Lesson Topic 1.2

THE ROLE OF THE GAS FREE ENGINEER

Introduction

As Gas Free Engineer personnel you are required to know the responsibilities and terms associated with Gas Free Engineering.

Enabling Objectives

- Select statements which describe the duties, responsibilities and qualifications of the Gas Free Engineer (GFE) in accordance with NSTM Chapter 074 Vol. 3, Gas Free Engineering
- Select statements which describe the duties and qualifications of the Gas Free Engineer Assistant in accordance with NSTM Chapter 074 Vol. 3, Gas Free Engineering.

Enabling Objectives

- Select statements which describe the duties and qualifications of the Gas Free Engineer Petty Officer in accordance with NSTM Chapter 074 Vol. 3, Gas Free Engineering
- Define program requirements, terms, and nomenclatures pertinent to Gas Free operations in accordance with NSTM Chapter 074 Vol. 3, Gas Free Engineering.

Gas Free Requirements, Training and Quals

GFEA

GFE

GFEPO

GFE

- 1 per Ship
- **E-7 or Above**
- CO’s Designation Letter
- Annual CPR
- Formal School
- 40 Hours Practical Work U/I (waiverable)

* GAS FREE ENGINEER WAIVER

C.O. May Waive Requirement for 40 Hours of Practical Training in Writing if:

- Candidate Has Graduated from Approved Training Within Past 36 Months

AND

- Unit Does Not Have Qualified GFE Onboard

Gas Free Program Administration

GFE

GF Program Manager

Establish Requirements in Gas Free Instruction

Establish Emergency Rescue & Medical Treatment

Maintain GF Log

Ensure Proper Equipment / PPE

APPENDIX C: NSTM 074v3

p. C-1 : SAMPLE GAS FREE NOTEBOOK

p. C-2: SAMPLE GAS FREE INSTRUCTION

p. C-18 - 20: SAMPLE DESIGNATION LETTERS

p. C-28: EMERGENCY CHECKLIST

APPENDIX B: SAMPLE TRAINING OUTLINE

Who Can Certify What For Initial Entry

- **Confined Spaces with Toxins & Flammables**
- **IDLH Spaces**
- **Tank Cleaning**
- **Confined Space Painting**
- **Inerting / Pressing Up**

GFE

Hot Work Inspections, Tests and Certificates

- Spaces with Flammables
- Machinery / Engine Room, Catapults, Bilges
- Pressurized Systems, Pipes, Coils, Pumps
- Hollow Drums, Stanchions

GFEA

- 1 per Ship
- **E-6 or Above**
- CO’s Designation Letter
- Annual CPR
- Formal School
- 40 Hours Practical Work U/I

Who Can Certify What For Initial Entry

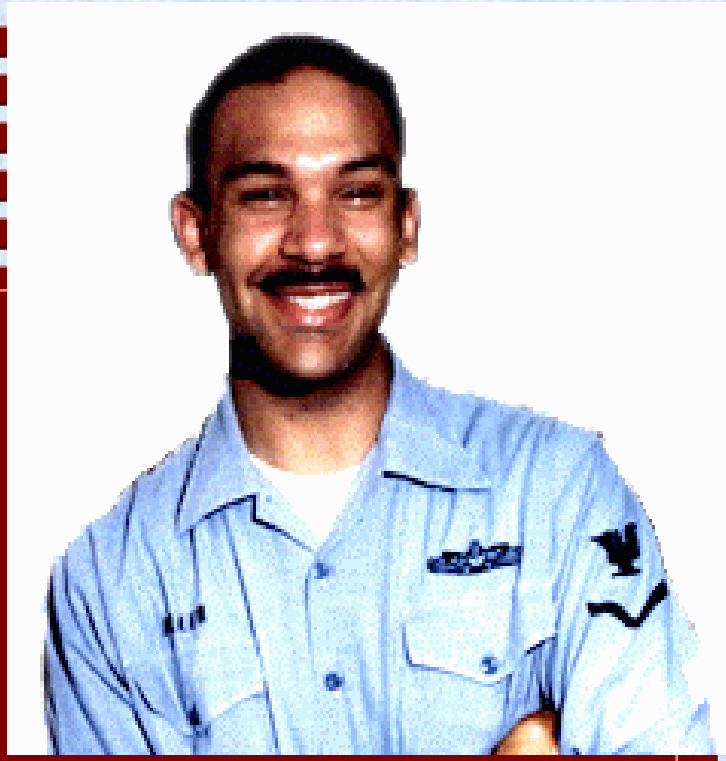
- **Same as the GFE**
- **Must be specified in Designation Letter**

GFEA

Hot Work Inspections, Tests and Certificates

- Same as the GFE
- Must be specified in Designation Letter

GFEPO



- 1 per IET (minimum)
- E-4 or above
- CO’s Designation Letter
- Annual CPR
- Formal School

Hot Work Inspections, Tests and Certificates

- No Spaces With or Near Flammable Boundaries
- No Machinery / Engine Rooms, Catapults, Bilges
- No Pressurized Systems
- No Pipes, Coils, Pumps, Hollow Drums, Bits, Stanchions...

Safety Supervision

GFE

GFEA

GFEPO

- Enforce Proper Procedures
- Ensure Personnel Do Not Work Alone
- Stop Work if Unsafe

ANNUAL AUDIT PROCEDURES

- Ship's **Safety Officer** Shall **Annually** Audit GFE Program (NSTM 074 v3)
- Audit May Follow **Responsibility** Guidelines for GFE (NSTM 074 v3)
- Evaluates the GFE Service Personnel for **Recertification**
- Document **Crew Training** Upon Reporting & Prior to an Availability
- GFE Personnel **Letter of Designation** and **Qualifications** shall be recorded in individual's service record

RECERTIFICATION PROCEDURES

1. Annual Refresher in CPR & Emergency Rescue Procedures
2. Engaged in GFE During the Year, Issued 10 Certificates
   - a.) If Above Has *Not* Been Satisfied, Complete 5 Gas Free Evolutions Under Supervision of a Certified GFE
   - b.) If Above Is *Not* Possible, Complete an Oral/Written Exam and a Practical Exercise

Gas Freeing Operations Involving Navy and Contractor GFE Services.

INSIDE U.S. TERRITORIAL WATERS

- Shipboard GFE Shall ***Not*** Certify Spaces for Contractors ***Except*** when Failure to do so Would Create:
  - ↑ Extreme Emergency for Personnel or Property
  - ↑ Increase Potential Liability
  - ↑ CO's Authorization Required

REMEMBER ---

If Both Navy & Contractor Personnel are Working in a Space at the Same Time

- **Both You and Contractor Must Certify Space**
- **You Must Inform Contractor of Your Findings**
- **Remind Contractor that He Retains Legal Obligation for Safety of Contractor Personnel**

OUTSIDE U.S. territorial waters

- Navy GFE personnel may perform services for U.S. contractor personnel when at sea or inport provided the contractor's competent person is not reasonably available.

