

# Health and exposures of firefighters exposed in the Fort McMurray fires of May 2016

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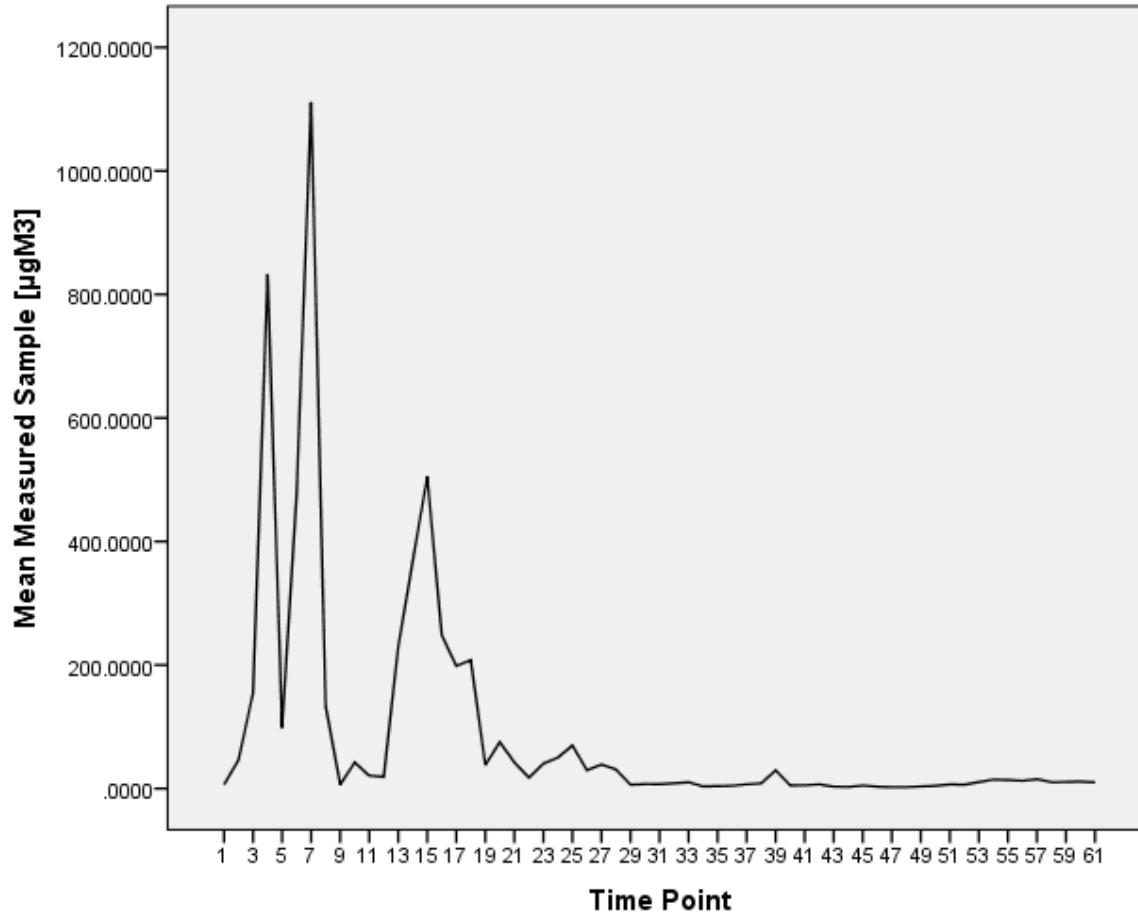
**University of Alberta, Canada**



