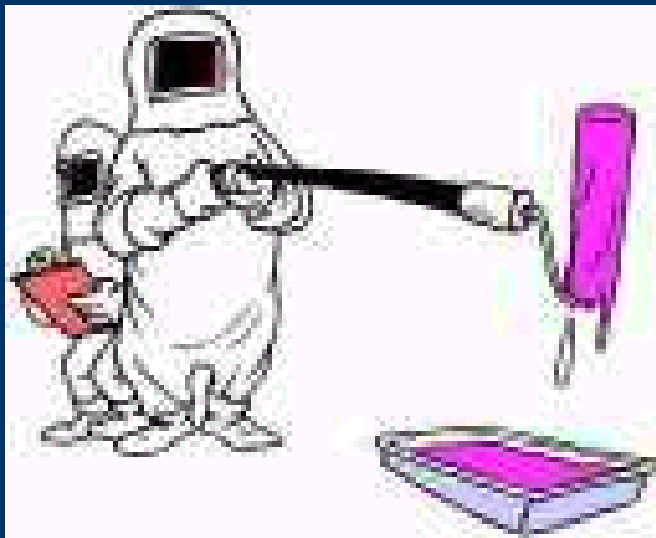


# Lesson Topic 3.3

## GAS FREE PROCEDURES FOR PAINTING OPERATIONS



# INTRODUCTION



⌘ *As Gas Free Engineering Personnel you will be required to know the procedure and safety precautions involved during painting operation in a confined space.*

## ENABLING OBJECTIVES



- ⌘ Describe gas freeing and safety precautions/procedures to be followed before, during, and after painting operations in accordance with NSTM Chapter 074 Vol. 3, Gas Free Engineering, NSTM Chapter 631 Vol. 1, Preservation of Ships in Service - General, NSTM Chapter 631 Vol. 2, Preservation of Ships in Service - Surface Preparation and Painting, and OPNAVINST 5100.19, series.



# PAINTING OPERATIONS

## General safety measures



⌘ Potential hazards that exists in all painting operations make a continuing and enforced safety program essential.

## General safety measures

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⌘ WORKING ENVIROMENT: Shall be studied before painters are sent into any work area.

# Spray Painting

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- ⌘ Performed to preserve and protect the ship's interior spaces
- ⌘ Principal hazard is the paint, its components, and the form in which it is applied

- ⌘ Spray gun produces airborne contaminants
  - ⌘ Vapors, mists, and aerosols
- ⌘ OSHA regulates worker exposure and the PPE standard

# Spray Painting



⌘ More hazardous than brush application due to:

- ☑ Volume of material being applied
- ☑ Flammable residue deposited by spraying which might spontaneously combust
- ☑ Harmful toxic mists created by spraying

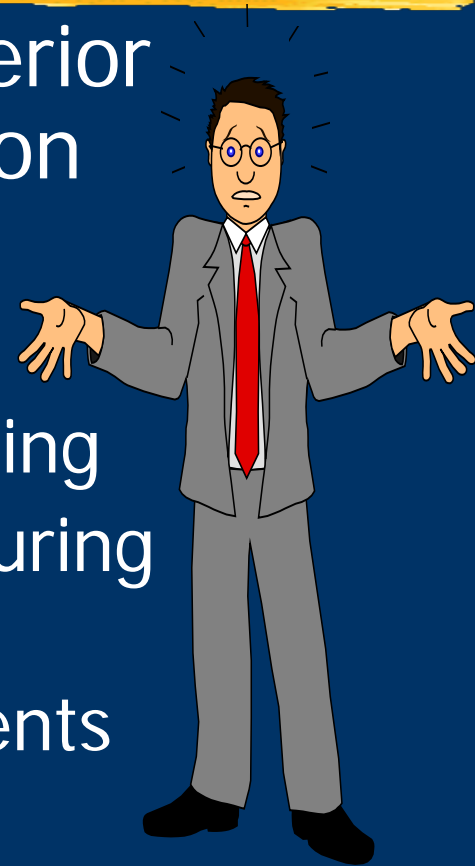


# What does the GFE have to do with Spray Painting?

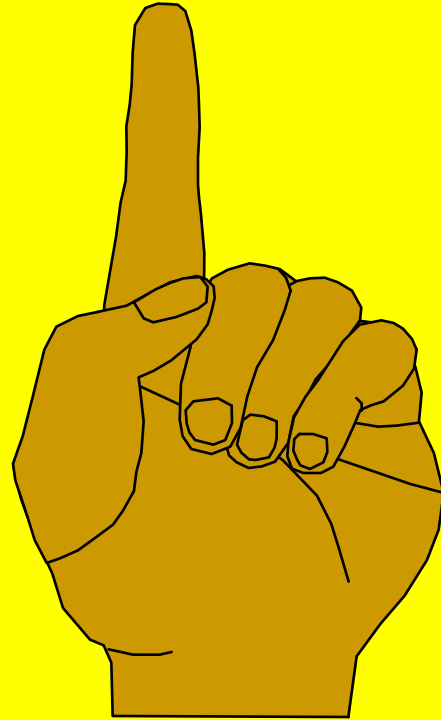
⌘ Ensure you are notified of any interior spray painting *prior* to the operation

