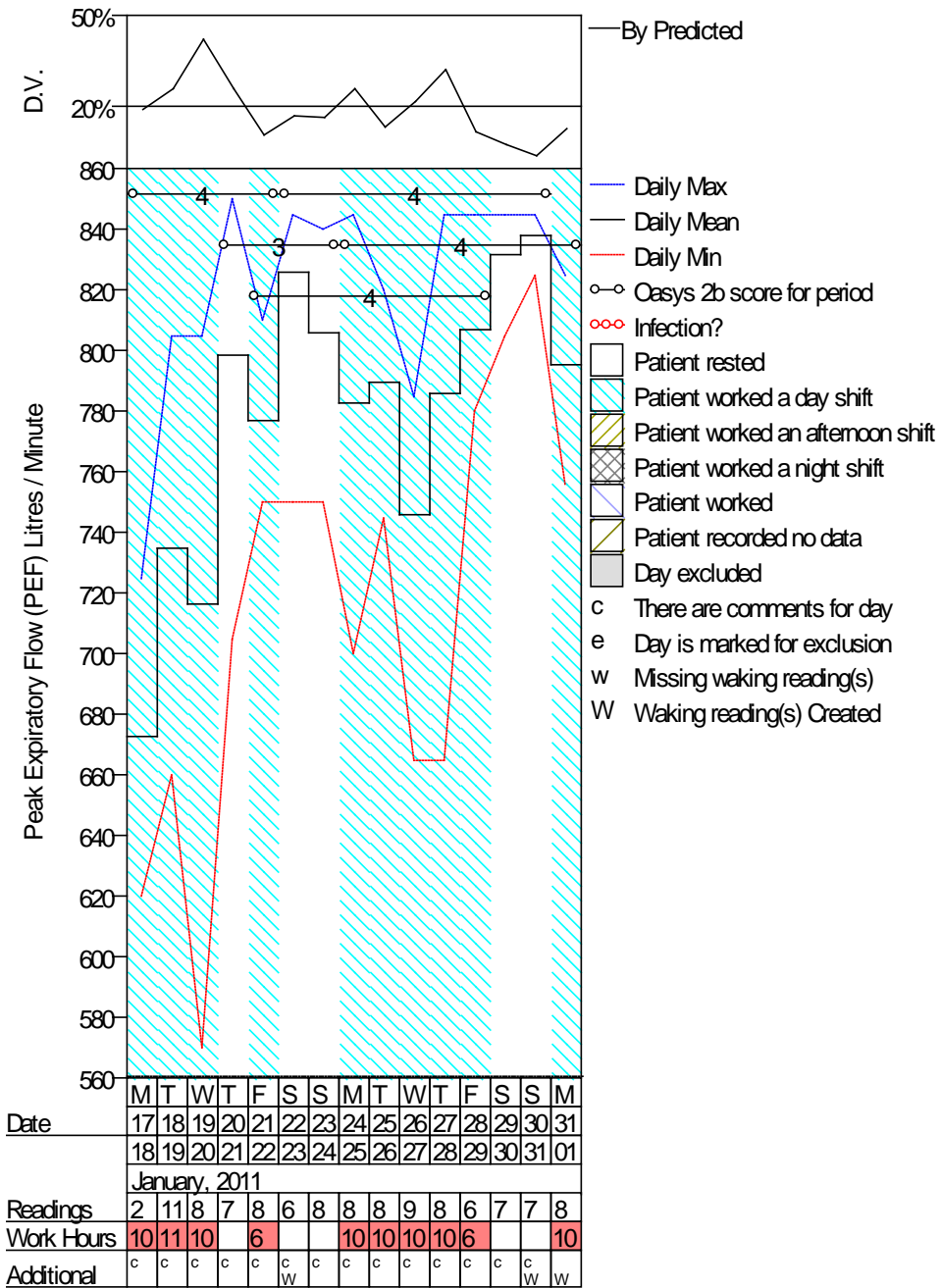
Common law and DWP; probability >50%

# Timing of PEF measurement

- Waking
- Arriving at work
- Each work break
- Leaving work
- After food
- Bedtime (ignore night-time waking)

# Improving the returns on PEF records

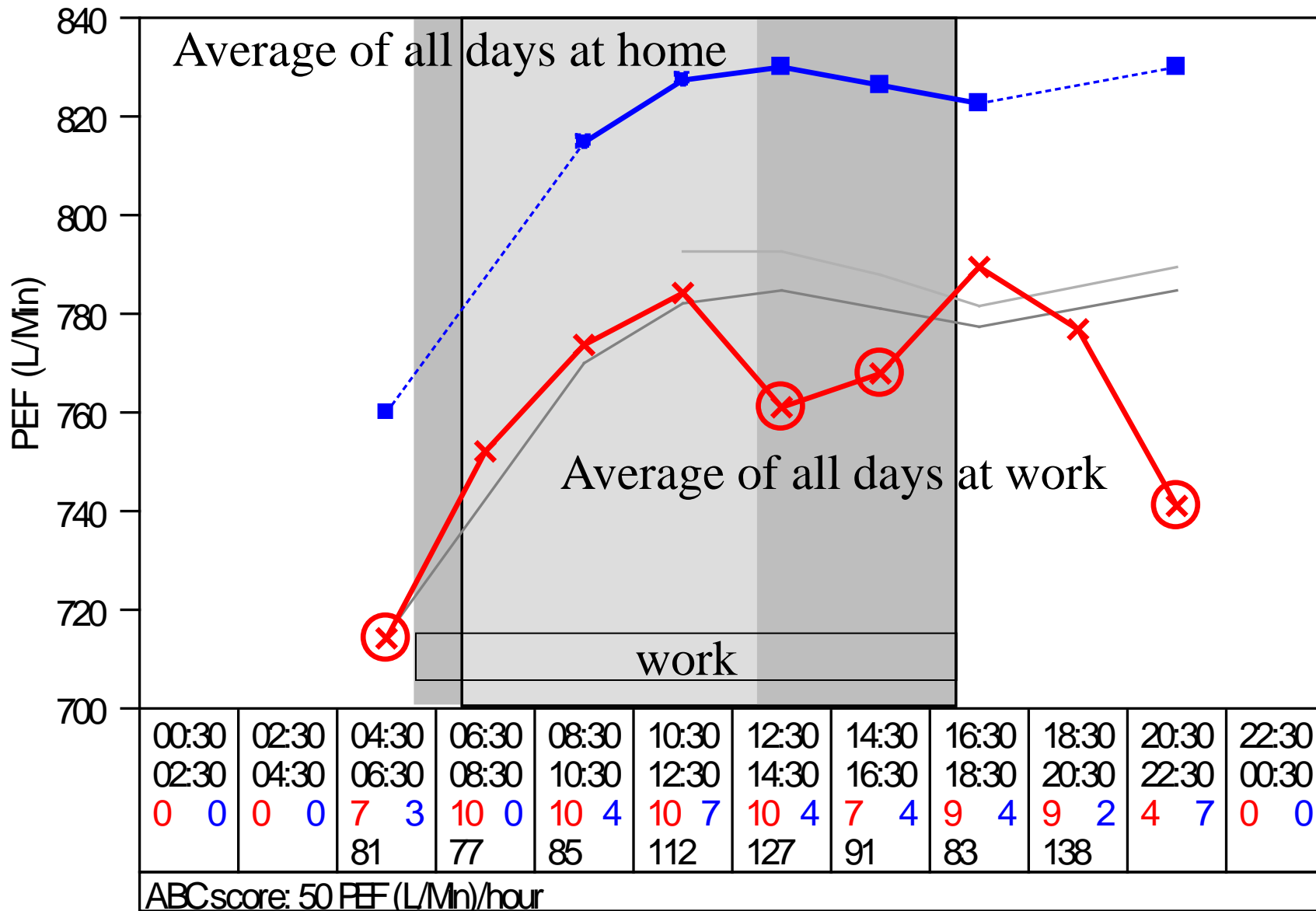
- Keep a record yourself
- Select a pocketable simple meter
- Be flexible over timing and dates, select dates with reasonable periods off work
- Keep any treatment constant
- Provide training and encouragement



