Status of WV Rules and Technology Options

Wheeling Jesuit
Mine Safety Meeting

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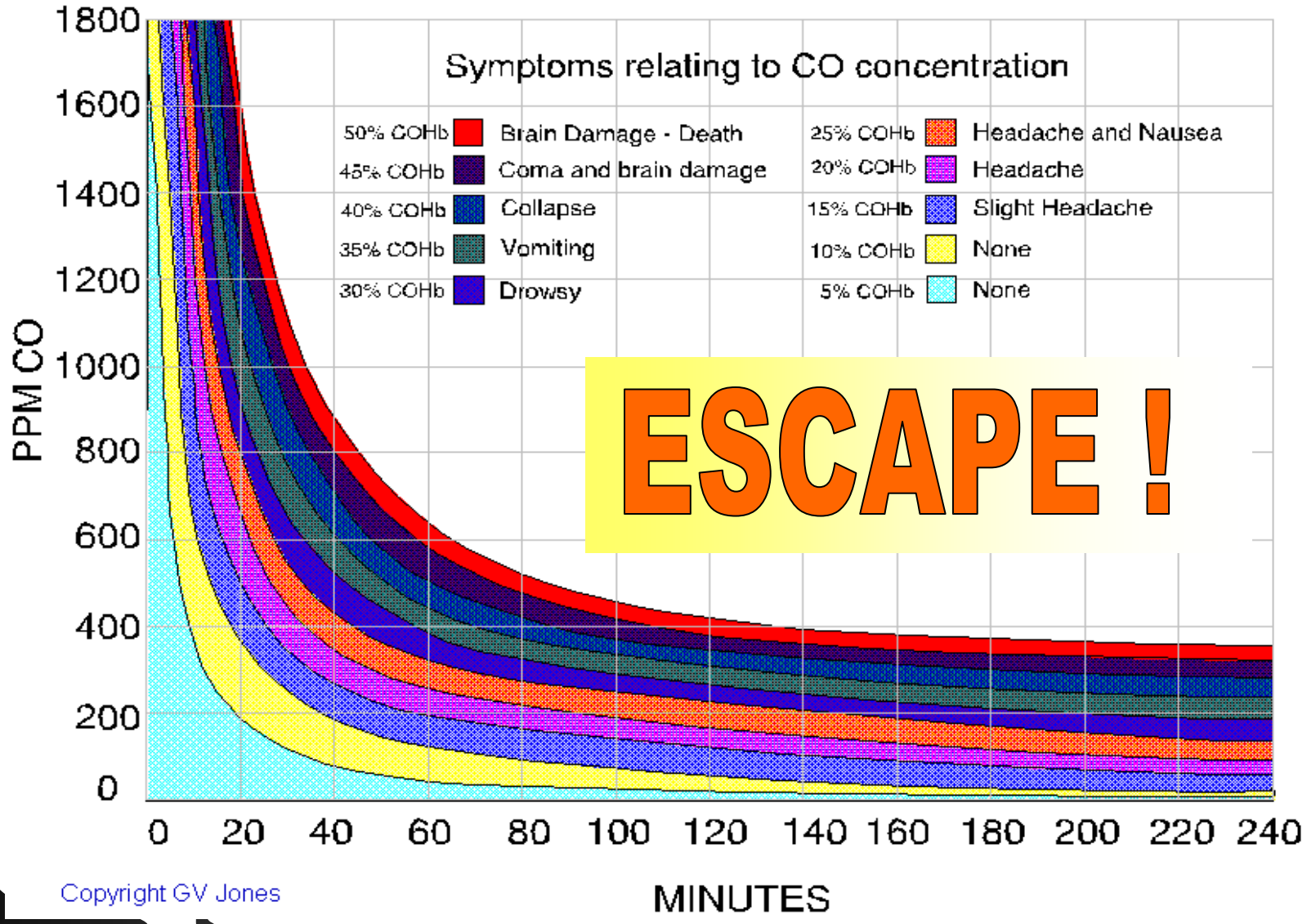
W. Va. Office of Miners' Health Safety and Training

April 26, 2007

Carbon Monoxide Kills



Four primary gases concern miners after an explosion or fire

Oxygen – Minimum levels needed for life support

Methane – Combustible watch combustible ranges if too high lowers oxygen

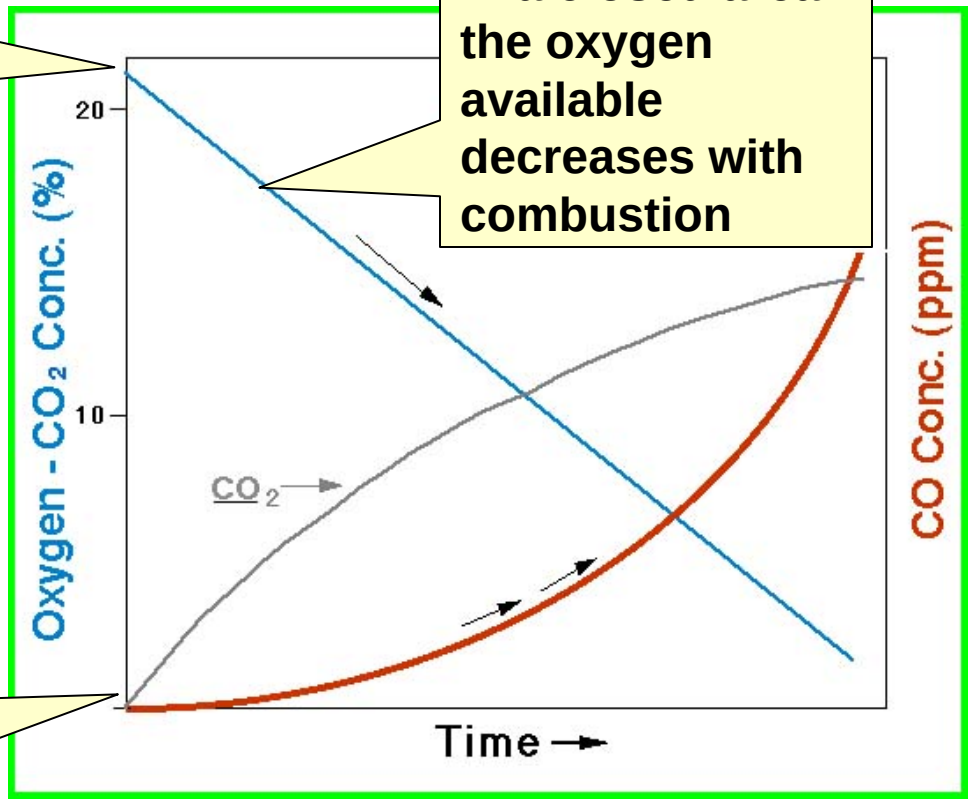
Carbon Dioxide – Maximum levels reduces oxygen

Carbon Monoxide – maximum levels causes asphyxiation

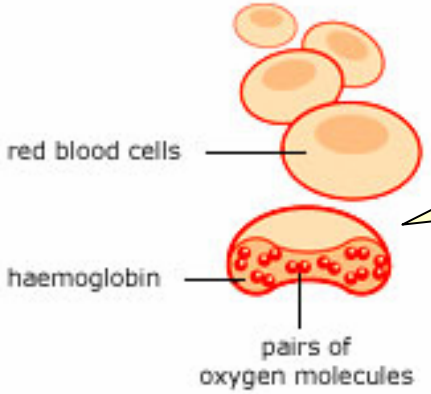
Combustion combines oxygen in the air with a fuel to create heat, carbon dioxide and water vapor

