Evaluation of the Reduction of Respiratory Protective Equipment (RPE) Fit Factors in Personnel with Facial Hair

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Background

- Checking that a respirator, with a tight fitting face piece, provides an adequate seal to the wearer's face has long been considered best practice as part of a general Respiratory Protective Equipment (RPE) programme.

- This is further advanced through the mandatory requirement for face fit testing via;

    - Control of Asbestos Regulations 2006
    - Control of Lead at Work Regulations 2002
    - Control of Substances Hazardous to Health Regulations 2002

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Background

- A clean shaven policy is hard to enforce, staff will normally shave for a "quantitative fit test", but in the real world, days/weeks later when they need the mask for protection, they may be unshaven.

- It is thought that facial hair such as beards or even being unshaven can significantly reduce the seal and the protection afforded by the RPE.... I had some personal experience of this when carrying out fit testing of RPE and decided to pursue this further.

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RPE Face Fit Testing - Clean Shaven?

Fit test factor = 43

Fit test factor = 2850

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Objectives

- To assess the reduction in protection of RPE, via Quantitative face fit testing during a period where the user is growing facial hair (2 weeks).

- The completed study will be fed back into the HSEQ team for cascading educational purposes and promote best practice.

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Method

- There were 6 tests in total for each of the twelve volunteers

  - Day 1 (clean shaven)

  - Day 3, Day 5, Day 8 and Day 12 (unshaven)

  - Day 13 (clean shaven – control to support day one)

- Also introduced a clean shaven volunteer for each test day, to ensure consistent results…

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Measurement

- Equipment - Portacount
  - Portable Particle Counting Device

- Measurement protocol
  - HSE method 282/28

- One type of RPE used
  - 3M 7500 half mask

Ethics

- The testing was carried out at 1 location, sampling safe ambient air particles.

- The study was open to volunteers only, if any volunteer were required to use RPE as part of their work during the study, they would be expected to shave prior to wearing their mask to ensure full protection during the work task, therefore they would exit the study immediately.

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Results…

Individual Fit Factors

	Day 1	Day 3	Day 5	Day 8	Day 12	Day 13
	Clean Shaven					Clean Shaven
V2001	7432	5235	3462	5437	597	7250
V2002	20902	27	61	14	55	18575
V2003	5105	80	162	430	502	5160
V2004	4713	813	269	441	103	4697
V2005	9530	698	278	962	37	8626
V2006	9677	4896	4353	8186	525	10299
V2007	3137	3118	3213	2436	382	3791
V2008	5783	4550	325	64	54	6018
V2009	6809	1112	5262	5720	36	7050
V2010	5540	1092	823	700	131	4568
V2011	6596	2337	3027	3834	3722	6065
V2012	1311	217	287	55	28	1427

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Results – Individual Fit Factors
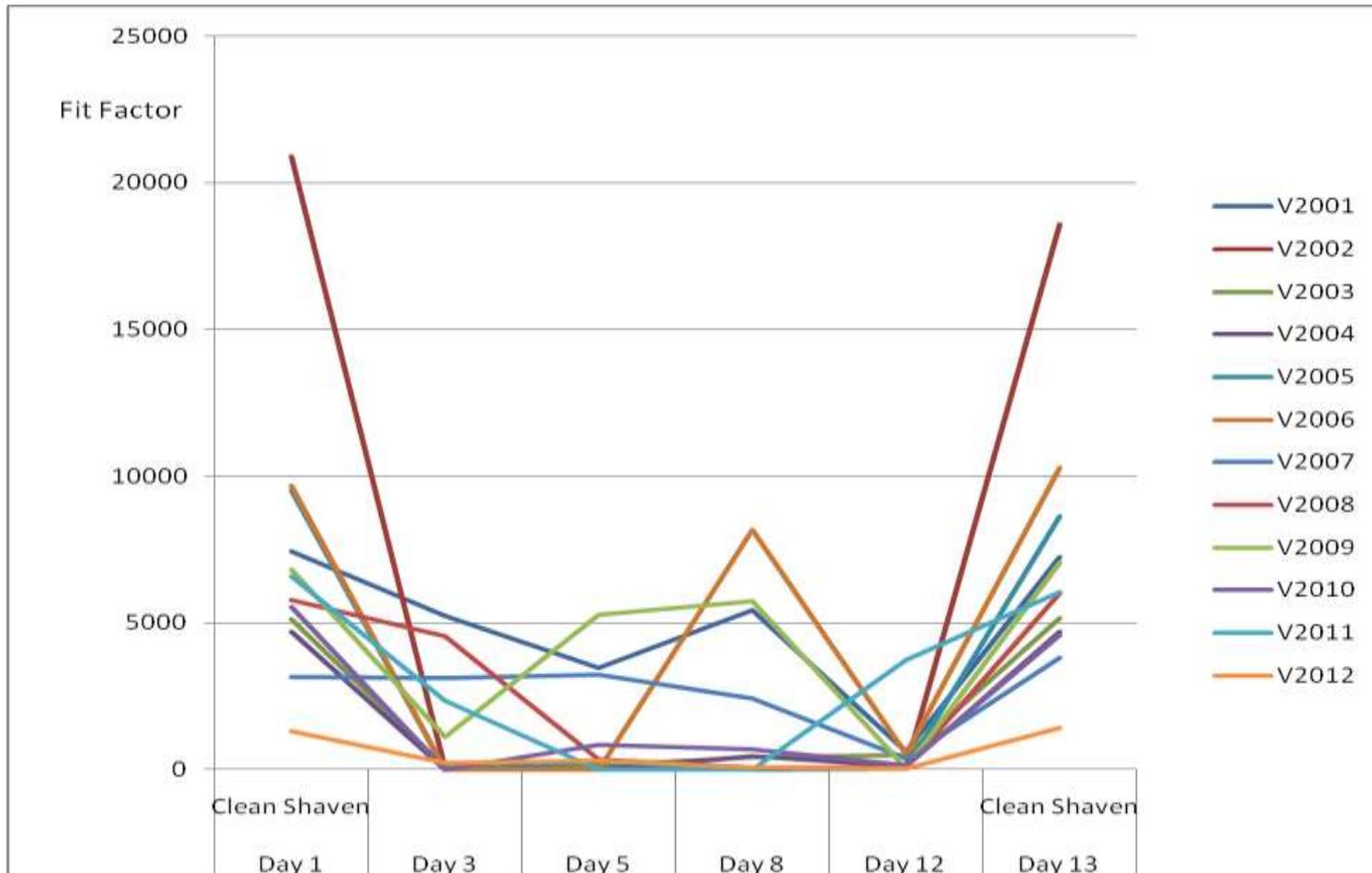
Results