Dormer window  
manufacture

methacrylate and styrene

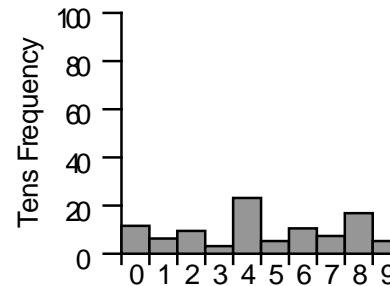
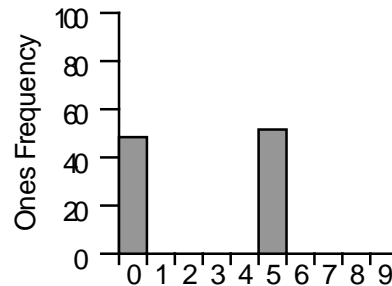
# Average Hour for Rest and Day Shift days



Time of Day, Number of Readings And Areas (Day Shift **x**) (Rest **■**)



## Number Preference



## Diurnal Variation

	By Predicted		
	Min	Mean	Max
Whole Record	4	<b>19</b>	42
Day Shift Days	11	<b>21</b>	42
Rest Days	4	<b>14</b>	26

## Scores

Definite occupational asthma, (psb)

Oasys score

**3.89**

Oasys score, Highest 3 consecutive quality complexes

**0.00**

Rest - Work PEF Difference Percent Predicted

**9.69%**

ABC (Area Between Curves) Clock Time (suboptimal data)

**49.68**

ABC (Area Between Curves) score (suboptimal data)

**55.96**

Timepoint Analysis:

**Positive (4)**

You have established a diagnosis of occupational asthma, but not identified the cause

What do you do next?

# Methods of identifying the cause of occupational asthma

- Specific IgE to a well characterised antigen
- Specific Inhalation Challenge
- Trial of relocation and serial PEF measurements

## Visit 2 conclusions

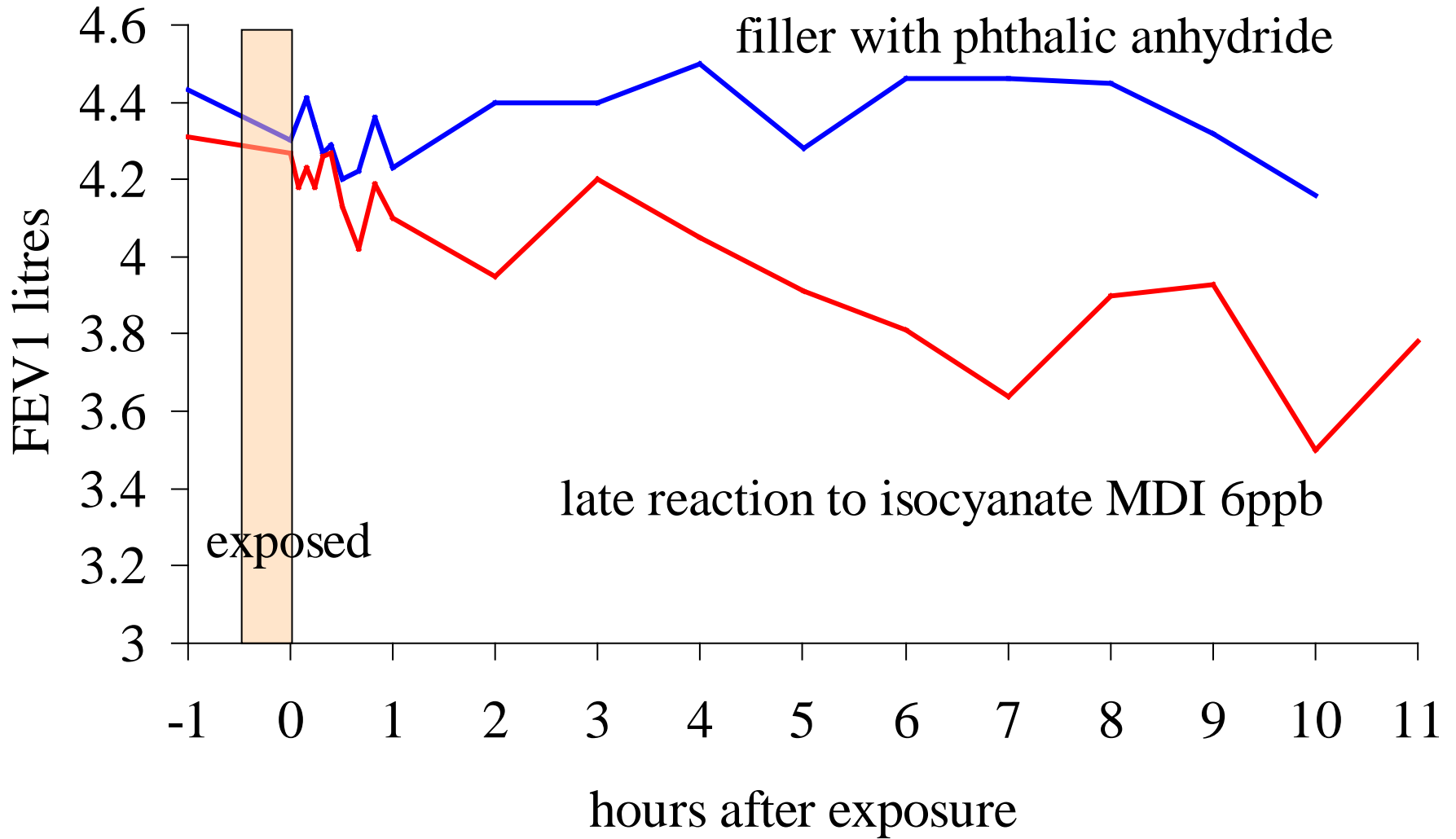
“He has carried out peak flow records with a logging meter which confirm occupational asthma. We clarified some of his work exposures, most of which is to styrene. He uses an adhesive with methyl methacrylate about twice weekly, but others use it daily, it is a good cause of occupational asthma. There is also a foaming process for which respiratory protection is used, this may be an isocyanate and if so would be the most likely cause of his occupational asthma. I plan to organise specific inhalation testing after a workplace visit to clarify exposures”

- A workplace visit identified several possible but uncommon causes of occupational asthma
- There was significant styrene exposure in the general environment, a very rare cause of occupational asthma
- Soft woods were sanded, again an uncommon cause for occupational asthma.
- Methyl methacrylate (a more common cause of occupational asthma) was used as an adhesive, but exposure was infrequent.
- A filler contained phthalic anhydride, a possible cause of occupational asthma
- A single worker used an isocyanate foam in place of fibreglass to insulate some of the dormer windows. He wore a mask supplied by air from outside; the booth was open to the general workplace

