

# 7.10 RESPIRATORY PROTECTION



# ENABLING OBJECTIVES



- **EXPLAIN** the principle of operation of the following classes of respiratory protective equipment:
  - Air Purifying
  - Supplied Air
  - Self-Contained Breathing Apparatus
  - SAR w/SCBA
- **DESCRIBE** the operating procedures, parameters, safety precautions & maintenance requirements for:
  - Air Purifying, Supplied Air, SCBA, SAR w/SCBA
- **DESCRIBE** the selection criteria for personal respiratory equipment



# REFERENCES :

(a) NSTM, CH 074, VOL 3, GAS FREE ENGINEERING

(b) NSTM, CH 631, PRESERVATION OF SHIPS IN SERVICE

(c) NSTM, CH 077, PERSONNEL PROTECTION EQUIPMENT

(d) OPNAVINST 5100.19 Series, NAVOSH PROGRAM MANUAL

(e) 29 CFR 1900 (SERIES)



# REPAIR AND MAINTENANCE ACTIVITIES

- Generate air contaminants
- Ventilation most effective method of protection
- When not practical, respirators necessary



# 6 Elements of a Respiratory Protection Program



# ADMINISTRATION



- Respiratory Protection Manager
  - Assigned by the CO
  - Administers program
  - Ensures there is a written SOP
  - Maintains roster of personnel in program
  - Ensures users are:
    - Fit Tested
    - Medically Qualified (done by DOC)
    - Trained in the wearing, usage, and storage
    - ANNUALLY



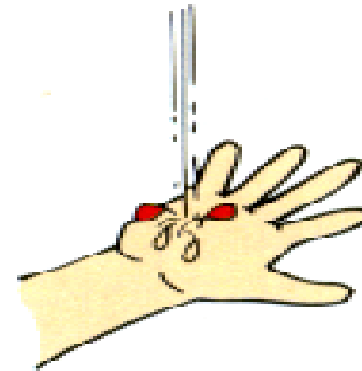
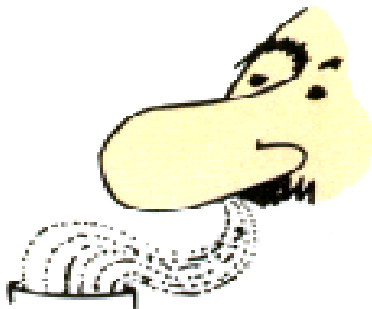
# KNOWLEDGE OF HAZARDS

Toxic Materials Enter Body 3 Ways

① Ingestion (eating, drinking)

② Absorption (touching)

③ Inhalation (breathing)



# CONTROL OF RESPIRATORY HAZARDS



But first, we have to know what the Respiratory Hazards are...





# RESPIRATORY HAZARDS



- ***OXYGEN DEFICIENCY*** -
- Occurs in Confined Spaces when oxygen is displaced or consumed (**less than 19.5%**)
- Chemical Reaction (rust), fire, welding



# RESPIRATORY HAZARDS



- ***CONTAMINANT LADEN***
- Particulate Matter (dust, fumes, mist)
- Gases or Vapors
- Combination of gaseous and particulate



# CONTROLLING HAZARDS

## HAZARD ASSESSMENT

- Gas free tests for:
  - Oxygen
  - Explosives
  - Toxics

## HAZARD CONTROL

- Nature of work:
  - Spray Painting
  - Solvent Cleaning
  - Power Sanding
  - Welding
  - Sandblasting



# SELECTION OF EQUIPMENT



## **ONLY NIOSH/MSHA APPROVED**

- IDLH Conditions
- Concentration
- Oxygen deficiency possible
- Degree of protection



# NIOSH



# CLASSES OF RESPIRATORY PROTECTION EQUIPMENT



- Air Purifying
- Supplied Air



# AIR PURIFYING

- Remove contaminants from atmosphere
- Do not generate oxygen (must be used in 19.5 - 22% O<sub>2</sub> atmosphere)

