Tab 3 Oxygen Supply Options Developed by Development Center for Operational Medicine, USAF

BRIEFING OUTLINE

- Objectives
- Assumptions
- Basic Systems
- Oxygen Generation Process
- Components--Comparison Matrix
- Options and Comparisons
- Additional Considerations

Objectives

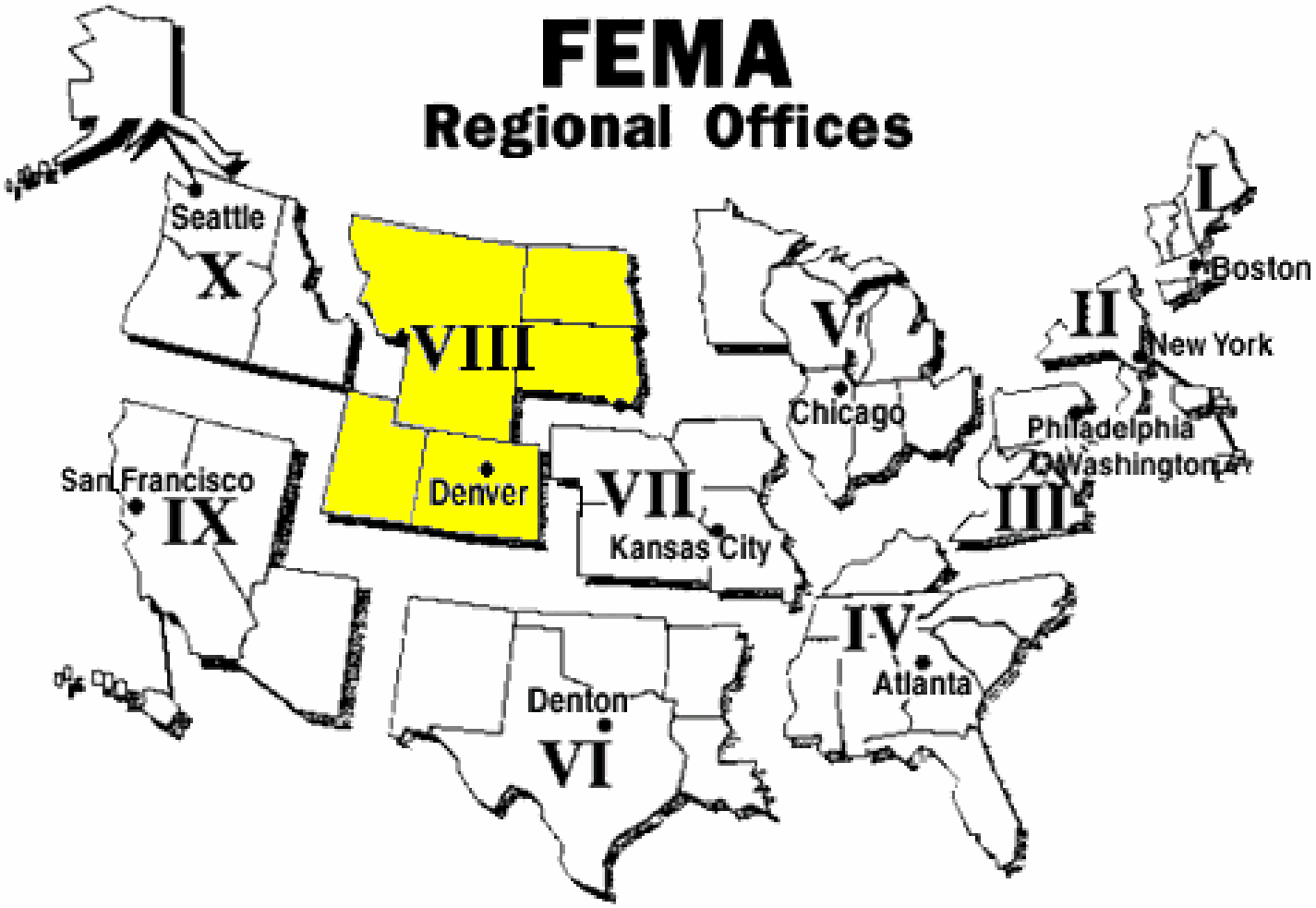
- To provide information about oxygen systems to FEMA for use in emergency mass casualty operations.
- To deliver Oxygen to converted medical facilities such as hotels which would become hospitals
- Provide procurement options

