

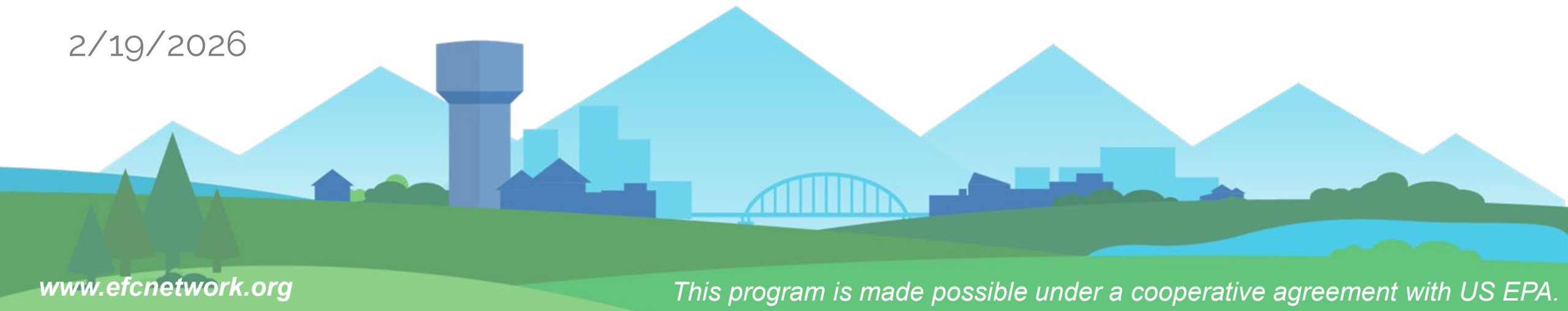


SOUTHWEST
ENVIRONMENTAL
FINANCE CENTER

US Territories Water Operator Training Series

Session 16: Safety Program Basics

2/19/2026



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Water Utility Trainer and Specialist

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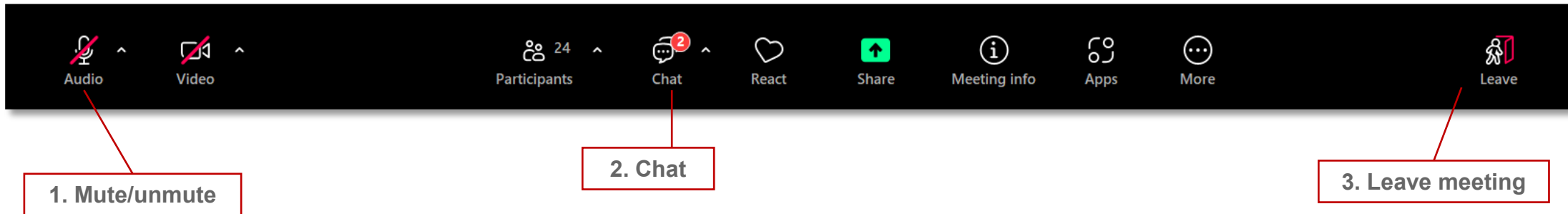


SCHOOL OF
ENGINEERING



This training series is funded by the US EPA

Attendee Meeting Controls



1. Mute/unmute

- Click the microphone icon to unmute yourself to speak (if you are not speaking, don't unmute)

2. Chat

- Click the chat icon and then use the dropdown next to send text instant messages to:
 - Everyone publicly: messages will be visible to all participants
 - Host only: messages will be sent only to the meeting host – Don't send a chat to only me; I won't have time to see it while presenting.
 - Any attendee directly: message will be sent to the selected meeting participant only

3. Leave meeting

- Click on the leave icon to exit the ZOOM Meeting

Schedule for 2026:

Date	Topic
1/22/2026	Alternative Treatment Processes
2/5/2026	Drinking Water Treatment Math & Concept Review
2/19/2026	Safety Program Basics
3/5/2026	Lead & Copper Rule and Corrosion Control
3/19/2026	Distribution Systems 1: Hydraulics, Pipe Types, Selection, Installation, and Water Quality
4/2/2026	Distribution Systems 2: Valves, Hydrants, Meters, and Service Connections
4/16/2026	Distribution Systems 3: Storage and Booster Pumping
4/30/2026	O&M: Pumps, Main, and Appurtenance Maintenance
5/14/2026	O&M: Cross Connection Control
5/28/2026	O&M: Distribution System Math and Concept Review
6/11/2026	Sampling & Lab Procedures/Analysis/Interpretation
6/25/2026	Management Overview
7/9/2026	Drinking Water Practice Exam and Review

Pacific Island Territories Operator Certification Trainings

This page is a repository of Wastewater and Drinking Water Operator Certification (Op Cert) Training Webinars offered by the SW EFC for systems in the Pacific Territories. Below you will find the **training webinar schedules (wastewater, then drinking water)** followed by a **training webinar recordings library**.

[Jump to Wastewater Trainings](#) [↓](#)[Jump to Drinking Water Trainings](#) [↓](#)

Wastewater Training Schedule

Please note all times are local to CNMI and Guam. The times in American Samoa are one day earlier at 11 am.

Session	Date	Training Topic & Link to Recording (click to view)	Supporting Materials (click to download)
1	6/25/2025	Program Overview, Test Format, Study & Test Tips	PPT slides
2	7/9/2025	Treatment Overview	PPT slides
3	7/23/2025	WW Math Part 1 (Areas & Volumes)	PPT slides
4	8/6/2025	WW Math Part 2 (Flow Rates & Detention Times)	PPT slides
5	8/20/2025	Collection Systems – Gravity systems	PPT Slides

Sign in for every session to ensure you get credit for attending



**US Territories Water & Wastewater Operator Certification
Virtual Training Series Group Attendance Sheet**

Session Title: _____

Session Date: _____

Training Location: _____

Attendee Name	Attendee Signature	Arrival Time	Departure Time

I hereby certify that the individuals listed above attended the referenced training session.

Name: _____
Signature: _____
Title: _____
Date: _____

Please scan this sheet after each training session and email it to swefc@unm.edu with the subject line: "US Territories Op Cert Attendance Sheet"



Water Safety Overview

Safety is your responsibility. Be safe
and make sure others are as well.

Don't be the headline



Three Construction Supervisors Die from Asphyxiation in Manhole

[Print](#)

FACE 8836

INTRODUCTION

The National Institute for Occupational Safety and Health (NIOSH), Division of Safety Research (DSR), performs Fatal Accident Circumstances and Epidemiology (FACE) investigations when a participating state reports an occupational fatality and

Safety Hazards



Safety Hazards



Chemical Hazards

- Toxic chemicals
- Acids
- Bases



Physical Hazards

- Machinery
- Lifting/slipping
- Fire
- Explosions
- Falls
- Noise



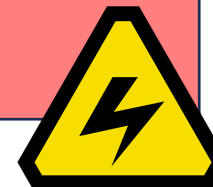
Biological Hazards

- Pathogens
- Infectious disease
- Infections



Other Hazards

- UV exposure
- Electrical shock
- ???