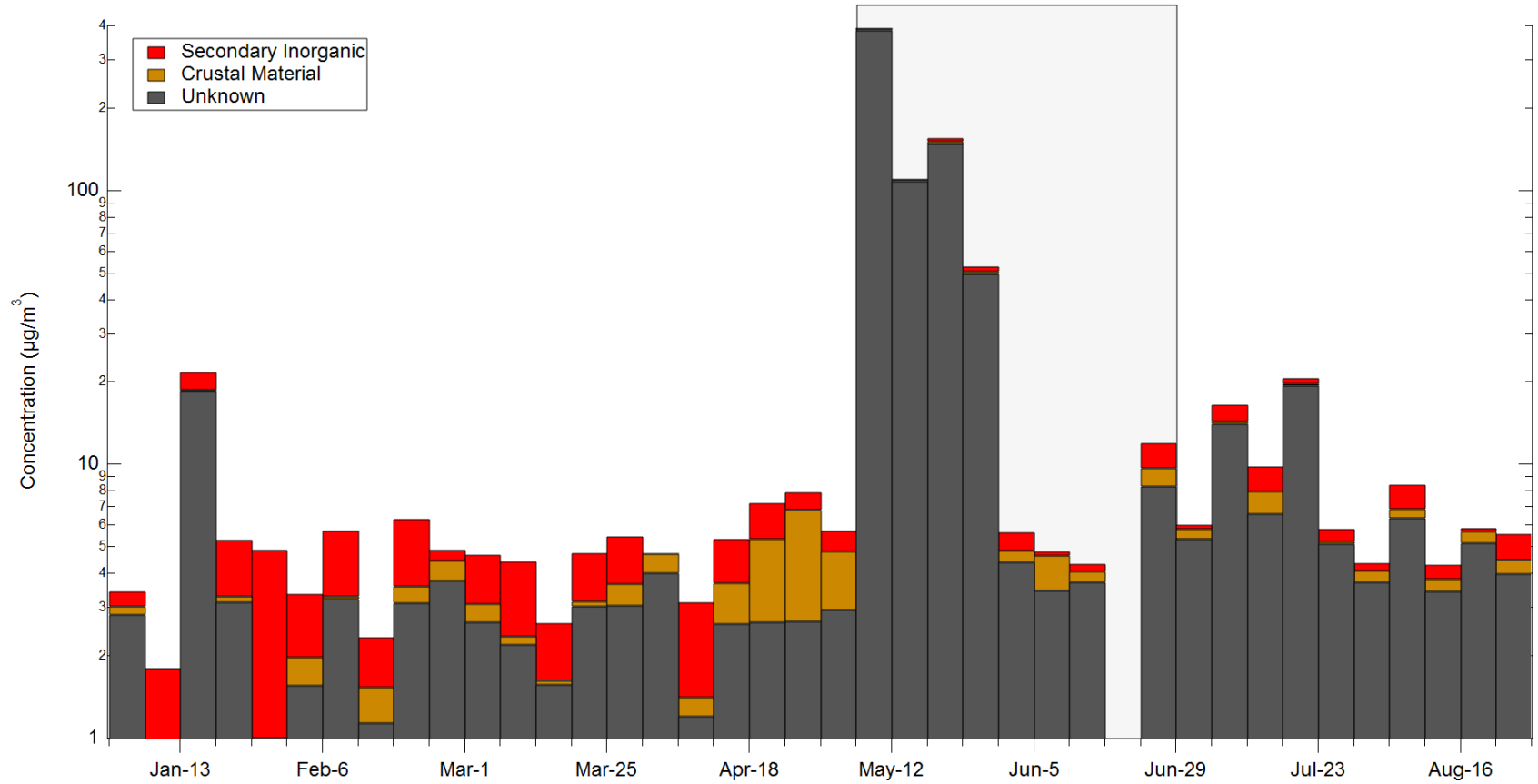
# The Fort McMurray Fire

- City of some 80,000, hub of the Northern Alberta oil and gas industry.
- Total evacuation 3<sup>rd</sup> May 2016.
- One road out – north to mining work camps.  
south to large conurbations.
- 3200 firefighters from throughout Alberta.
- Firefighting within the city most intense in early–mid May:  
continued burning away from the city until late August