⌘ This allows you to:

- ☑ Ensure operating personnel set up ventilation properly and keep it running
- ☑ Ensure space is monitored for CO during and *after* completion
- ☑ Consider LEL/Vapor Volume of solvents involved per 074 Vol. 3 page 21-10



*SAFETY IS YOUR  
NUMBER ONE  
PRIORITY*



# Safe Painting Operations

*Two most important factors:*

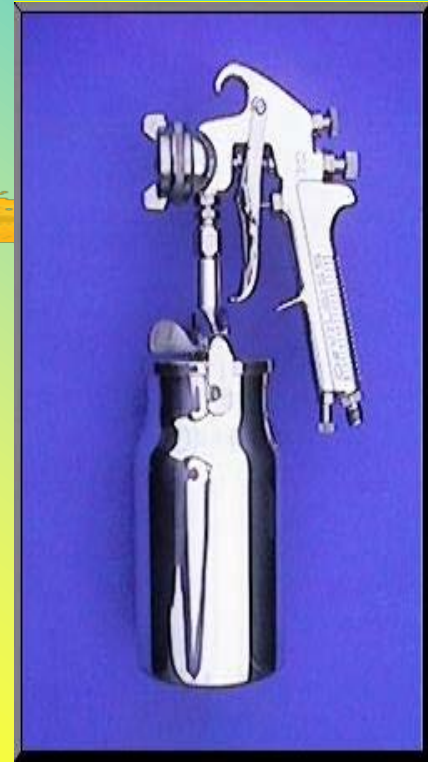
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- ★ Responsibility of Supervisors and Operating Personnel
  - ☒ Obtain Gas Free Engineer's Approval prior to commencing painting
  - ☒ Ensure GFE is advised when ventilation is secured after painting is completed

- ☒ Gas Free Engineer provides technical assistance (ventilation set up, PPE) as needed in addition to gas free testing

- 🕒 Training

*PRIOR TO  
PAINTING*



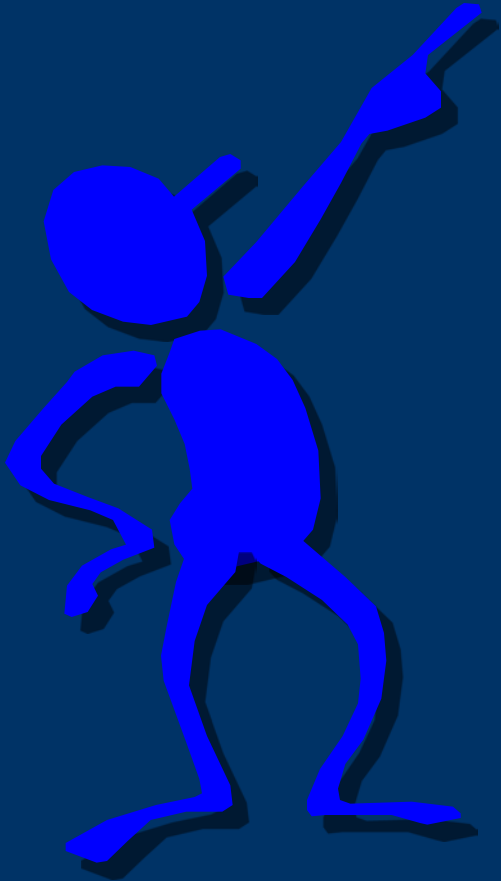


*"For contaminating operations... within a confined or enclosed space, the (GFE) certificate shall specify applicable requirements such as ventilation, PPE, respiratory protection, explosion proof and sparkproof equipment and suitable fire protection equipment."*

*NSTM 074 VOL 3*

# Basic Safety Guidelines

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◆ Always protect your crew against the three major hazards:

↪ *Mishaps*

✦ *Fire*

✦ *Toxicity*

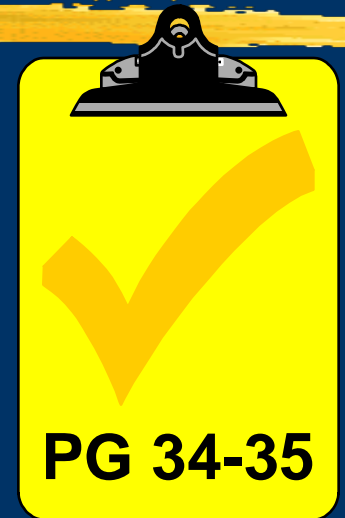
## General safety measures

⌘ Hazards to be considered, include:

- ☑ Poor Ventilation
- ☑ Noxious Fumes
- ☑ High Temperatures
- ☑ Type of material and how applied
- ☑ Type of space

# Basic Safety Guidelines

- Ensure the work supervisor uses a safety checklist
- An example is provided in NSTM 631 Vol. 1 *"Preservation of Ships in Service"*





# General safety measures



⌘ BUDDY SYSTEM

⌘ COMMUNICATION

⌘ SAFETY OBSERVER

⌘ WORK ENVIRONMENT

⌘ VENTILATION REQUIREMENTS

⌘ PPE REQUIREMENTS

# Buddy System - Communications - Supervision

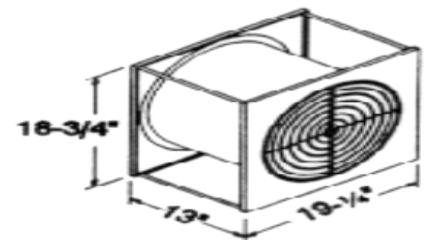
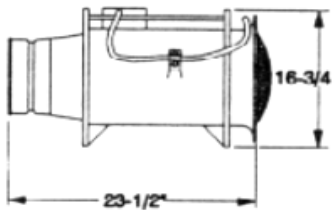
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- ⌘ Personnel shall never work alone in hazardous areas
- ⌘ Communications should be maintained
- ⌘ Operation should be supervised
- ⌘ Ensure you state on the Gas Free Certificate:

*"Observe Two Man Rule"*

# VENTILATION Requirements

- ⌘ Required to control the toxic and flammability hazard
- ⌘ Use *dilution*-type ventilation to protect adjacent areas
  - ⌘ Ensures vapor concentrations remain below 10% of the LEL
- ⌘ Run ventilation continuously
- ⌘ Continue ventilation for at least one hour after painting is completed



## Ventilation requirements / procedures



⌘ Outside air shall be provided at a minimum rate of 1 air change every 3 minutes, but not less than that required to provide a safe, life - supporting atmosphere.

## Ventilation requirements / procedures

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- ⌘ Use outside (fresh) air for supply, and exhaust directly to outside air.
- ⌘ Carefully consider the number, placement and capacity of blowers, number and size of flexible ducts, size and shape of space.

## Ventilation requirements / procedures

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- ⌘ Point of exhaust shall be as far as practical from point of supply.
- ⌘ Place ducts in areas where vapors may collect.

# Ventilation requirements / procedures

⌘ Selection of supply or exhaust ventilation shall be based on:

- ☑ Internal configuration of the space
- ☑ Location of openings
- ☑ Blower availability
- ☑ Staging distribution and other considerations

# Ventilation requirements / procedures

## ⌘ Safety Precautions

- ☑ Rope off and post DANGER AREA signs
- ☑ Prohibit smoking, hot work, and open flame in the area.
- ☑ All electrical leads shall be sealed.
- ☑ All equipment requiring grounding shall be grounded.
- ☑ Fire extinguishing equipment shall be in the ready condition.



# Protective Equipment



⌘ Respirators: All devices shall be approved by NIOSH and Mining Safety and Health Administration (MSHA).

# Protective Equipment



☒ SUPPLIED AIR RESPIRATORS: Used in closed areas where ventilation cannot be supplied.

# Protective Equipment



## ⌘ Respiratory care

- ☑ Equipment shall be cleaned immediately after use.

