Closed Circuit
Escape Respirator

Presented to Members of the NIOSH NPPTL PPT Program Stakeholders Meeting
March 20-21, 2012
Drivers for a SMART SCSR

- Two biggest ‘atmospheric’ threats to a miner which result from an explosion or fire are oxygen (O2) deficiency and/or an excess of carbon monoxide (CO)
- Low ambient O2 calls for SCBA
- Normal ambient O2 and high CO calls for Filtered Self Rescuer (FSR)
- No escape device currently exists that manages both threats as a system
- Users looking for small package and extended breathing duration
SMART SCSR Concept

A system which utilizes an FSR to provide filtered breathing air and which then adds O2 as needed to ‘top up’ any short fall of oxygen detected in the breathing loop. Such a ‘Smart Escape SCSR’ would be composed of four major components:

- O2 supply
- O2 sensing and dosing electronics
- CO FSR
- Carbon bed broad spectrum filter

This is an open loop breathing device using ambient O2 as the breathing base.
SMART SCSR Duration Scenarios

Smart SCBA Operating Life With A 110-L O2 Bottle At Varying Levels Of Ambient O2

[Graph showing system duration in hours versus respiration flow in lpm for different oxygen levels (20.0%, 18.0%, 16.0%)]
SMART SCSR Duration Scenario

MSHA provided data on the 1984 Wilberg mine fire which included threat gas levels derived for a point immediately adjacent to the actual fire and progressive distant locations. Additionally they found CH4 and H2 levels immediately adjacent to the fire of 4% and 35% respectively 30 minutes after coal ignition.

<table>
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<th>TIME</th>
<th>FIRE SITE</th>
<th>SITE 1</th>
<th>SITE 2</th>
<th>SITE 3</th>
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<td>O2%</td>
<td>CO2%</td>
<td>CO%</td>
<td>O2%</td>
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<tr>
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<td>21</td>
<td>0.0</td>
<td>0.0</td>
<td>21</td>
</tr>
<tr>
<td>5</td>
<td>18</td>
<td>1.3</td>
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<td>30</td>
<td>5</td>
<td>8.0</td>
<td>2.5</td>
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SMART SCSR Advantages

- Potential for smaller package size and weight
- FSR can provide lasting protection against CO, CO2, H2S, NO2, H2, NH3, SO2
- Conservation of O2 source if ambient O2 levels are normal or slightly less than normal
- O2 sensing and dosing is automatic – no decision making by user
- Aural/Nasal mask allows for communication (c.f. SCSR mouthbits)
SMART SCSR Potential Hurdles

- Identifying ‘typical’ low O2 atmosphere in an emergency
- Use of electronics for first time is a self-rescue device
- Periodic maintenance – 5 year sensor life
SMART SCSR Program Status

• Performance and system requirements have been defined
• O2 sensing & dosing sub-system has been developed
  o Demo of O2 sub-system given to NIOSH on February 14
  o Testing performed on ABMS at Technical Products, Inc. out of Sterling, MA (partner in this effort)
• Next step is prototype development of a complete platform incorporating all major components (O2 supply, O2 sensing and dosing electronics, and FSR) – anticipated by Summer 2012
Thanks go to NIOSH & CDC

Questions?

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