OUTSIDE US. territorial waters

- Navy GFE personnel may perform services for NON-U.S. contractor personnel when at sea or inport when the host nation's competent person is not reasonably available.

Gas Free Engineering Terms and Definitions

WHY ARE TERMS AND DEFINITIONS IMPORTANT?

- You, the GFE, must be able to use and understand terms
- Prevents misunderstandings between you, military personnel, and civilian personnel (think liability!)
- Lends credibility to your qualifications and your program

WHY ARE TERMS AND DEFINITIONS IMPORTANT?

WHY ARE TERMS AND DEFINITIONS IMPORTANT?

- LEGALITY
- STANDARDIZATION

CONFINED SPACE

- Limited and restricted accesses
- Lack of natural ventilation
- May contain or produce hazardous contaminants or oxygen deficiencies or enrichment
- Not intended for continuous occupancy

CONFINED SPACE CHARACTERISTICS

- Large enough for worker to enter
- Contains or can contain hazardous atmosphere produced by sludge, chemicals, sewage
- Laid out so anyone who enters may be trapped or asphyxiated

CONFINED SPACES

- Tanks
- Voids
- Interior machinery (boilers, condensers, oil sumps)
- Non-ventilated storerooms
- Ventilation & Exhaust ducts

BOUNDARY SPACE

- The outermost border or limit immediately surrounding a confined space above, below, and on all sides
- Outside walls of a fuel tank

TOXIC RELATED TERMS

- **ATMOSPHERE**
  - Immediate gaseous surroundings of a location or confined space
  - Includes normal air plus any air contaminants and oxygen deficiency/excess

ATMOSPHERIC CONTAMINANT

- Substance or material that is foreign to the normal composition of the atmosphere
- Occurs in the form of:
  - Aerosols - Dust
  - Fumes - Mist
  - Gases - Vapors

PARTICULATE MATTER

- **FUMES**
  - SOLID PARTICLES FORMED BY CONDENSATION OF METALS FROM THE GASEOUS STATE
  - WELDING

PARTICULATE MATTER

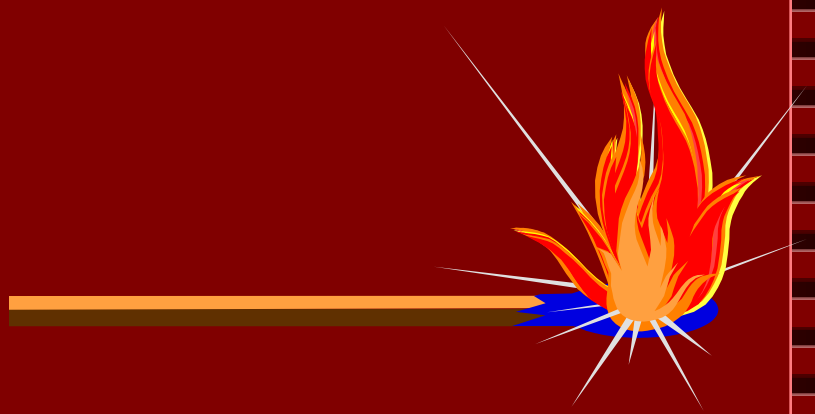
- **GASES**
  - MATTER WHICH DIFFUSES & OCCUPIES SPACE EVENLY
  - NOT SOLID OR LIQUID AT STP
  - (32 DEG. F & 14.7 PSI)
- **VAPORS**
  - GASEOUS FORM OF A SUBSTANCE THAT IS NORMALLY A LIQUID OR SOLID

FLASH POINT

- LOWEST TEMPERATURE AT WHICH A LIQUID GIVES OFF ENOUGH VAPOR TO FORM A FLAMMABLE MIXTURE WITH THE AIR ABOVE THE LIQUID.
- **(WILL NOT SUSTAIN FLAME)**

FIRE POINT

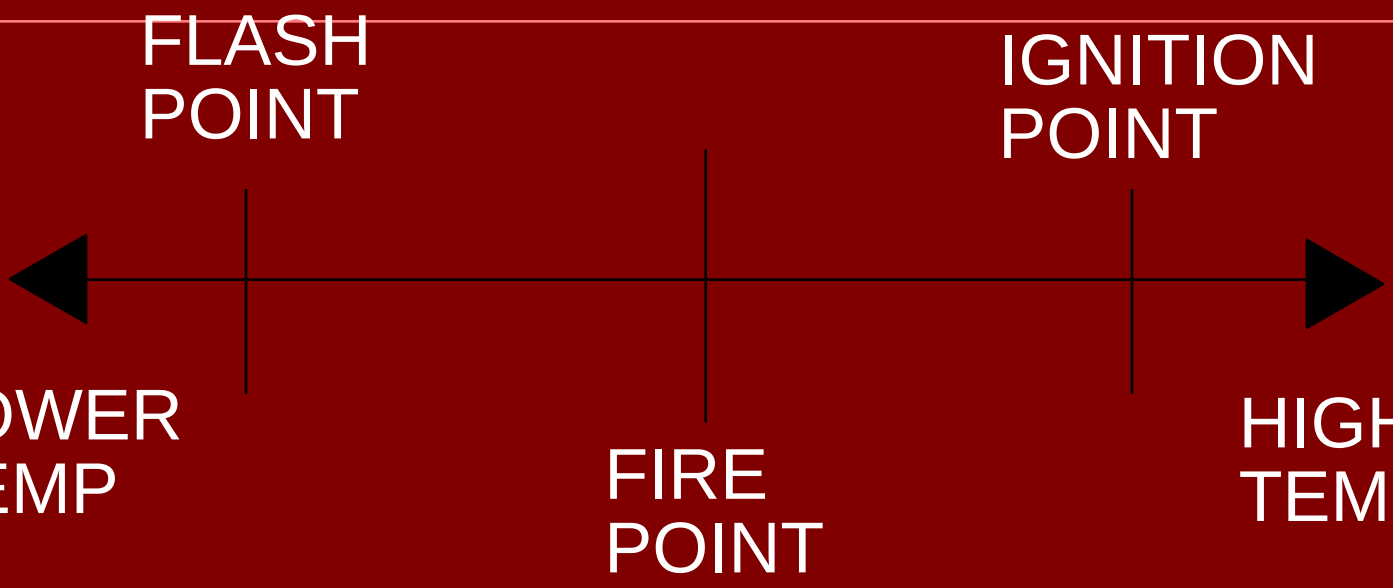
- LOWEST TEMPERATURE AT WHICH SUFFICIENT VAPOR IS GIVEN OFF TO CONTINUE BURNING AFTER IGNITION.



AUTO-IGNITION POINT

- THE LOWEST TEMPERATURE REQUIRED TO INITIATE SELF-SUSTAINED COMBUSTION OF A SUBSTANCE INDEPENDENT OF EXTERNAL IGNITION SOURCES.