Environmental Hazards

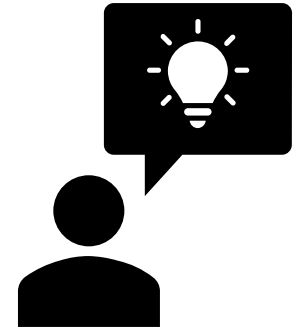
- Heights
- Confined spaces
- Drowning
- Engulfment/entrapment
- Animals
- Traffic
- Weather



Safety Roles

- Management's responsibility is to provide each employee with a safe place of employment
- The operator has primary responsibility for their own safety

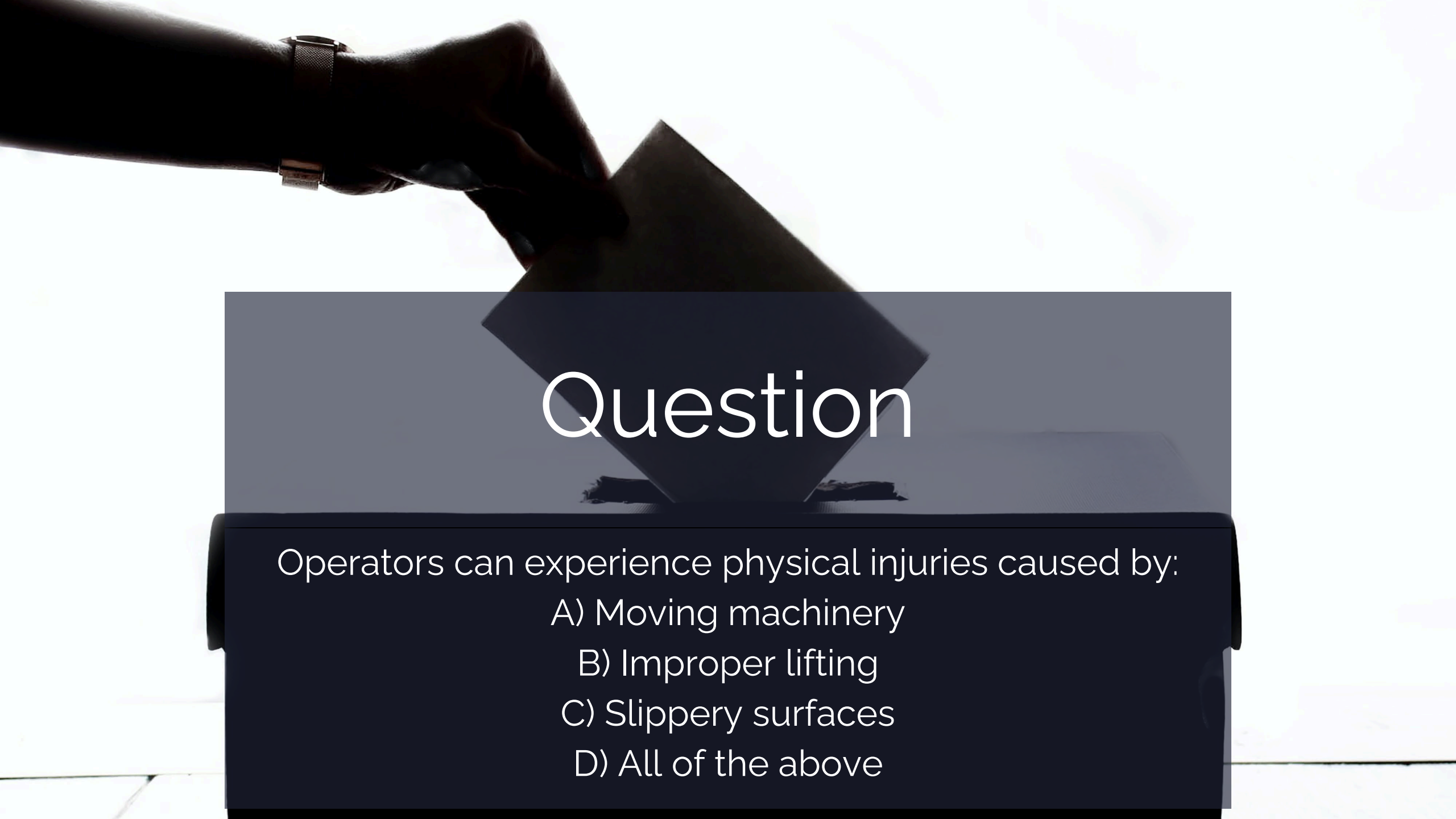
Most utility injuries
are caused by the
injured employee