Assumptions

- FEMA Region 8 possesses the following equipment:
  - Respirators
  - Transportation sources
  - Facilities
- FEMA has procedures for:
  - Emergency Response Plans
  - Memorandum of Understanding with Military Medical Organization
  - Procurement/Funding

FEMA REGION 8

serving CO, MT, ND, SD, UT, WY



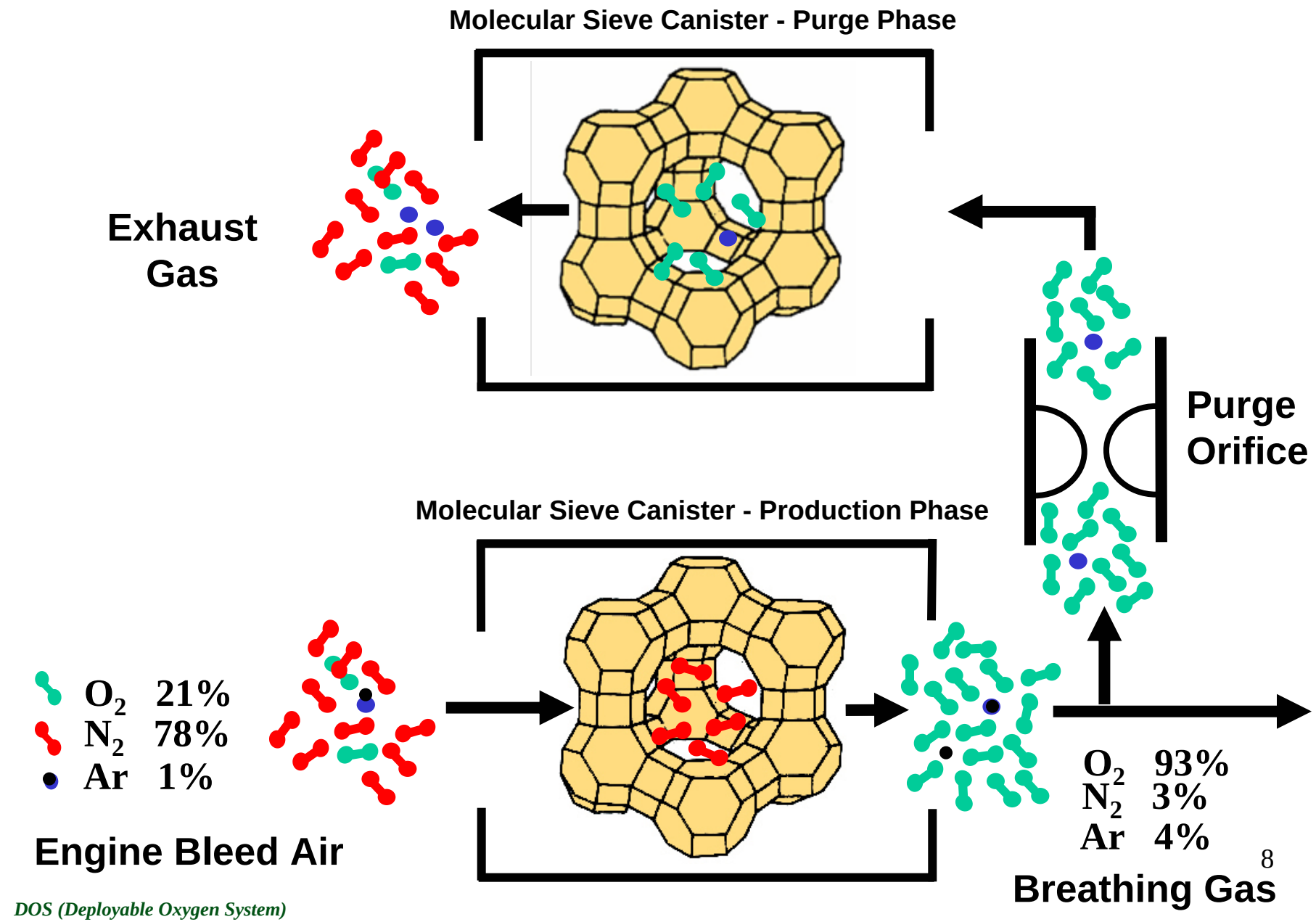
Basic Systems

- **Oxygen Generation Systems**
  - Deployable Oxygen Generation System (DOGS)
  - Expeditionary Deployable Oxygen Concentration System (EDOCS)
  - Home Fill Systems
- **Oxygen Storage Systems**
  - Mobile Oxygen Storage Tank (MOST)
  - New Generation Portable Therapeutic Liquid Oxygen (NPTLOX)
  - Hospital Oxygen Backup System (HOBS)
- **Oxygen Distribution Systems**
  - Portable Oxygen Distribution System (PODS)
  - Surgical Oxygen Distribution System (SODS)