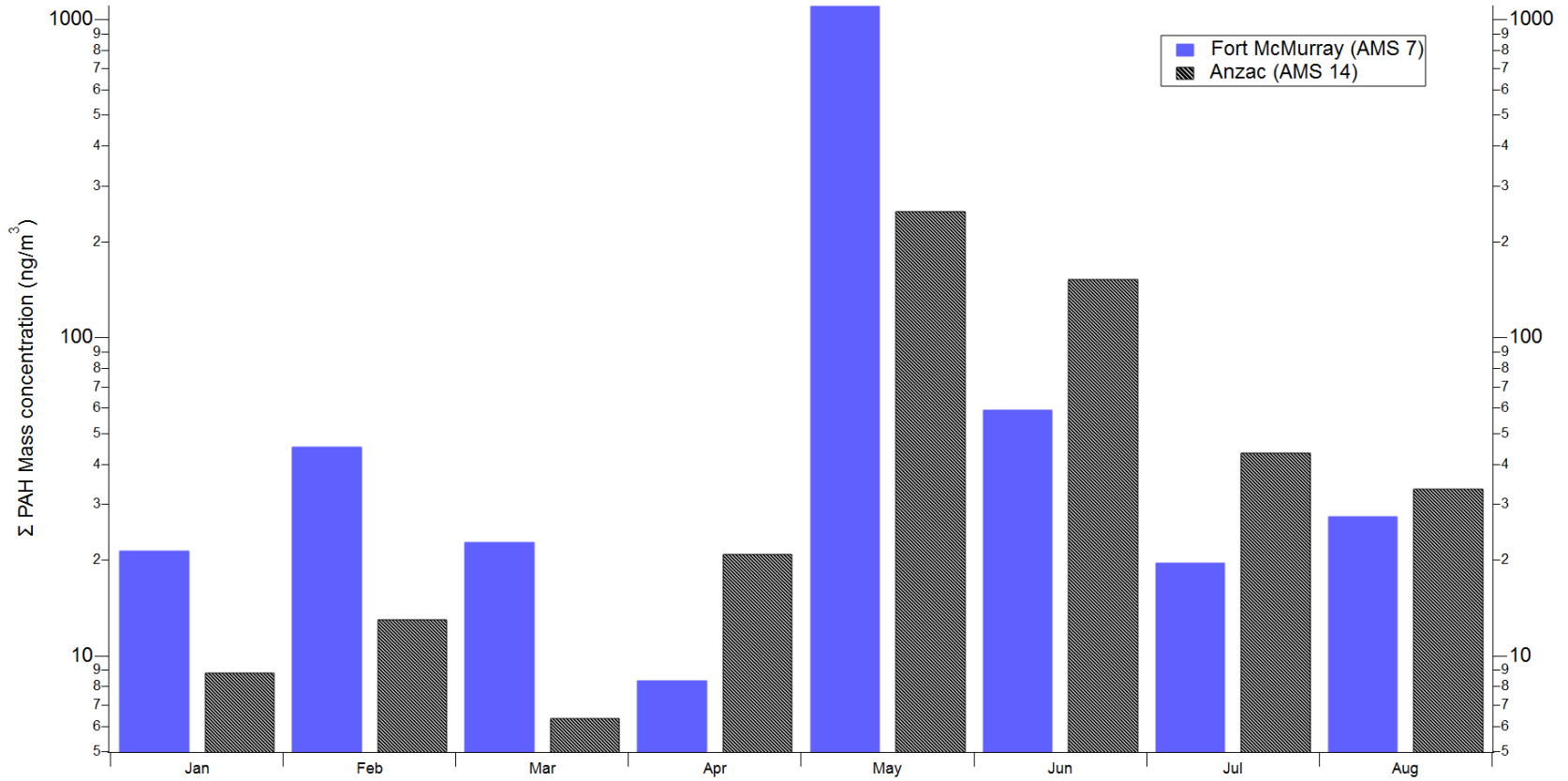
# Particulate (PM2.5) concentrations May 1-June 30th (Alberta Environment)



# Exposure composition: organic



# Exposure concentration PAHs



# U of A study of health effects

## Phase 1

Use of mobile clinical laboratory (delivered to the group on May 3rd) to recruit recently deployed fire fighters to look at **acute effects**.