PERSPECTIVE



PERSPECTIVE

FLASH POINT

IGNITION POINT

LOWER TEMP

FIRE POIN

HIGHER MP

PERSPECTIVE

FLASH POINT

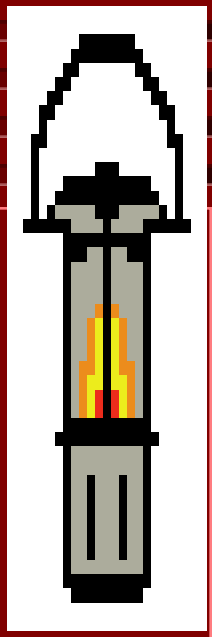
IGNITION POINT

LOWER TEMP

FIRE POIN

HIGHER MP

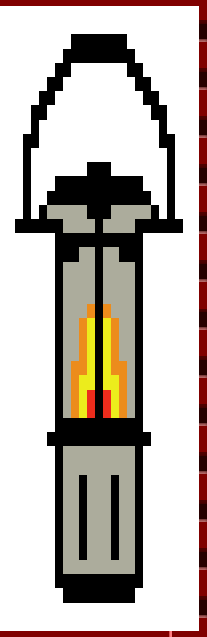
EXPLOSIVE RANGE



- Scale that indicates the explosive nature of gases or vapors
- Relationship of the concentration of the vapor present, its temperature & pressure
- Expressed as percent by volume in air

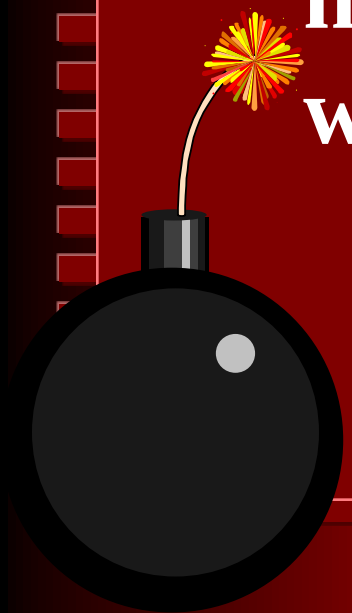
EXPLOSIVE RANGE

- If Explosive Range falls below the Lower Explosive Limit (LEL), the mixture of air and vapor is too *lean* for an explosion
- If Explosive Range is above the maximum explosive range or Upper Explosive Limit (UEL), the mixture of vapor and air is too *rich* to be explosive



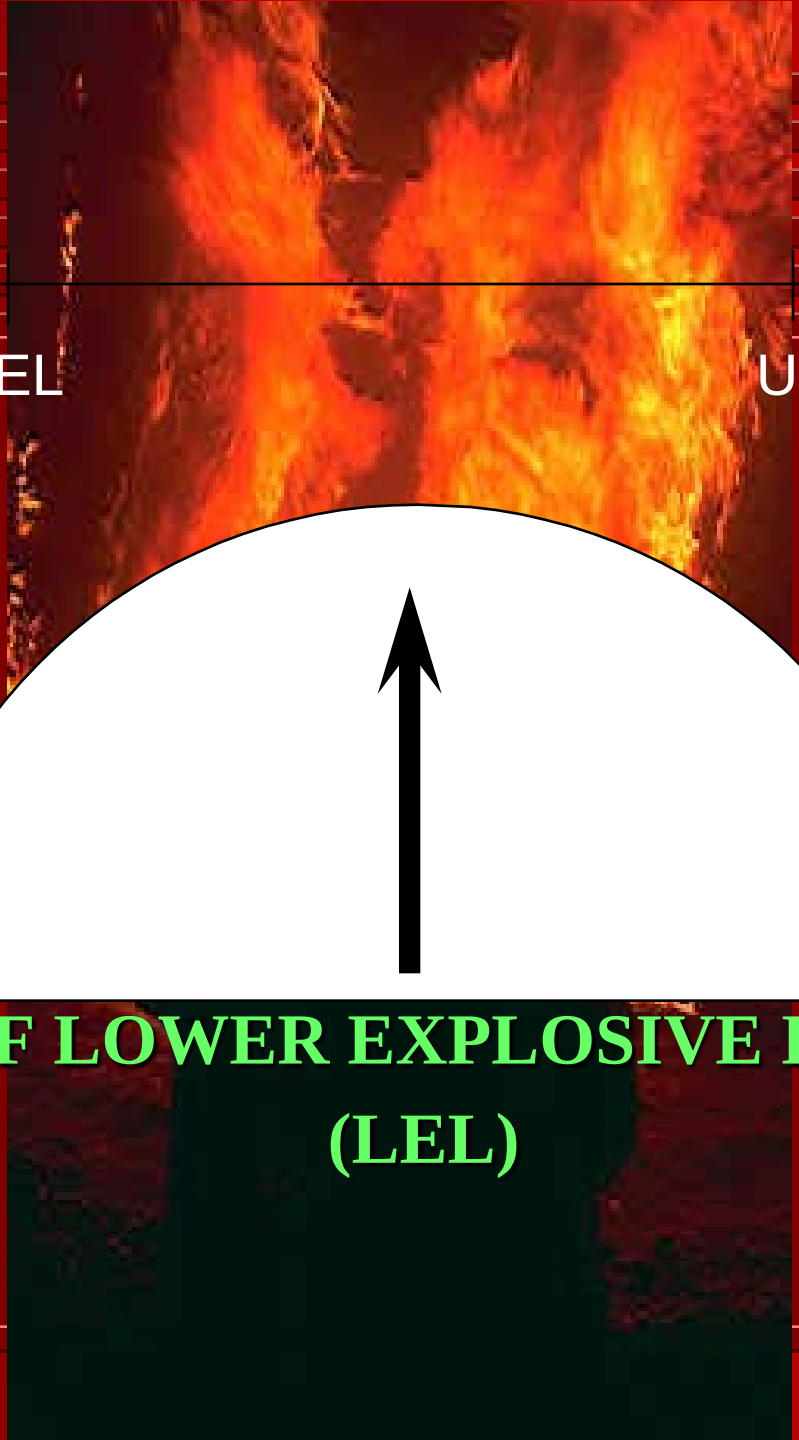
Lower Explosive Limit (LEL)

- Lower end of the explosive range.
  - The minimum percent by volume of a gas that, when mixed with air at normal temperature and pressure, will form a flammable mixture.



Upper Explosive Limit (UEL)

- Upper end of the explosive range.
- Concentrations above this limit are too rich to explode or burn.



LEAN

RICH

0%

LEL

UEL

100%

% OF LOWER EXPLOSIVE LIMIT (LEL)

HOT WORK

- Any operation which produces a flame, spark, or temperatures in excess of 400 deg F.
  - GRINDING
  - WELDING
  - CUTTING
  - DRILLING
  - HOT RIVETING
  - ABRASIVE BLASTING

Explosion proof

- Describes an apparatus, device, or equipment that is tested and approved for use in hazardous atmospheres.

