7.1 Gas Free Engineering Program

Enabling Objectives

- STATE the *need* for a GFE Program
- STATE the *purposes* of the GFE Program
- EXPLAIN the contents and applicability of the various GFE *references*
- EXPLAIN the *responsibilities* of the various levels of the chain of command
  - CO
  - DHs, DIVO's, LPO's
  - Officers/POIC's
  - Operating Personnel
- DESCRIBE the basic elements of the *GFE Program*
- EXPLAIN the purpose of the GFE Instruction and Toxic Gas Bill
- DESCRIBE the procedures for all hands hazard awareness training

7.1 GFE DUTIES AND RESPONSIBILITIES

REFERENCES:

(a) Title 29, Code of Federal Regulations, 1900 (series)

(b) NTTP 3-20.31, Surface Ship Survivability

(c) OPNAVINST 3120.32B, Standard Organization & Regulations of the U. S. Navy (SORM)

(d) OPNAVINST 5100.19(series), NAVOSH Program Manual for Forces Afloat

(e) NSTM Chapter 074, vol. 3, Gas Free Engineering Manual for Forces Afloat

(f)NSTM Chapter 555, Firefighting Ship

Unit 7 at a Glance

GFE Program GFE Duties Hazardous Atmospheres	Ventilation Procedures Hot Work Emergency Rescue
GF Inspection GF Equipment GF Equipment Lab GF Pub Exercise	HAZMAT Tank Cleaning Spray Painting Sewage Safety
Reports & Records Liability Respiratory Protection Protective Clothing	GFE & BOARDINGS GF MISHAPS Gas Free Practical*** Unit 7 Review Unit 7 Exam*** CPR CERTIFICATION

What is Gas Free Engineering?

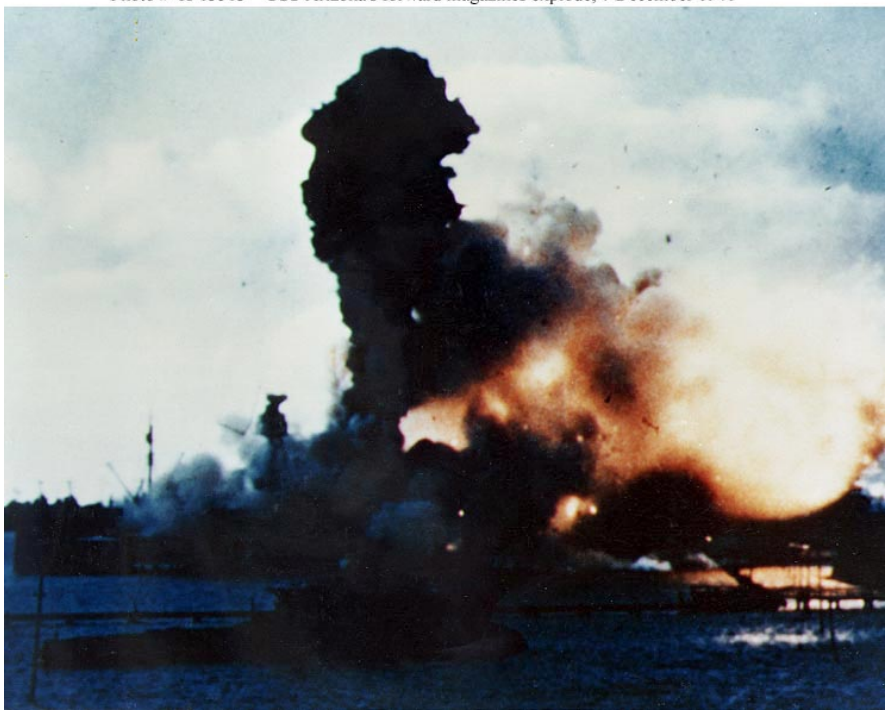
- Performing testing, evaluating, removing or controlling hazardous materials or conditions within or related to a confined space
- Controlling hazards to personnel entering or working in, on or adjace
- ***No routine hazard, with the exception of ordnance, is as dangerous as the presence of potentially lethal atmospheres in ship's spaces***


GFE History

GFE History

1941 - Navy begins using gas test equipment after deaths during Pearl Harbor salvage ops

Photo # K-13513 USS Arizona's forward magazines explode, 7 December 1941



Toxic Gases: As in the case of the [USS] *California* and the [USS] *Nevada* there existed a considerable hazard due to the presence of toxic gases. The principal offender was hydrogen sulphide, H2S (sewer gas), which was generated in the contaminated stagnant water. It was found that the most serious gas concentrations occurred in storerooms containing a large amount of paper or where there was a large quantity of cardboard containers. Numerous cases of oxygen deficiency were found and some cases of carbon monoxide.

