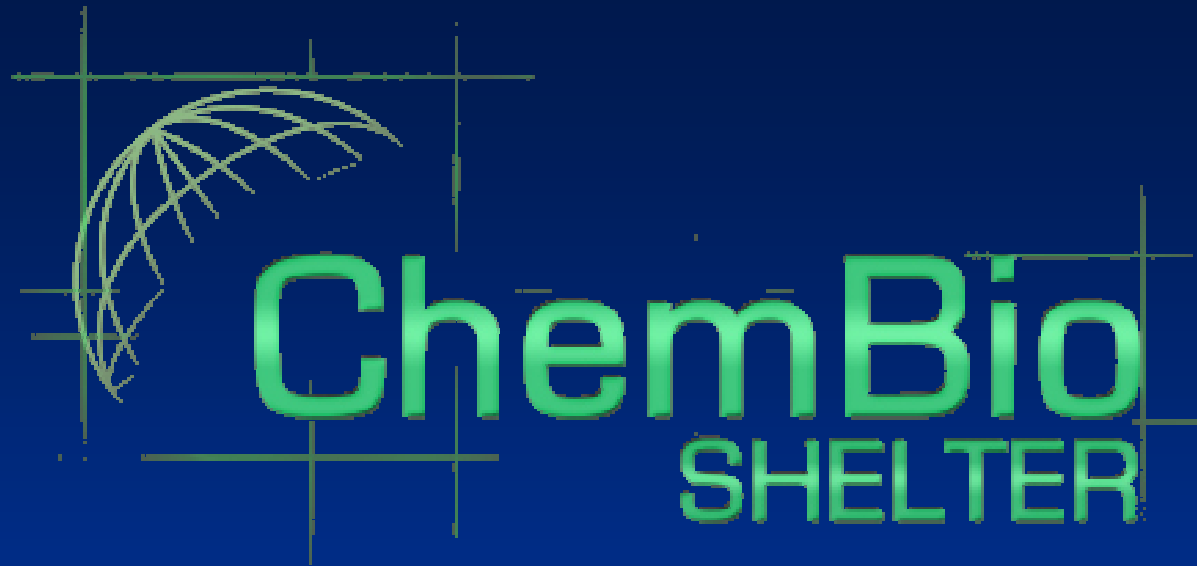


Thank you for your interest in



Collective Protection without filters.

www.ChemBioShelter.com

Presented by:

Ed Roscioli

CEO

ChemBio Shelter, Inc.

Topics to be covered

Theory of operation.

Problems addressed by system design.

Technologies used.

Service life and maintenance.

Manufacturing capacity.



ChemBio Shelter

- A totally new approach for protection from any airborne agent.
- No filter of any type is needed.



Theory of Operation

- Completely isolate people from the outside environment.
- People are hermetically sealed in shelter.
- Shelter air is processed using various chemicals.



Problems addressed by system design

Current filters might not remove Toxic Industrial Chemicals.

Filter changes and maintenance are difficult.

Airlock problems – personnel throughput, contamination of TFA, leakage.

Leakage in connections from one shelter module to another.

Zipper failure from dirt or thermal expansion.

Failure at shelter to structure interfaces due to shock wave forces.



Three models

- Basic Model - includes the air processing equipment and associated chemicals.
- Liner Model – Basic Model with a “liner” for use in buildings, tents, land vehicles, aircraft, and ships.
- Tent Model – Basic Model with a tent type material and frame.



**Portable atmospheric control unit (PACU)
Combines CO₂ scrubbing with oxygen candles.**

All models include

- Carbon dioxide scrubbing.
- Online measurement, alarm and control of oxygen, carbon dioxide and pressure difference.
- Operation in automatic or manual mode.