# Isocyanate monitoring results

HPLC MDHS25/3 methods

	MDI mg/m <sup>3</sup>
Leader with little spraying	<0.0004
Leader mostly spraying	0.004
Static 1m outside opening	0.0007
Static 3m from spraying rear of booth	0.001
8 Hour TWA	0.02



<b>Exposure</b>	<b>Length of exposure (mins)</b>	<b>FEV1 (L)</b>	<b>% Max Immediate reaction</b>	<b>% Max Late reaction</b>
styrene +catalyst	70	4.43	-5.19	-6.09
MDI (6ppb)	70	4.37	-0.23	-13.04
MDI (6ppb)	120	4.31	-6.73	-18.79
Norsodyne resin + phthalic anhydride	70	4.31	-0.23	-9.74



## Was it worth it?

	Income £	Marginal costs £
Band 7 scientist 5 days		839
Isocyanate in air measurements (2)		45
Methacholine (2) (fixed tariff)		240
4 nights in hospital		2,276
Consultant 1 hour		58
Isocyanate RAST (processing only)		10
Report		30
Total (elective asthma admission)	395	3,258

You have now established the isocyanate MDI  
as the cause of the occupational asthma

What do you do now?

# Audit standard; BTS standards of care for occupational asthma Thorax, 2008; 63: 240

All patients with suspected occupational asthma should have the following clearly documented in the medical case notes by the second consultation:

- A full list of occupations held and likely associated occupational exposures.
- FEV<sub>1</sub> and FVC.
- If at work, serial PEF measures taken for at least four continuous weeks including rest days with at least four good quality readings per day analysed by a validated method.
- If exposed to allergen with appropriate specific IgE measure or skin prick test, the result of this test.
- **Letter to patient** concerning advice about continuing employment once a diagnosis has been made.
- Compensation advice appropriate to the case.

# Clinic letter extracts to patient

- “This is to confirm that I have told you today that in my opinion you have developed occupational asthma due to sensitisation to the isocyanate that you are incidentally exposed to at work. I have given you information about compensation from the DWP. If you wish to make a common law claim you should do so within three years of knowing of your problem. You are fit to work in any place where there are no isocyanates”.

# Clinic letter extracts to his manager

“This man gives permission for me to write to you about his occupational health. He has occupational asthma due to the isocyanate MDI that he is incidentally exposed to at work. He should not be exposed to isocyanates in the future. I would also request that that reasonable adaptations are made with respect to the Equality Act. Obviously this would include future episodes of sickness absence which may occur due to exacerbations of his asthma. He should be notified under the RIDDOR regulations. He is fit to work in any place where there are no isocyanates”.

A good outcome requires a specific diagnosis  
and a cooperative employer

He was transferred to another building  
where porches and canopies were made  
using identical methods but without  
insulation. His work-related symptoms  
stopped, he continued to wheeze with  
respiratory infections.

# Was it worth it? Depends on action in the workplace

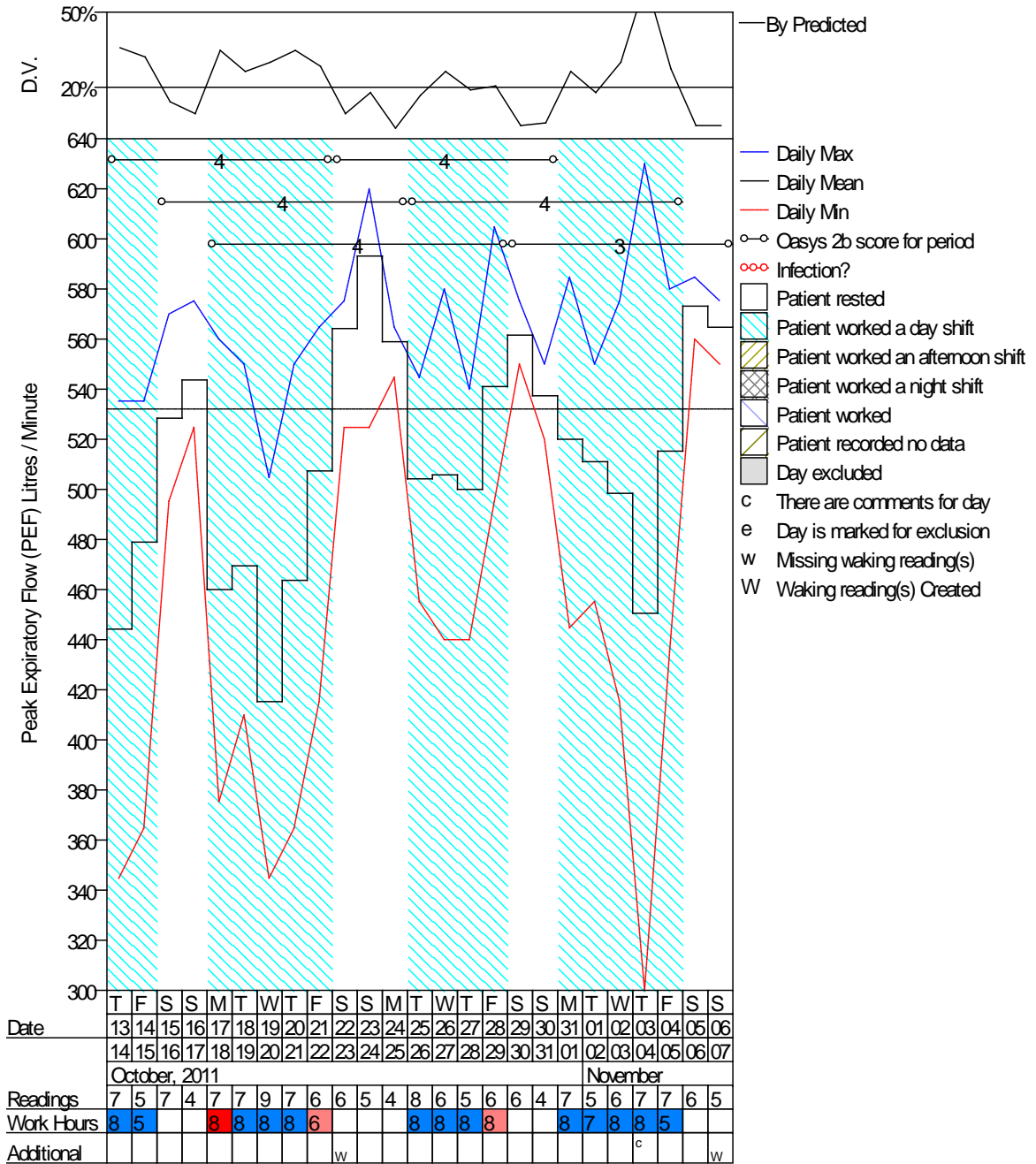
To hospital trust		Average lifetime costs, direct + indirect	Estimated lifetime saving (assuming same direct costs)
Income	Marginal Cost		
£697	£4049	£262,464	£177,450

A foreman in a company manufacturing PCBs develops asthma requiring several periods off work with improvement and one hospital admission. There are a number of people soldering in the workplace with colophony based fluxes without local exhaust extraction. There is also an encapsulation process which uses two systems, one is an isocyanate (MDI) and one is another material (DP190) with unknown constituents. Both are applied cold but are heated with a hot air blower for curing and then air cured. There is also a hot melt adhesive and occasional uses of a Loctite adhesive containing an acrylate. He has never had any occupational health surveillance.