## Phase 2

Approaching ALL deployed to look for **longer term** effects by linkage to health datasets





# Structure of the **Phase 1** dataset

**Baseline** (2-16 weeks post May 3<sup>rd</sup>)

355 firefighters from 13 services

Biomarkers sub-study

Location 1

Location 13

Early

4 Month

4 month

# Estimated **exposure** to individual firefighters

We have:

**When** they were (first) deployed

**What hours** they worked each day

**Where** they worked

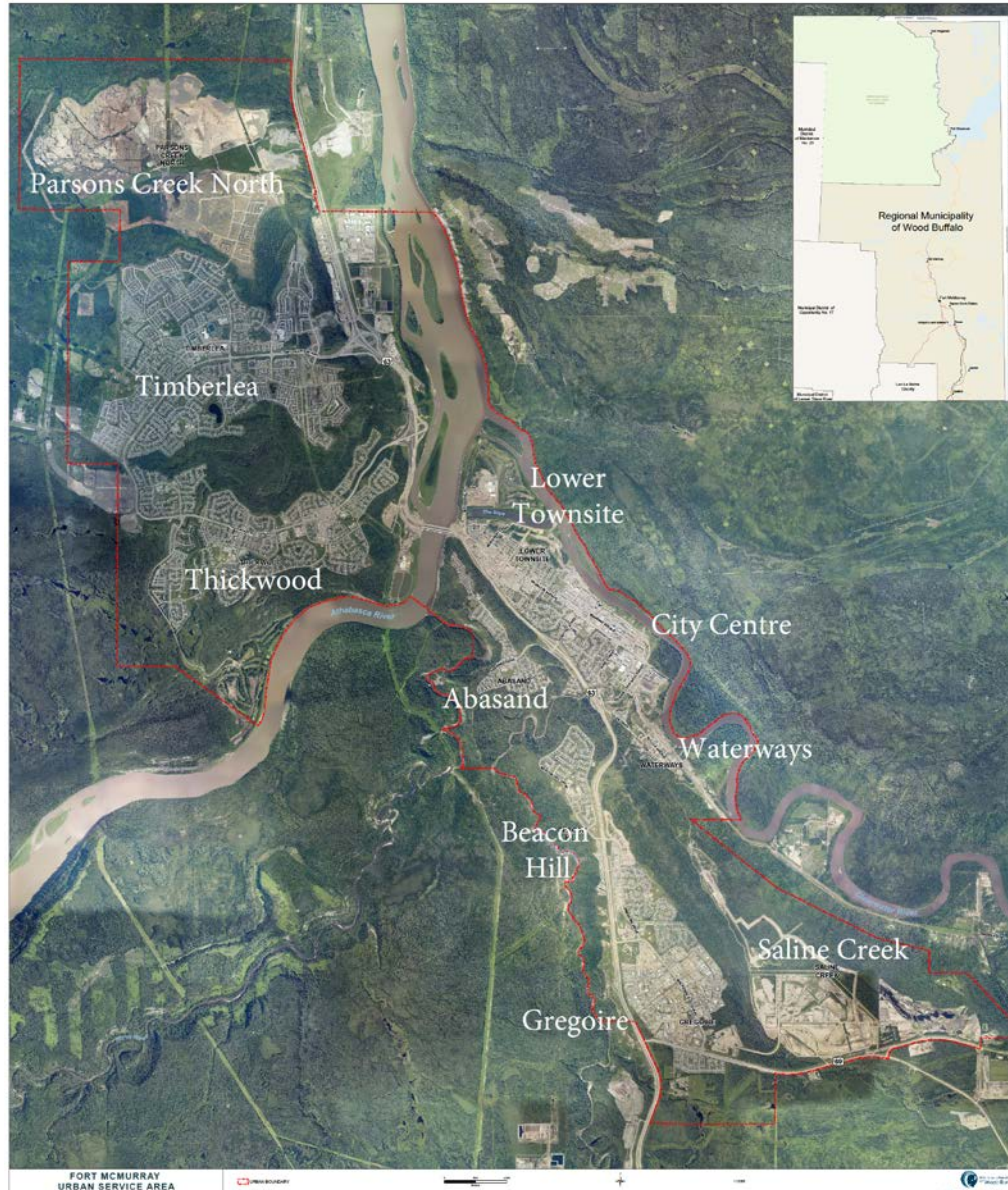
**What tasks** they did

What **respiratory protection** they wore

Their report of **smoke intensity**

Alberta Environment estimates for **each location each day**

# Locations



# Cartridge Respirators Used in Firefighting

## Full Face or Half Face ?

**Full face respirator:**  
covers the entire face  
and has built-in eye  
protection



**Half face respirator:**  
covers the nose and  
mouth only



## Filters and Cartridges

P100 filters are generally pink or purple:



Filters may be combined with a gas or vapour cartridge.  
The colour of the cartridge label depends on the gas or vapour  
targeted.



Organic vapour cartridge (**black**)  
and P100 filter

## Other Products



“WHIFFS” wrap-around  
mask with moist gel filter  
insert



“Respro FB-1”  
mask with dry  
filter insert



P100 filters  
with “nuisance  
organic vapour  
relief”



Multiple gas and vapour  
cartridge (**olive**) and P100  
filter



N95 or P95 filters are  
generally white  
and may also be combined  
with gas and vapour  
cartridges



## Smoke Level Rating Guide



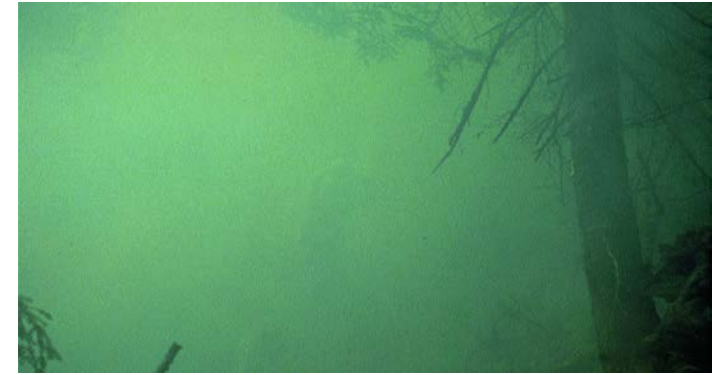
Light smoke level



Medium smoke level (difficult to see beyond 100 yards)