Oxygen Generation Process

- Example:
  - On Board Oxygen Generating System (OBOGS)

SIMPLIFIED OBOGS OPERATION



DOS (Deployable Oxygen System)

Components

O2 Generation Systems	Oxygen Flow Rate	Power Req	Effectiveness	Cube	Cost	O2 Purity
	Liters/Minute	KW	O2 LPM/KW	Ft^3	K	
Expeditionary Deployable Oxygen Concentration System (EDOCS) 120	120	8	15	108	131	93 +/- 3
Portable Therapeutic Oxygen Concentration System (PTOCS)	45	7	6	75	40	93+
Portable Oxygen Generation System (POGS)	33	12	3	27	35	93-95
Patient Ventilation Oxygen Concentration System (PVOCS)	20/20	4.3	5	73.5	35	93 +/- 3
Invocare HomeFill Oxygen Compressor	3	0.2	15	2.8	2.5	93 +/- 3
*provides oxygen and medical grade air	Oxygen/Air					

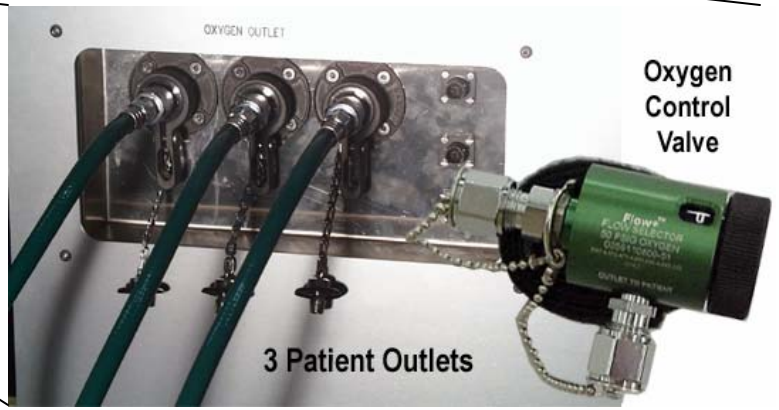
Generation Systems

- EDOCS
- DOGS
- Home Fill System

DEPLOYABLE OXYGEN GENERATION SYSTEM (DOGS)

Essex Cryogenics

- PTOCS Concentrator
- P/N 60C-0169-0100



EDOCS

EDOCS vs DOGS

Parameter	EDOCS 120	DOGS
Oxygen Purity	90 – 96%	>93% with potential to meet 95%
FDA Approval	Yes	Yes
Oxygen Outflow control	No information available	0.5 – 15 LPM at each outlet
System Weight	3800 lbs	870 lbs
Portability	Forklift	4-person carry on
Oxygen flow rate	120 LPM	45 LPM
Oxygen outlets	4 Oxygen Fill Ports to fill H-Tanks (comes with M tanks)	3 oxygen outlets with a minimum flow rate of 11 LPM per outlet at 50 +- 5 psig
Cube size	108 cubic feet 2 units can fit on a 463L	43 cubic feet 3 units can fit on a 463L pallet
Dimensions	94” L X 40”W X 50”H	Air tank module--23 ½” W X 43 ½” L X 27 ½” H Compressor--23 ½” W X 43 ½” L X 27 ½” H Concentrator module--21”W X 30”L X 38” H HP cylinder refill component--34”W X 27”L X 23 ¾
Cost	$140K	$33K (POM) (Boost 66 20K) $39K surge estimate
Power	8 KW (estimated 2-3KW	6.8 KW

Home Fill System

- 3 liters per min @ 14-21psi
- 110V AC and 200 Watts
- Light weight - 33 lbs
- Approx $2,500

Storage Units

- MOST
- NPTLOX
- HOBS

Mobile Oxygen Storage System (MOST)

- Capacity 11,320 liters @ 2015psi
- 150 lbs
- Non Standard Connections
- Not FDA Certified
- Aluminum Lined

Next Generation Therapeutic Liquid Oxygen (NPTLOX)

- Delivers gaseous oxygen at a rate of 66 LPM at 50 $\pm$ 5 psig
- Liquid oxygen storage capacity of 20 liters
- Has 6 oxygen outlets for patient use, supplies 11 lpm maintaining pressures of 50 $\pm$ 5 psig
- Weight: 150 lbs when filled to capacity
- Accessory kit for O_2 delivery devices
- Includes a fast-fill interface similar to the current PTLOX.