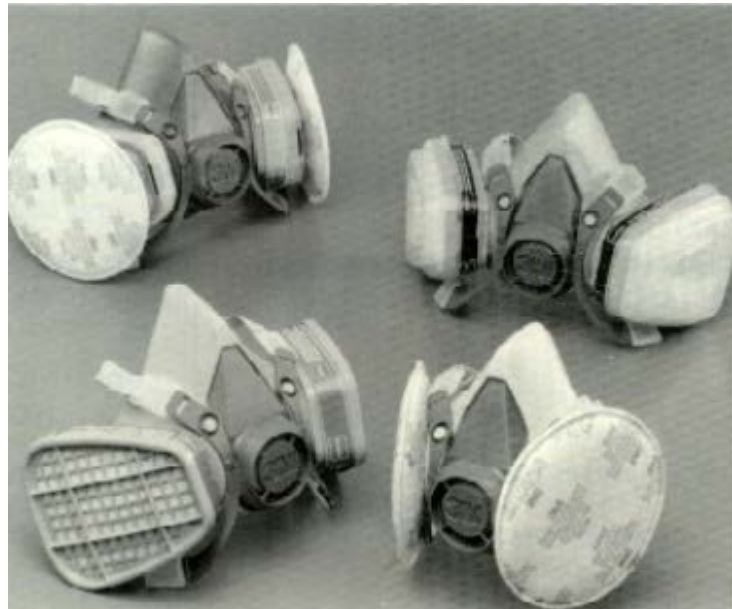


# AIR PURIFYING



🕒 Mechanical - protection from particles (dust, fumes, fog)

📁 Chemical - vapors and gases in low concentrations



# CARTRIDGE SELECTION



- Color coded for intended use

→ LISTING OF COLOR CODE:  
MANUFACTURER'S CHART  
NAVOSH MANUAL B-6

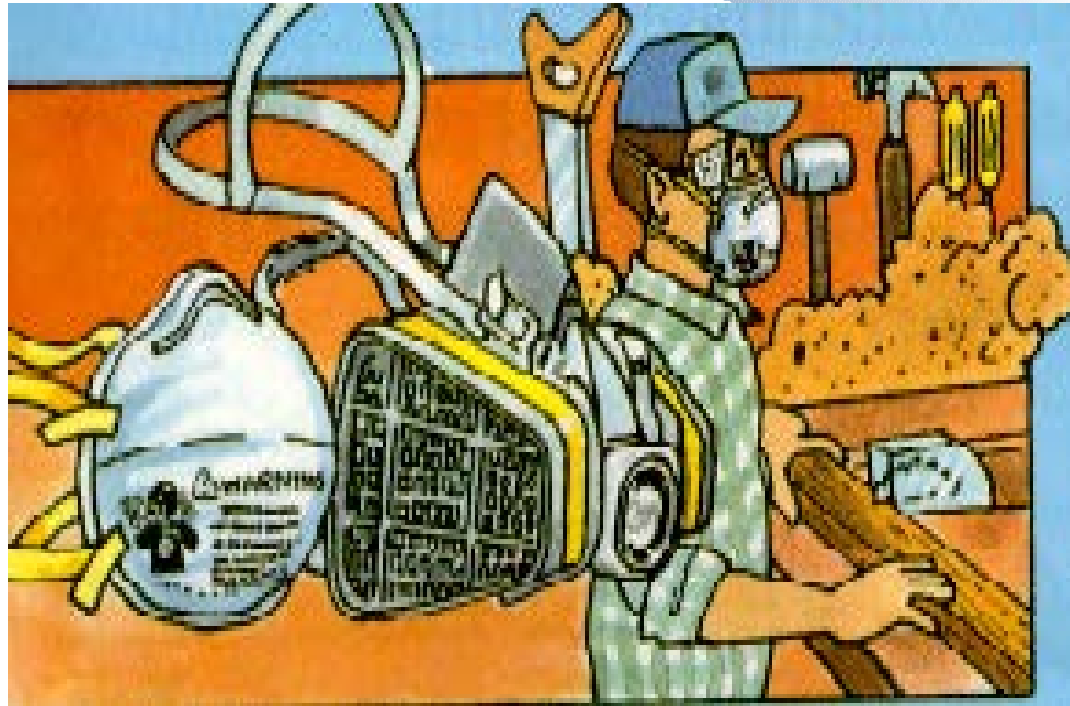
- Filters labeled
- Cartridge combinations