Intrinsically Safe

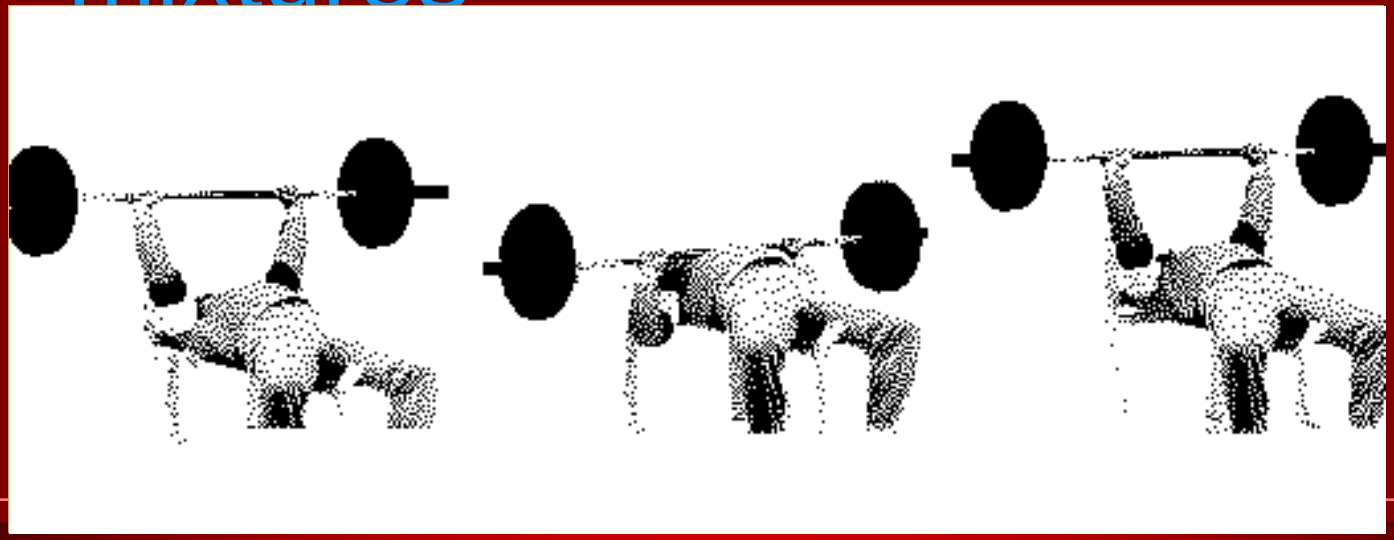
- An item or equipment that by design, does not have, or is not capable of producing sufficient levels of energy to cause ignition.

INERTING

- Process in which an inert or non-flammable gas is introduced into an atmosphere
  - *Carbon Dioxide*
  - *Helium*
  - *Argon*
  - *Nitrogen*
- Prevents flammable vapor/air mixtures from exploding

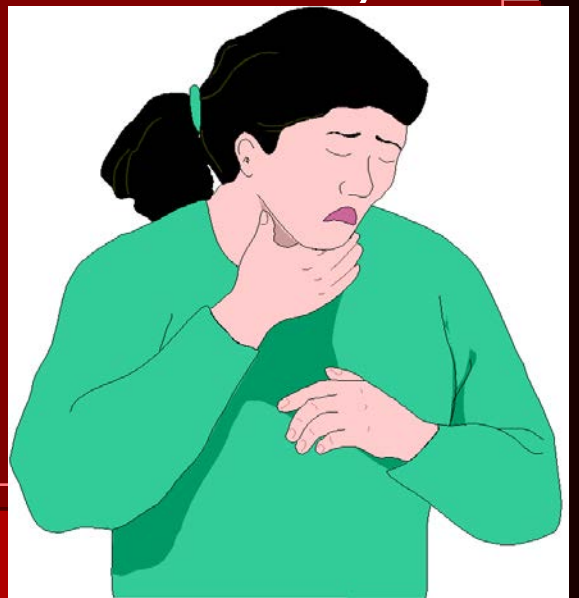
PRESSING UP

- Process of completely filling a space with water to displace flammable vapor/air mixtures



TOXIC SUBSTANCE

- A solid, liquid, or gas that can damage living material, impair the central nervous system, or cause illness or death through inhalation, ingestion, or skin absorption. (poisonous)



PERMISSIBLE EXPOSURE LIMIT (PEL)

- The maximum permissible concentration of a toxic agent to which personnel may be exposed.
- Published by OSHA - ***Force of law***
- Based on a TWA for a normal 8-hour day, 40 hour, 7-day week
- Expressed in parts per million (ppm)
- Single toxicants only
- ***Listed in Appendix G of NSTM 074 Vol 3***

WARNING:

THE FOLLOWING INFORMATION COULD SAVE YOUR LIFE OR SOMEONE ELSE'S

IMMEDIATELY DANGEROUS TO LIFE OR HEALTH (IDLH)

- Any atmosphere that meets one or more of the following conditions
  - Oxygen content < 19.5 or > 22%
  - Flammable vapors at a concentration of 10% or > LEL
  - Presence of toxicants above IDLH limits (Appendix G of 074 Vol. 3)

SPACES ASSUMED TO BE IDLH

- SEWAGE TANKS
- FUEL TANKS
- CHEMICAL HOLDING TANKS

IDLH SPACES

- CO's permission to enter
- Notify CO immediately upon *discovering* an IDLH condition