Working safely
is a condition
of employment

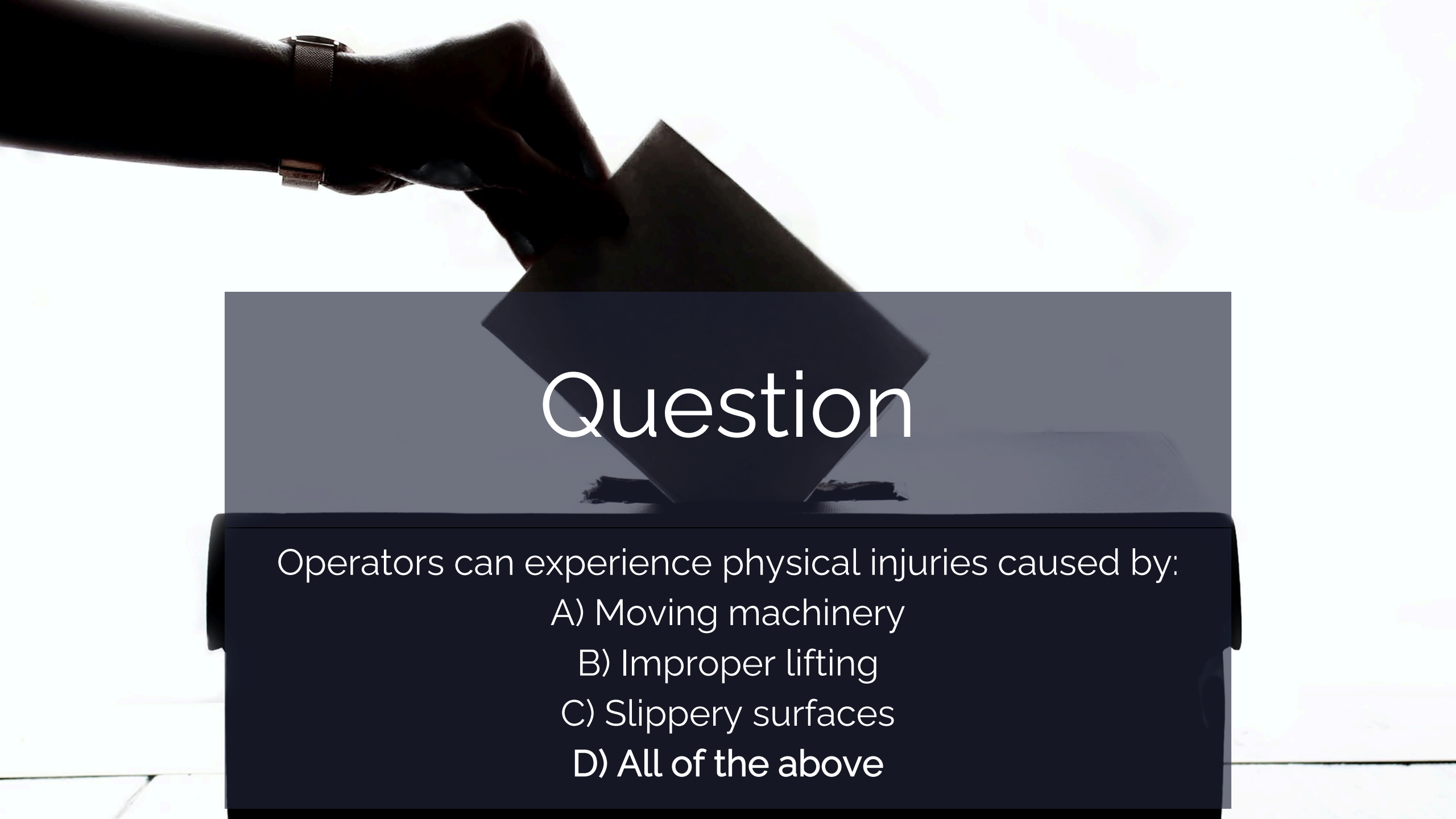
Safety is your
responsibility

A hand with a metal watch is holding a dark, rectangular object, possibly a piece of paper or a small book, against a bright, overexposed background. The hand is positioned in the upper left corner, and the object is held vertically. The background is a bright, almost white, sky-like area with some faint, wispy clouds.

Question

Operators can experience physical injuries caused by:

- A) Moving machinery
- B) Improper lifting
- C) Slippery surfaces
- D) All of the above

A hand with a metal watch is holding a dark, rectangular block against a bright, overexposed background. The hand is positioned in the upper left corner, and the block is tilted diagonally. The word "Question" is written in white text on a dark, semi-transparent rectangular area that covers the lower half of the image.

Question

Operators can experience physical injuries caused by:

- A) Moving machinery
- B) Improper lifting
- C) Slippery surfaces
- D) All of the above

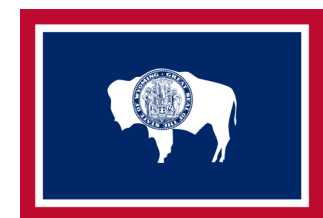
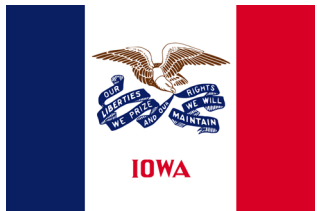
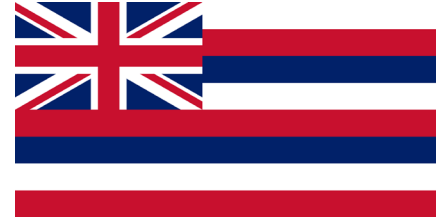
Occupational Safety and Health Regulations



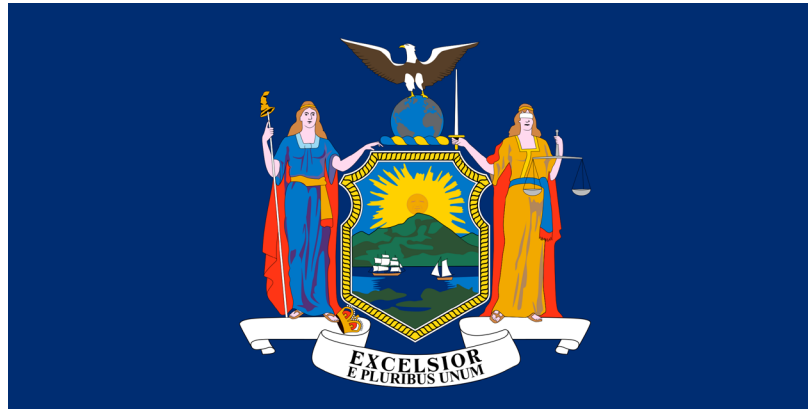
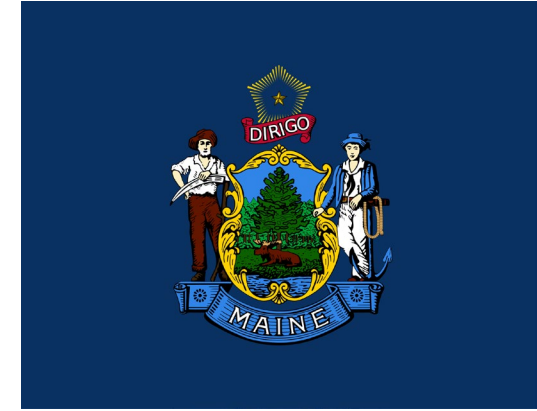
OSHA's Mission

“to assure safe and healthy working conditions for working men and women by setting and enforcing standards and by providing training, outreach, education, and assistance.”

