
Innovations in Respirator Design and Fit Testing

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Research Goals

- Identify 5-6 successful innovations that led to improvements in respirator fit
 - Identify 2-3 less successful innovations
 - Surveys of respirator experts (16 received)
 - Review written materials (patents, research reports and publications, etc.)
 - Interview experts for each innovation
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Background

- Product innovation can result from
 - “Market Pull” – recognition of market needs
 - “Technology Push” – advances in technology
 - Regulations may act in a complex manner on company activities – both a stimulant or a deterrent
 - Reduce risk
 - Limit unpredictable product liability
 - Encourage innovation in new technologies or markets
 - Encourage collaboration on research and development
 - Additional costs and expertise (may prevent smaller companies from entering the market)
 - Delays to marketing (testing and approval)
 - Redirect personnel (participate in regulatory-related activities)
 - Decrease period of patent protection
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Interview Questions

- What were the incentives for this innovation?
 - What were the costs of research, development and commercialization?
 - What effect did this innovation have on respirator use and regulations?
 - What effect did regulations have on the success of this innovation?
 - What were the primary reasons for success (or lack of success)?
 - What effect did this design have on respirator fit?
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Innovations

- Successful innovations
 - Double flanged facepiece (elastomeric respirators)
 - Flat fold design (filtering facepiece respirators)
 - Portacount
 - Head-strap cradle
 - Less successful innovations
 - Adhesive respirators
 - User seal checks
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Portacount

■ Incentives

- Air Force and Army seeking automated, easy-to-use fit test system
- Army wanted small, portable, rugged method

■ Costs of R&D and commercialization

- \$1 million to develop and field test a ruggedized, portable CNC for soldiers, using ambient aerosol
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Portacount

- Effect on respirator use and regulations
 - Quantitative fit test results
 - Method was allowed by OSHA (de minimus violation) and then included in 1998 respiratory protection standard
 - Reasons for success
 - Cost effective, easy to use, quick and accurate results, quantitative results, portable, uses ambient air
 - Effect on design of better fitting respirators
 - Allowed quantitative testing of respirators with protection factors greater than 100
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 - Jeff Weed, WeedRPS LLC
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Flat Fold Design

■ Incentives

- Employees wanted a respirator that was easier to store and more convenient to use

■ Reasons for success

- Not successful at first, because employees didn't like the "look"
 - Research and fit testing experience showed that some flat fold respirators fit more people
 - Easier to breathe through (more surface area)
 - Easier to store
 - Easier to manufacture than cup-shaped designs
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Flat Fold Design

- Effect on respirator fit
 - Many manufacturers have developed flat fold respirators
 - Some research and mostly anecdotal evidence that flat fold respirators fit more facial sizes
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