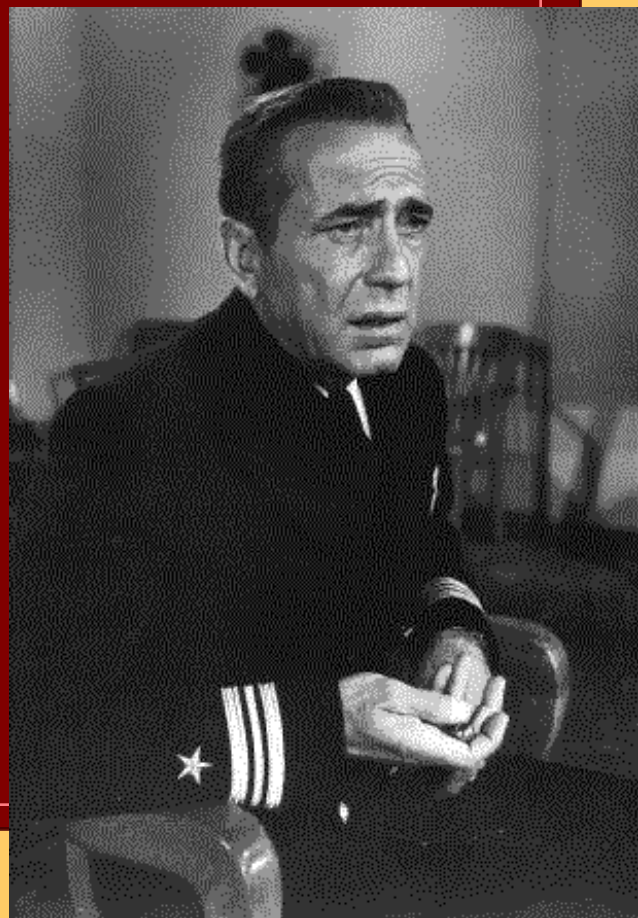
DO NOT ENTER

GAS FREE
PERMIT REQUIRED
CONFINED SPACE

IDLH

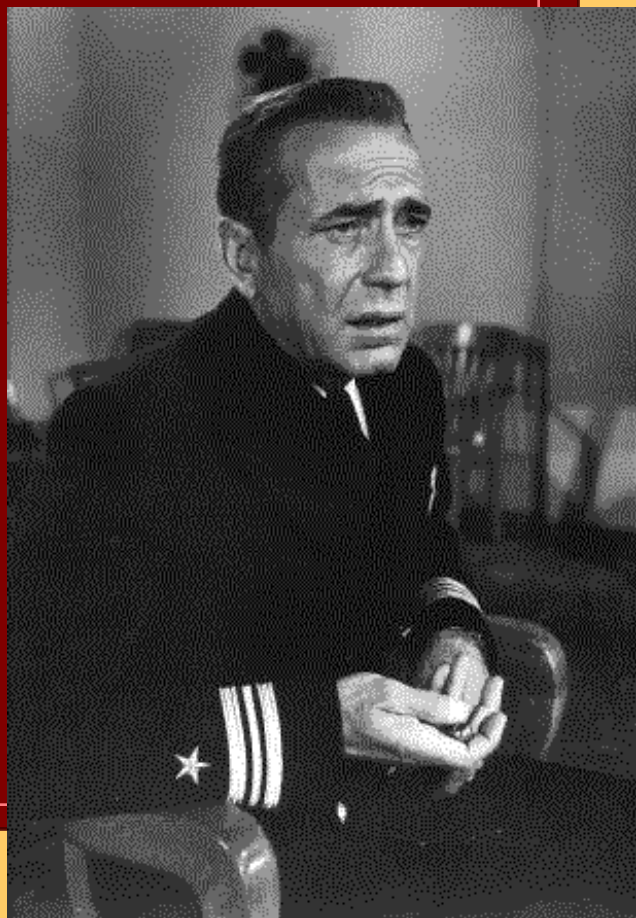
WHEN CAN I GAS FREE AN IDLH SPACE?

- EMERGENCY/OPERATIONAL NECESSITY
- CO'S PERMISSION



IDLH RESTRICTIONS

- EMERGENCY/OPERATIONAL NECESSITY
- CO'S PERMISSION



DIFFUSION

- Process of scattering or mixing of physical states or of gases (when one gas is introduced to another)

Out-gas

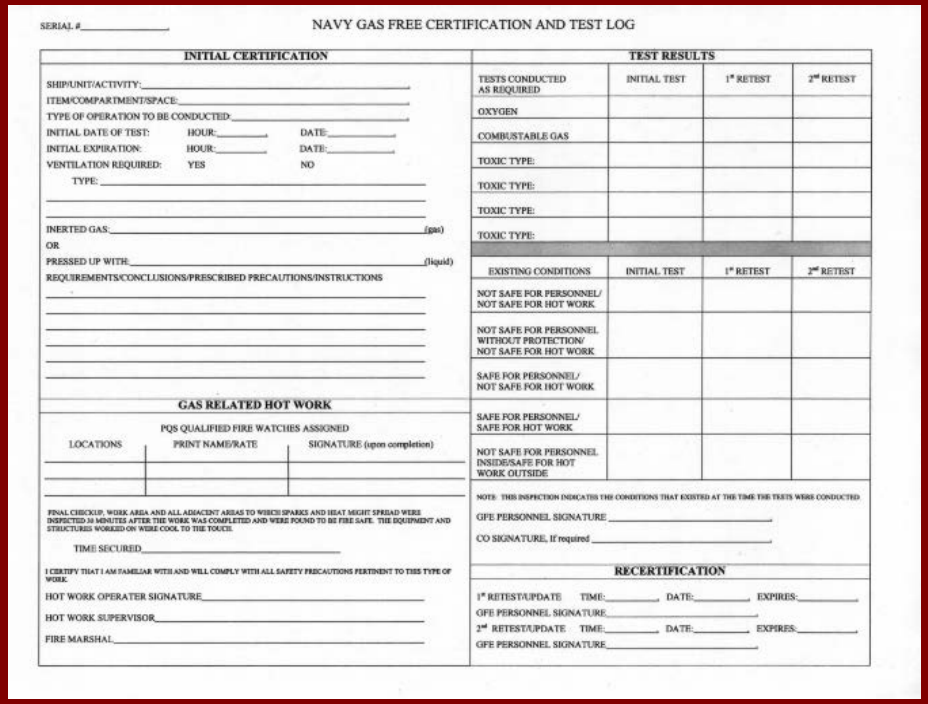
- To remove imbedded gas from a substance by heating.

INITIAL TESTING

- Testing conducted on confined space when space is first opened after a period of closure
  - Tests conducted on fuel tank when tank has been in service and will be taken out of service for repair

Initial Certification

- **The certificate issued by GFE personnel as a result of the initial test.**



SERIAL #_____

NAVY GAS FREE CERTIFICATION AND TEST LOG

INITIAL CERTIFICATION

SHIP/UNIT/ACTIVITY:_____

ITEM/COMPARTMENT/SPACE:_____

TYPE OF OPERATION TO BE CONDUCTED:_____

INITIAL DATE OF TEST: HOUR:_____ DATE:_____

INITIAL EXPIRATION: HOUR:_____ DATE:_____

VENTILATION REQUIRED: YES NO

TYPE:_____

INERTED GAS:_____(gas)

OR

PRESSED UP WITH:_____(liquid)

REQUIREMENTS/CONCLUSIONS/PRESCRIBED PRECAUTIONS/INSTRUCTIONS

GAS RELATED HOT WORK

PQS QUALIFIED FIRE WATCHES ASSIGNED

LOCATIONS	PRINT NAME/RATE	SIGNATURE (upon completion)

FINAL CHECKUP, WORK AREA AND ALL ADJACENT AREAS TO WHICH SPARKS AND HEAT MIGHT SPREAD WERE INSPECTED 30 MINUTES AFTER THE WORK WAS COMPLETED AND WERE FOUND TO BE FIRE SAFE. THE EQUIPMENT AND STRUCTURES WORKED ON WERE COOL TO THE TOUCH.

TIME SECURED_____

I CERTIFY THAT I AM FAMILIAR WITH AND WILL COMPLY WITH ALL SAFETY PRECAUTIONS PERTINENT TO THIS TYPE OF WORK.