Precautions Taken Against Toxic Gases: A systematic procedure for testing for toxic gas was employed, and was in charge of by Lieutenant Commander C. M. Parker, USN, who is a specialist in industrial gas hazards. A large bulletin board was kept marked up to indicate to personnel which compartments were safe and which should not be entered without proper mask protection. Although extraordinarily high concentrations of gases were found on the *West Virginia* (200,000 PPM) there were no persons overcome by gas. If the concentration reached the points of 20 parts in a million, as shown by detectors, the space was considered unsafe except with a rescue breathing apparatus or suitable face plate with air lead.

Ventilation: In order to combat the gas hazard and to permit work to go on with the least possible delay there were installed a large number of exhaust ventilation units. As the water was pumped down these were connected up to the ship's ventilation pipes so that all parts of the ship could be reached and the toxic gases withdrawn.


SD 55

GFE History

1947 - "NFPA" National Fire Protection Agency is formed for ship fire safety

1963 - NFPA certifies Marine Chemists

GFE History

1965 - Vessel Explodes in Guam; CO's start designating GFE as collateral duty

*1970 - "OSHA" formed; mandates gas free program guidelines under 29CFR1915 on all vessels

OSHA U.S. Department of Labor Occupational Safety and Health Administration

1982 - Formal GFE Program established by NAVSEA S6470-AA-SAF-010 "Safe 10" Manual (Later updated as NSTM 074 v 3)

1986 - USCG mandates Marine Chemist inspections before USCG vessel inspections

GFE History

1994 - Navy issues "NAVOSH Manual" for managing safety programs

1998 - NSTM 074 v 3 Rev 3 tightens program guidelines & introduces rescue procedures

2003 – NSTM 074 v 3 Rev 4 changes pay grade for GFEPO, audit checklist available at NAVSEA DC website .

Why Do We Need a Gas Free Engineering Program?

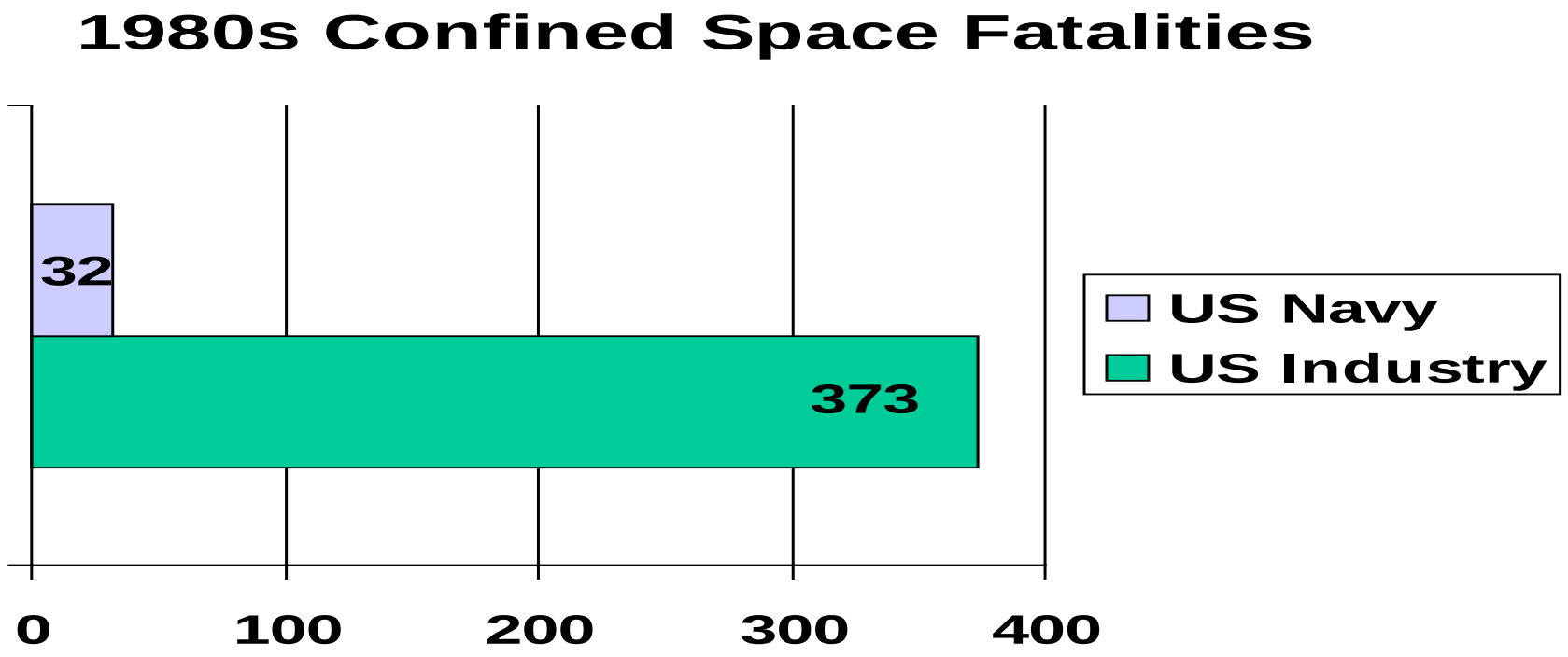
- Hazardous atmospheres may be created that can explode or cause asphyxiation
- Personnel attempting to save a fallen shipmate may become ***overcome and killed*** by undetected vapors
- For this reason, every *confined space* must be gas freed