Heavy smoke level

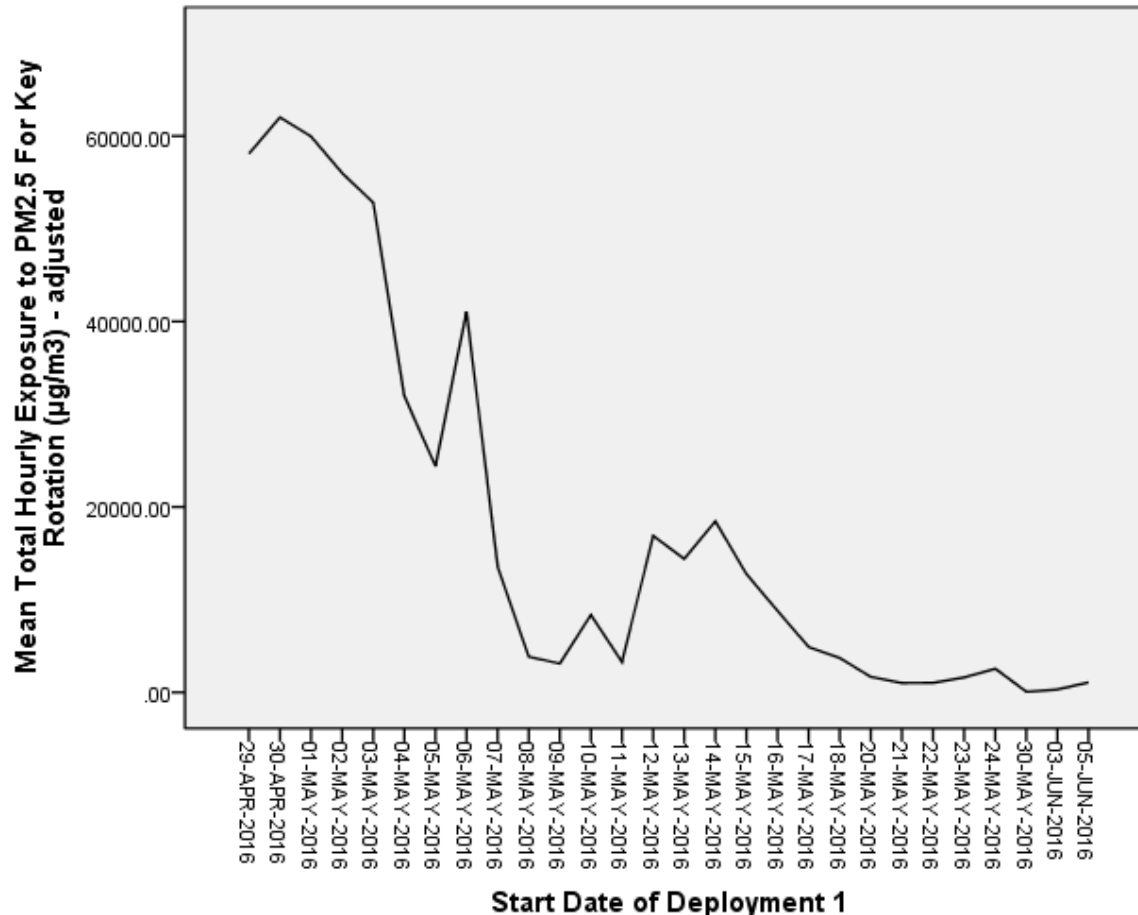


Very heavy smoke level

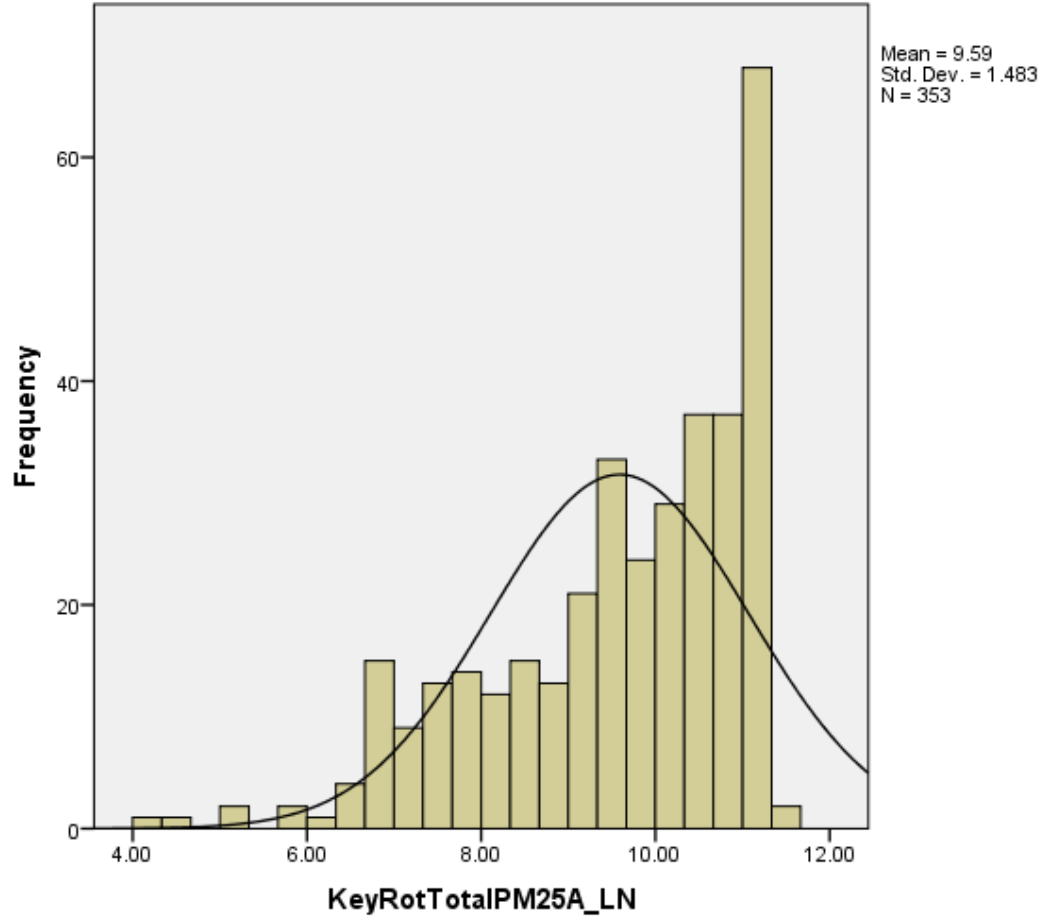
# Reported respirator use

Task	Ever used	most common	used >50%
Attack	84%	disposable (N95)	44%
Hot spots	82%	disposable (N95)	48%