# Protective Equipment

## ⌘ Eye Protection

- ☑ Must be worn in areas where there is a possibility of particles, mists or vapors entering eyes

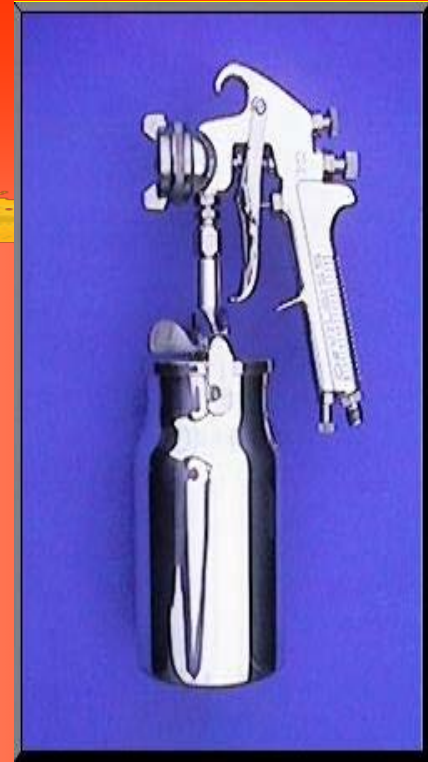
**NOTE**: Emergency eyewash stations shall be available at the site or portable eyewash stations available if fixtures are not installed.

# Protective Equipment



⌘ Personnel shall wear adequate clean clothing and gloves to prevent skin contact with painting and cleaning materials.

*GAS FREE  
ENGINEER  
INSPECTION*



# APPLICATION OF PAINT IN A CONFINED SPACE

⌘ Conduct periodic gas free tests

→ GFE conducts the initial test

→ GFEA/GFEPO conduct retesting

⌘ Conduct testing during work breaks

→ Exhaust side of portable ventilation

→ Air intakes



# CHECK FOR OR STATE THE FOLLOWING:

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- ⌘ Type of ventilation to be used
- ⌘ How you want ventilation set up
  - ⌘ Spell this out on your Gas Free Chit
- ⌘ Ensure all DC numbers and plates are covered or numbers & location are recorded

- ⌘ Type of respiratory protection
  - ⌘ Spell this out on your Gas Free Chit
- ⌘ Type of PPE to use
  - ⌘ Spell this out on your Gas Free Chit



# Gas Free Testing Requirements

## ⌘ Oxygen test

☑ 19.5 - 22 percent

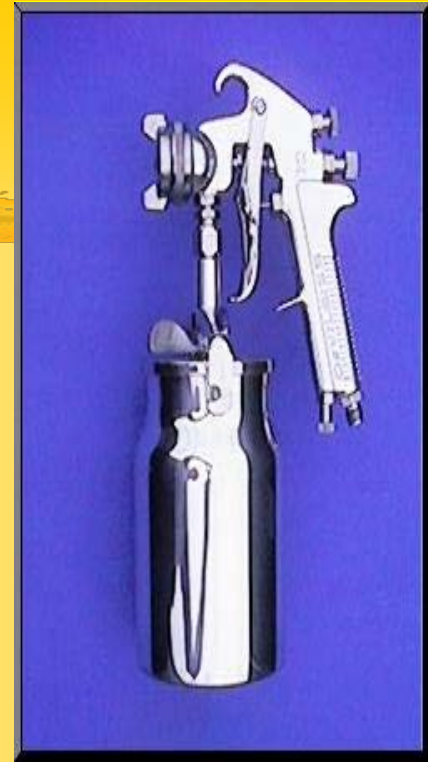
## ⌘ Explosive test

☑ Remain below 10 percent of the LEL

## ⌘ Toxic tests

☑ Remain below their PELs

***DURING PAINT  
OPERATIONS***



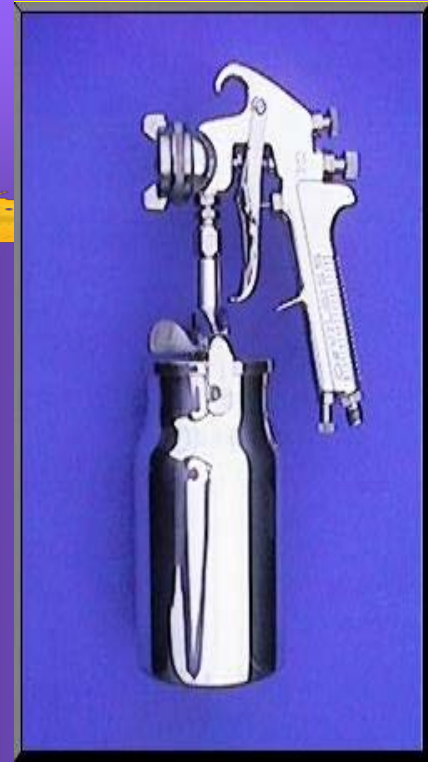
# DURING PAINT OPERATIONS



- ◆ Never test levels at the nozzle of spray gun
  - ◆ Receive inaccurate readings
  - ◆ Ruin GFE equipment
- ◆ Only one day's paint can be in a space at any one time

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# *POST PAINTING CONCERNS*



# POST PAINTING CONCERNS

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- ⌘ Ventilation should run for 1 hour after job completion
- ⌘ Ensure DC labels & plates are restored correctly!!!
- ⌘ Clean respirators & dispose of hazardous material properly
- ⌘ *10 minutes after ventilation shutdown, ensure space is gas free*

# Requirement from OPNAVINST 5100.19C (C18)

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“Wear supplied air respirators when engaged in spray painting operations internal to the ship or in confined external areas...”