60 %

of Casualties are Well-Intentioned Rescuers

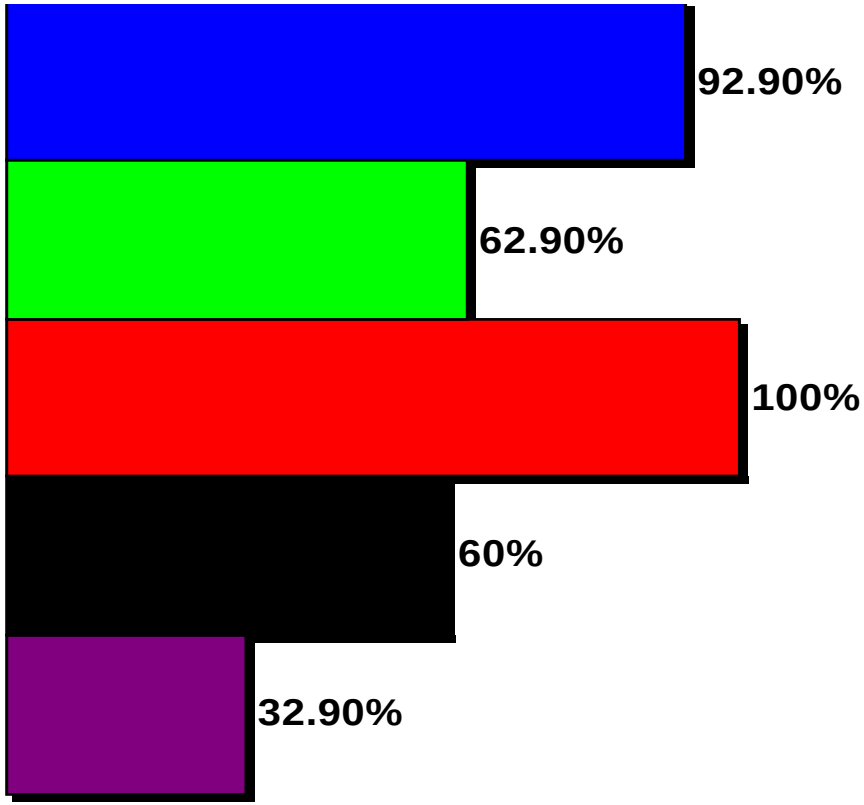
RISK MANAGEMENT

Confined Space Deaths Resulting from Hazardous Atmospheres



Navy & Civilian Industry documented numerous fatalities through the 1980's.