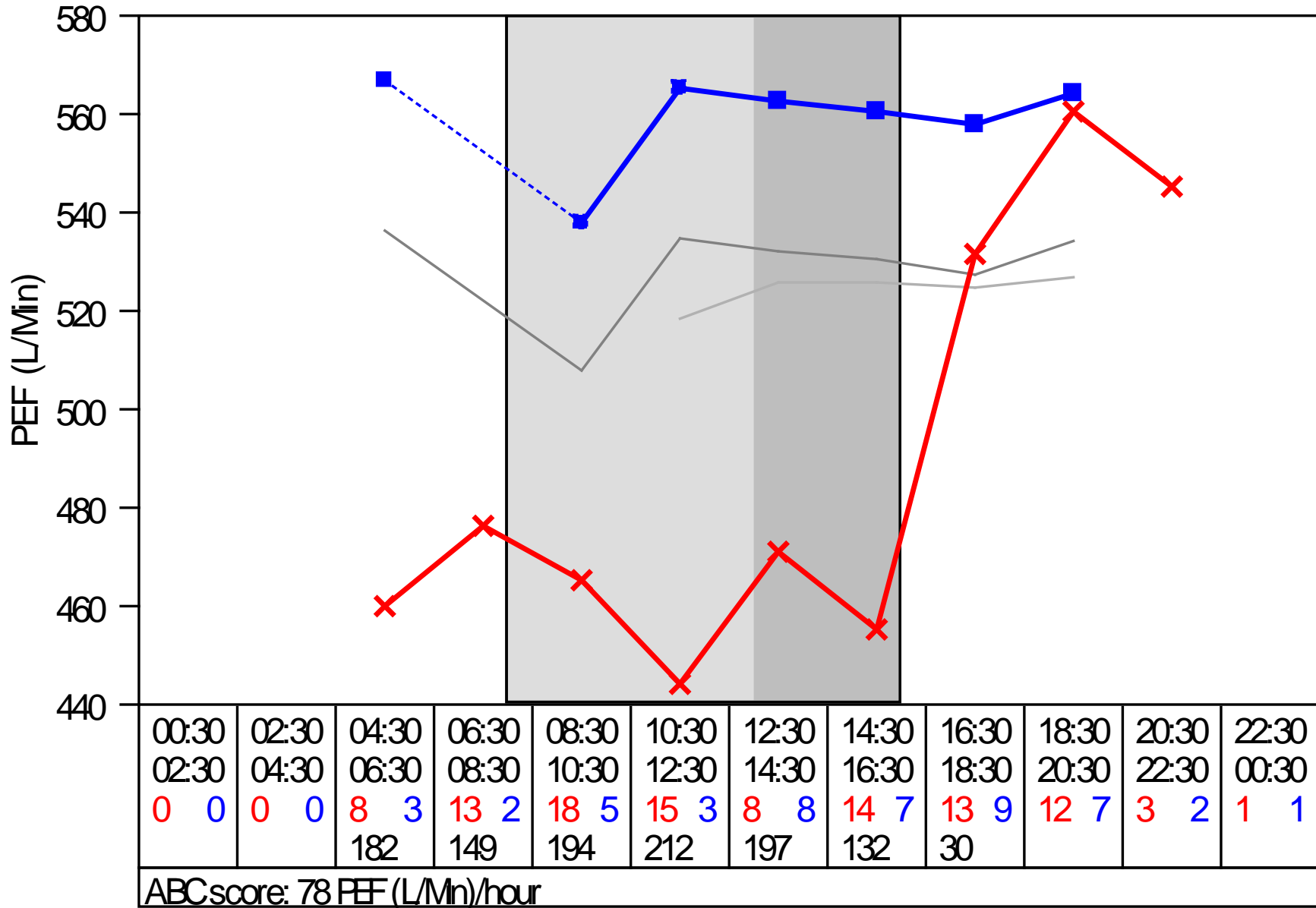
# What would you do next?

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- Measure some workplace exposures (what?) and reassure the worker if the levels are within the occupational exposure standards
- Do something else?



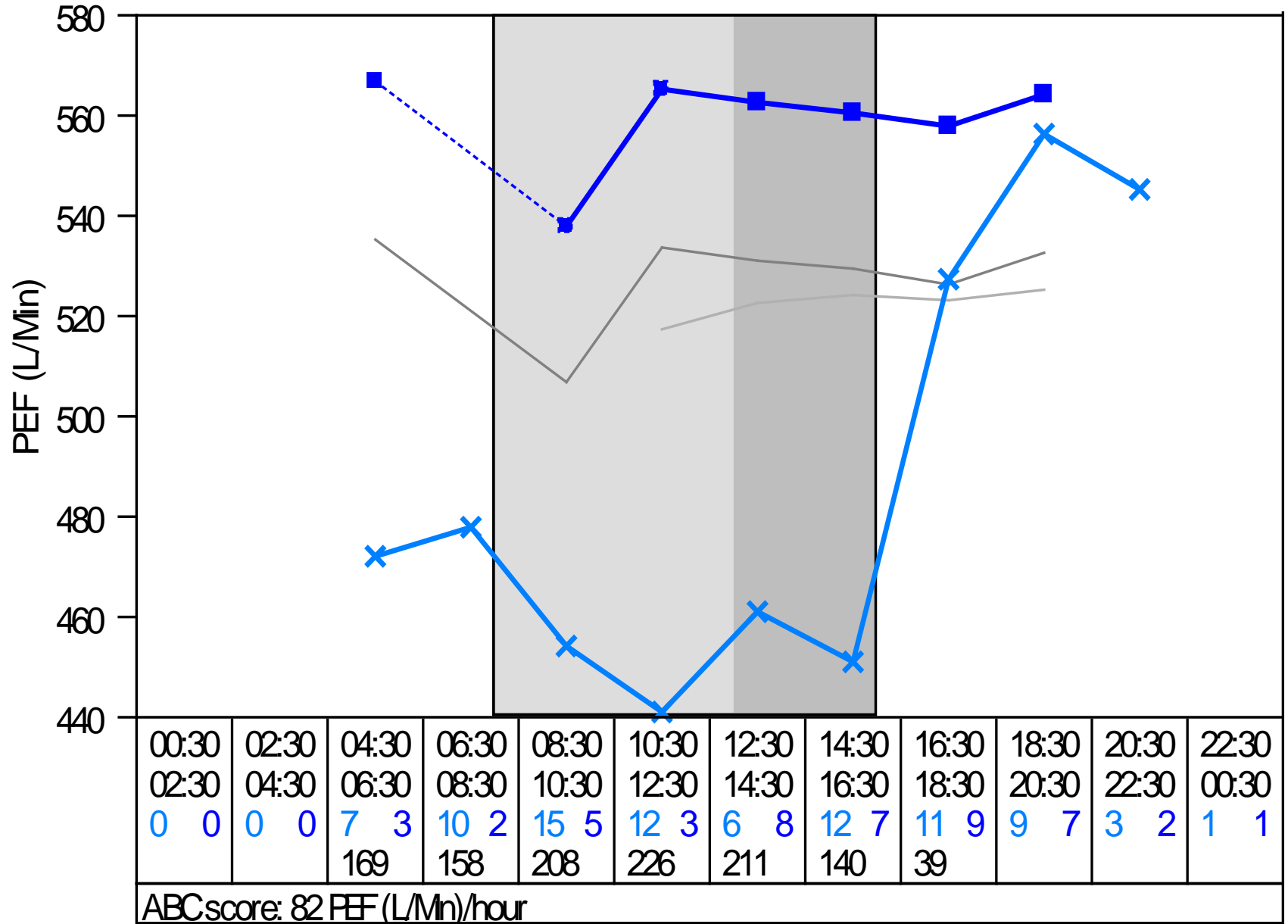
soldering and encapsulation done by others
  Colophony solder flux himself, MDI nearby  
 isocyanates (MDI) Blue potting hiself by less hours

