



**SAFETY EVENT- MOISTURE AND
OIL INGRESS INTO BREATHING
APPARATUS
November 2018**

Background



- Feb 2017 Fire Service Circular 2017-02
- Feb 2018 BFRS purchase Factair 6000 and commence random testing
- Nov 2018 Safety Event- moisture had been found when carrying out routine BA cylinder testing
- Coincided with a fault discovered on the compressor at Bletchley fire station.

Initial response



- Ascertain the source and scale of the problem
- Understand and isolate the risk
- Locate and impound contaminated equipment
- Safeguard the health and safety of our staff
- Engage with staff through a range of means

Initial findings



BA COMPRESSOR - WEEKLY TEST
(for Brigade Personnel)

DATE	OIL	WATER	RUNNING TOTAL	DEFECT/ACTION	NAME	BOG NO
9/3/17	✓	✓	195		Jarvis	899
16/11/17	✓	✓	196		Seakow	1314
23/3/17	✓	✓	196	Service new Filter oil changed etc Air Party bit found R. Spiller to pressure ok	Seakow	1314
11/5/17	✓	✓	197		Seakow	1314
14/5/17	✓	✓	203		Seakow	1314
31/8/17	✓	✓	203		Timothy	0694
16/9/17	✓	✓	216		Joneson	289
21/9/17	✓	✓	217		Joneson	289
12/10/17	✓	✓	217		ASHAM	0970

QUARTERLY AIR PURITY TEST
(for Service Engineers)

Date	Oxygen	H ² O	Oil	CO ²	CO
21/3/18	20.1%	4 mg/m ³	0	0	0

COMMENTS & SIGNATURE
New Filter found Test. H3 Reat 25mg
Fire Filter Contamin.

BA COMPRESSOR - WEEKLY TEST
(for Brigade Personnel)

DATE	OIL	WATER	RUNNING TOTAL	DEFECT/ACTION	NAME	BOG NO
20/10/17	✓	✓	220		ASHAM	0970
16/11/17	✓	✓	220		Seakow	1314
5/11/17	✓	✓	221		HIGGINS	0086
28/9/17	✓	✓	225		HIGGINS	0086
20/10/17	✓	✓	230		HIGGINS	0086
23/10/17	✓	✓	233	Service new Filter oil changed etc. Note about charging valve H3 to be changed.	HIGGINS	0086
23/10/17	✓	✓	246	BPV REPAIRED MOTIVATE AGT, PLUS NEW VALVE H3	MCCANNY	2081
10/1/18	✓	✓	246		MCCANNY	2081
12/1/18	✓	✓	246			

QUARTERLY AIR PURITY TEST
(for Service Engineers)

Date	Oxygen	H ² O	Oil	CO ²	CO
23/3/18	21.2%	4 mg/m ³	0	0	0

COMMENTS & SIGNATURE
Service oil change new Filter oil Air purity tested
found test. H3 Reat 25mg H3 Filter 25mg Reat.

BA Cylinder Charging Log Bletchley Fire Station

Cylinder No	Type of Use: Incident/Drill/Routine	Name	Signature	Brigade No	Date
047		JARVIS	Jim	2106	6-9-18
327		JARVIS	Jim	2106	6-9-18
399		JARVIS	Jim	2106	6-9-18
078		JARVIS	Jim	2106	6-9-18
150	DRILL	JARVIS	Jim	2106	7-9-18
256	DRILL	JARVIS	Jim	2106	7-9-18
047	ROUTINE	JARVIS	Jim	2106	6-10-18
171	"	"	"	"	"
233	"	"	"	"	"
253	"	"	"	"	"
158	ROUTINE	KEANE	Se	2003	"
163	"	"	Se	2003	"
234	DRILL	KEANE	Se	2003	6-10-18
080	DRILL	KEANE	Se	2003	6-10-18
118	INCIDENT	DEVLIN	Se	1962	10/10/18
168	"	"	Se	"	"
080	DRILL	KEANE	Se	2003	12-10-18
125	ROUTINE	ADAMS	Ru	1254	17-10-18
234	"	"	"	"	"
070	"	JARVIS	Jim	"	8-11-18
111	ROUTINE	MCCANNY	Se	2081	8-11-18
359	"	MCCANNY	Se	"	"
195	"	"	"	"	"
087	"	"	"	"	"

Completed forms to be returned to BA service Dept. at Bletchley

Initial Findings



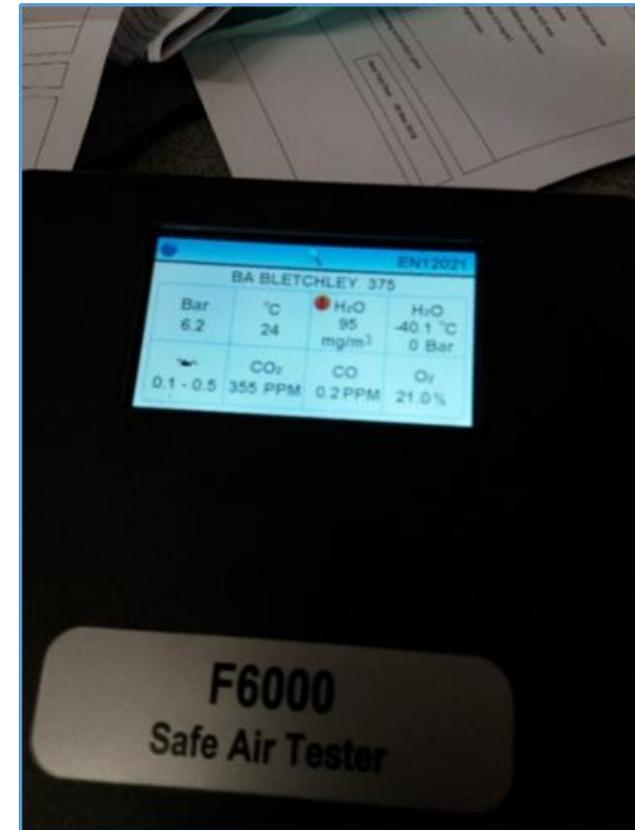
Evidence of oil contamination



- Sintered filter (left) from BA set which had failed a function and leakage test