Complete combustion is dependent upon excess oxygen in the air

In a closed area the oxygen available decreases with combustion



Carbon monoxide production increases when insufficient oxygen

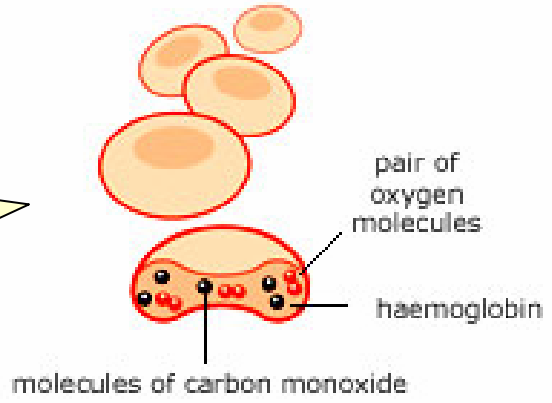


As blood cells move through the lung they absorb oxygen and release carbon dioxide

As they move through the body they release oxygen to the cells and absorb carbon dioxide

If carbon monoxide is present in the lungs it takes the place of oxygen preventing the absorption of oxygen

As the blood cells move through the body carbon monoxide is not released – cells lack oxygen and can not get rid of their carbon dioxide



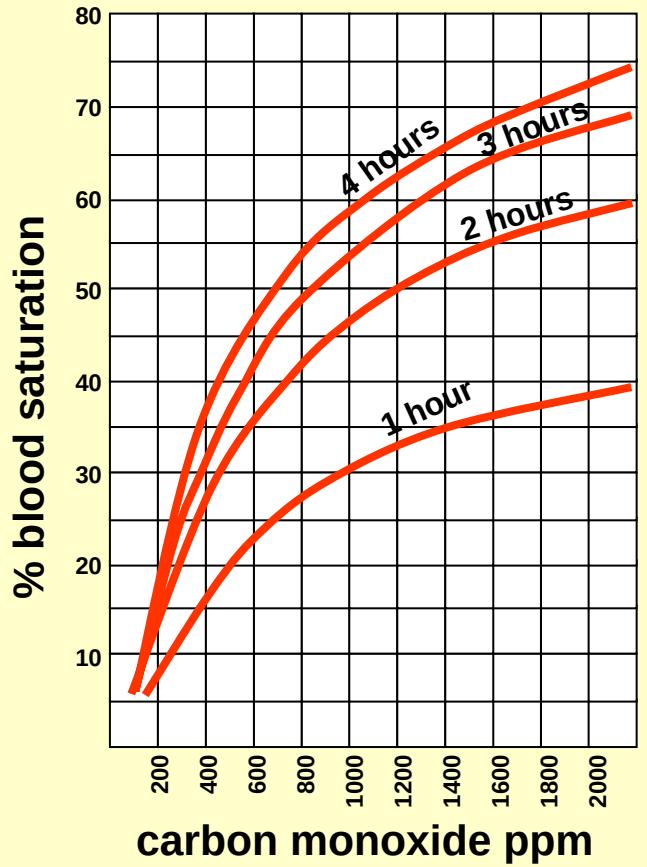
Carbon monoxide is rapidly absorbed into the blood

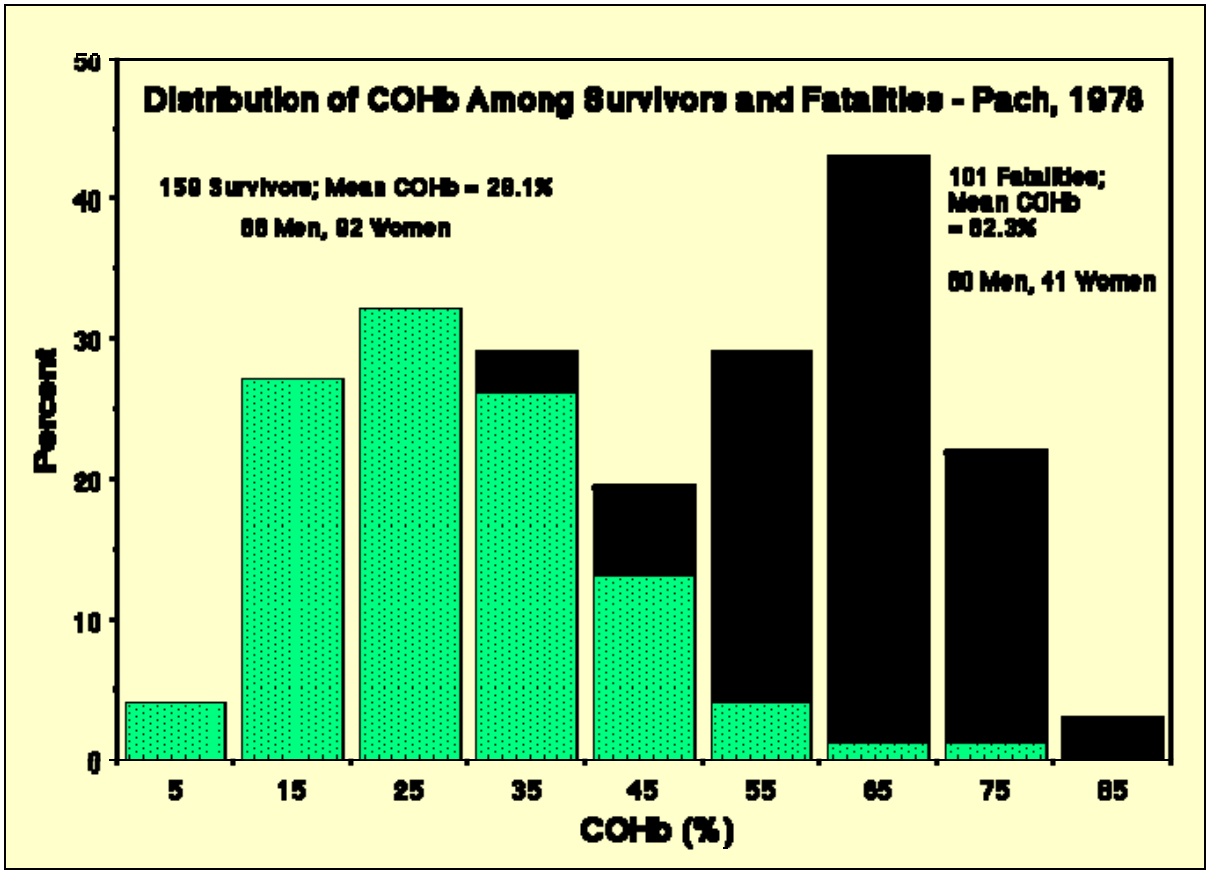
Onset of affects begin at saturation levels between 15 and 25%

Levels above 20% for healthy people and 15% if heart or lung conditions generally require hospitalization