# Average Hour for Rest and Day Shift days



Time of Day, Number of Readings And Areas (Day Shift x) (Rest ■)

# Average Hour for Rest and Colophony solder flux himself, MDI nearby



Time of Day, Number of Readings And Areas (Colophony solder flux himself, MDI nearby ×) (Rest

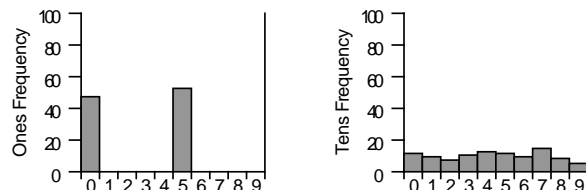
## Quality

The data is of suboptimal quality for timepoint analysis due to waking time differences.

The record is sloping at 3 l/min per day.

There are 7 outlying readings. Outlying readings are lower than 371 l/min or higher than 639 l/min, which is the 95% confidence interval for the readings. Please check these readings.

## Number Preference



## Diurnal Variation

	By Predicted		
	Min	Mean	Max
Whole Record	4	22	62
Day Shift Days	17	29	62
Rest Days	4	8	18

## Work Exposures

Name	Colour	Rest - Work	Number of Work Days
soldering and encapsulation done by others (in)	Light Red	6.43%	2
Colophony solder flux himself, MDI nearby (in)	Blue	14.72%	13
isocyanates (MDI) Blue potting himself by less hours (in)	Red	18.49%	1

## Scores

Definite occupational asthma, Not clearly isocyanate rather than colophony (sb)

Definite occupational asthma, unclear whether colophony or isocyanate exposure is the cause of the OA (sb)

Oasys score **3.91**

Oasys score, Highest 3 consecutive quality complexes **4.00**

Rest - Work PEF Difference Percent Predicted **14.03%**

ABC (Area Between Curves) Clock Time **78.28**

ABC (Area Between Curves) score **87.24**

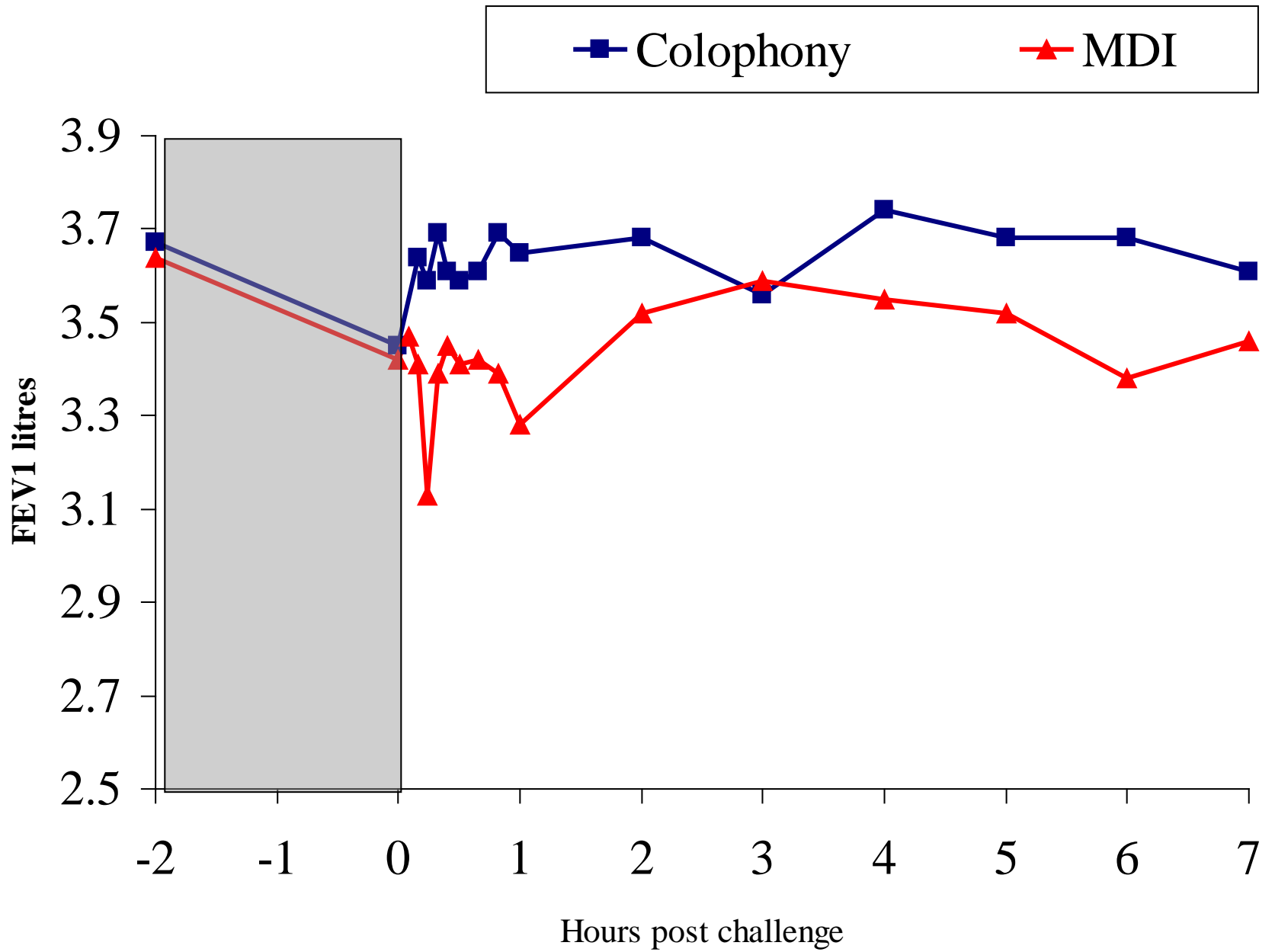
Timepoint analysis not available due to waking time differences.

This man gives me permission to write to you about his occupational health. He has developed occupational asthma confirmed by testing. I believe he is exposed to several different possible causes in your workplace, including colophony (rosin) in the solder fluxes, isocyanates (MDI) in the encapsulation material, acrylics in the Loctite and probably epoxy curing agents as well. The precise agent causing his occupational asthma is currently unknown. Isocyanates would be the most likely and colophony the second most likely and I am going to organise specific inhalational tests to try and find the precise cause.

He should be notified under RIDDOR as having occupational asthma. Once we have identified the precise cause he should no longer be exposed to this in an inhalable form.

# HSE Improvement notice

Site visit following complaint from an employee diagnosed with occupational asthma. Guarding not in place on machine not in use at time of visit and control of substances containing diisocyanates not adequate. IN (303609642) issued to plan how to guard machinery & IN (303614660) issued to implement measures to control exposure to isocyanates.