# MAINTENANCE-FREE HALF MASK

- Not really used
- Thrown away when used to capacity



# REUSABLE HALF MASK

- Replaceable cartridges to capture gases and vapors
- Prefilter to trap particles



# FULL FACE

- Face piece to protect eyes and face
- Works like reusable half mask
- Special glasses



# SUPPLIED AIR RESPIRATORS

- Air-line
- Self-Contained Breathing Apparatus (SCBA)



# THREE TYPES OF SUPPLIED AIR RESPIRATORS

- Demand
- Pressure Demand
- Continuous Flow



# DEMAND MODE

- Supplies air upon user inhalation
- Creates negative pressure within face piece
- Some leakage may occur



# PRESSURE DEMAND MODE

- Continuous **positive** pressure within face piece
- Prevents leakage into face piece
- SCBA (Scott Air Pack)
- SAR with SCBA



# CONTINUOUS FLOW

- Continuous ***positive pressure and flow*** of air to face piece
- Rhine Air Pump



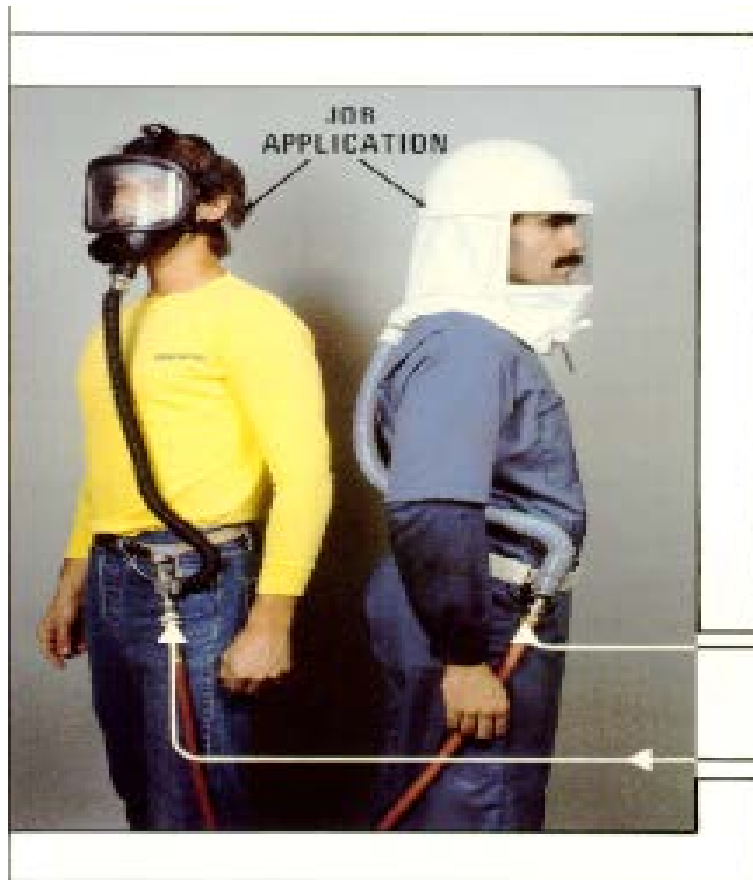


# RHINE AIR PUMP

- LP air driven
- Ambient air
- 50 Ft collapsible hose
- 2 Person capacity
- Common in both USN & USCG
- Snorkel
- ***No back-up air!***