(Realize that 631 and 5100.19C differ on this issue. NSTM 631 only requires supplied air for Vinyl and Epoxy paints.

***Always err on the side of SAFETY!!***



**“VENI, VIDI,  
VENTILATE!!!”**

Loosely translated means

**“Ventilate, Ventilate,  
Ventilate!!!”**



# REVIEW AND SUMMARY



# REVIEW AND SUMMARY



⌘ Painting Operations



**THE END**

# GAS FREE MISHAPS

"DEATH IN A COFFERDAM"



# BACKGROUND



- ⌘ East Coast Amphib has leak in a MOGAS tank and contracts job to civilians to clean, inspect and fix tank
- ⌘ MOGAS tank located underneath the well deck
- ⌘ XO puts out at O-Call that no contractors will be working in tanks/voids that day
- ⌘ CDO present at O-Call

# BACKGROUND



- ⌘ Contractor comes on board and informs CO that he will be “going in and out of the” MOGAS tank all day
- ⌘ OOD, CDO never notified
- ⌘ CDO unfamiliar with Gas Free Engineering - didn't even know what IDLH stood for

# TIMELINE



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0805

“C” fire

- “C” fire in 1 of 4 shore power cables
- Base Fire Dept. called to secure cable
- Ship remains on shore power

# TIMELINE



0805

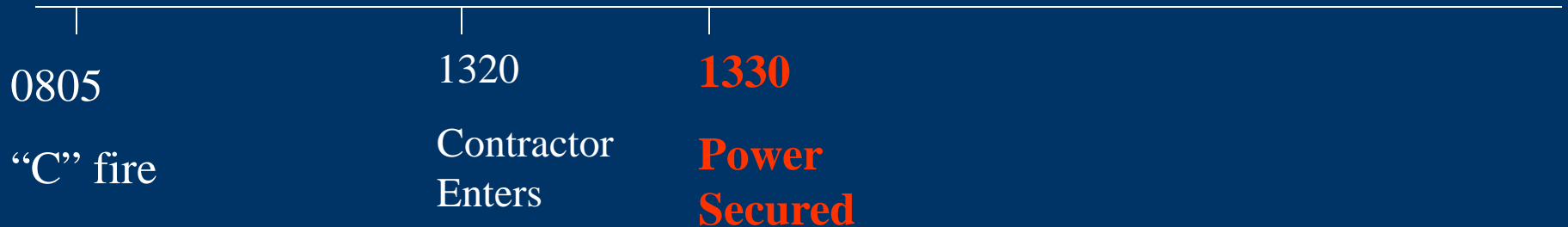
“C” fire

1320

**Contractor  
Enters**

- 1315 Contractor dons an electrically powered SAR with no back-up air supply to search for leak
- Space not gas freed
- 1320 Contractor enters the cofferdam

# TIMELINE



0805	1320	<b>1330</b>
“C” fire	Contractor Enters	<b>Power Secured</b>

- 1330 Ship goes from Shore to Ship's Power while Public Works changes out bad cable
- Word is passed over 1MC
- Power interruption stops the Contractor's SAR



# TIMELINE

Shore Power  
Restored

1335



- 1335 New cable in place and Shore Power restored
- Power surge shuts down several breakers, to include the one that powers the Contractor's SAR