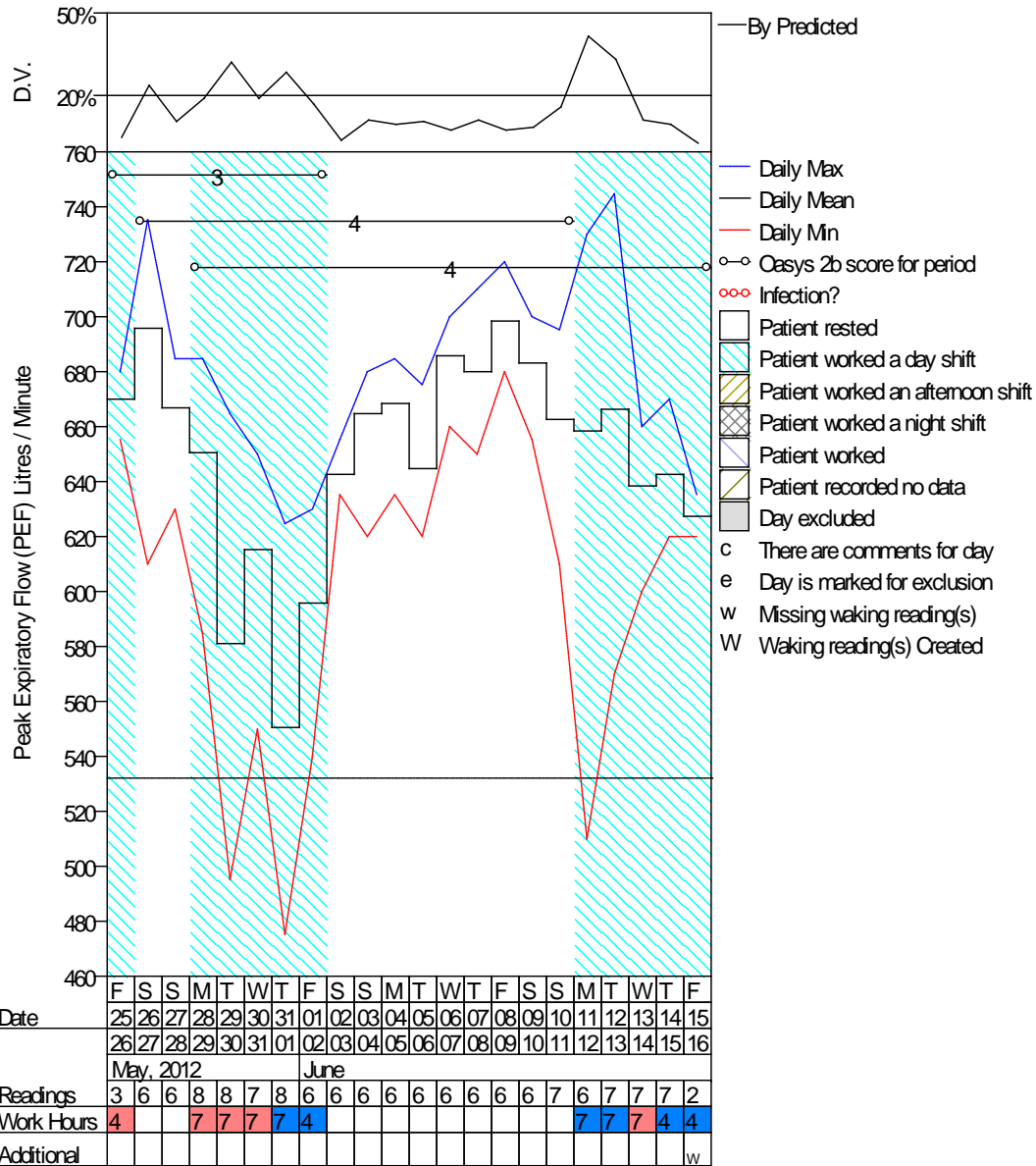




- Isocyanate process enclosed
- Some heating of the DP190 when problems need rectifying
- The unpowered half-face mask issued does not protect him against isocyanates

“I hope that you are managing to look into respiratory surveillance on all of your exposed workers as you have respiratory sensitizers i.e. isocyanates and colophony in your work place”.

# Post RPE and enclosure



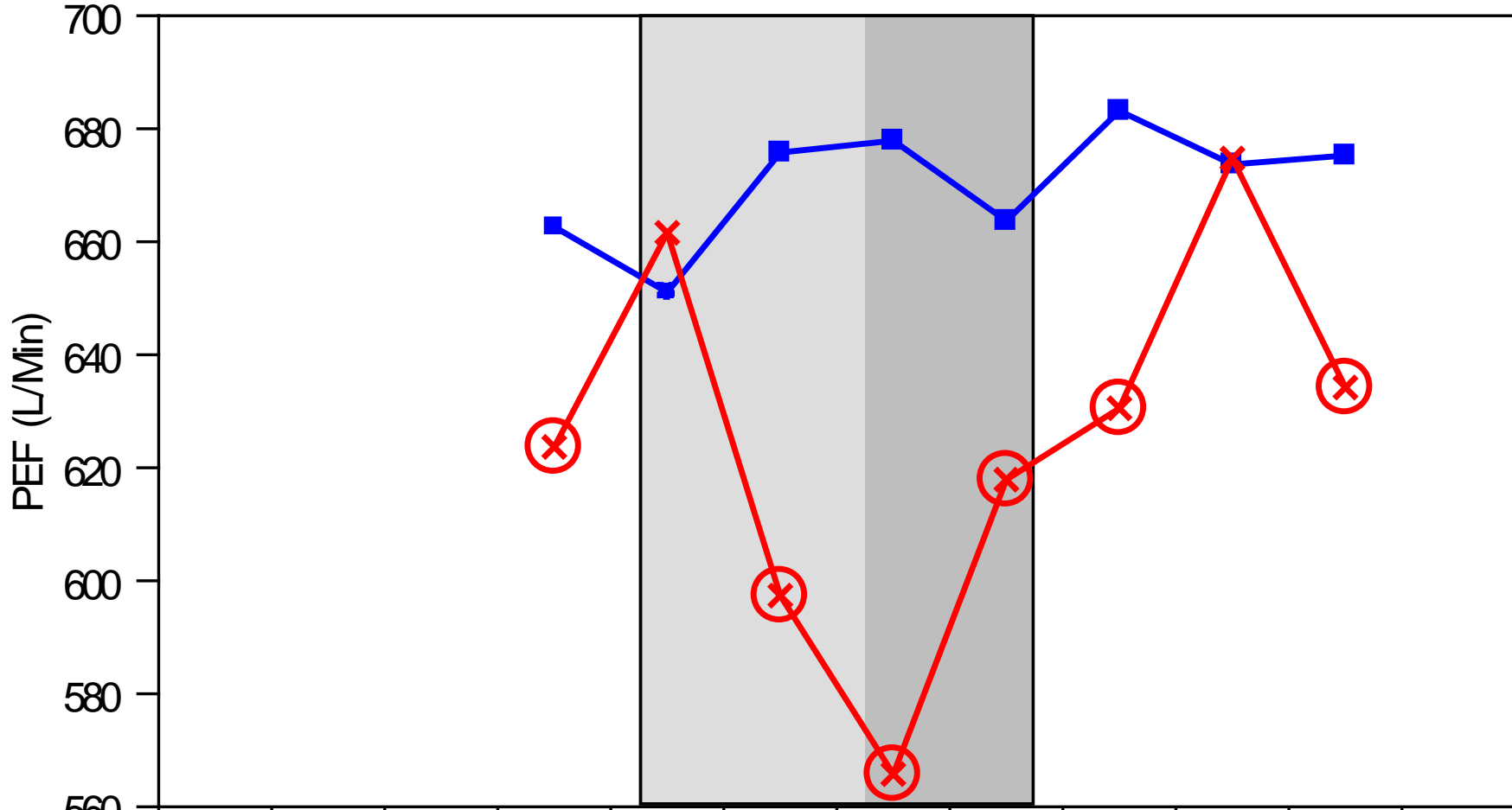
minimal soldering BLT flux used by colleagues