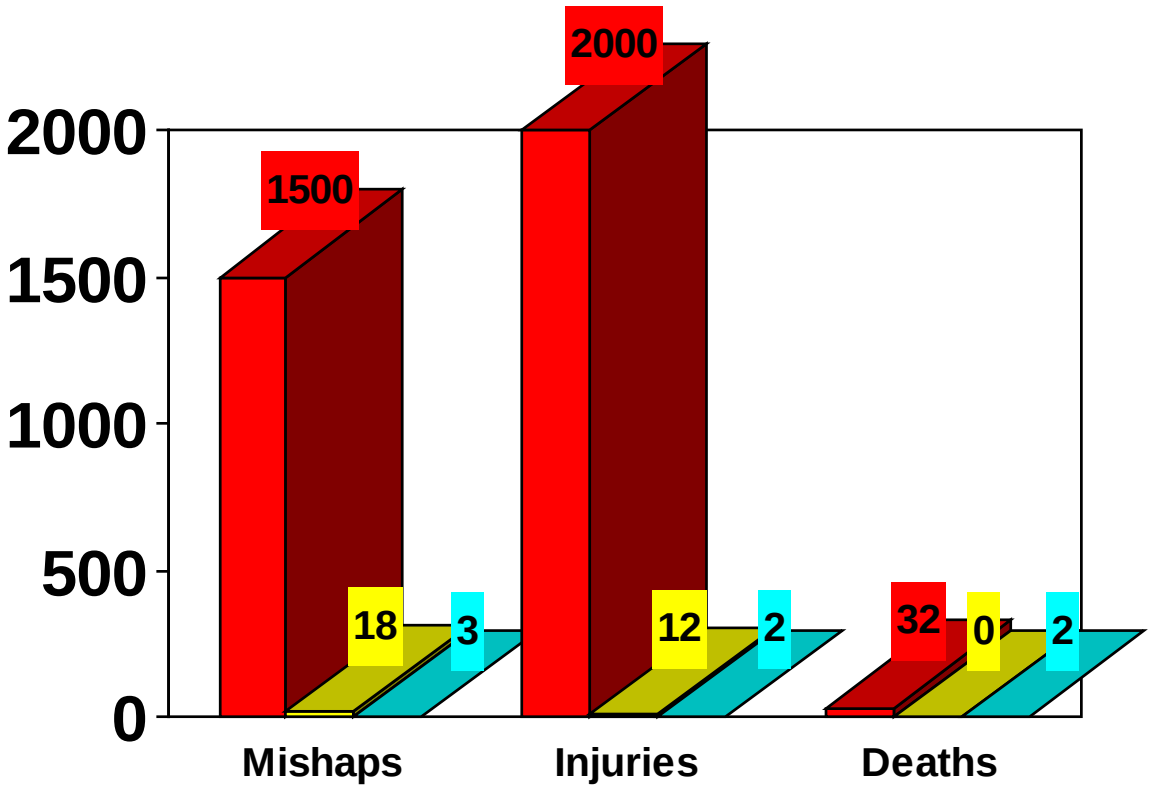
Investigation of 109 Confined Space Fatalities in Industry, 1983-1993



Source: NIOSH

OSHA made all these safety precautions mandatory as of 1993.