FF Average

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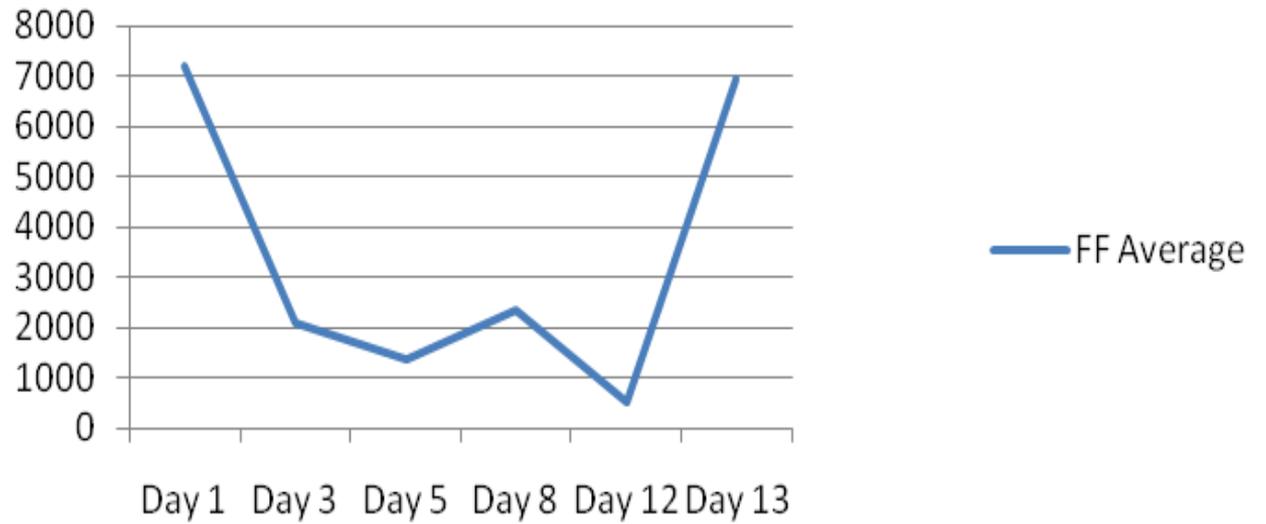
Results

- No significant difference between the 2 clean shaven days (day 1 & day 13)

- The findings revealed that only 11 out of 72 fit tests failed the 282/28 standard, this equates to 15%

- So what?

- This seems rather low considering there were volunteers with heavy stubble/beards being tested

- Significant loss of protection from day 3 onwards

- A significant loss, but there were still passes?

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Conclusions

- The study showed there was a high variation of test results for all clean shaven volunteers who undertook the face fit study.

- The ambient average of particulate in the testing location remained at a very steady level throughout the study, which ensured consistent and comparable fit tests results.

Conclusions 2

- The statistical evidence shows that the measurements were reliable. It highlighted that 2 days of growth (by day 3) is sufficient to jeopardize the mask's efficiency, even though things tend to worsen by day 12, however, the exact day of deterioration was inexplicable.

- The results for Day 12 showed a significant reduction in fit factors for at least 50% of the volunteers, although, when analysing the data, only 15% of the fit tests failed the HSE protocol, this included all the unshaven tests.

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Conclusions 3

- Therefore, this minimum figure of "100" could be interpreted as inappropriate for quantitative fit testing using the Portacount method with this type of mask?

- It is possible for bearded users to achieve a numerically acceptable fit test, although the performance of the mask will be significantly reduced; hence facial hair degrades the performance of RPE and therefore reduces the protection factor.

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Conclusions 4

- As discussed facial hair clearly degrades RPE from day 3 onwards (& probably before); this is a significant finding and will clearly reinforce the need for face fit testing of RPE and why users need to be counselled about facial hair and its impact on the effectiveness of RPE.

- Finally, the time spent during the initial training sessions, including the repeat face fit tests, was extremely beneficial. It highlighted many aspects that can be utilised as good practice within Face-Fit Testing.

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Unanswered Questions – future research?

- Introduce further testing at the front end of the study, for example every 4 hours (where practical) during the first 3 days, this could be of value in pinpointing the specific time when deterioration in the mask performance begins...

- Introduce 2 tests/day for each volunteer, this will ensure consistent results and reduce anomalies...

- It was noted during the trial, when facial hair was inside the RPE it could introduce extra particles. No experimental data was collated for this scenario...

- Finally, this study only compared fit testing in relation to facial hair with one type of mask. Future studies could take into account different masks and also introduce full face masks...

Acknowledgments...

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Thank you...

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