Oxygen and carbon dioxide monitors

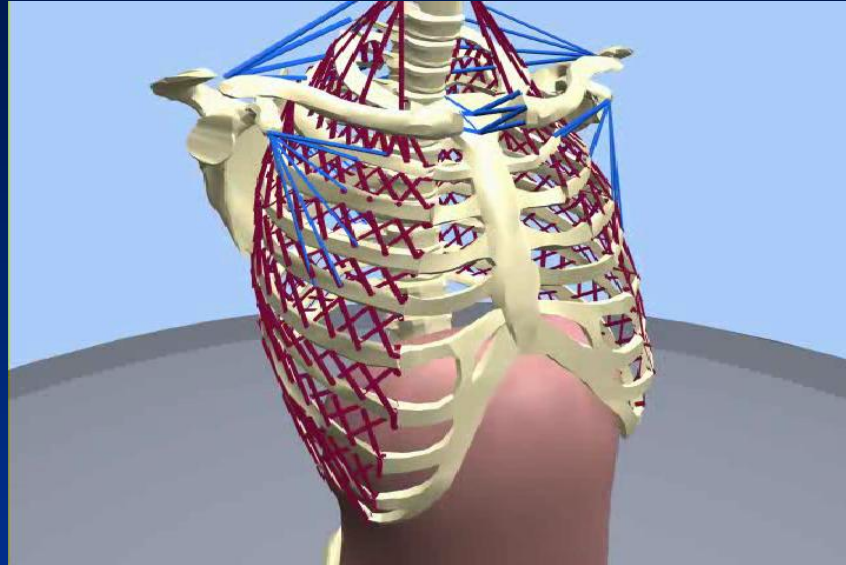
Air processing includes

- Carbon dioxide scrubbing (below 5000 ppm, typically 1200 ppm)
- Oxygen replenishment (19.5% to 21.5%)
- Positive pressure (0.5 to 0.7 inches of water.)



Sodium Percarbonate reaction

Respiration Capacities



Human respiration typically consumes 0.5 to 1.0 liters of oxygen per minute per person and produces 0.4 to 0.8 liters of carbon dioxide per minute.

One man-day consumes 720 to 1440 liters of oxygen and produces 576 to 1152 liters of carbon dioxide.

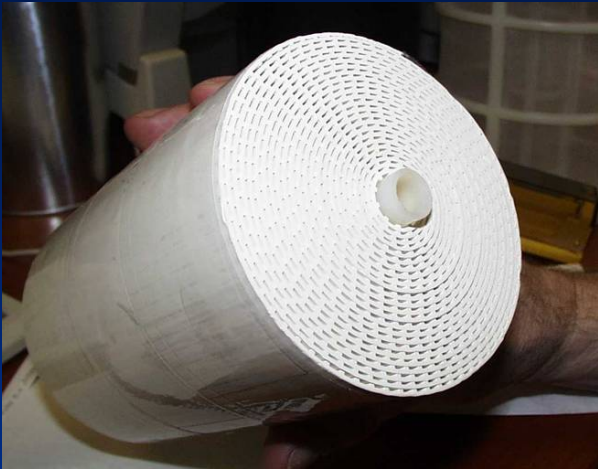
Carbon Dioxide Scrubbing Options

Lithium Hydroxide

Proven technology used in submarines.

6.6 lb cartridge absorbs 1500 liters of CO₂ (2.6 man days at .4 lpm)

Can be used without power.



Soda Lime

Proven technology used in rebreathers.

One lb absorbs 75 liters of carbon dioxide.

2.6 man-days requires 20 lbs (at .4 lpm).



Oxygen Generation Options

- Sodium chlorate candles (oxygen candles) - proven technology used in submarines.
- One SCOG 26 weighs 25.3 lbs and produces 2600 liters of pure oxygen in 75 minutes.
- One SCOG 26 provides 3.6 man-days at 0.5 lpm consumption rate.



SCOG 26

PACU

- Portable Atmospheric Control Unit.
- The PACU combines CO₂ scrubbing (using soda lime) with O₂ generation (using sodium chlorate candles).