US Navy Toxic Exposure Incidents



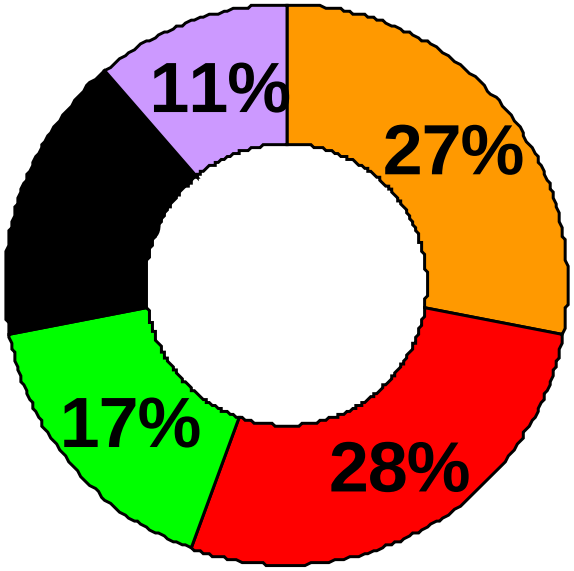
- 1980's

-1990's

-2000's

COMMON TOXIC HAZARDS

US Navy Mishaps 1989 - 2004



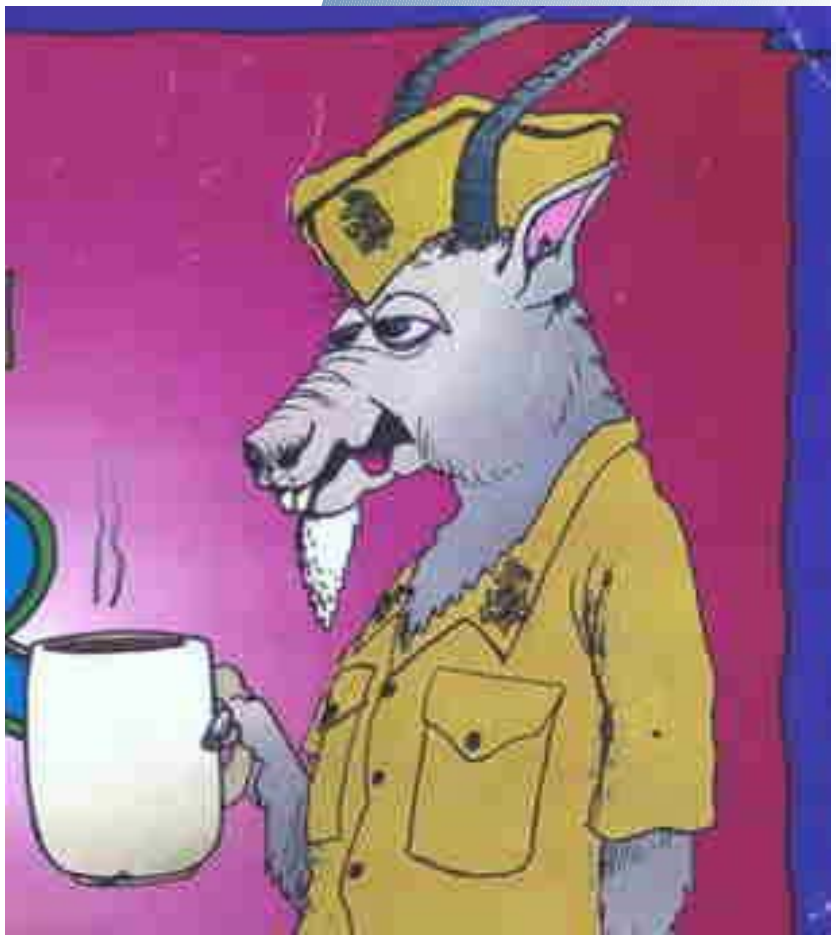
Source: NAVSAFECEN

- Fuel Vapors (Hydrocarbons)
- Hydrogen Sulfide
- Oxygen Deficiency
- Smoke/Other
- Freon/Phosgene