22 States & Puerto Rico have OSHA approved programs



5 States and the US Virgin Islands
have OSHA approved programs that
cover public sector employees

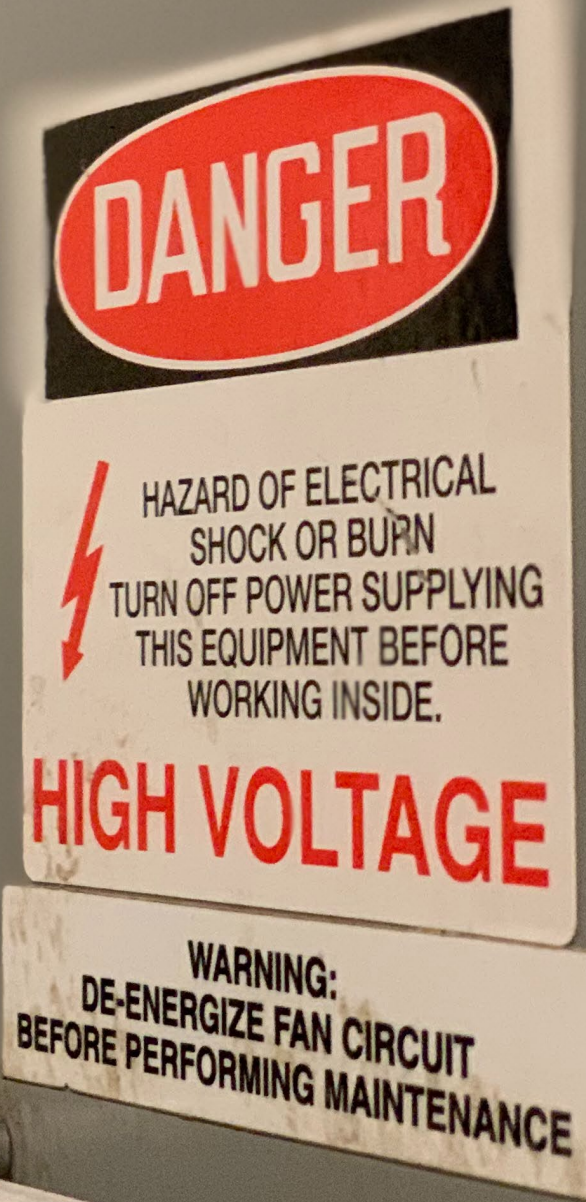


Be Aware of Your Local Occupational Safety and Health Regulations



Safety Programs

Safety is everyone's
concern



Safety Programs

- Identify the causes of accidents, illness, and injuries
- Provide safety training
- Implement an accident reporting system
- Hold supervisors responsible for implementing the safety program

Operator Safety Duties

- Ask about your employer's safety program, and participate in it
- Follow safety protocols and standards when doing your job
- Use your safety equipment, like SCBA, hardhats, goggles, gloves, and other PPE
- Report safety hazards and injuries

Management Safety Duties

- Develop a written safety statement & establish a safety program
- Assign responsibilities for injury prevention
- Appoint a safety officer or coordinator
- Establish realistic safety goals & revise them to encourage continual improvement
- Evaluate safety program results

Three safety program training components

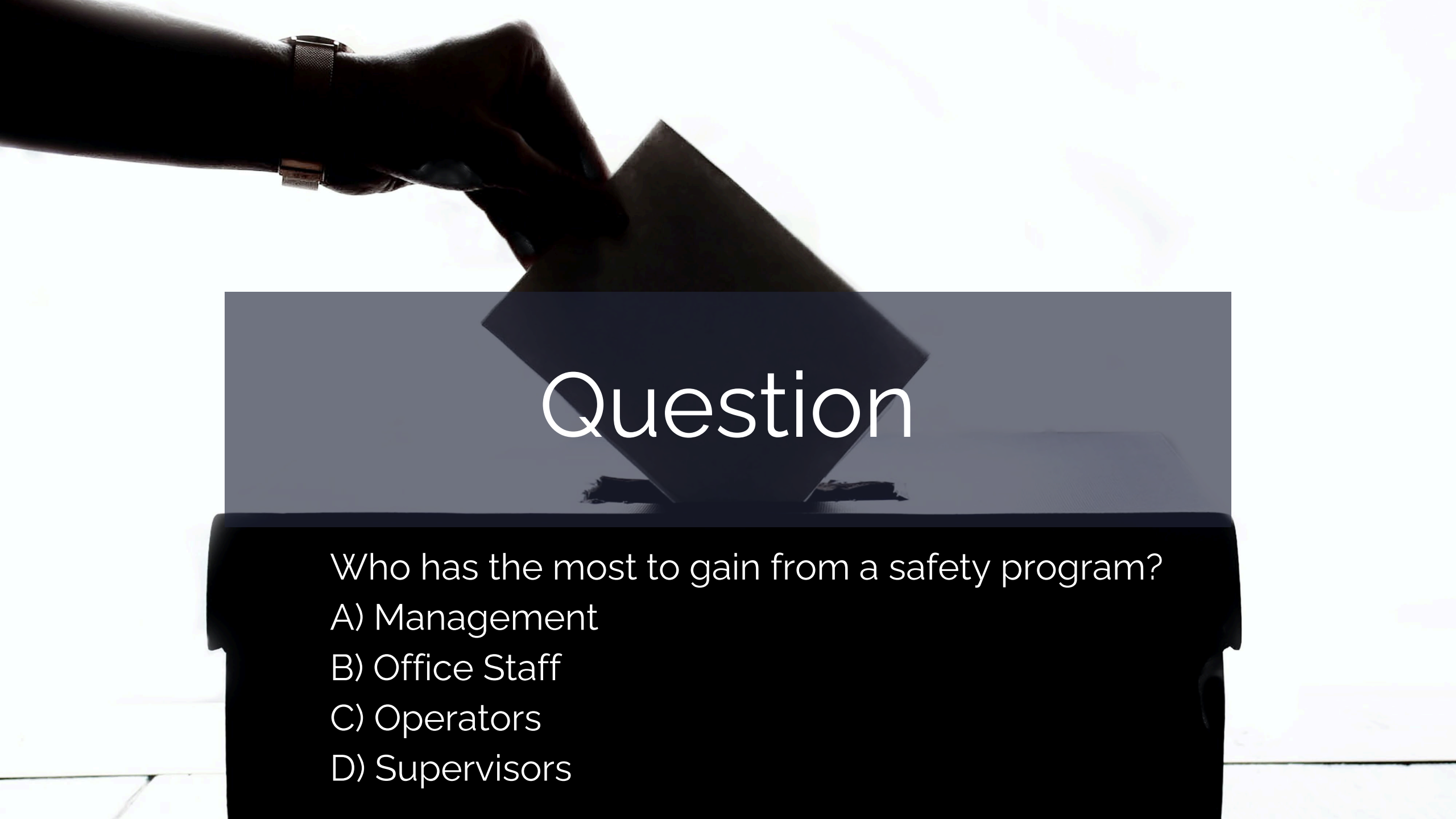
1. Safety education of all employees
2. Reinforced education in safety
3. Safety education in the use of tools and equipment

Three safety program training components

1. Safety **education** of all employees
2. Reinforced **education** in safety
3. Safety **education** in the use of tools and equipment