Risks- EN12021

- Moisture content within the cylinder compressor should be filtered to below the Standard threshold of 35mg/M³. Lubricating oil should also be filtered to below a Standard threshold of 0.5mg/M³.
- High moisture levels can lead to freezing within the BA pneumatics, particularly around the pressure regulator and breathing valve assembly, increasing a risk of equipment failure.
- elevated oil content carries a risk of:
 - over-lubrication of moving parts,
 - an explosive mixture within the tertiary chamber of the pressure reducer (which is open to atmosphere)
 - degradation of the internal lining of pneumatic hoses over time.
 - Additionally, oil contaminate awould deliver an undesirable odour to the wearer.



Health Risks



- No health risks were identified from breathing in the contaminated air
- Normal air contains approximately 16,500mg/M³ at 75% humidity
- The lubricating oil (Anderol 555 used within this particular compressor) does not present an aspiration toxicity classification to the wearer.
- There were no reports of staff sickness or absence attributed to the incident.
- However, as a precautionary measure, monitoring of occupational health referrals and sickness absence was intensified, and continues.

National Resilience



- There was no stock available to buy quickly (UK or Germany)
- London Fire Brigade were very helpful - 6 litre cylinders, would have required Bodyguard reconfiguration, but enough was made available if required
- National Resilience were very helpful - Double our requirement of 9 litre 200 bar cylinders and Drager PSS 7000 sets made available to BFRS within 24 hours

Scientific Advice



- Third Party Spectrum Analysis through Motivair
- Airservices (UK)
- Bureau Veritas

Remedy



- Complete lockdown on cylinder movements
- BA training was temporarily suspended
- 400 cylinders purged and recharged x 4 times (Twice initially)
- Regime of individually testing every BA set and cylinder still ongoing following agreement with Drager
- Guidance and information relating to Breathing Apparatus reviewed and refreshed, to include all elements of CFOA circular 2017/02.
- BFRS now routinely tracking and auditing the movement of BA cylinders through an established asset management system. All crews are required to carry out their inventories and tests diligently using the asset management equipment provided.

Remedy



- Processes around each of our six compressor sites have also improved, ensuring the compressor room logbooks (and asset management records) are an accurate reflection of charging activity and testing.
- BFRS has also enhanced the air purity spot-checking routine by ensuring each compressor site is tested at three monthly intervals, in-between the three-monthly planned maintenance schedules as well as spot checking cylinders.
- Our BA compressor-servicing contractor has tightened their control around acceptance testing the filtration system parts for this particular type of compressor.
- We are implementing a programme of assurance across the full range of breathing apparatus capability, which will focus on face-fit testing/leakage and pre-operation testing and use of Bodyguard as well as cylinder charging, inspection and general standards of cleanliness.

Post event assurance



Attention now focuses on post event assurance. Due to the nature of this particular event, this assurance programme focuses on Service compliance levels in three key areas:

1. [Our strategic responsibilities as described in the National Operational Guidance training specification for Breathing Apparatus](#)
2. [The Breathing Apparatus Foundation Document, fire and rescue service responsibilities](#)
3. [The Breathing Apparatus Foundation Document Pre-incident procedures, including the responsibilities of fire and rescue services, supervisory managers, BA entry control operatives, and BA wearers](#)

A task-and-finish group is established to audit all our sites to ensure the above parameters can be tested and the respective assurance provided.

The group report findings with recommendations to complement the findings of the HSE investigation.

National Operational Learning



SAFETY EVENT- MOISTURE AND OIL INGRESS INTO BREATHING APPARATUS

A case study into a safety event in Buckinghamshire Fire & Rescue Service involving the failure of a Breathing Apparatus cylinder charging facility

Health and Safety Executive



Findings from HSL investigation - January 2019

- a lack of procedures / instructions and associated training and staff awareness of the need to check for moisture around connectors before attachment of cylinders to BA equipment
- the potential for failures in the completion of the cylinder recharge logs
- the potential for failures in the management of compressor maintenance and the associated air quality checks (including moisture levels).

Stakeholder Engagement



- Regular communication with our employees, employee representatives, suppliers, specialist contractors, scientific advisors, and other Fire and Rescue Service (FRS) stakeholders was pivotal in ensuring a thorough and appropriate response to the event was taken.

Financial Impact



Direct costs

- 2018/19 £35,180
- 2019/20 £4000 (approx.)

Indirect costs

- Between Nov 8th and 21st December over 700 hours of managerial time attributed to the event, equating to £17,000
- Unable to itemise cost of crews responding to requirements to purge/recharge cylinders
- Substantial time lost on other critical projects and core business

Wider impact



- The event demonstrated the sizable impact an event like this can have on a Service
- The post event assurance programme is an opportunity for BFRS to focus on any cultural and procedural issues across all levels of the Service and will lead to Service improvement.
- It helped us to understand the limits to arrangements with our contractors, and how we can build organisational resilience in a different way through collaborative thinking.
- We are better prepared to react to BA related issues (hand-wheels/LDV)
- By sharing the learning, we hope to better prepare other Services to mitigate and manage similar events



Any Questions

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