COMMON THREADS TO GFE MISHAPS

- Lack of Hazard Awareness

- Lack of Khaki Supervision

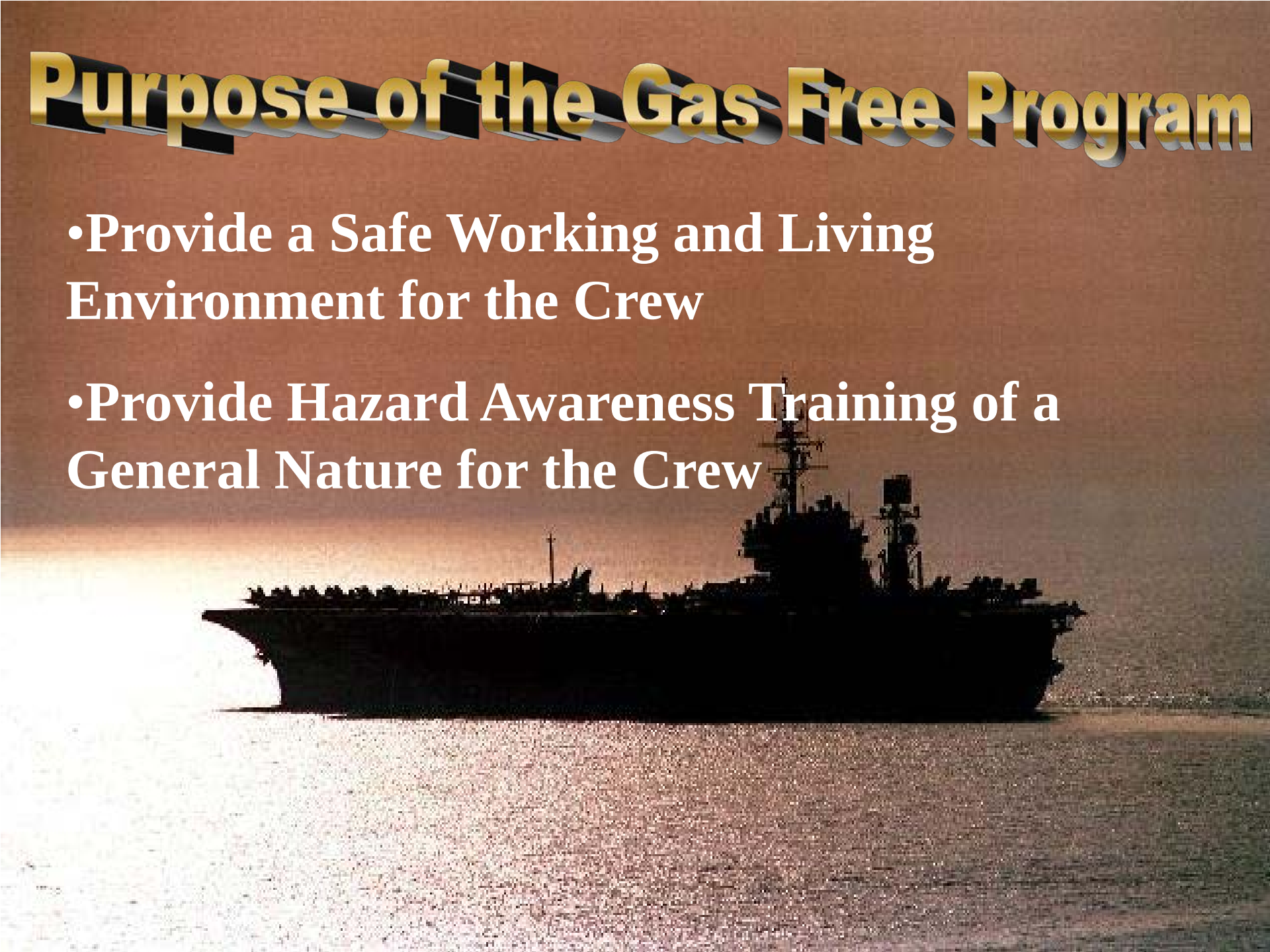


Why Do We Need a Gas Free Engineering Program?

- Too Little Oxygen
- Too Much Oxygen
- Combustible Atmosphere
- Toxic Atmosphere

Purpose of the Gas Free Program

- **Provide a Safe Working and Living Environment for the Crew**
- **Provide Hazard Awareness Training of a General Nature for the Crew**



Civilian References

- PL 91-5967, The Occupational Safety and Health (OSHA) Act Of 1970
- The Code of Federal Regulations (CFR)
  - -- 29 CFR 1915,1916,1917 OSHA Standards

The NAVOSH Manual

- **OPNAVINST 5100.19 series, Navy Occupational Safety & Health (NAVOSH) Program Manual For Forces Afloat**
  - **Chapter B3 *HAZMAT***
  - **Chapter B6 *Respiratory Protection Program***
  - **Chapter B8 *GFE Program***
  - **Chapter B12 *PPE***
  - **Chapter C11 *Welding, Cutting, Brazing***
  - **Chapter C15 *MSD***

The SORM

- OPNAVINST 3120.32 (series) Standard Organization & Regulations of the U. S. Navy
  - 630.17 *Tag Out Bill*
  - 640.1 *General Emergency Bill*
  - 640.8 *Toxic Gas Bill*

NSTMs

- NSTM 074 vol 1:Welding and Allied Processes (Sect. 10 Safety Precautions)

- NSTM 077: Personnel Protection Equipment (PPE) (Sect. 3 Breathing Apparatus and Equipment

- NSTM 555: Firefighting (Post Fire Gasses & Atmospheric Testing)