HOBS - Hospital Oxygen Backup System

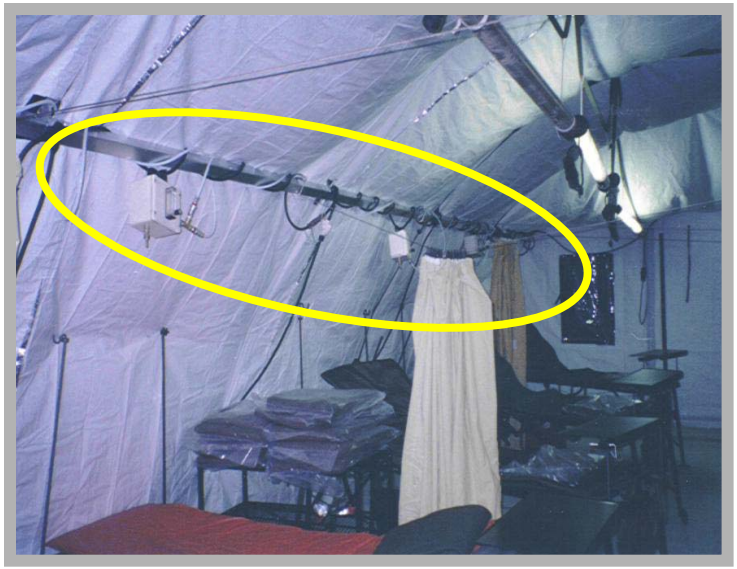
- **Configured bank of eight steel cylinders with manifold connection for large storage needs**
- **55,000L capacity**

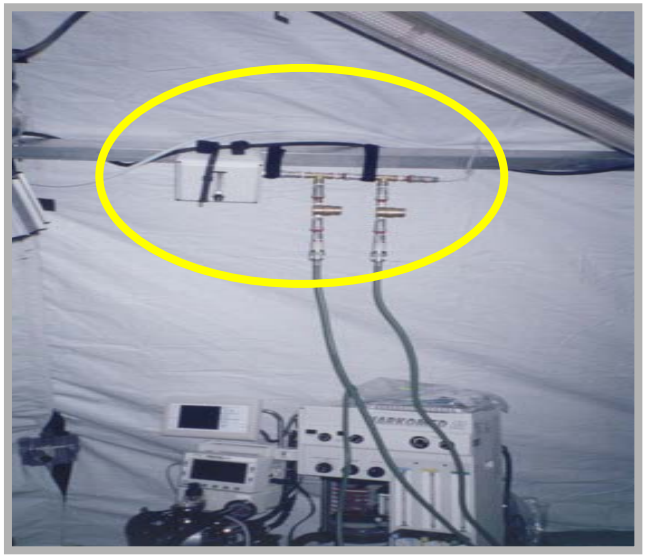
Storage Units

Criteria	PTLOX	NPTLOX	Cylinders	MOST
Weight (lbs)	103 lbs	150 lbs	Variable by type	150 lbs
Maturity *(yes/no)*	Yes	Yes	Yes	Yes
Proven	In use by AFMS	Not fielded yet, IOC pending $	In use by AFMS	Proven technology, new application & configuration
Power Requirements	9 volt battery	9 volt battery	None	None
Cube ($Ft^{3)}$	3.75	7.3	Variable *by type and size*	9
Availability	In use	Jun- Jul 03	In use	12-13 weeks
Cost ($)	$14K	~$25K	~$190-250	~$13K

Distribution Systems

- **PODS - Patient Oxygen Distribution System**
  - **Mimics hospital system**
  - **Off the floor - no tripping hazard**





SODS - Surgical Oxygen Distribution System

(Operating room equivalent to PODS)

Pressure Drop

- Pressure drops over the length of distribution system
  - Keep hoses as short as possible
- With the storage capacity limitation the distributions will not be too long.