Levels above 30% limit the ability for self-protection

Levels above 60% limit cellular oxygen to near minimum for life



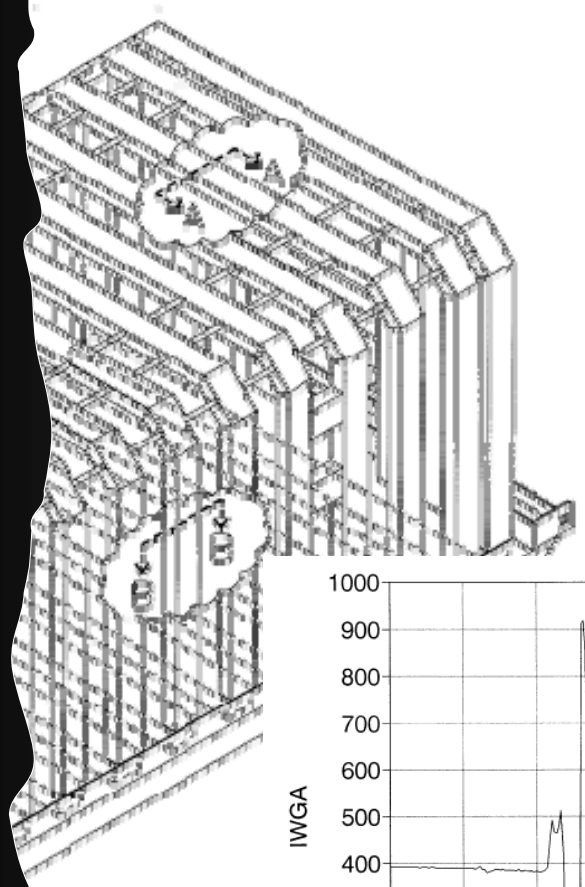


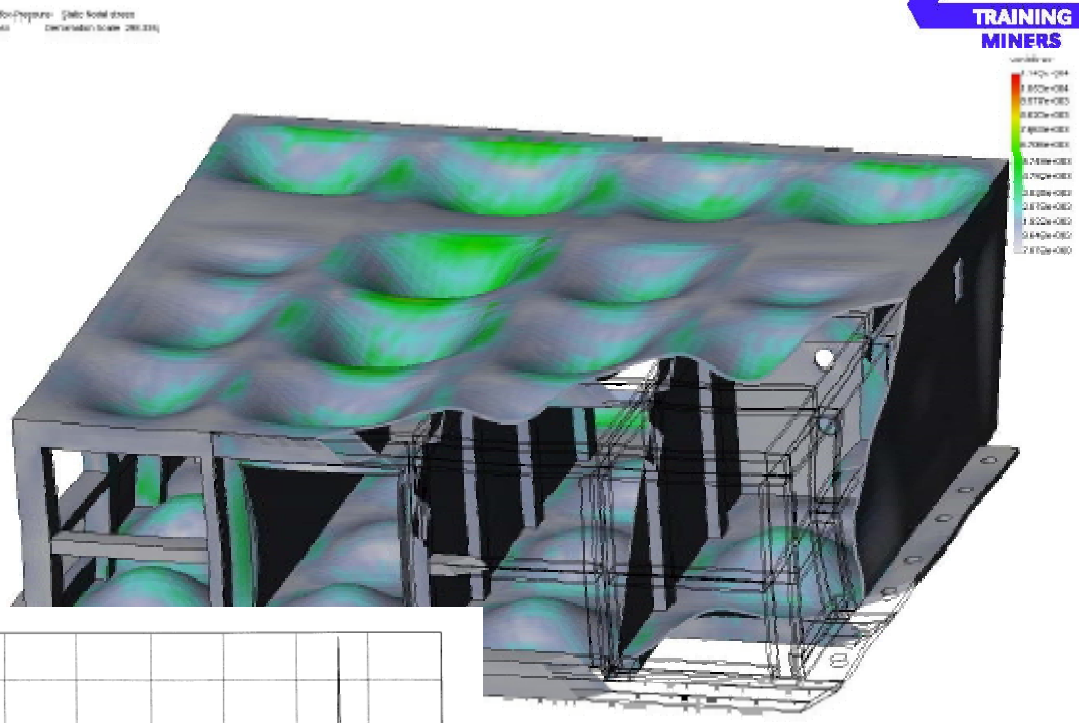
Fatal saturation levels vary by person from 30% to 80%

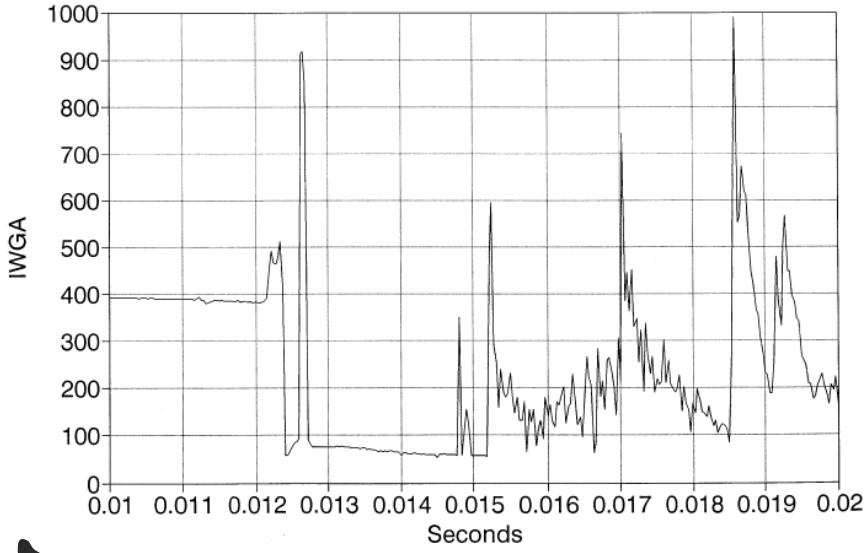
WV §56-4

- Provide an alternative to barricading for miners who have tried to escape and couldn't – **SHELTER IS LAST RESORT**
- Within 1,000 feet of working face
- Provide life-support for maximum likely number of miners on section
- Currently approved 6 models from 5 companies with two more in review
- Shelter Plans due 4-16-2007

Structural Requirements





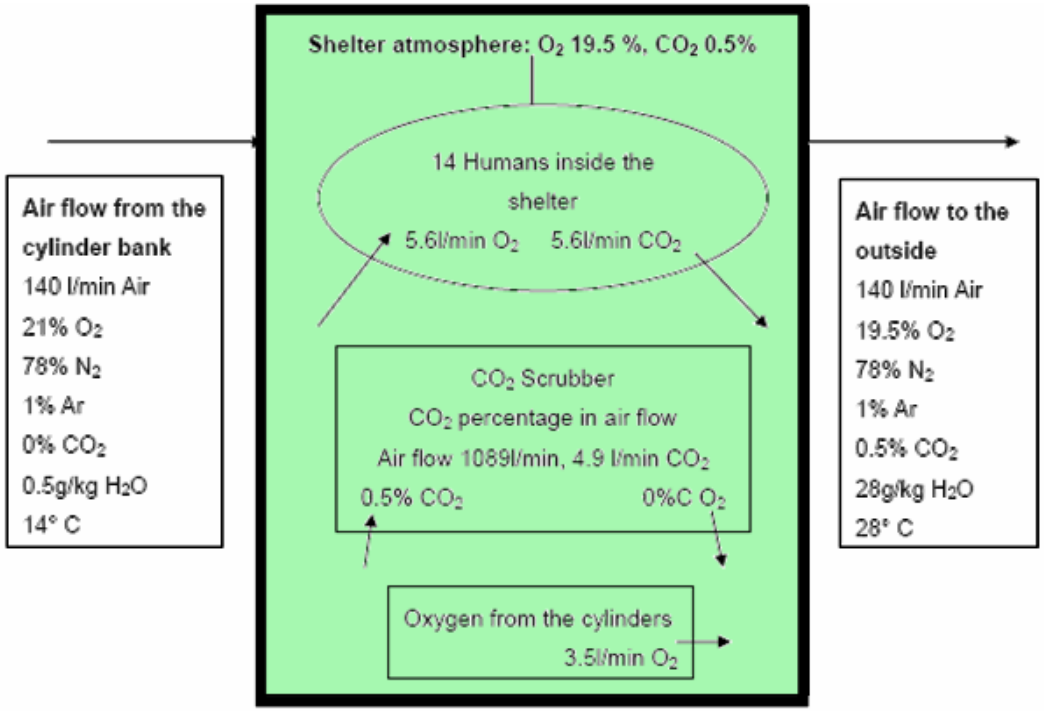


15 PSI Overpressure

300ºF Flash Fire

Life-Support Requirements

consumption of oxygen (O_2)	0,4 l/min	(person in a rested mode)
output of CO_2	0,4 l/min	(person in a rested mode)
Respiratory quotient	1.0	(uptake of O_2 is equal to CO_2 production)
heat emission	100 W	(constant between 25°C and 30°C)
humidity emission	1,5 l/ day	(person in a rested mode)