HOT WORK OPERATER SIGNATURE_____

HOT WORK SUPERVISOR_____

FIRE MARSHAL_____

TEST RESULTS

TESTS CONDUCTED AS REQUIRED	INITIAL TEST	1st RETEST	2nd RETEST
OXYGEN			
COMBUSTABLE GAS			
TOXIC TYPE:			
TOXIC TYPE:			
TOXIC TYPE:			
TOXIC TYPE:			

EXISTING CONDITIONS	INITIAL TEST	1st RETEST	2nd RETEST
NOT SAFE FOR PERSONNEL/ NOT SAFE FOR HOT WORK			
NOT SAFE FOR PERSONNEL WITHOUT PROTECTION/ NOT SAFE FOR HOT WORK			
SAFE FOR PERSONNEL/ NOT SAFE FOR HOT WORK			
SAFE FOR PERSONNEL/ SAFE FOR HOT WORK			
NOT SAFE FOR PERSONNEL INSIDE/SAFE FOR HOT WORK OUTSIDE			

NOTE: THIS INSPECTION INDICATES THE CONDITIONS THAT EXISTED AT THE TIME THE TESTS WERE CONDUCTED

GFE PERSONNEL SIGNATURE_____

CO SIGNATURE, If required_____

RECERTIFICATION

1st RETEST/UPDATE TIME:_____ DATE:_____ EXPIRES:_____

GFE PERSONNEL SIGNATURE_____

2nd RETEST/UPDATE TIME:_____ DATE:_____ EXPIRES:_____

GFE PERSONNEL SIGNATURE_____

Continuous Testing

- No more than 15 minutes between tests.

Periodic Testing

- Testing at intervals greater than 15 minutes based on the nature of the space.

Retesting and Recertifying

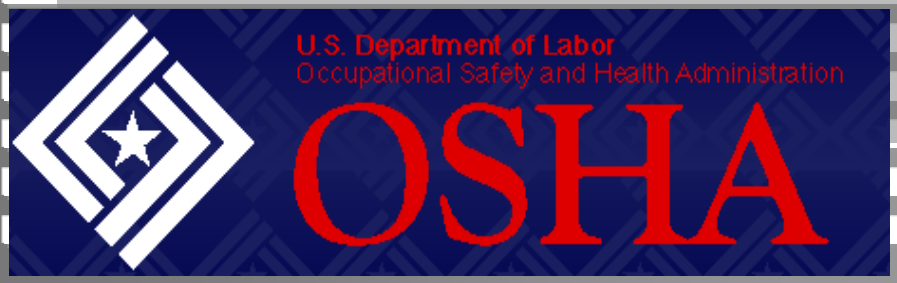
- The process of testing, evaluating, and certifying a confined space by the Gas Free Engineer (GFE).

Hazardous Substances

- A substance likely to cause property damage, serious injury, or death

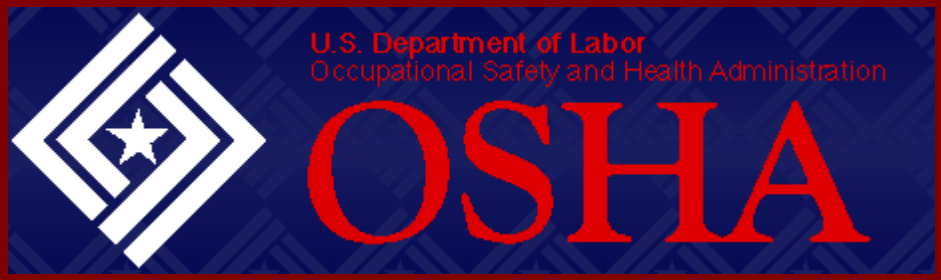
Danger Plate or Decal

GAS FREE ENGINEERING RELATED ORGANIZATIONS



OCCUPATIONAL SAFETY & HEALTH ADMINISTRATION (OSHA)

- US DEPT OF LABOR
- REGULATORY AGENCY WITH ENFORCEMENT AUTHORITY
- WRITES TITLE 29, CFR
- SETS PEL's FOR TOXIC SUBSTANCES



NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY & HEALTH (NIOSH)

- **US Dept of Health & Human Services**
- **US Public Health Services**
- **Centers for Disease Control (CDC)**
- **Non-regulatory agency**
- **No enforcement authority**
- **Tests & approves equipment**
- **Similar to Underwriter's Lab (U/L)**
- ***Recommends toxic exposure limits to OSHA***
- ***Defines IDLH atmospheres***

MINE SAFETY & HEALTH ADMINISTRATION (MSHA)

- US DEPARTMENT OF LABOR
- PERFORMS SIMILAR FUNCTION TO NIOSH
  - RESPIRATORS, PERSONAL PROTECTIVE CLOTHING

AMERICAN CONFERENCE OF GOVERNMENT INDUSTRIAL HYGIENISTS (ACGIH)

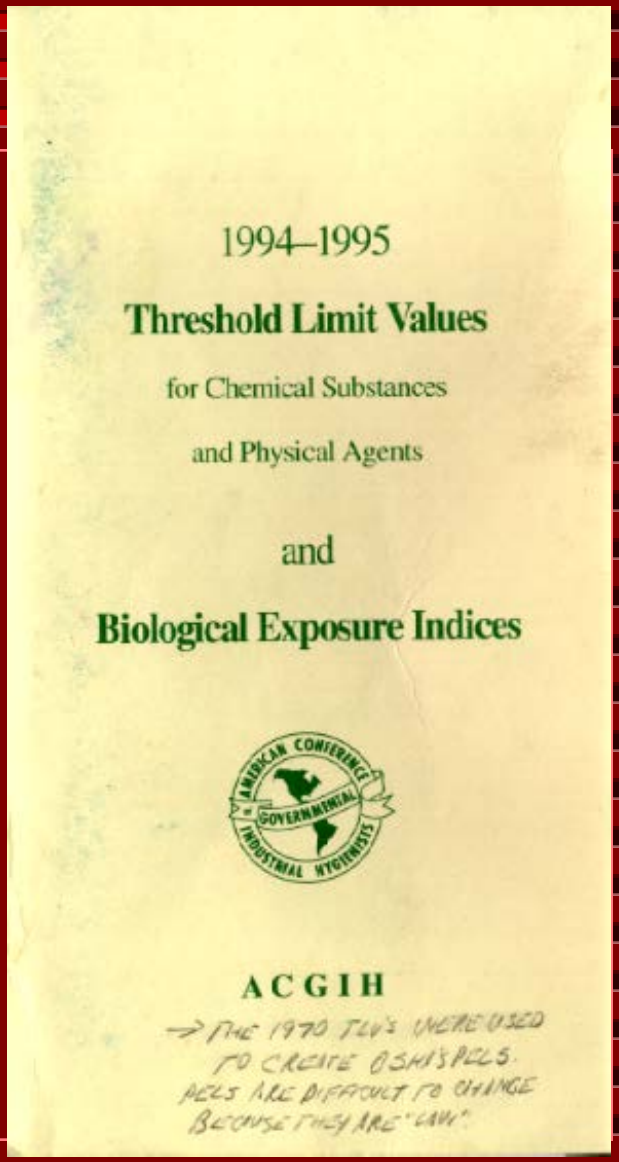
- PROFESSIONAL SOCIETY
  - NOT GOVERNMENT AGENCY
- PUBLISHES INDUSTRIAL VENTILATION STANDARDS
- NON-REGULATORY, NO ENFORCEMENT AUTHORITY

ACGIH® WORLDWIDE

Celebrating 60 years of outstanding service to occupational and environmental health and safety!