Tailgates aren't just for parties

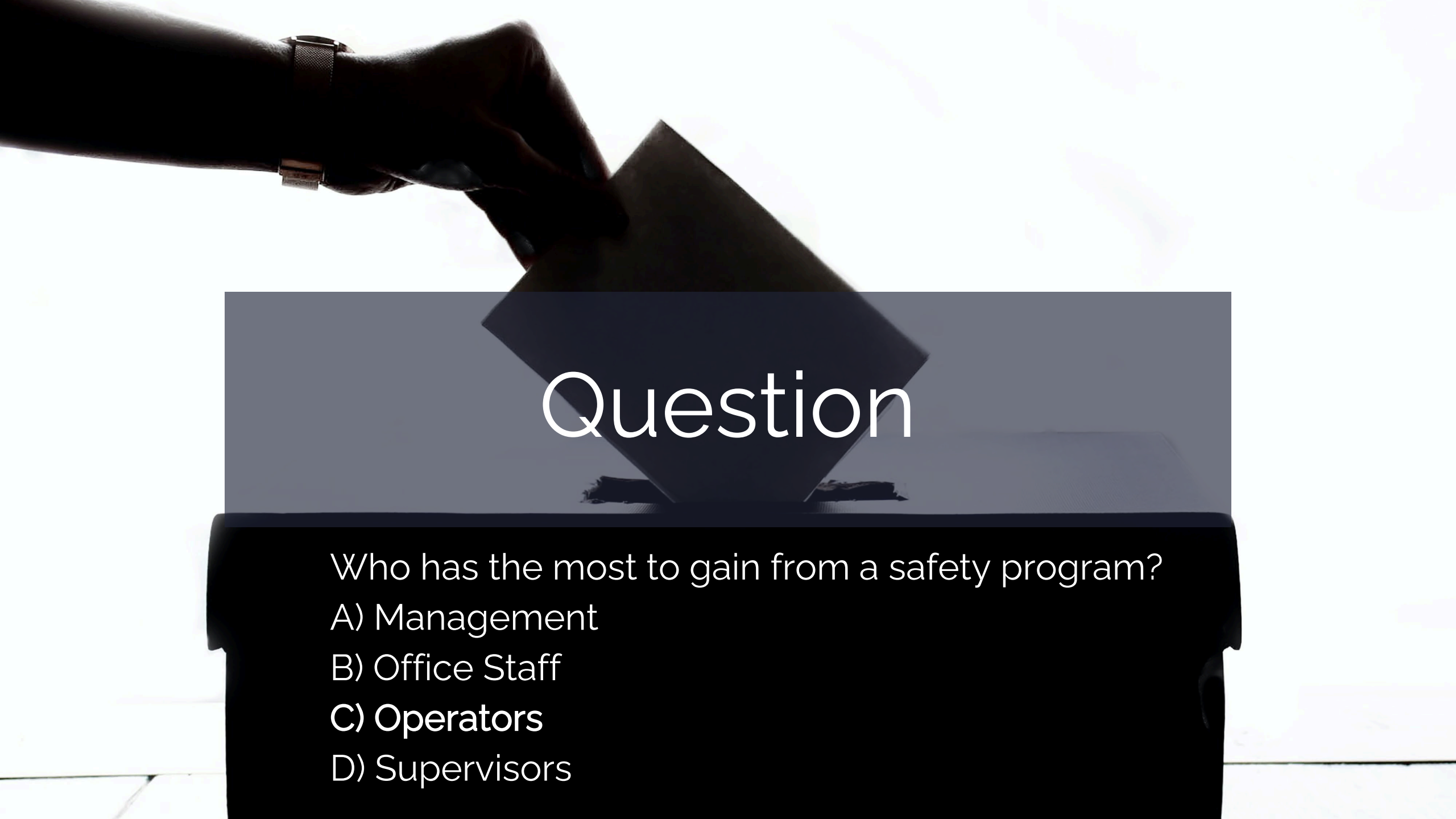
Short: 10-20 minutes, held
approximately weekly or before
new work

A hand wearing a watch is shown holding the lid of a ballot box. The background is a bright, slightly blurred outdoor scene. The word "Question" is written in white on a dark grey rectangular area that covers the middle of the image.

Question

Who has the most to gain from a safety program?

- A) Management
- B) Office Staff
- C) Operators
- D) Supervisors

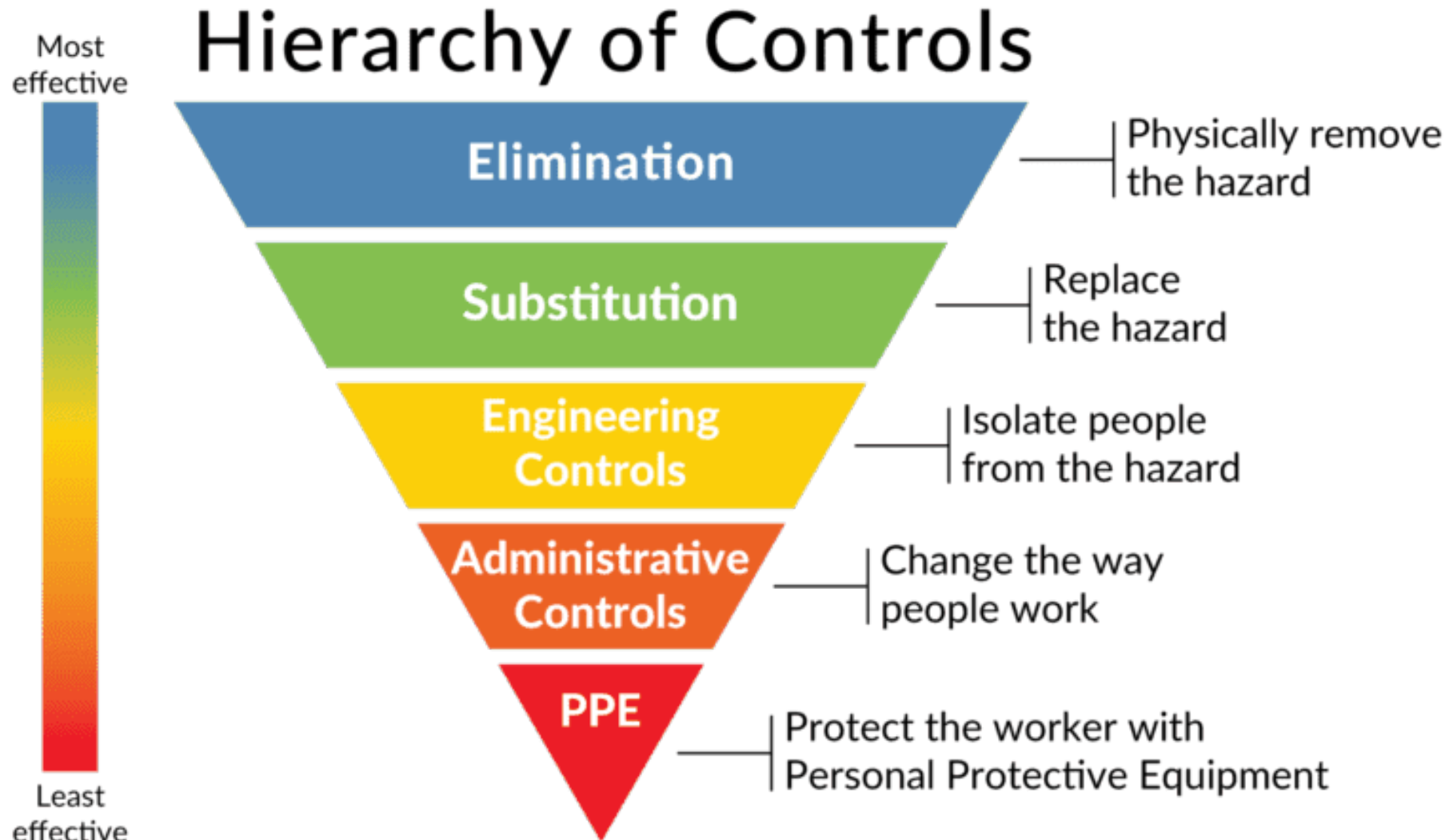
A hand wearing a watch is shown from the top left, holding a piece of paper and placing it into a ballot box. The background is a bright, slightly blurred outdoor scene. A dark grey rectangular overlay covers the middle of the image, containing the word 'Question' in white. Below this, a black rectangular overlay contains the question and its options in white text.