OPTION I

- Expeditionary Deployable Oxygen Concentration System (EDOCS)
- HOBS (8 - cylinder manifold system)
- Mobile Oxygen Storage Tank (MOST)

EMERGENCY OXYGEN GENERATION AND DISTRIBUTION SYSTEM

O_2 Generation System

O_2 Storage System

or

Patient rooms

O_2 Distribution System

Patient rooms

Requirements and Limitations

- EDOCS
  - Supplies 10 patients at 11.0 lpm (respirator) or 55 patients at 2.0 lpm (nasal cannula)
  - Designed to operate 24hrs/day
  - Takes 7 hrs to fill 1 HOBS
- MOST
  - Unique hoses and regulators
  - Less supportable than the standard H Cylinder

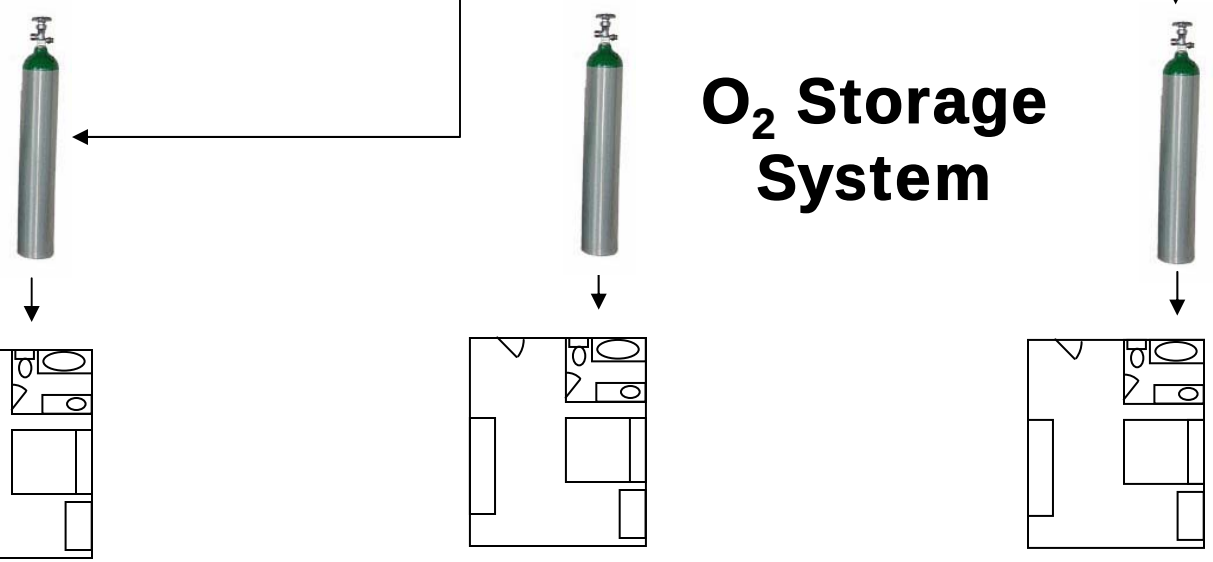
OPTION II

- Deployable Oxygen Gas System (DOGS)
  - Requires a Boost 66
- HOBS (8 - cylinder manifold system)
- Mobile Oxygen Storage Tank (MOST)

EMERGENCY OXYGEN GENERATION AND DISTRIBUTION SYSTEM

O_2 Generation System

Boost 66



O_2 Storage System

Patient rooms

Requirements and Limitations

- DOGS
  - 3 patient outlets
  - 1 additional fill port
- Requires Boost 66
- 1 HOBS stores 55,000 liters of O_2
- Takes 130 hrs to fill up HOBS to full pressure (without patient use)
- 10 patients per 1 HOBS
- Capable of Operating 24 hrs straight

OPTION III

- LOX Storage
- Filling Tank with NPTLOX

EMERGENCY OXYGEN GENERATION AND DISTRIBUTION SYSTEM

LOX Storage / Filling Tank

LOX Storage System

NPTLOX

Patient rooms

O_2 Distribution System

6 patients per LOX

Requirements and Limitations

- Availability of LOX
- Extensive Training is Required

OPTION IV EMEDS

Requirements and Limitations

- Max 25 Patients per EMED layout
- Extensive activation procedures
- Surgical Capabilities
- Experienced Personnel