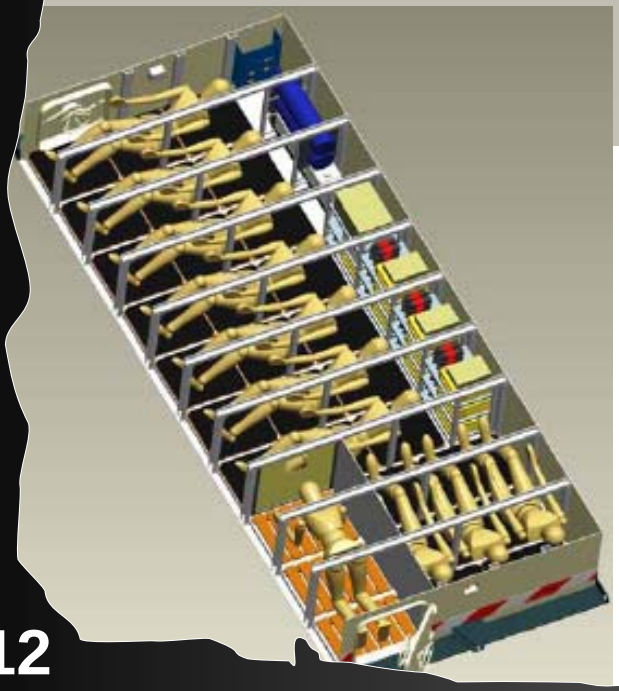


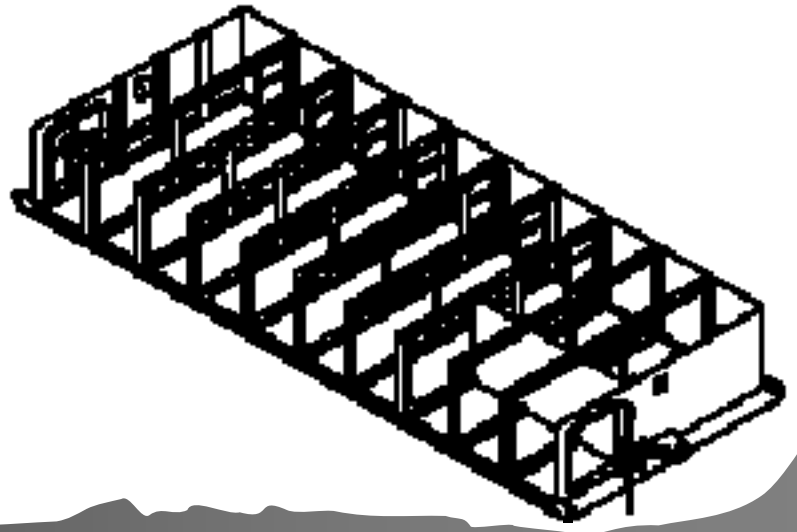
Asked for Minimum 48 hours

Got 96 hours plus

LifeShelter™

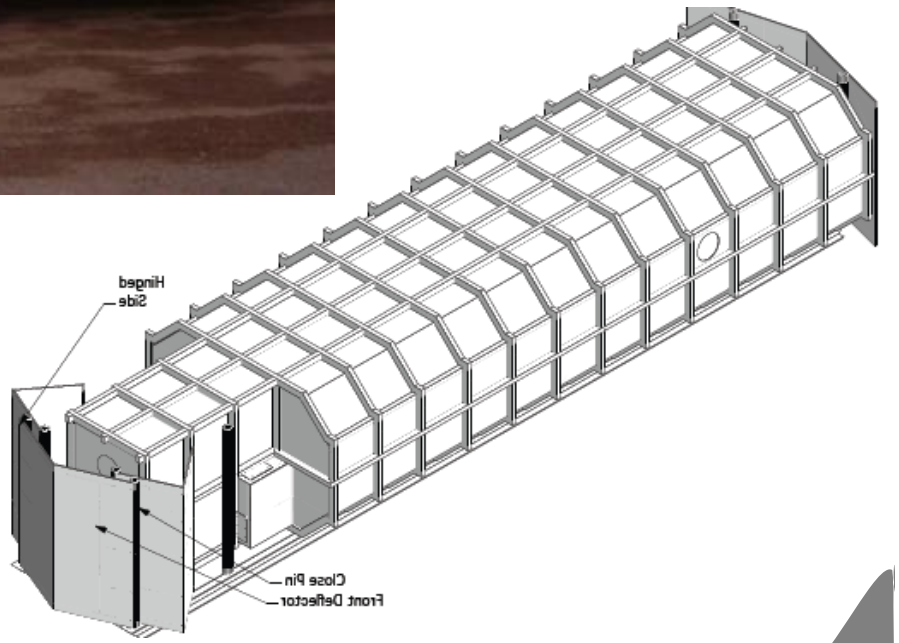
Dräger Escape Shelter™





Kennedy Shelter™

Mine Refuge Chamber™

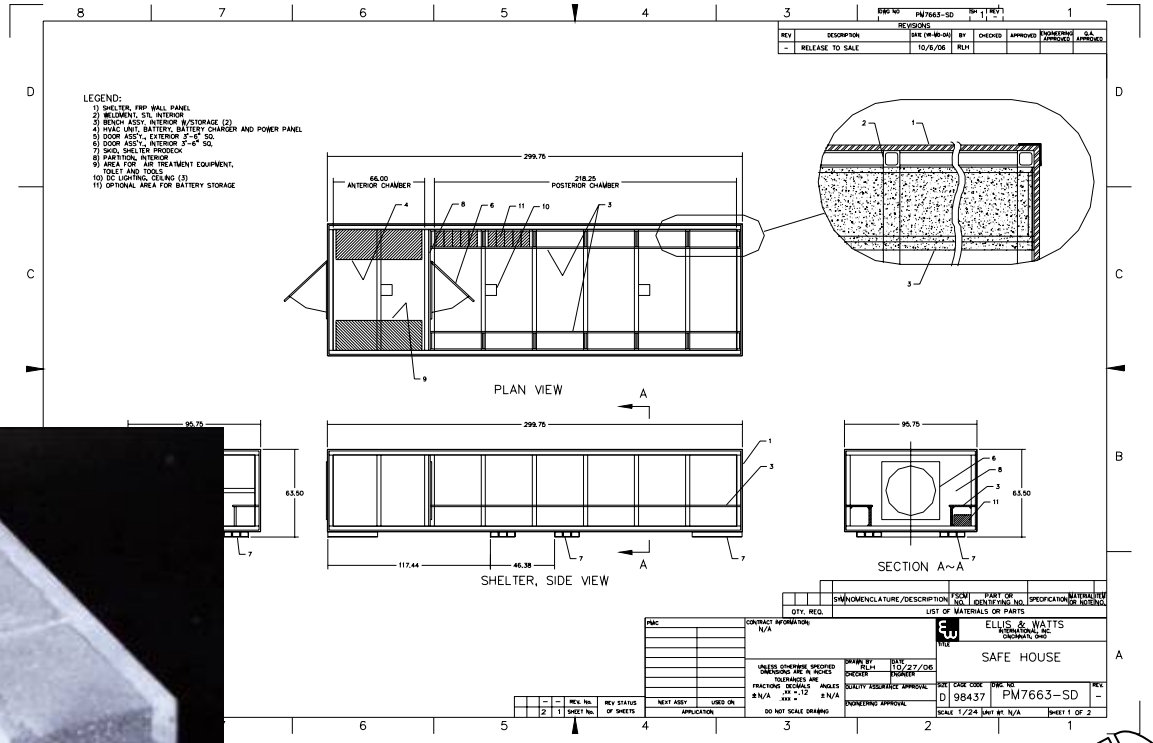


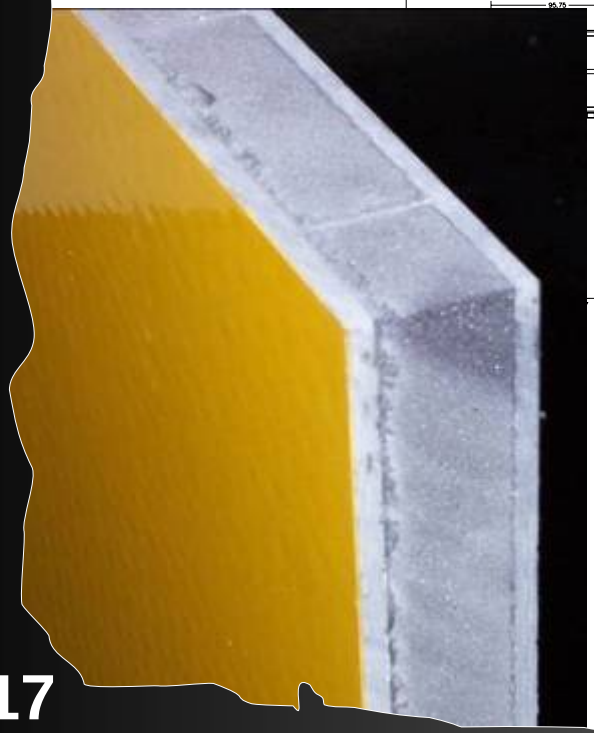
Fresh Air Bay™ &
Mine Refuge Chamber™

LifePod™

PENDING