ACGIH

- ***PUBLISHES TLV's***
  - **FREQUENTLY ADOPTED BY OSHA AS PEL's**



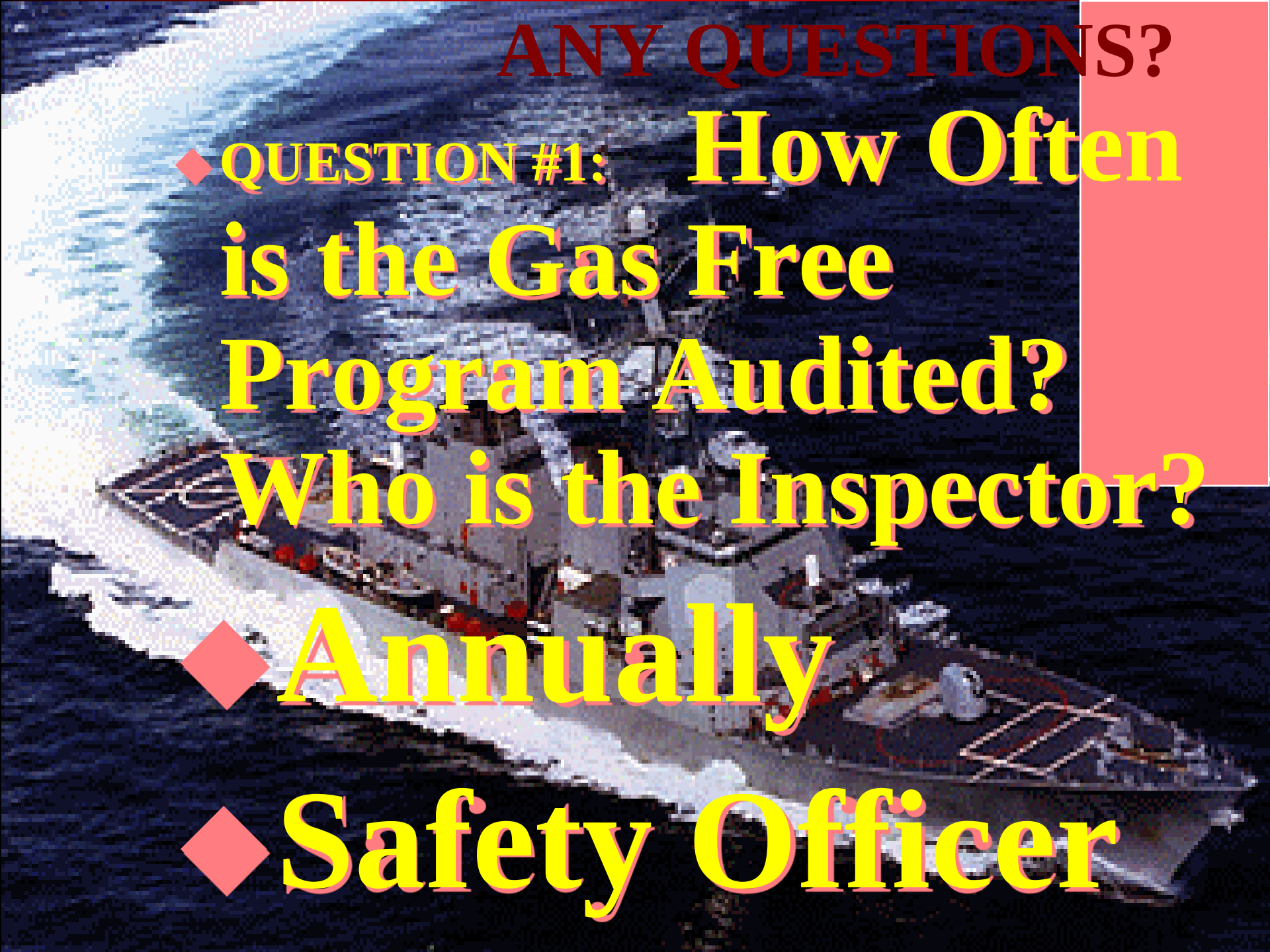
NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

- Professional organization
- ***Certify Marine Chemists***
- Publish a wide variety of fire safety related standards

Review and Summary

- Gas Free Engineer
- Gas Free Engineer Assistant
- Gas Free Engineer Petty Officer
- Gas Free Engineer Program
- Gas Free Engineering Terms and Definitions

ANY QUESTIONS?



ANY QUESTIONS?