Other	50%	disposable (N95)	32%

# Exposure estimates for **individual** firefighters by start of deployment



# Exposure estimates: distribution



Log  
transformed  
mean PM2.5



# Outcome measures

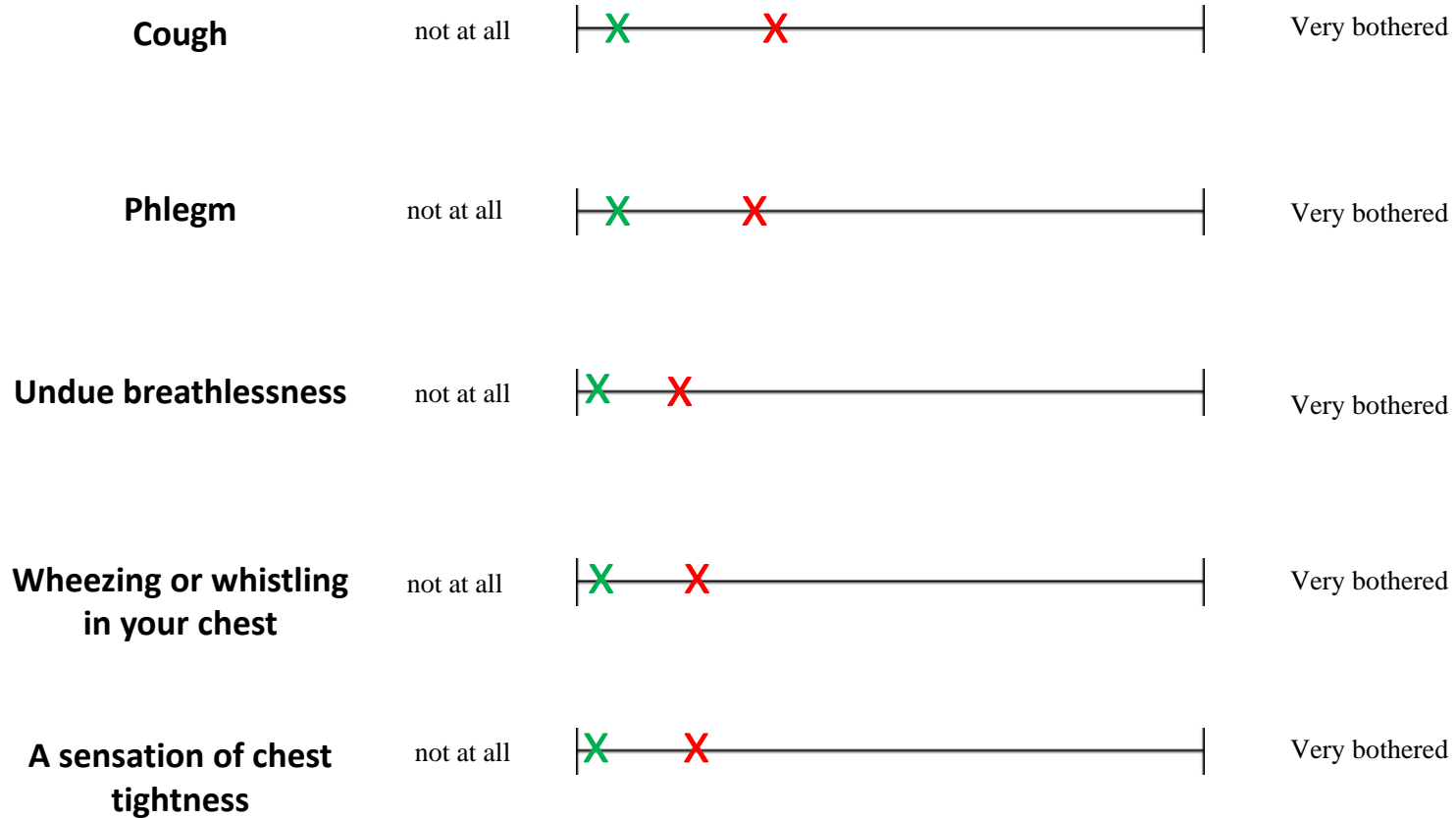
- Respiratory ill health *caused or made worse* by the fire 'immediately after the fire' and 'now'
- Visual analogue reports of being bothered by: cough; phlegm; wheeze; breathlessness; chest tightness before the fire, immediately after the fire and 'now'
- **Spirometry** (since the fire)