## Opinions And Comments

Definite occupational asthma  
 no real difference between when BLT flux used and not. previous challenge positive to MDI

Post RPE and enclosure

Average Hour for Rest and Day Shift days



00:30	02:30	04:30	06:30	08:30	10:30	12:30	14:30	16:30	18:30	20:30	22:30
02:30	04:30	06:30	08:30	10:30	12:30	14:30	16:30	18:30	20:30	22:30	00:30
0	0	1	7	7	16	9	5	7	11	6	0
		0	4	8	11	9	7	11	7	10	0
			29	69	191	158	98	51	40		

ABCscore: 45 PEF (L/Mn)/hour

Time of Day, Number of Readings And Areas (Day Shift x) (Rest ■)

# 9 months later

Occupational asthma from isocyanates currently off work  
Depression induced by lack of work and management issues

SPIROMETRY	:	<u>Predicted</u>	<u>Measured</u>	<u>%</u>
FEV1		3.63	3.52	97
FVC		4.39	4.28	97
FEV1/FVC		80	82	103
EXHALED BREATH NO		7 ppb (NORMAL)		

This man's main problem is depression. This has been brought on by the problems at work and his inability to do his original job and his relationship with the management which is unsatisfactory.

He should not be exposed to isocyanates in the future, otherwise from a lung point of view he is fit to work but clearly his depression is in the way at the moment.

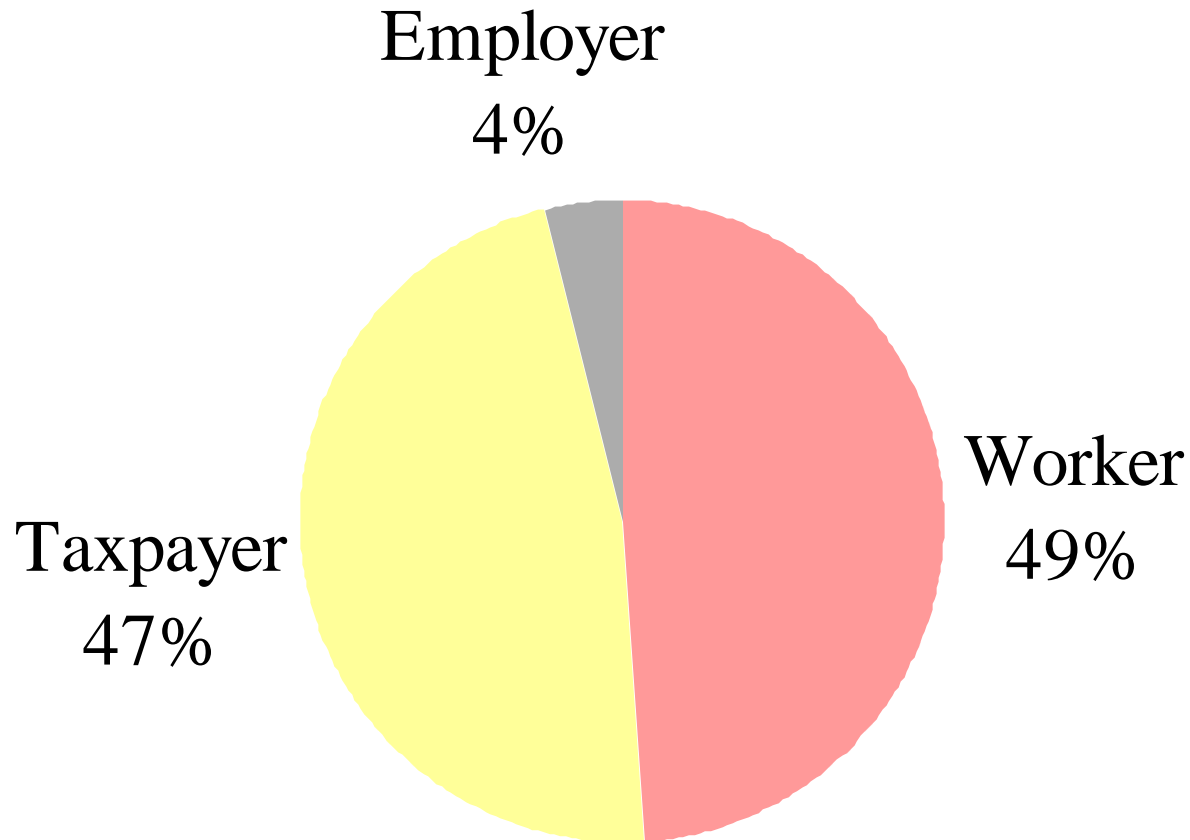
# From Ayres Thorax 2011;66:128.

- Direct costs include medical care and industrial injuries benefit.
- Indirect costs assume 25% stay in same job with 30% losing 20% income
- 25% change jobs with same employer; 20% losing 20% income
- 15% change employer; 85% losing 50% income (including periods of unemployment)
- 15% retire
- 20% remain unemployed
- 2012 prices assuming retirement age 67

**Average lifetime costs, direct + indirect**

**£262,464**

# Lifetime costs of occupational asthma in the UK £72-100,000,000



# Employers and their health and safety personnel should:

- **provide regular health surveillance where a risk of occupational asthma is identified, to include a respiratory questionnaire with functional and immunological tests where appropriate.**

**\*\* SIGN C**

- **assess exposure in the workplace and enquire of relevant symptoms among the workforce when a worker develops symptoms suggestive of rhinitis or asthma to identify opportunities to institute remedial measures to protect other workers.**
- **ensure that measures are taken to ensure that workers diagnosed as having occupational asthma avoid further exposure to its cause in the workplace.**