Question

Who has the most to gain from a safety program?

- A) Management
- B) Office Staff
- C) Operators
- D) Supervisors

Actions to Control Workplace Hazards



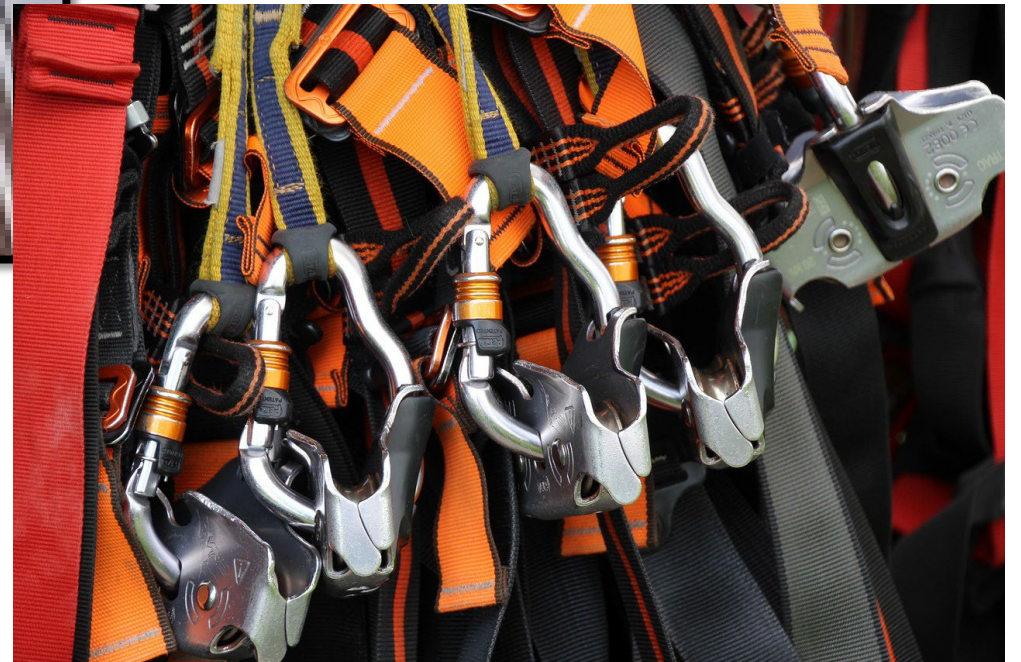


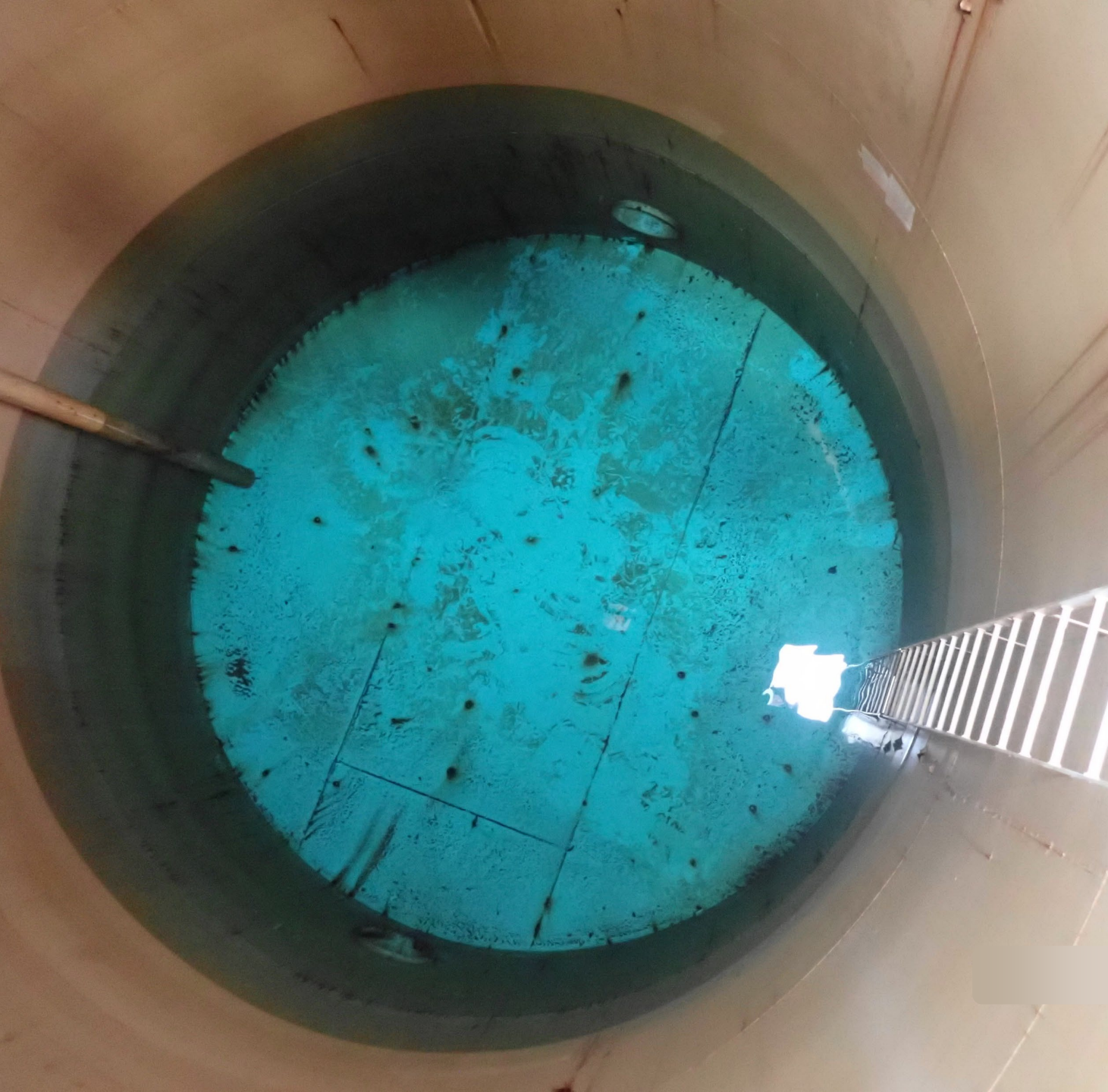
Well Vaults:

- Confined spaces
- Electrical hazards
- Slippery surfaces
- ?...