# RHINE AIR PUMP



1) INTAKE FILTER  
SNORKLE DRAWS  
IN AMBIENT AIR  
(CAN BE EXTENDED)

3) AIR EXITS MANIFOLD  
THROUGH DESIGNATED  
RESPIRATORY HOSE

2) AIR IS ROUTED  
THROUGH OIL-LESS  
PUMP

4) SIMULATED TRAVEL PATH  
OF AIR THROUGH RESPIRATORY  
HOSE



# RHINE AIR PUMP

# BULLARD AIR PUMP



# SELF-CONTAINED BREATHING APPARATUS (SCBA)



- Face piece and source of air carried by wearer
- ★ Closed circuit - OBA
  - CO<sub>2</sub> or Water Vapor exhaled is removed or reacts w/chemicals to provide wearer with oxygen
- 🕒 Open circuit - Scott Air Pack
  - Air is provided by compressed air cylinder



# IDLH RESPIRATORY REQUIREMENTS



- “Full face piece, SCBA in pressure demand mode”

or

- “Full face piece air-line respirator in pressure demand mode with 15 minute auxiliary air supply”

NSTM 074 vol 3



# SUPPLIED AIR RESPIRATOR WITH SCBA (SAR WITH SCBA)

- Fulfills requirements of NSTM 074 Vol 3



PASP

RASP

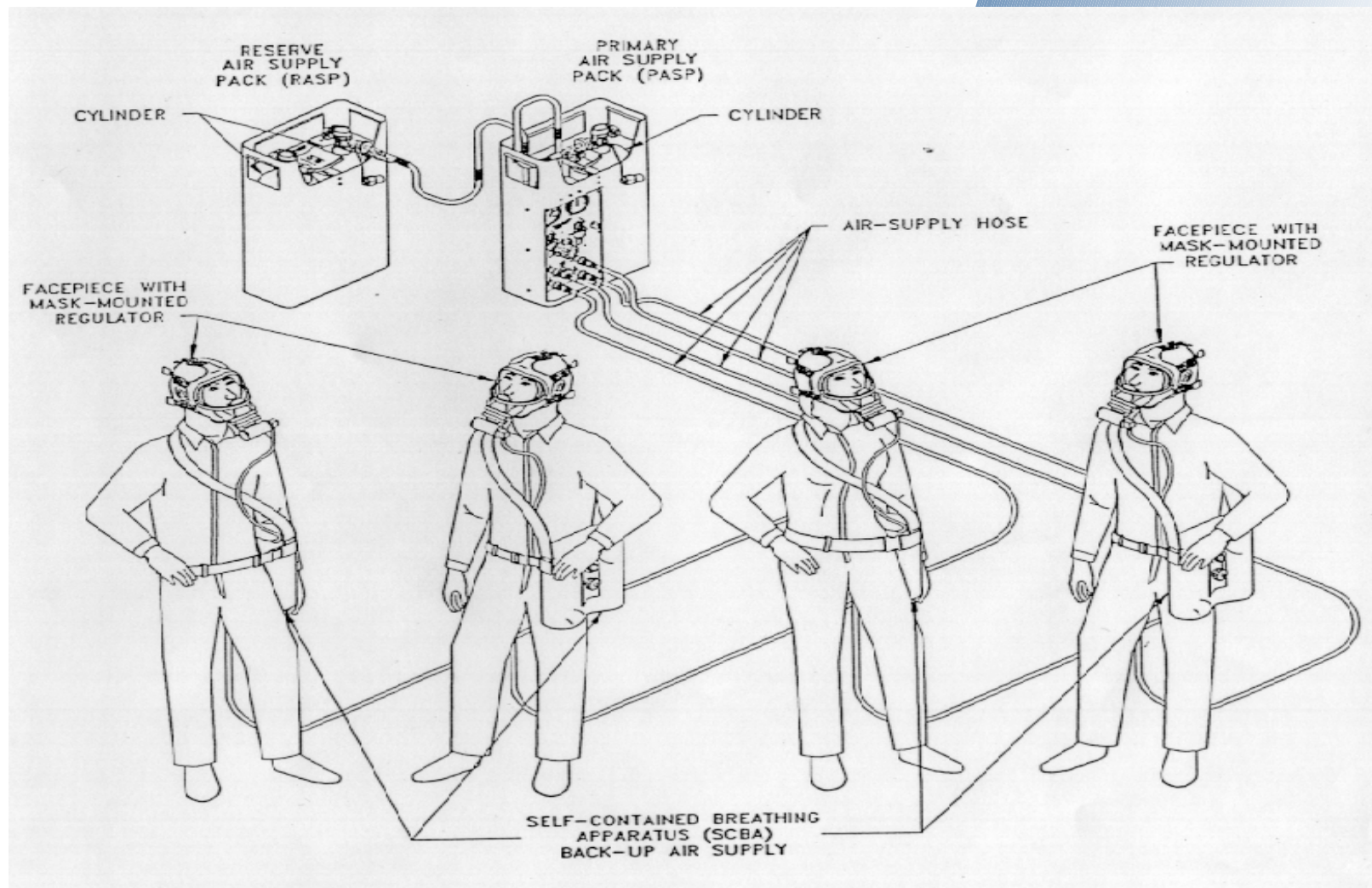
SCBA



SUPPLIED AIR RESPIRATOR WITH SCBA  
(SAR WITH SCBA)



# Supplied Air Respirator/Self-Contained Breathing Apparatus (SAR/SCBA)





# ADVANTAGES OF SAR W/ SCBA OVER OBA

- Longer stay time
- 15 minute Back-up air supply
- Pressure-demand
- No heat produced
- Compatibility with developmental fire fighting SCBA equipment



# ARE OBA'S OBSOLETE?



- **No!!!**

- Rescue efforts
- Safety observer
- Non-IDLH spaces