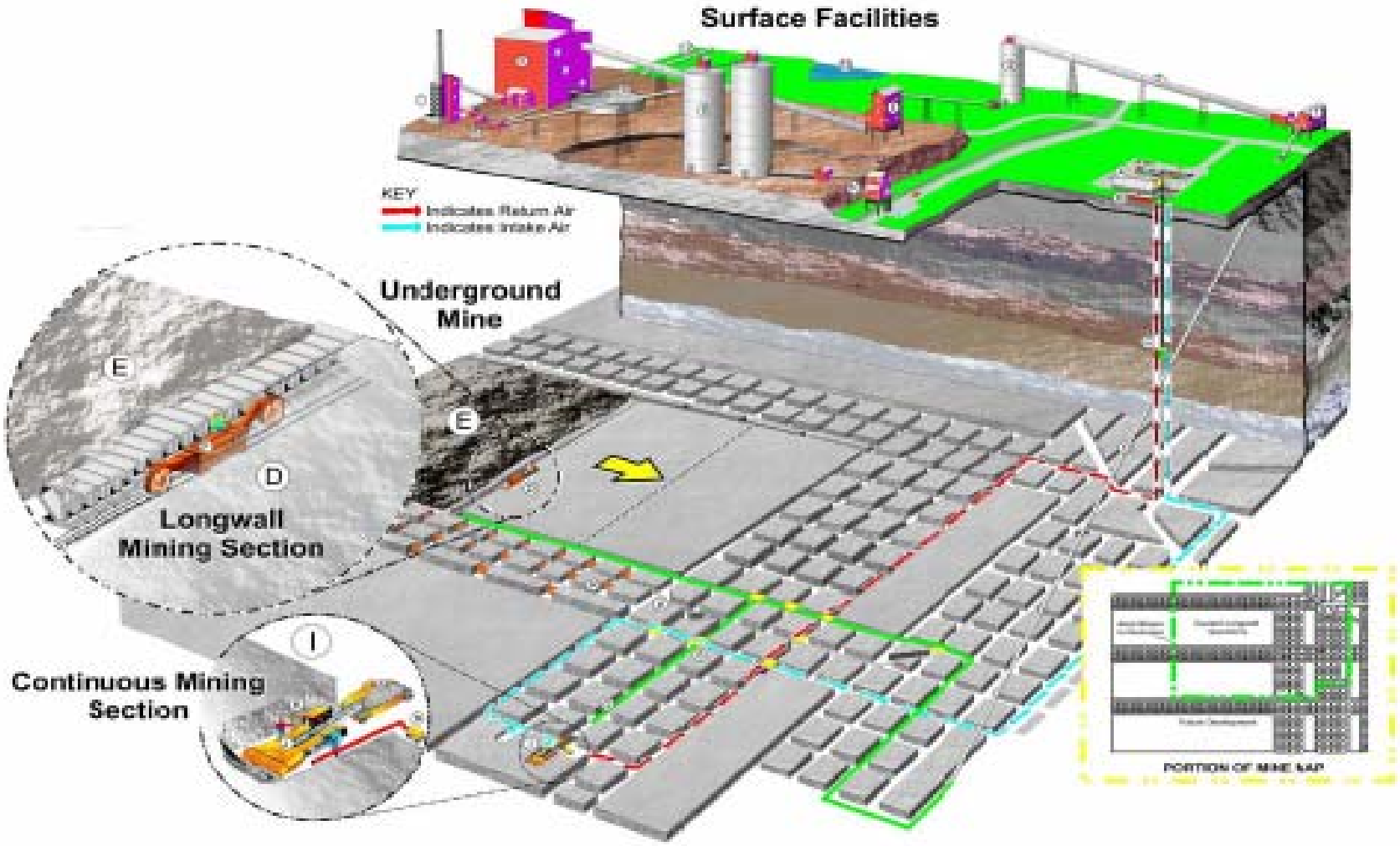
Mine Safehouse™





PENDING

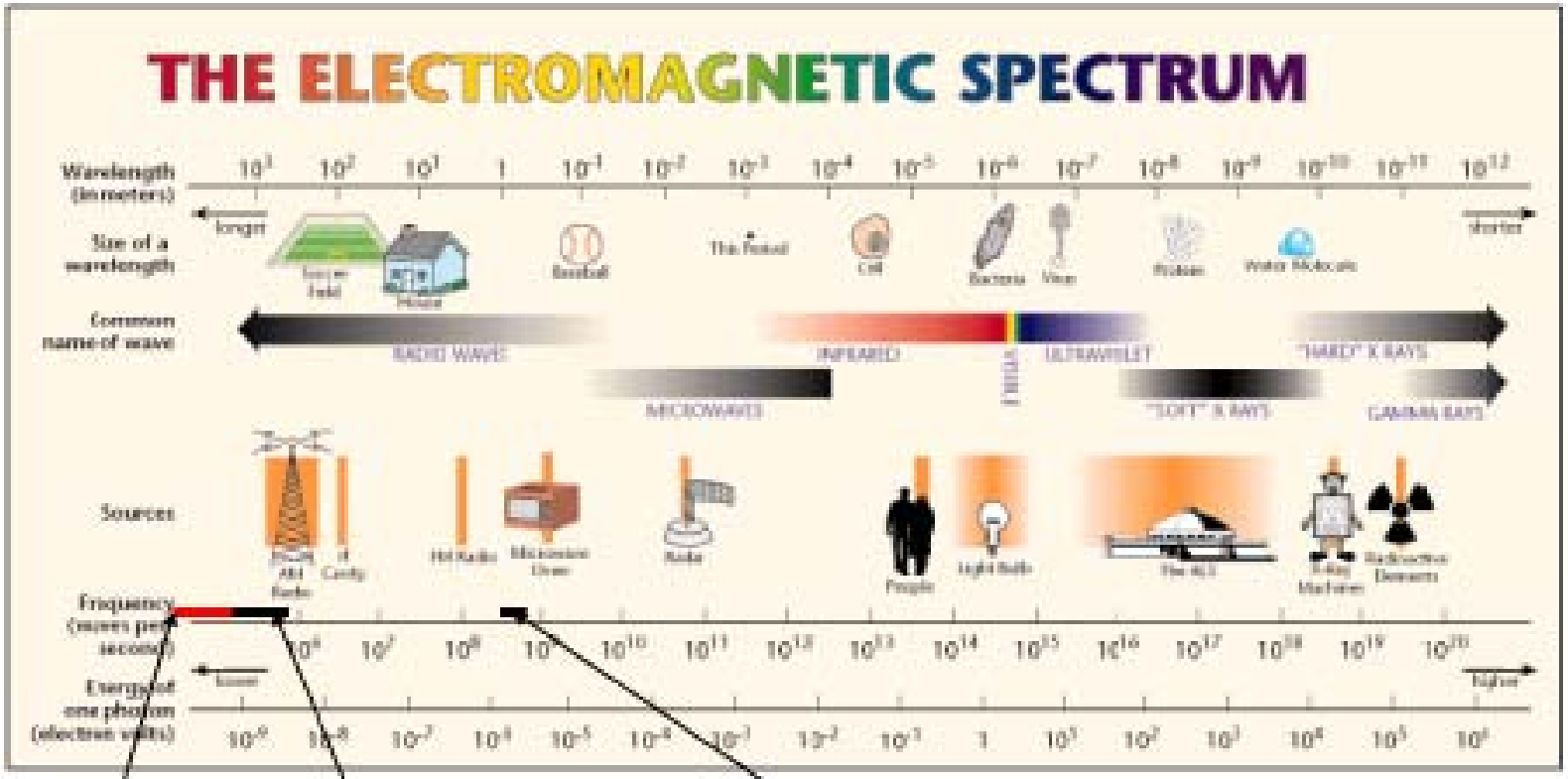
Communication Challenges



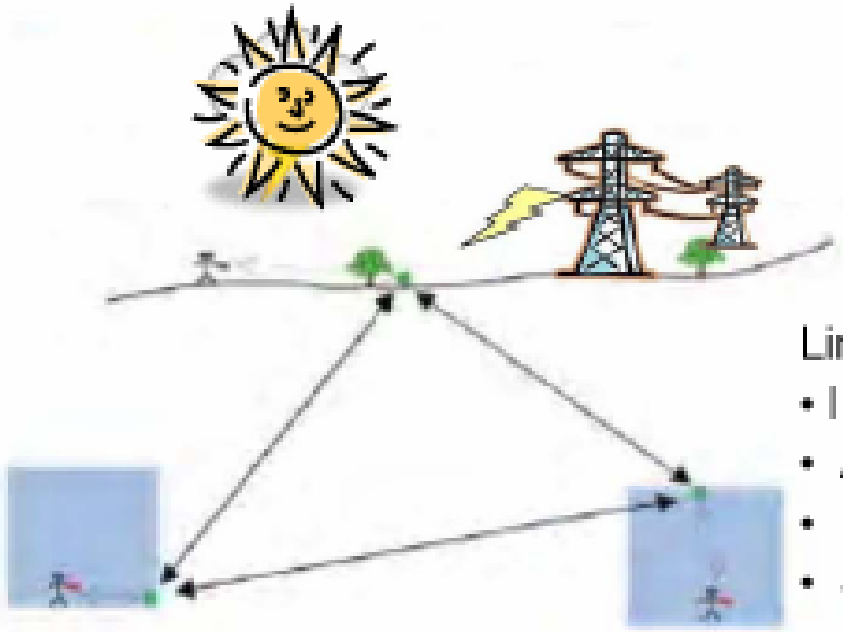
WV §56-4

- Wireless – miner not connected by wire
- Two-way communications to each miner in at least two separate airways
- Tracking each miner in relation to known points prior and in escapeways after
- Operators submit Communication/Tracking Plan by July 31, 2007