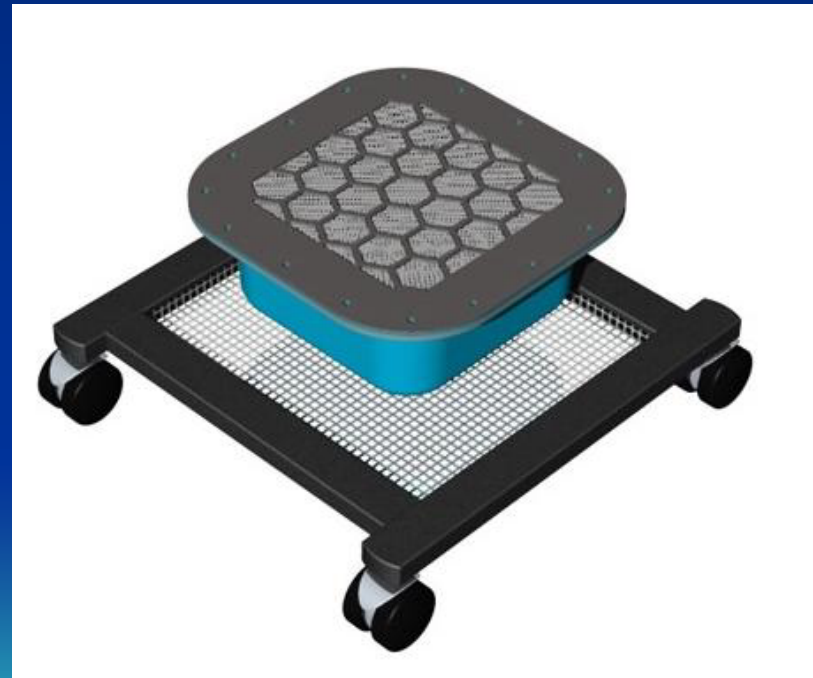


PACU Air Flow Pattern



CASPA

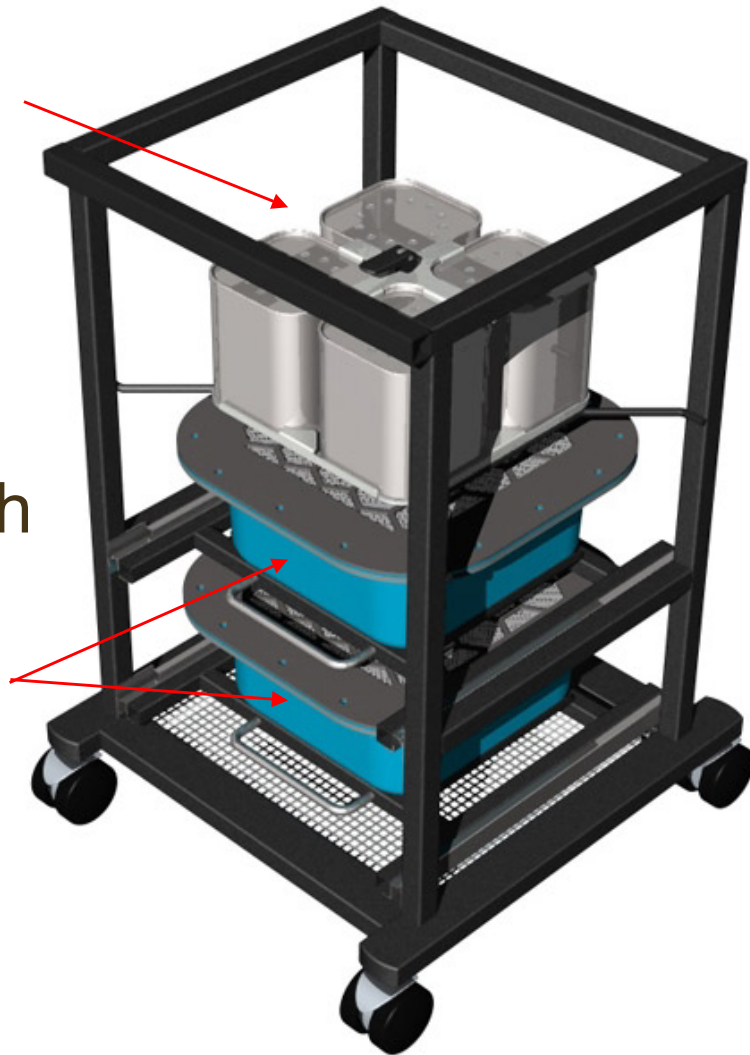
- CARbon dioxide Self Powered Absorber.
- Self contained absorption unit for removal of CO₂.
- CO₂ capacity of unit > 1600 liters.
- Each unit is capable of removing the CO₂ produced by 4 people in a 12 hour period.
- Storage life – 10 years.