Water Tanks:

- Falling hazards
- Drowning
- ? ...





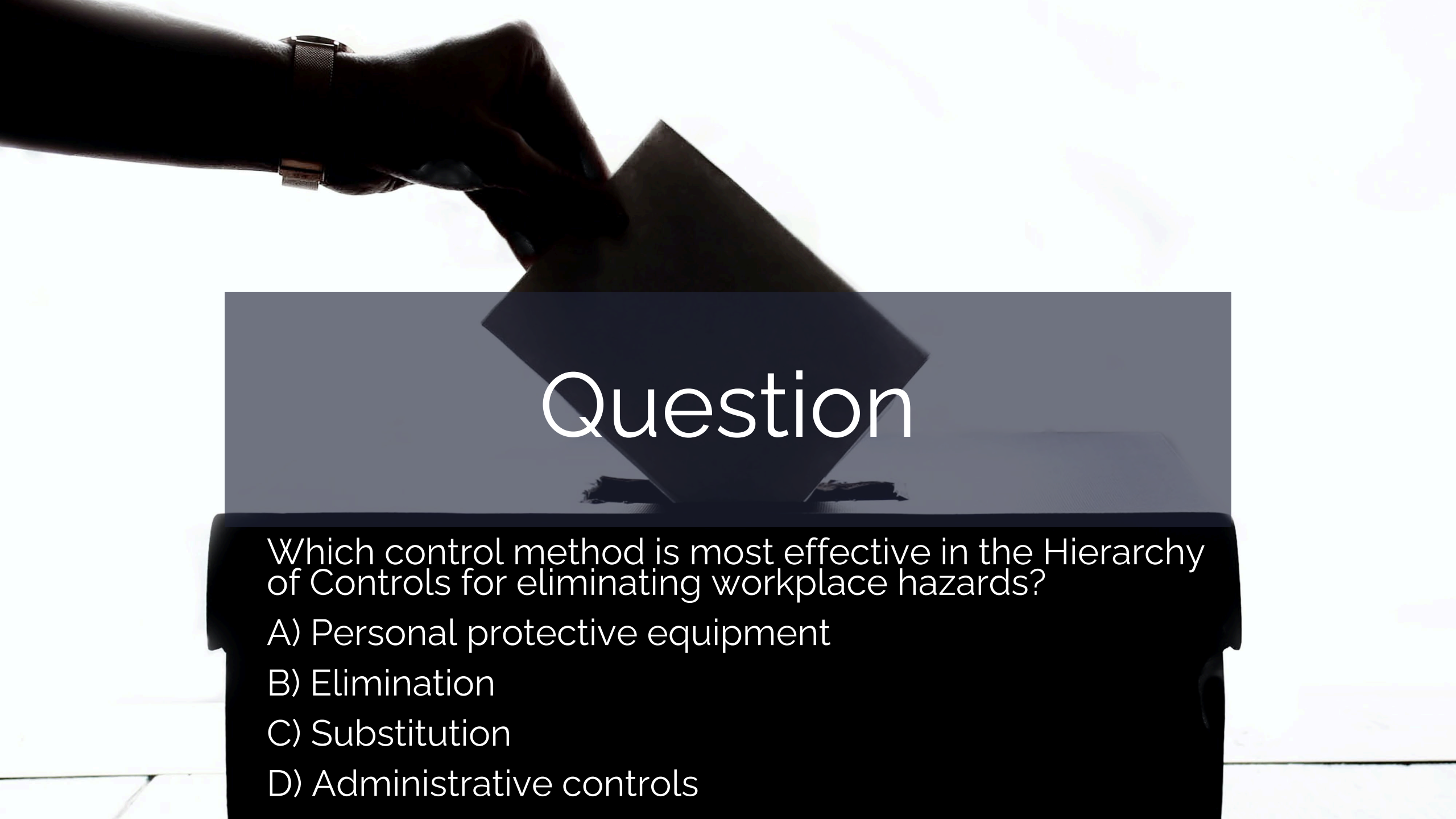
Water Safety

- Keep handrails and ladders in good repair
- Replace damaged rails and ladders
- Use extra caution in wet and icy weather