- Understand needs and thought through risks
- Survive accident or be quickly repairable
- Communication center operator needs red-hat card

Few Spectrum Options



Through the Earth



Underground Radio Station

Through-the-Earth Radio Link

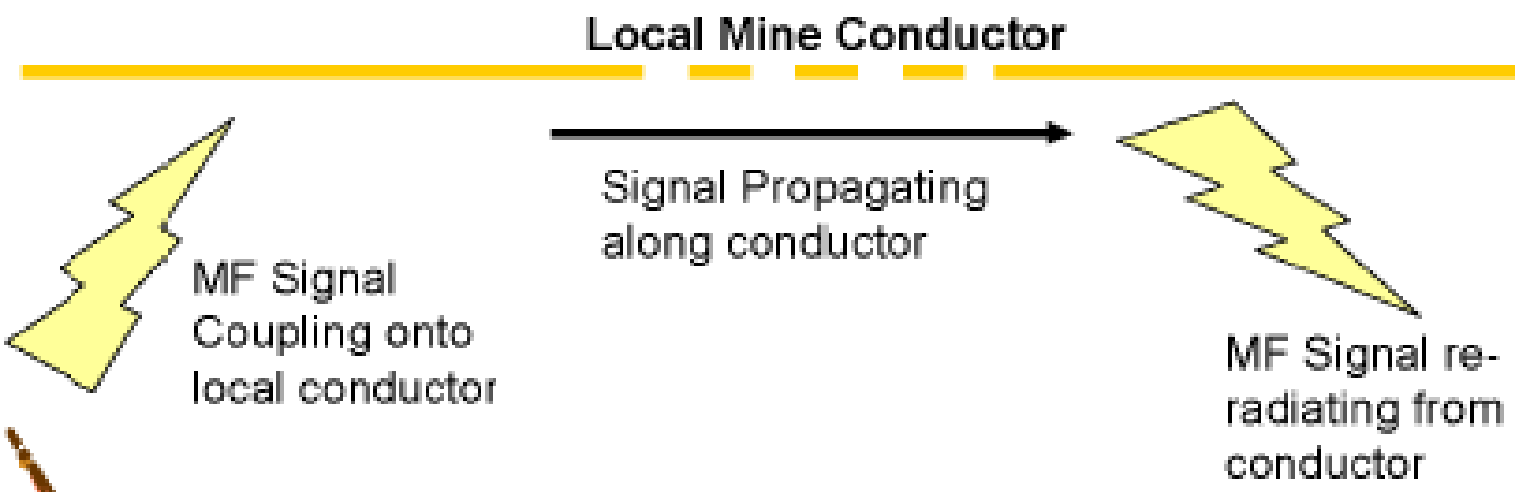
Conventional Surface Radio

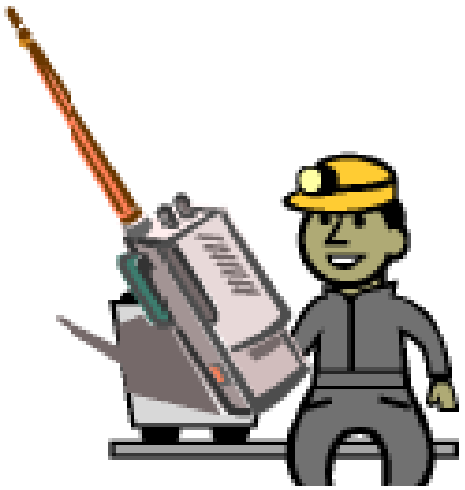
Conventional Radio Link

Limitations:

- Interference Sources
- Antenna Size
- Knowledge Base
- Safety Understanding
- Bandwidth Limitations
- No Market Base

Mid Frequency

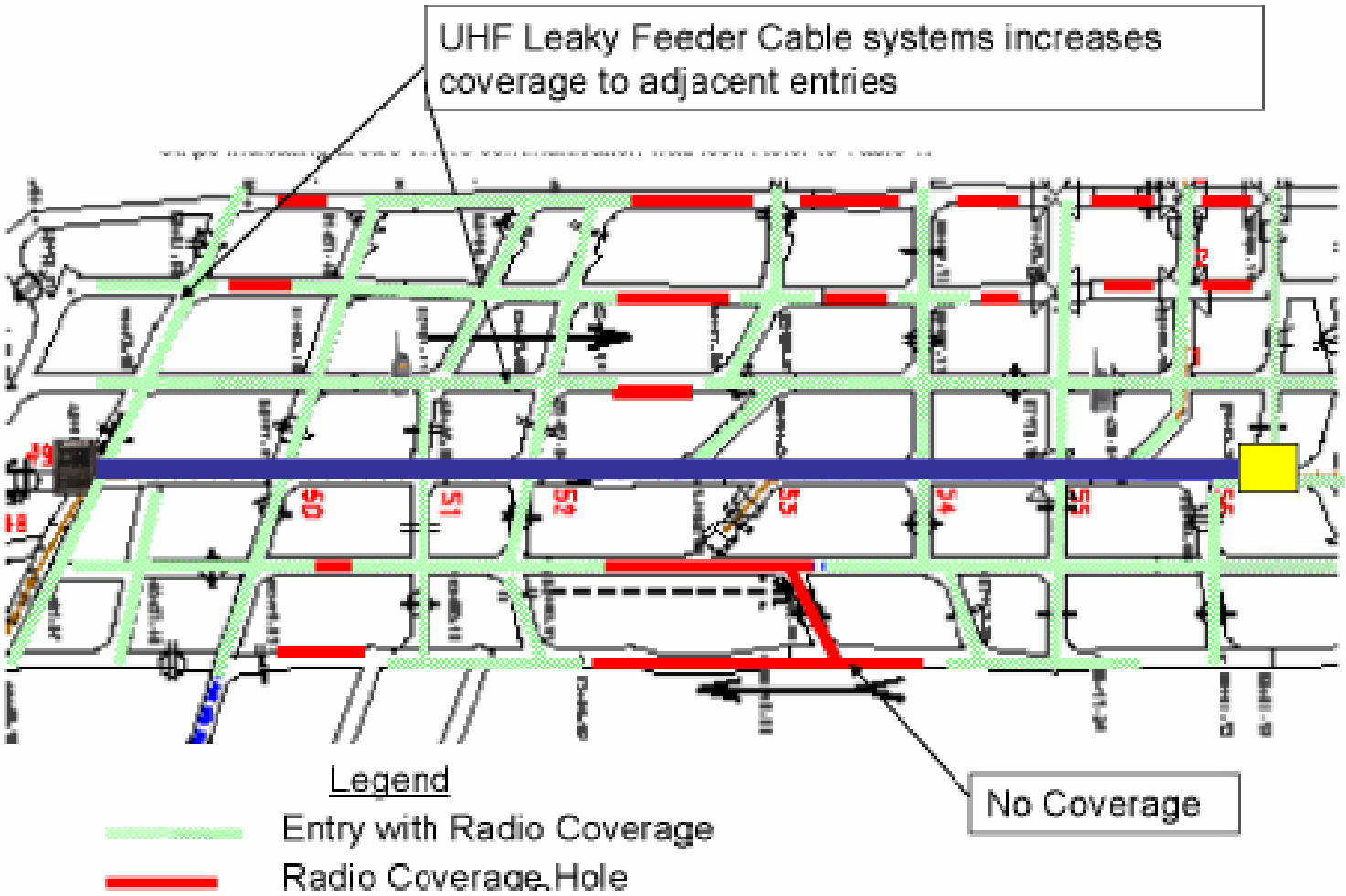




Limitations:

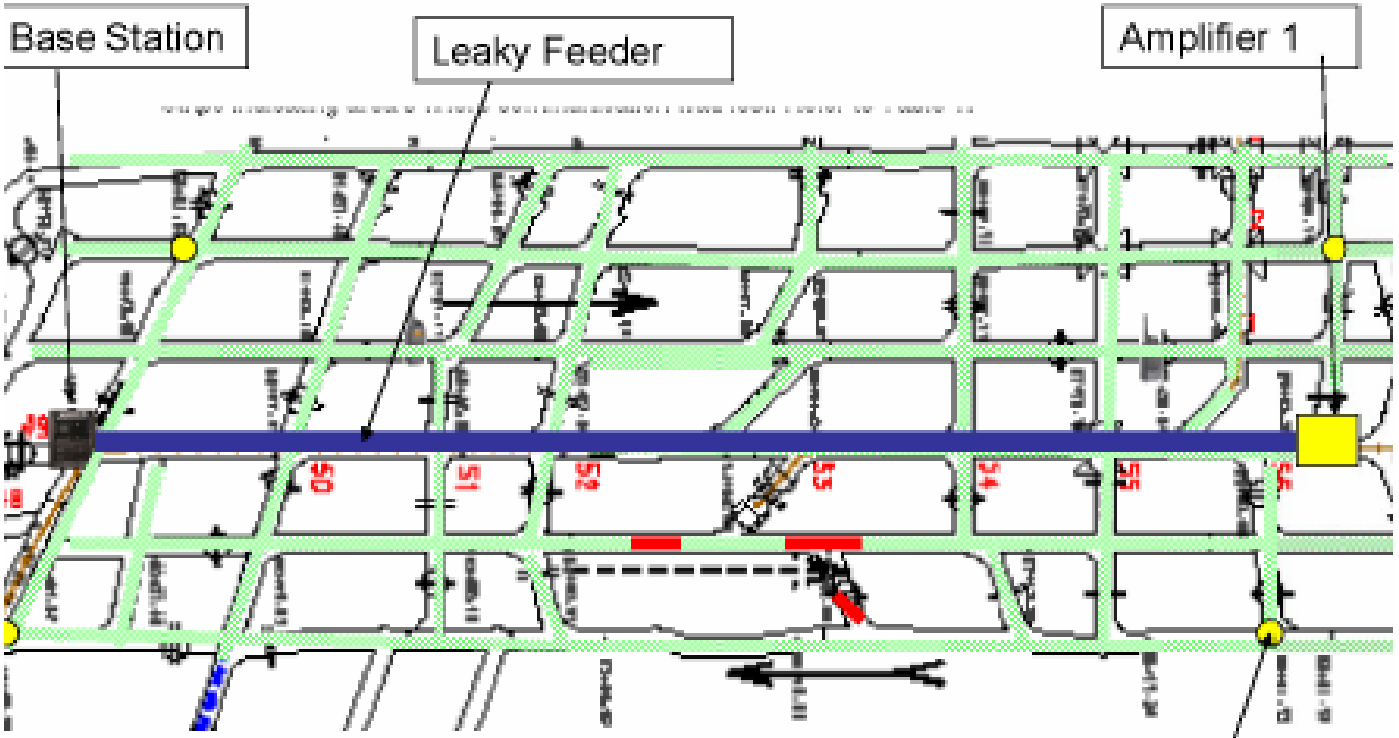
- *Knowledge Base*
- *Safety Understanding*
- *Bandwidth Limitations*
- *Limited Market Base*