Internal PACU components

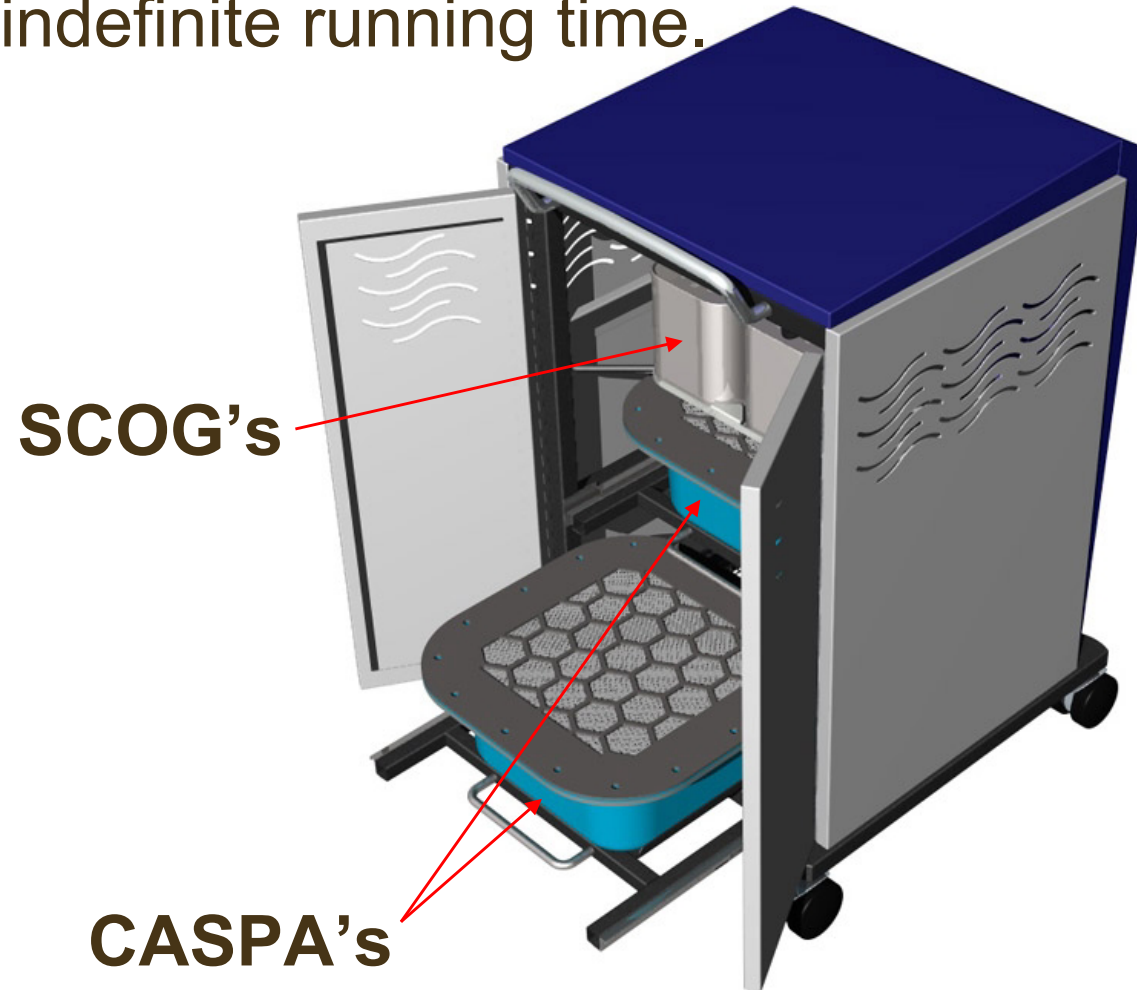
4 SCOG's

2 CASPA's - each
containing 15.4
lbs soda lime.



PACU Design

Consumables can be replaced for indefinite running time.



SCOG initiated
when O_2 drops
below set value



CO_2 absorber
initiated when CO_2
rises to set value

Oxygen Generation Options (cont'd)

- Nitrous oxide decomposition - COTS catalysts, still testing applicability for collective protection.
- One size 1F cylinder (3.86 cubic ft internal volume) of liquid nitrous oxide provides enough oxygen for 49 man-days assuming .5 lpm consumption rate.
- Decomposing one size 1F cylinder of nitrous oxide at 0.5 cfm produces enough oxygen for 14 people (at .5 lpm per person) and would last 3.5 days.



Oxygen Generation Options (cont'd)



- Sodium percarbonate - successfully demonstrated in a full scale prototype
- One lb of sodium percarbonate produces 50 liters of oxygen.
- One man-day consumes 14.4 lbs of sodium percarbonate at 0.5 lpm.

Positive Pressure Options

Compressed air cylinders - commercial off the shelf (COTS).

One size 1F cylinder contains 590 cubic feet of air at 2250 psig.

Adding 590 cubic feet of air to a 20 ft by 20 ft by 8 ft shelter module (400 sq ft) would increase the pressure by 76 inches of water.



Positive Pressure Options (cont'd)

Nitrous oxide decomposition – provides the option of generating electrical power.

One size 1F cylinder of liquid nitrous oxide at 750 psig decomposes to 2552 cubic feet of nitrogen and 1275 cubic feet of oxygen for a total added volume of 3827 cubic feet.

Decomposing 10 cfm of nitrous oxide could maintain positive pressure even with a leak of up to 15 cfm. This would also allow production of 4 kW of electrical power.



Service Life and Maintenance

- Chemical shelf life 2 years.
- All other equipment at least 10 years.
- Oxygen detector - non depleting zirconium oxide.
- Carbon dioxide detector - NDIR (infra red).
- Radial blower mean time between failure (MTBF) - 80,000 hours.



Ultimate Configuration Flexibility

Three different models.

Size, number and placement of modules.

Used as stand alone shelter or in existing buildings, tents, land vehicles, aircraft, and ships.

Air processing options.



Current manufacturing capability

- 10,000 shelters per month.
- Allows sizes up to 20 ft by 100 ft and up to 10 ft high.
- Includes all components and chemicals.
- American suppliers have signed 3-year contracts.



Thank you for your interest in ChemBio Shelter



...Collective Protection without filters.