# Reported ill-health (N=355)

	Respiratory	Mental ill-health
Immediately after the fire	37.7%	4.2%
Now	19.4%	3.1%*

\* 15% by anxiety and depression scale

## Chest symptoms before and immediately after May 3rd



# Relation of exposure indices to **spirometry** (N=352)

	Total hours		exposure score	
	coef*	p=	coef*	p=
FEV1%	-2.3	0.02	-2.0	0.04
MEF75	-3.0	0.00	-2.0	0.05
MEF50	-1.7	0.09	-0.2	0.85

\* Regression model allowing for clustering within location

# Relation of exposure indices to reported respiratory ill-health 'caused by the fire'

	Total hours		exposure score	
	coef*	p=	coef*	p=
Respiratory ill-health				
Immediately after the fire	1.01	0.00	1.04	0.00
'Now'	1.00	0.43	1.02	0.00

\* Logistic regression model allowing for clustering within location

# Relation of exposure indices to change in chest symptoms before/after (N=353)

	Total hours		exposure score	
	coef*	p=	coef*	p=
Cough	0.03	0.51	0.43	0.00
Phlegm	0.02	0.54	0.34	0.00
Wheeze	0.03	0.35	0.25	0.00
Breathless	0.06	0.05	0.34	0.00
Tightness	0.01	0.71	0.36	0.00

\* In a regression model allowing for clustering within location

# Biomarker sub-study

## Blood/serum

41 inflammatory markers -

247 blood samples of which 70 repeats (early/ 4 months).

Component analysis: **exposure (not effect) marker.**

## Urine (so far)

1-hydroxypyrene (62 samples of which 20 repeats):  
**low** concentrations (range 24-548 ng/g creatinine)

# Going forward

## Phase1

Still to do!

- Evaluating biomarkers
- Tracking down pre-exposure LFT
- Assessing impact of RPE

## Phase 2

Report 2019



# Conclusions

- The Fort McMurray fire **was** associated with respiratory symptoms and ill-health during the first 4 months post fire.
- High exposure and long hours of work associated with both early respiratory and mental ill-health.
- Assessment of longer term health outcomes important and underway: exposure scores for all calculated using the same algorithm