**\*\* SIGN B**



# **What should you do following identification of a respiratory sensitiser?**

- **Screening questionnaire**
- **Spirometry**

# **Surveillance questionnaire for occupational asthma**

**Since your last medical**

**Have you had any episodes of wheeze or chest tightness?**

**Have you taken any treatment for your chest?**

**Have you woken from sleep with cough or chest tightness?**

**Have you had any episodes of breathlessness?**

**Have you had any time off work with chest illness?**

**Have you developed chest tightness or breathlessness after exercise?**

**Have you developed difficulty breathing?**

# **Surveillance questionnaire for occupational rhinitis**

**Since your last medical**

**Have you had irritation or watering of the eyes?**

**Have you had a stuffy nose?**

**Have you had soreness of the nose, lips or mouth?**

**Have you had itching or irritation of the skin?**

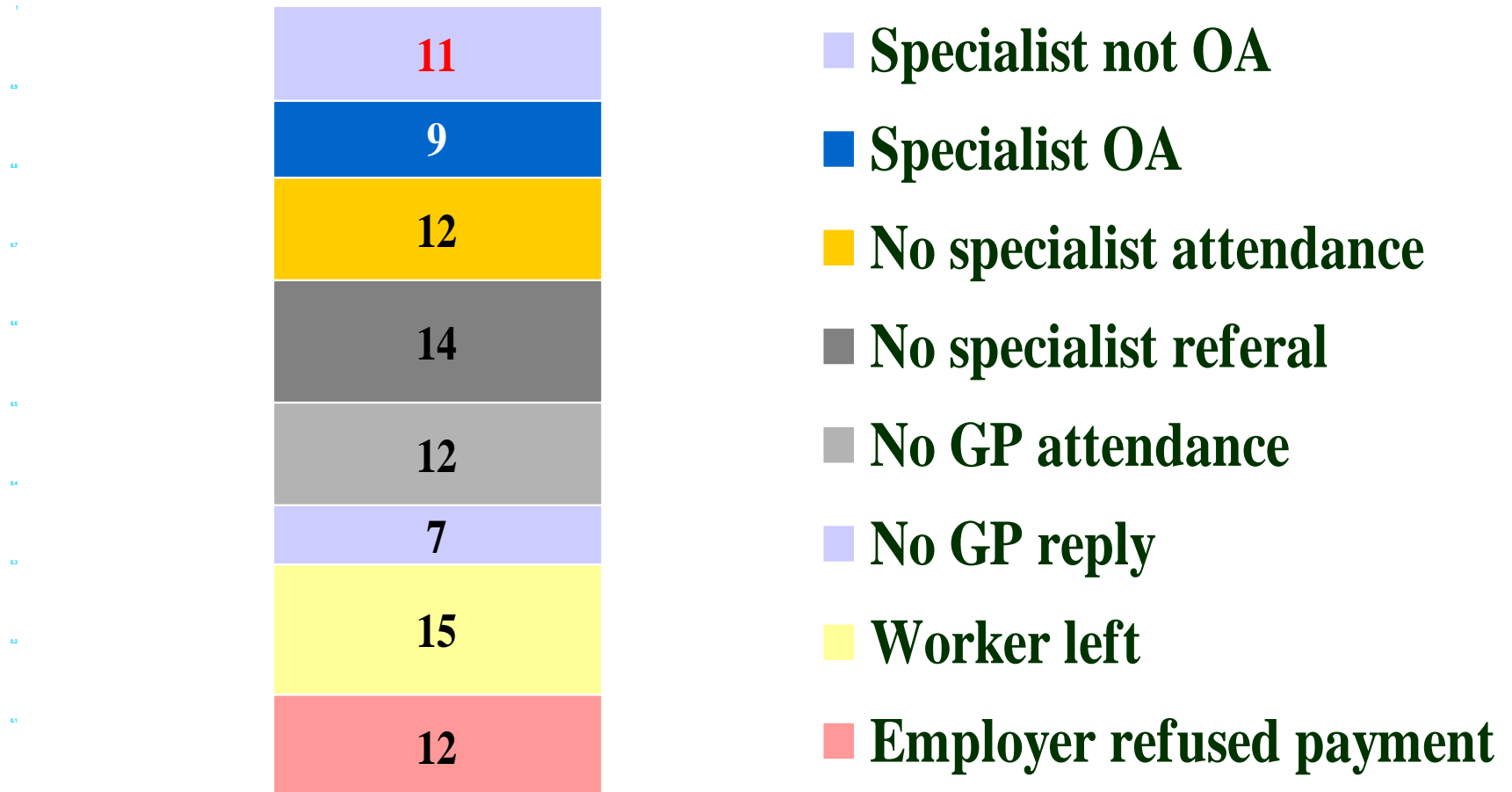
# If any question positive

- Assessment by health professional
  - Is any asthma definitely excluded?
    - Continue standard surveillance
  - Is asthma possible?
    - Serial PEF measurements and medical assessment
      - Asthma excluded; return to standard surveillance
      - Asthma present but not clearly occupational; heightened surveillance
      - Occupational asthma; relocate

# **If you are doing respiratory surveillance for a sensitiser**

- **You should expect to find surveillance failures**
- **You should have an agreed plan for investigation and management of these workers**

# OHD letter to GP recommending specialist referral for OA 1995-2000



# What we offer you

**[www.occupationalasthma.com](http://www.occupationalasthma.com)**

- **Support for you and your patients for the diagnosis of occupational asthma via our website**
- **A specialist NHS service for workers with possible occupational lung diseases at the Birmingham Chest Clinic**



## Oasys and Occupational Asthma

This website contains information on Occupational Asthma and a free multi award winning computer program called OASYS, which is used to help diagnose Occupational Asthma from serial peak flow records. [Oasys](#) shows further information and downloads for the Oasys program. [References](#) is a searchable database of more than 4,500 published papers in the field of occupational asthma. [Causes](#) shows some of the causes of occupational asthma. The [Shield](#) scheme reports some statistics for occupational asthma, mainly in the West midlands region, UK. [BOHRF](#) shows the evidence based occupational asthma guidelines for the UK. The interactive [Case Histories](#) are a learning resource for interested health professionals. There are also [Medics](#), [Specialists](#), [Employers](#) and [Worker](#) sections.

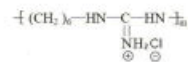
### Latest News



[Occupational asthma in a chef cooking yellowfin sole](#) 22 10 2014



[Why do workers with the highest exposure to laboratory animals have less disease than those with intermediate exposure?](#) 05 09 2014



[Fatal lung disease in adults and children using humidifiers at home containing detergent biocides](#) 18 08 2014



[Cobalt dissolved in metal-working fluid causes an ongoing outbreak of occupational asthma](#) 16 07 2014



[job strain is probably not an important risk factor for severe asthma exacerbations leading to hospitalization or death.](#) 02 06 2014

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### Latest Publications



Okudera H, Morita H, Iwashita T, Shibata T, Otagiri T, Kobayashi S, Yanagisawa N ,  
[Unexpected nerve gas exposure in the city of Matsumoto: Report of rescue activity in the first](#)



## Isocyanates



Isocyanates are the most common cause of occupational asthma at the moment. They are present in 2-pack paints (where they are a problem during mixing, painting and curing), glues, foams, rubbers, pesticides and dyes. They can also be a problem for welders, solderers, assemblers, moulders, core makers, printers, and anyone who is working in an environment where Isocyanates are used.



[See published papers on "Isocyanates" from this website.](#)



[See information on "Isocyanates" from the HazMap \(Information on Hazardous Chemicals and Occupational Diseases\) website.](#)



[See information on "Isocyanates" from the AsmaPro website \(database of occupational asthma cases\).](#)

### Oasys Notifications for Isocyanates

The Oasys Audit scheme started midway through 2010 and collects agents typed in through the Oasys program. The years before 2010 show old data entered during 2010 or later and are likely to have many fewer notifications. We expect Oasys to become more widely adopted as time goes by so increasing notifications does not necessarily mean an increasing problem.

### Super Categories

[All Agents](#)

[Low Molecular Weight Agents](#)

[Isocyanates](#)

### Subcategories

[Hexamethylene diisocyanate \(HDI\)](#)

### Known Synonyms

isocianatos

Isocyanate

isocyanates?

MDI

polyurethane

TDI

[Create new author here](#)

[Choose people displayed here](#)

# Conclusions

- **Workers with possible occupational asthma are the responsibility of the NHS and warrant specialist referral**
- **Isocyanate exposure will continue to cause occupational asthma at levels well below exposure standards**
- **Reducing the numbers incidentally exposed will reduce the incidence of isocyanate asthma and allow relocation of sensitised workers**
- **It can stop you working, even as a hygienist, doctor or nurse**
- **It can close workplaces**