NSTMs

- NSTM 593: Pollution Control (Sect. 4 Sewage)

- NSTM 631: Preservation of Ships in Service (Sect. 2 Safety Information)

- NAVSEA OP 4: Ammunition Afloat (Chpt 2 General Regulations)

NSTM 074 Vol 3

- **NSTM CHAPTER 074 Vol. 3**
  Gas Free Engineering

Principle Course Reference

GFE's Handbook

Responsibilities

AS PER NSTM 074 vol 3

Commanding Officer

- Safety of ship and crew
- Initiate procedures/issue directives
- Require GFE inspections
- Require contractors to meet applicable laws and standards

Dept. Heads and Divos

- Ensure provisions and procedures of NSTM 074 Vol 3 are met.
- Ensure GFE personnel conduct required inspections in areas of responsibility

Petty Officers in Charge

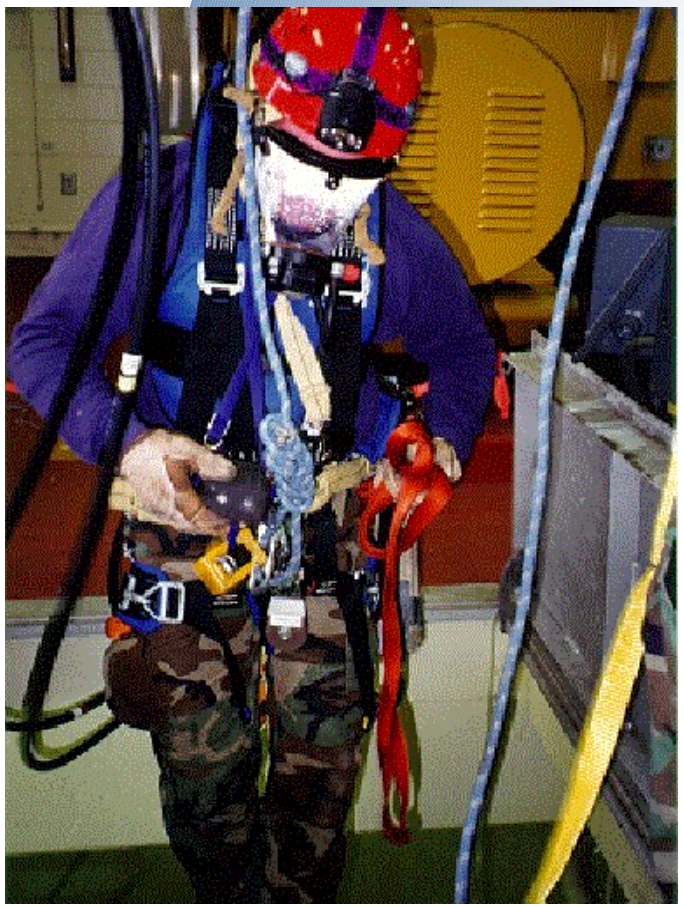
- **Explain Possible Hazards and Precautions to Subordinates**
- **Enforce Safety Requirements**
- **Report Unsafe Conditions or Procedures**
- **Cease All Unsafe Operations**

Operating Personnel

- **Report Unsafe Conditions, Procedures or Equipment**
- **Warn Endangered Personnel**
- **Report Injuries or Health Problems Occurring in the Course of Duty**

How to Build a Gas Free Program

- **Gas Free Notebook**
- Staffing
- Establish Procedures
- Inspections
- Equipment
- **Training**
- Documentation



Gas Free Notebook

NSTM 074 Vol 3 App. C

A. Gas Free Instruction***

B. Active Gas Free Chits

C. Inactive Gas Free Chits (1 yr)

D. Gas Free Engineering Procedural Working Guide

E. IDLH Space Emergency Entry Checklist

F. Closed Compartment Opening Request Form

Options:

Index w/ Serial Numbers / Audit Sheet & Comments / Inspection Checklists

Blank Gas Free Certificates / Hot Work Certificates / Opening Requests

Designation Letters for Gas Free Personnel / CPR Quals / Schools

PROGRAM ORGANIZATION

- What bills and instructions can I consult to help me organize and administer my GFE program?
- Two documents
  - Gas Free Instruction
  - Toxic Gas Bill

GFE INSTRUCTION

- Management tool
- Details shipboard policy and responsibilities
- Justifies program
- Should be required reading