# TIMELINE

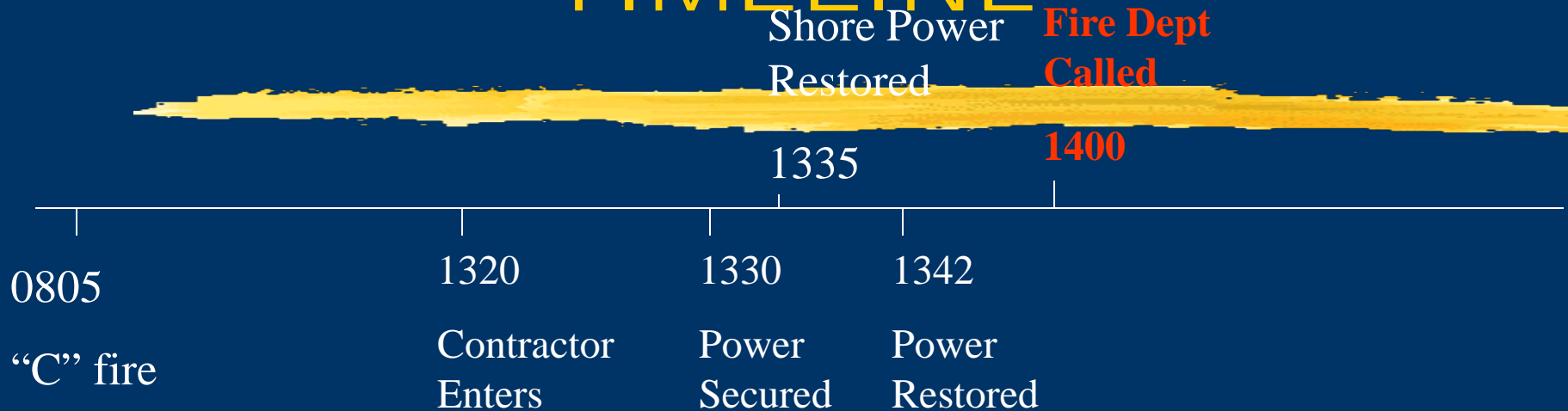
Shore Power  
Restored

1335



- 1342 Power restored to compressor but by this time Contractor was without air for 7 minutes
- R & A called away
- Drop test conducted at entrance and space is determined to be in the UEL

# TIMELINE



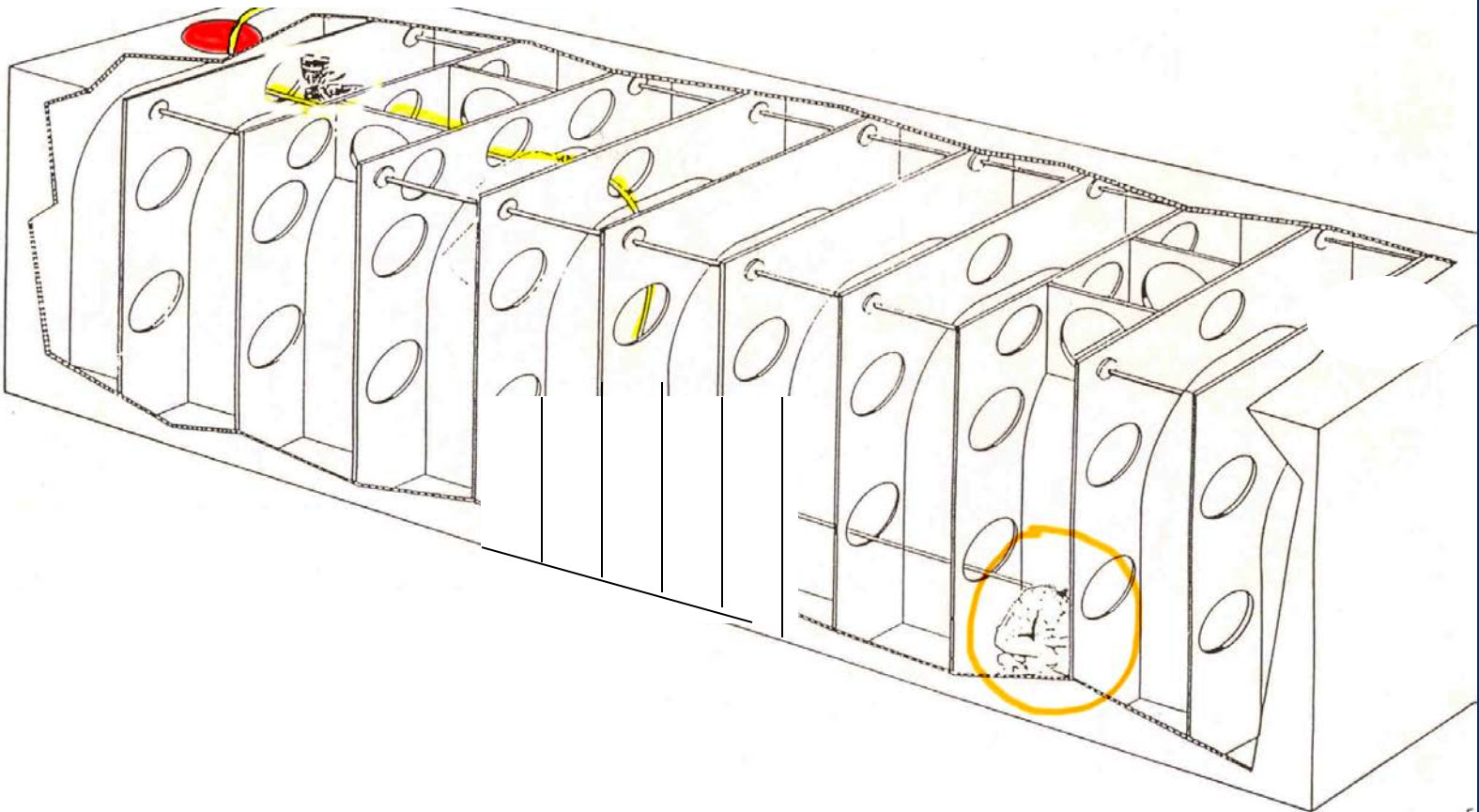
- 1355 Ship calls Base Medical to report "unknown illness"
- 1400 Ship calls Base Fire Dept. and reports "Man down at quay wall"