OPTION V

- Home Fill Oxygen Compressors
  - Low flow oxygen requirements
  - One per patient (3 lpm) enough for nasal cannula
  - Combinations of 2 or more units increase capabilities

Comparison

Choices	Method	Advantages	Disadvantages
Option I (EDOCS) 10 patients each	• Gas	• H Tanks readily available • High yield capability	• Large Unit • Requires additional distribution network
Option II (DOGS) 3 patients each	• Gas	• H Tanks readily available • Man Portable	• Higher power consumption
Option III (NPTLOX) 6 patients each	• LOX	• High volume capacity	• Availability of liquid oxygen •Training
Option IV (EMEDS/DEPMEDS) 25 patients max	• EMEDS	•Experience and Practice	• Activation Procedures
Option V (Home Fill Unit) 1 patient each	•Gas	•Small/Portable •Low power consumption •Low oxygen yield patients •Long Shelf-life	•Only for non critical patients (3 lpm)

Oxygen Equipment Vendors

Product	Vendor	POC Web site	Phone
PTOCS NPTLOX	Essex Cryogenics	Timothy Bannister www.essexind.com	(314) 832-8077
EDOCS MOST HOBS	Pacific Consolidated Industries	Lee Smith www.pci-intl.com	(714) 979-9200
Home Oxygen Systems	OxLife	None www.oxlifeinc.com	1-800-780-2616
Home Oxygen Systems	Preferred Healthcare	None www.phc-online.com	1-866-553-5319
POGS	Onsite Gas	None www.onsitegas.com	(860) 667-8888

Additional Considerations

- Storage
- Transportation
- Maintenance
- Power Demands

Storage Concepts

- Preposition major Oxygen system components within the key cities in Region 8
- Acquire items and use in a mobile medical assemblage to supply remote locations

Transportation

- Components should be palletized for storage and immediate transport
- Systems could be transported from storage site to emergency location via ground transportation

Maintenance

Contract Logistics support should include:

- Training
- Support annual reviews
- Spares
- Repairs and replacement parts
- Warranty

POWER & OXYGEN REQUIREMENTS

	Basic	+ 10	+ 25
MAX POWER DRAW	81 KW	146.4 KW	205.1 KW
AVAILABLE POWER	100KW	200KW	200KW
EST O2 USAGE	89 LPM	162 LPM	281 LPM
EDOCS (120 LPM)	8 KW	(2) 16 KW	(3) 24 KW
(EST) BOOST 66	2-3 KW	(2) 4-6 KW	(3) 6-9 KW
O2 FLOW	120 LPM	240 LPM	360 LPM
EDOCS COST	140K	280K	420K
W/ BOOST 66 COST	160K	320K	480K
DOGS (45 LPM)	(2) 13.4 KW	(4) 27.2 KW	(7) 47.4 KW
O2 FLOW	90 LPM	180 LPM	315 LPM
REG COST	66K	132K	231K
SURGE COST	72K	144K	252K

MAX POWER REQUIREMENTS

	Basic	+10	+25
EMEDS	64.2 KW	122.7 KW	174.5 KW
CP-EMEDS	10.5 KW	17.4 KW	24.3 KW
Water Tent	4 KW	4 KW	4 KW
CP-Water Tent	2.3 KW	2.3 KW	2.3 KW
MAX POWER DRAW	**81 KW**	**146.4 KW**	**205.1 KW**
AVAILABLE POWER	**100KW**	**200KW**	**200KW**
EDOCS (120 LPM)	8 KW	(2) 16 KW	(3) 24 KW
(EST) BOOST 66	2-3 KW	(2) 4-6 KW	(3) 6-9 KW

QUESTIONS

- Oxygen Plants in Region 8
- Hotels in contract with FEMA (floor plans/layout)
- Oxygen Equipment in FEMAs inventory (*i.e. ventilators, anaesthesia machines, etc*)
- Medical Support/Capability of remote Hospital (Concept of Operation)
- What is the O2 Equipment in a CDC Push Pack and how much does it consume?

Credits

- Col Daniel K. Berry, 311 HSW/YAM
- Lt Col Lloyd S. Shackelford, 311 HSW/YAMA
- 2d Lt Clifford A. Hewitt II, 311 HSW/YAMA
- MSgt Ernesto V. Lozares Jr, 311 HSW/YASA
- SSgt Marc C. Paradis, USAFSAM/ATR
- Mr. Gregory J. Iltis, Contractor, 311 HSW/YAMA