- Some ship's won't have SAR w/ SCBA



# SAR/SCBA INSURV DISCREPANCIES

- SAR/SCBA: 28 OF 42 (66 PERCENT) OF THE SHIPS SURVEYED HAD SIGNIFICANT PROBLEMS WITH THEIR SAR/SCBA EQUIPMENT.
- PASP/RASP BOTTLES OUT OF PERIODICITY FOR HYDROSTATIC TEST (36 MONTHS)
- PASP/RASP CYLINDERS BELOW MINIMUM PRESSURE (3375-4500 PSI)



- SCBA CYLINDERS BELOW MINIMUM PRESSURE (2500-3000 PSI)
- PASP PRESSURE GAUGES OVERDUE FOR CALIBRATION (PERIODICITY 18 MONTHS)
- PASP HOSES EXCEEDED HYDROSTATIC TEST DATE (PERIODICITY 6 YEARS)
- SCBA HOSES HAVE EXCEEDED MAXIMUM SERVICE LIFE (PERIODICITY 12 YEARS)
- THE REQUIRED 6 YEAR OVERHAUL WAS FOR SAR/SCBA NOT COMPLETED.



- CYLINDER EXTERNAL FIBERGLASS SURFACE DAMAGE EXCEEDED PMS REQUIREMENT DUE TO IMPROPER HANDLING AND STOWAGE. MRC S-4R ON MIP 5510/015 PROVIDES THE REQUIRED DAMAGE CRITERIA FOR THESE BOTTLES IN THREE CATEGORIES. REPAIR AND OVERHAUL OF THIS EQUIPMENT MUST BE PERFORMED BY AN AUTHORIZED MSA SERVICE FACILITY.



# SUMMARY

- We explained the principle of operation of the following classes of respiratory protective equipment:
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- We described the operating procedures, parameters, safety precautions & maintenance requirements for:
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## REVIEW QUESTION

What are the classes of respiratory protection equipment?

- Air Purifying
- Supplied Air