⌘ Firefighters arrive on scene and determine that it is a Rescue vice Recovery

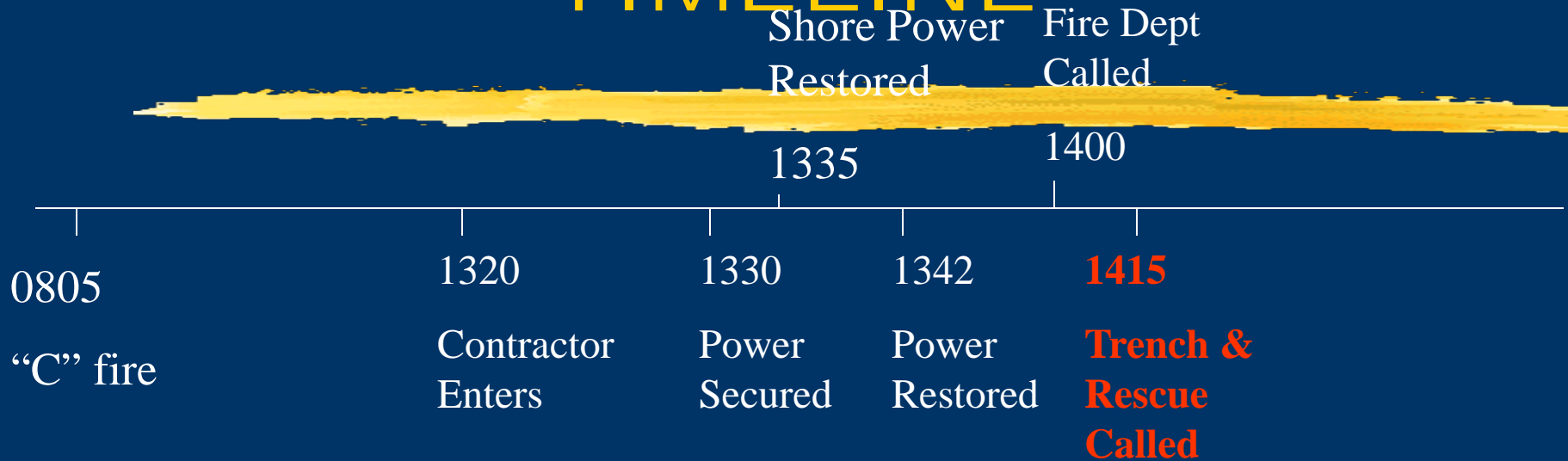
⌘ Fire Chief and Firefighter enter space with SCOTT SCBA and no back-up air supply