TOXIC GAS BILL

- Required by SORM

  DCA's responsibility

- Covers initial actions for watchstanders in unplanned, accelerated GFE evolution

  How to report, word to be passed, controlling actions

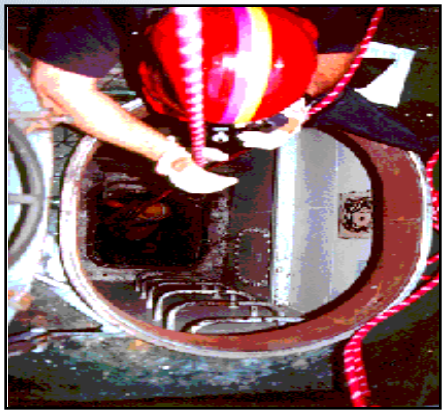
- Toxic Gas Drill MOB-D-31-SF

TRAINING

NSTM 074 Vol 3 App. B

Upon Reporting & Annually

- Recognizing hazards
- Identifying confined spaces and precautions regarding confined space entry
- Requesting Gas Free Services
- Helping shipmates in an emergency



ONGOING

TRAINING

- Divisional GMT lectures
- POD Notes
- DC Team training
- Fire Watch
- Site TV

SUMMARY

- **We stated the need for Gas Free Engineering Program**
- **We stated the purpose of the Gas Free Engineering Program**
- **We explained the contents and applicability of references**
- **We explained the chain of command**
- **We described the basic elements of this program**

REVIEW - QUESTION #1

- What are the two purposes of the Gas Free Engineering program?

To ensure a safe working and living environment for the crew

To provide an all hands hazard awareness training program

REVIEW - QUESTION #2

- **What instruction or bill outlines the requirements to be met in the event of an emergency GFE evolution?**

TOXIC GAS BILL

REVIEW - QUESTION #3

- **How often must All Hands receive training in Hazard Awareness?**

Upon reporting

Annually

INSURV

NAVOSH:

- THE GFE PROGRAM WAS NOT EFFECTIVE. GFE PERSONNEL WERE NOT PROPERLY TRAINED, KNOWLEDGEABLE, OR PROFICIENT IN CONDUCTING GAS FREE EVOLUTIONS.

- 6 OF 10 FOUR-GAS ANALYZERS (GFE SUPPORT EQUIPMENT) WERE INOP, 6 OF 10 CALIBRATION KITS WERE NOT ONBOARD, AND 3 OF 4 CALIBRATION GAS BOTTLES IN THE KITS ONBOARD WERE OUT-OF-PERIODICITY.

- THE RESPIRATORY PROTECTION PROGRAM WAS NOT EFFECTIVELY ESTABLISHED.

- ACCIDENT INJURY REPORTS WERE NOT BEING GENERATED FOR ALL MISHAPS.

-5 OF 5 HAZMAT SPILL KITS WERE NOT ONBOARD.

- ALL INSTALLED H2S ALARMS WERE INOP (CASREP 04031).

- CHT PUMPROOM BILGE ALARMS WERE INOP.

INSURV

20-24 SEP 04

QUICKLOOK REPORT FOR USS XXXXX (LPD-15):

- THE GAS FREE ENGINEERING PROGRAM WAS INEFFECTIVE. THE GAS FREE ENGINEER AND ASSISTANT HAD NOT COMPLETED REQUIRED ON-THE-JOB TRAINING.

- THE FOUR-GAS ANALYZER COULD NOT BE CALIBRATED AND SPACES CERTIFIED SAFE FOR PERSONNEL ENTRY DESPITE FOUR-GAS ANALIZER READINGS THAT INDICATED SENSORS NEEDED TO BE CHANGED.

- ADDITIONALLY, REQUIRED QUANTITIES OF DRAEGER TUBES WERE NOT ONBOARD.

- FLOODING ALARMS, LOW AIRFLOW ALARMS, AND HYDROGEN SULFIDE ALARMS WERE DEGRADED TO THE POINT WHERE SAILORS MIGHT RECEIVE NO WARNING BEFORE ENTERING A SPACE WITH A POTENTIALLY DEADLY ATMOSHERE.

UNIT 7 GAS FREE ENGINEERING PROGRAM

LEARN CPR you can do it!