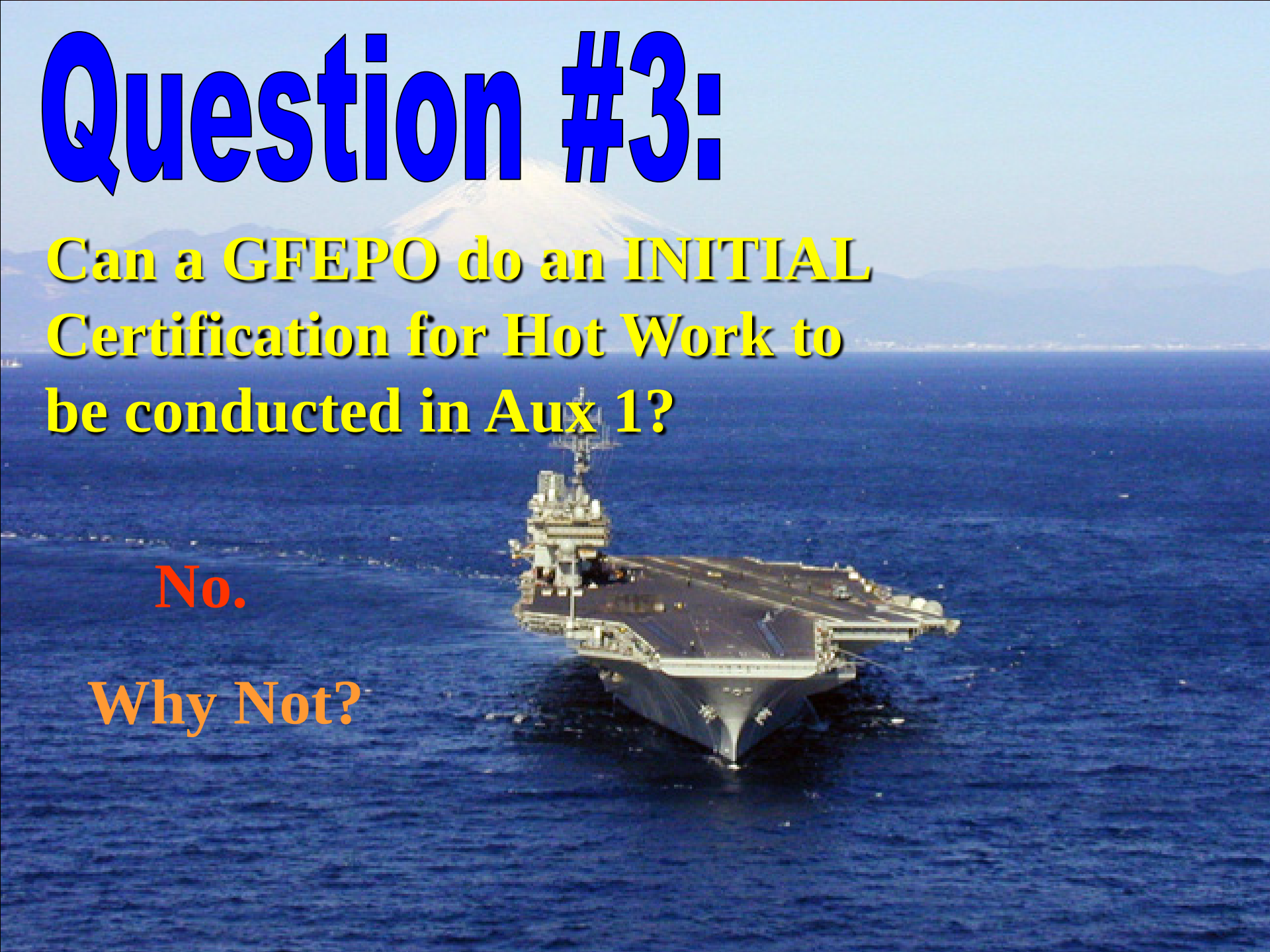
- QUESTION #1: How Often is the Gas Free Program Audited? Who is the Inspector?
  - Annually
  - Safety Officer

QUESTION #2: Describe the Recertification Procedures for all GF Personnel

- Annual CPR Qual
- Annual Emergency Rescue
- Issue 10 Certificates
  - If Not Feasible, Perform 5 GFE Evolutions Under GFE Supervision
  - Or Oral/Written and Practical Exam

Question #3:

Can a GFEPO do an INITIAL Certification for Hot Work to be conducted in Aux 1?



No.

Why Not?

QUESTION #4:

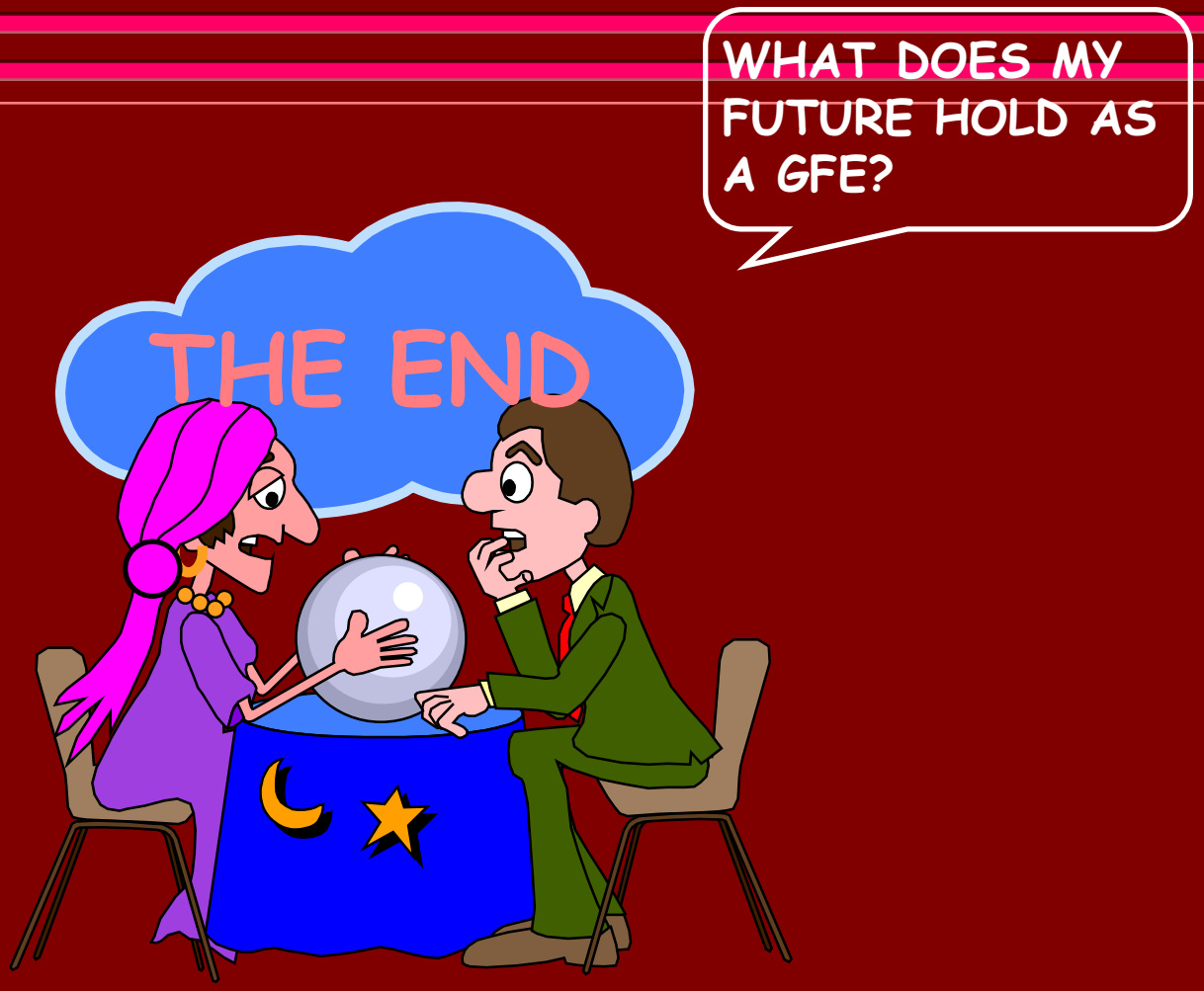
- Why is a complete understanding of GFE terms and definitions necessary?
- Legality
- Standardization

QUESTION #5

- WHAT IS HOT WORK?
- Operations involving open flame, arms, sparks, slag or other ignition sources or that produce heat of 400 deg. F or more.

LAST QUESTION

- When are you allowed to enter an IDLH space?
- Emergency or operational necessity
- After receiving the CO's permission


WHAT DOES MY FUTURE HOLD AS A GFE?
THE END