Leaky Feeder VHF & UHF



Leaky Feeder Coverage Enhancement

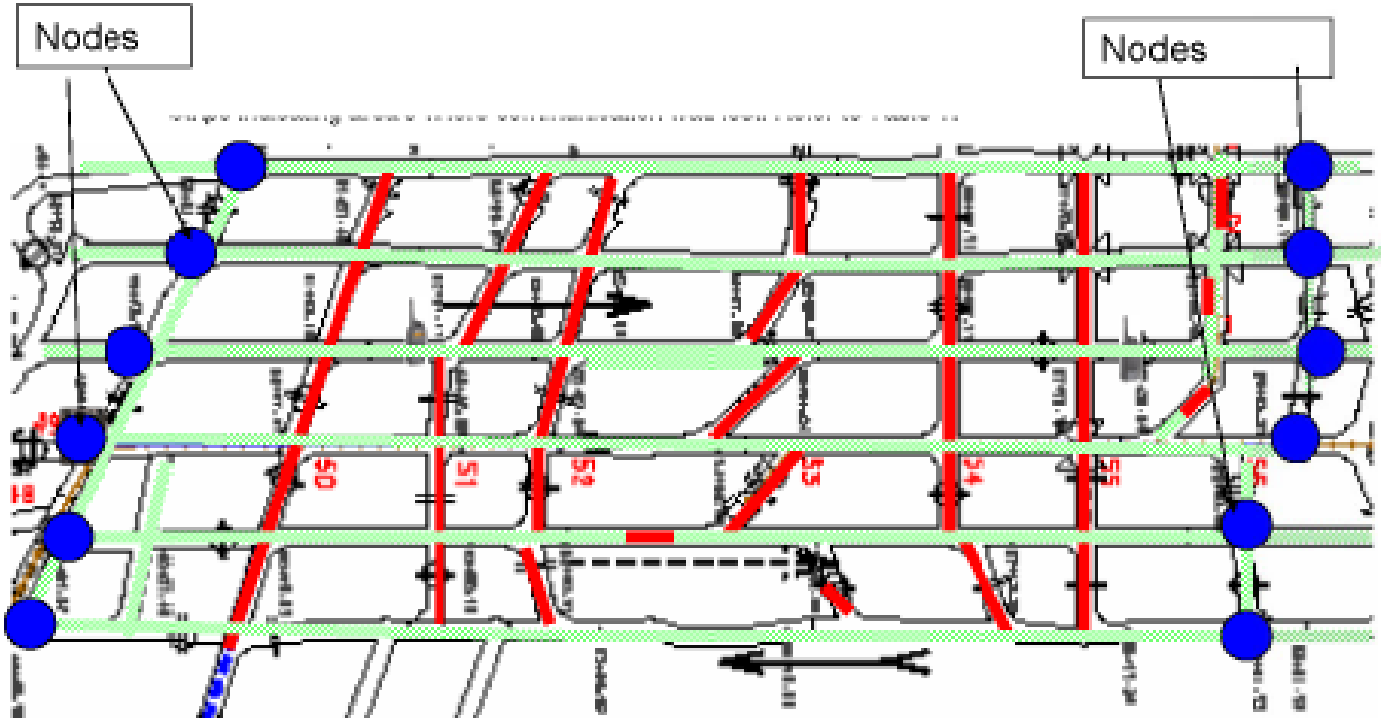
UHF Leaky Feeder w/ Coverage Extension



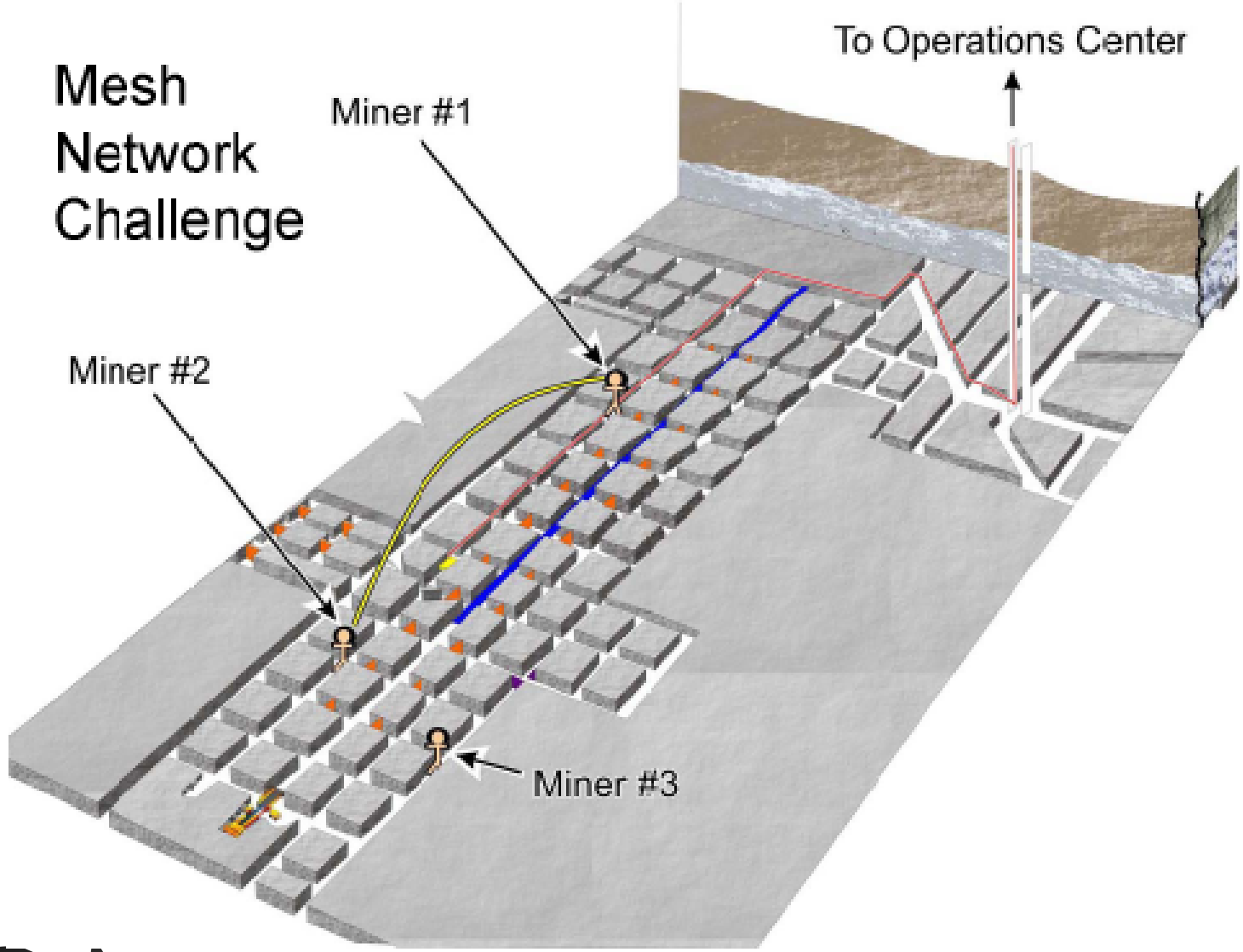
Note: Coverage includes implementation of coverage extension approaches

Wi Fi

"Commercially Available" WiFi Mesh nodes at 2.4 GHz (upper UHF)



Mesh Challenge



Next Generation…Redundancy