⌘ Holes in swash plates 15 in x 22 in





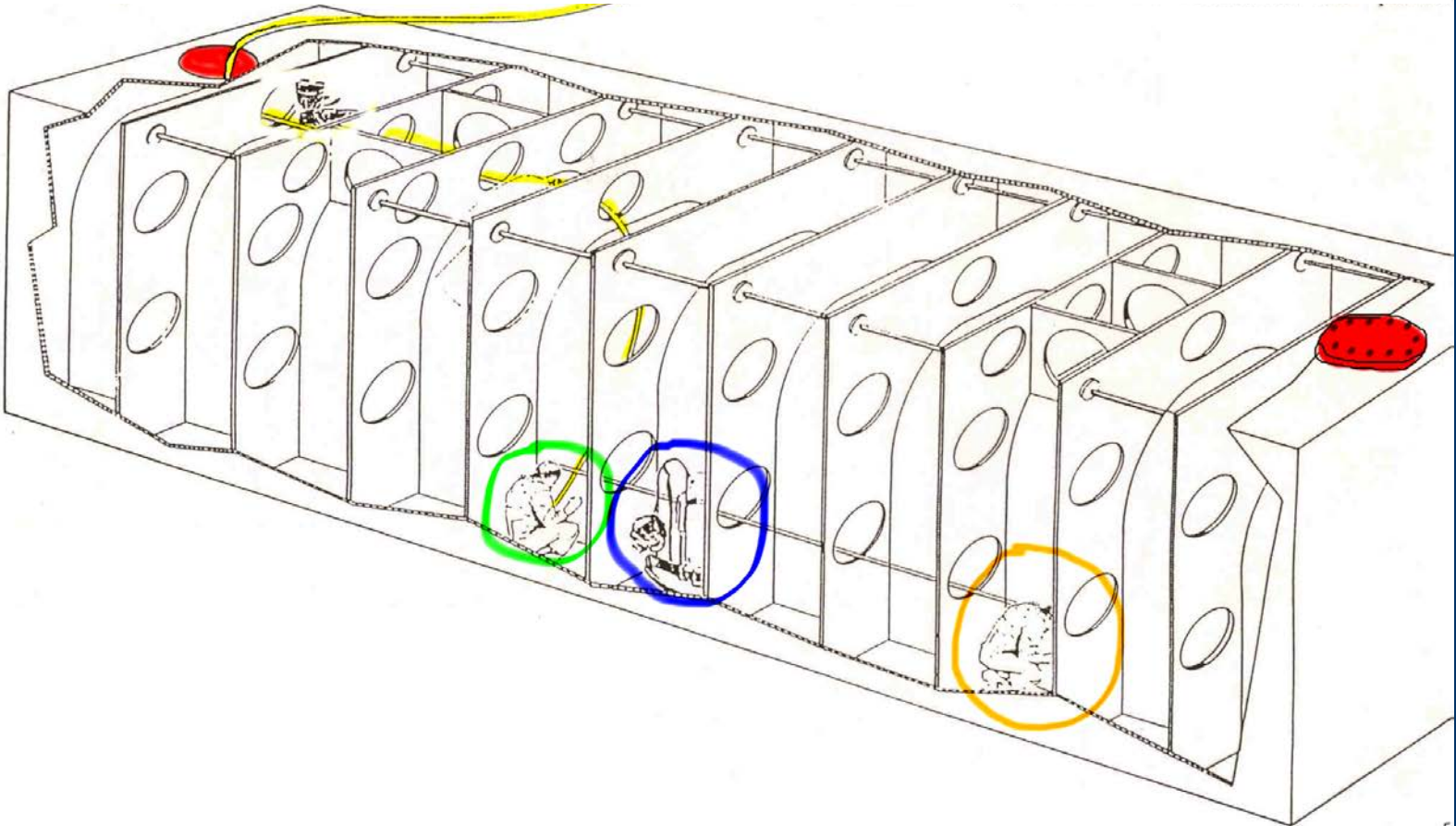
# TIMELINE



- 1415 Asst. Fire Chief calls Trench and Rescue Team to be brought in


- ⌘ Trench and Rescue Team arrives and asks to see ship's drawings for another possible entrance
- ⌘ Positive Pressure ventilation and atmospheric monitoring ordered







# TIMELINE



		Shore Power Restored	1335		Fire Dept Called	1400	
0805	1320	1330	1342	1415			
“C” fire	Contractor Enters	Power Secured	Power Restored	Trench & Rescue Called			<b>1517</b> <b>2 Man Team Enters for Recovery</b>

- 1517 Two man Rescue Team enters cofferdam for recovery

- Max 25 minute stay time due to atmosphere

⌘ Took 7 teams of two to three personnel more than 4 hours to recover the bodies of the Contractor and the Fire Chief



# Final Analysis

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- ⌘ Contracting company charged with 30 violations of 29 CFR, to include not providing a Marine Chemist to perform a Gas Free test and inadequate respiratory protection
- ⌘ CO, CDO, Air Officer, Fuels Officer and DCA all went to Admiral's Mast

# Final Analysis Cont.

The CO was charged with overall responsibility for the safety and health of all people on his ship and 2 people died. The CO went on to 2 other major commands.

The CDO was charged with a violation of the SORM “The CDO shall keep himself informed of all events onboard the ship.” Charges eventually were dismissed.

The DCA was charged for numerous violations of NSTM 074.

The Air Officer and Fuels Officer were charged with failure to clean the MOGAS tank and cofferdam **IAW NSTM's**