Water Safety

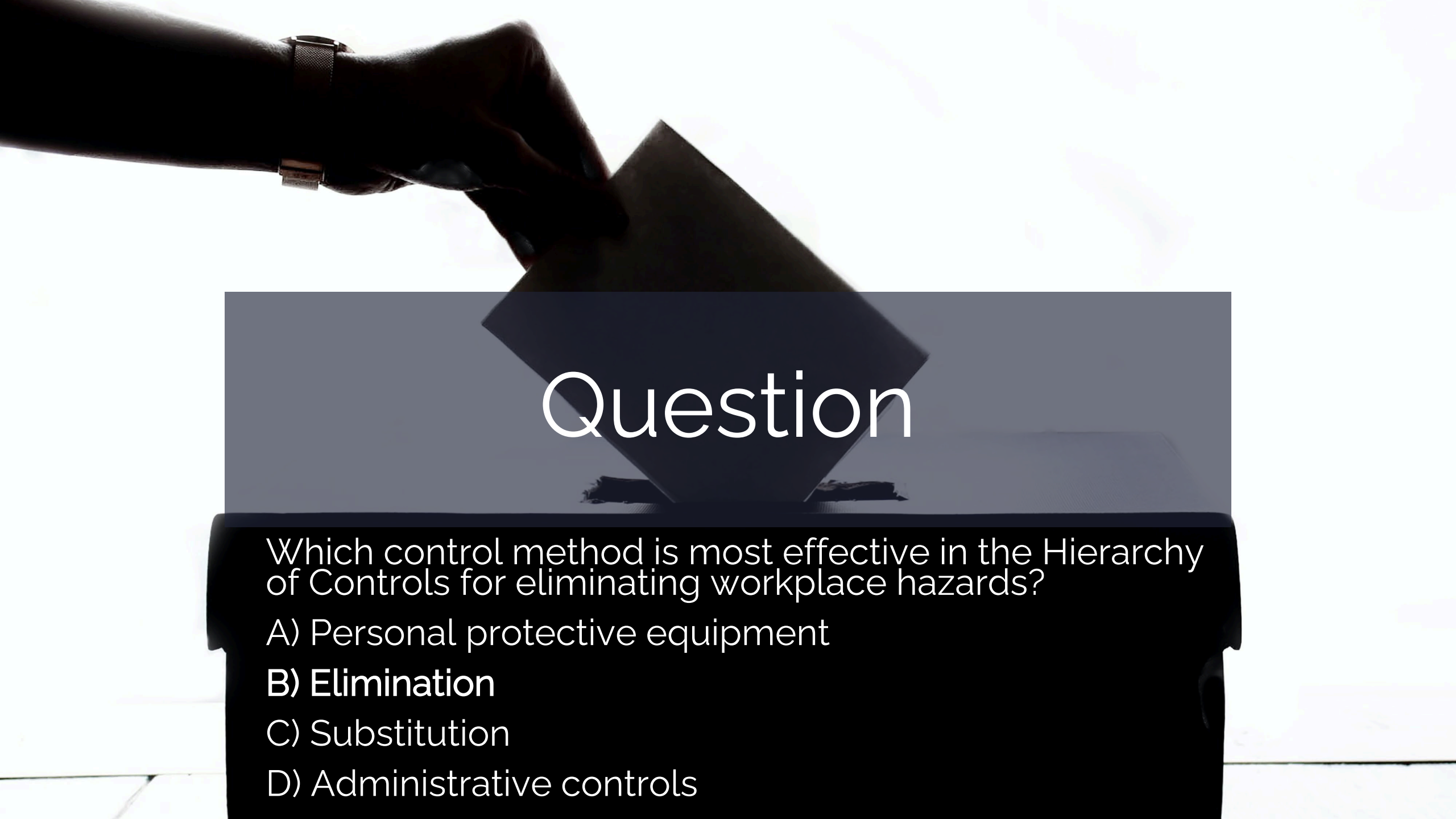
- Reduce slip hazards
- Station approved emergency gear near filters and basins:
 - Safety vests
 - Buoys
 - Life poles
- Learn how to swim
- Use personal floatation devices

A hand wearing a watch is holding a dark rectangular object, possibly a card or a piece of paper, over a dark rectangular box. The box contains text. The background is a bright, slightly blurred outdoor scene.

Question

Which control method is most effective in the Hierarchy of Controls for eliminating workplace hazards?

- A) Personal protective equipment
- B) Elimination
- C) Substitution
- D) Administrative controls

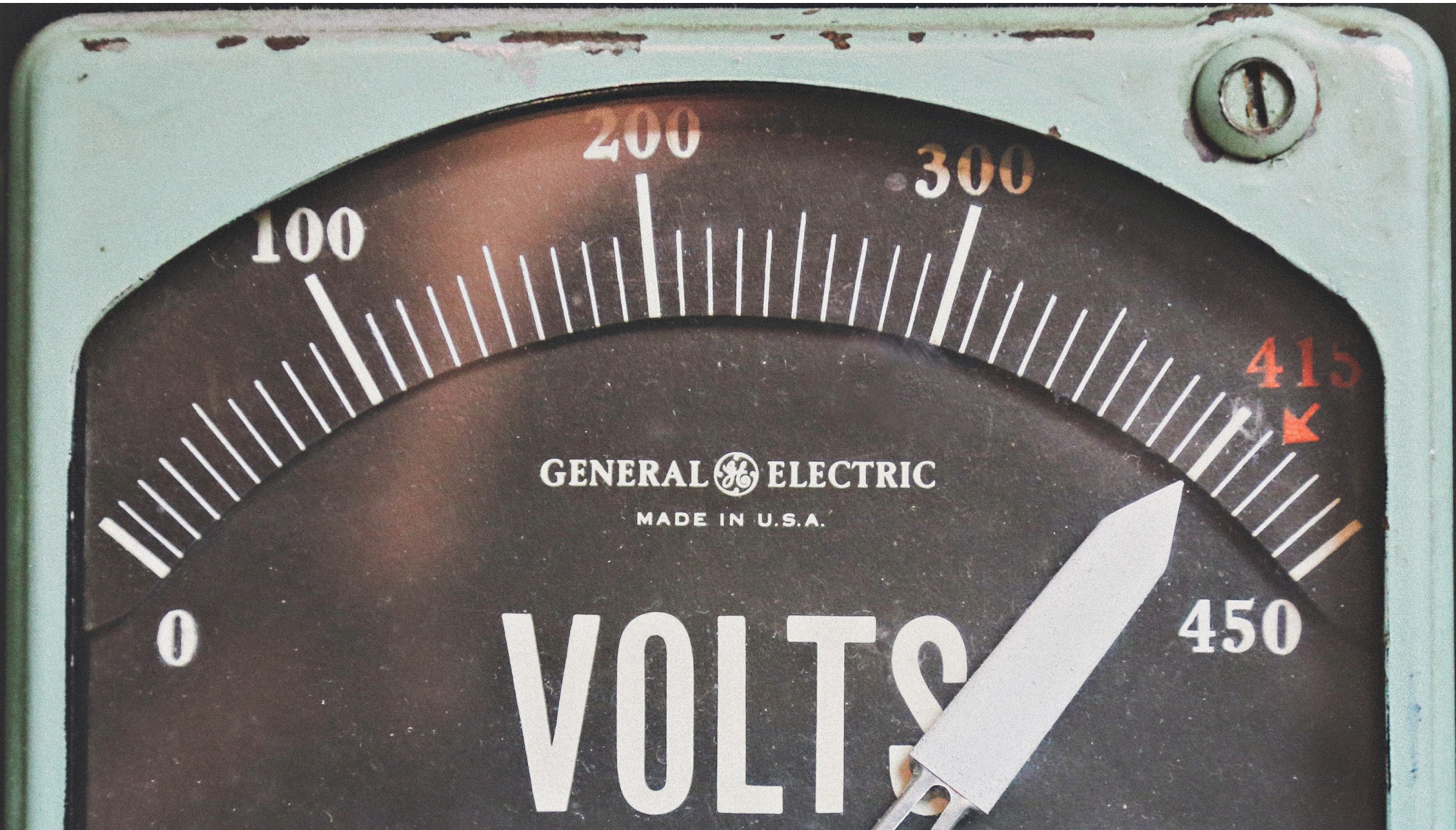
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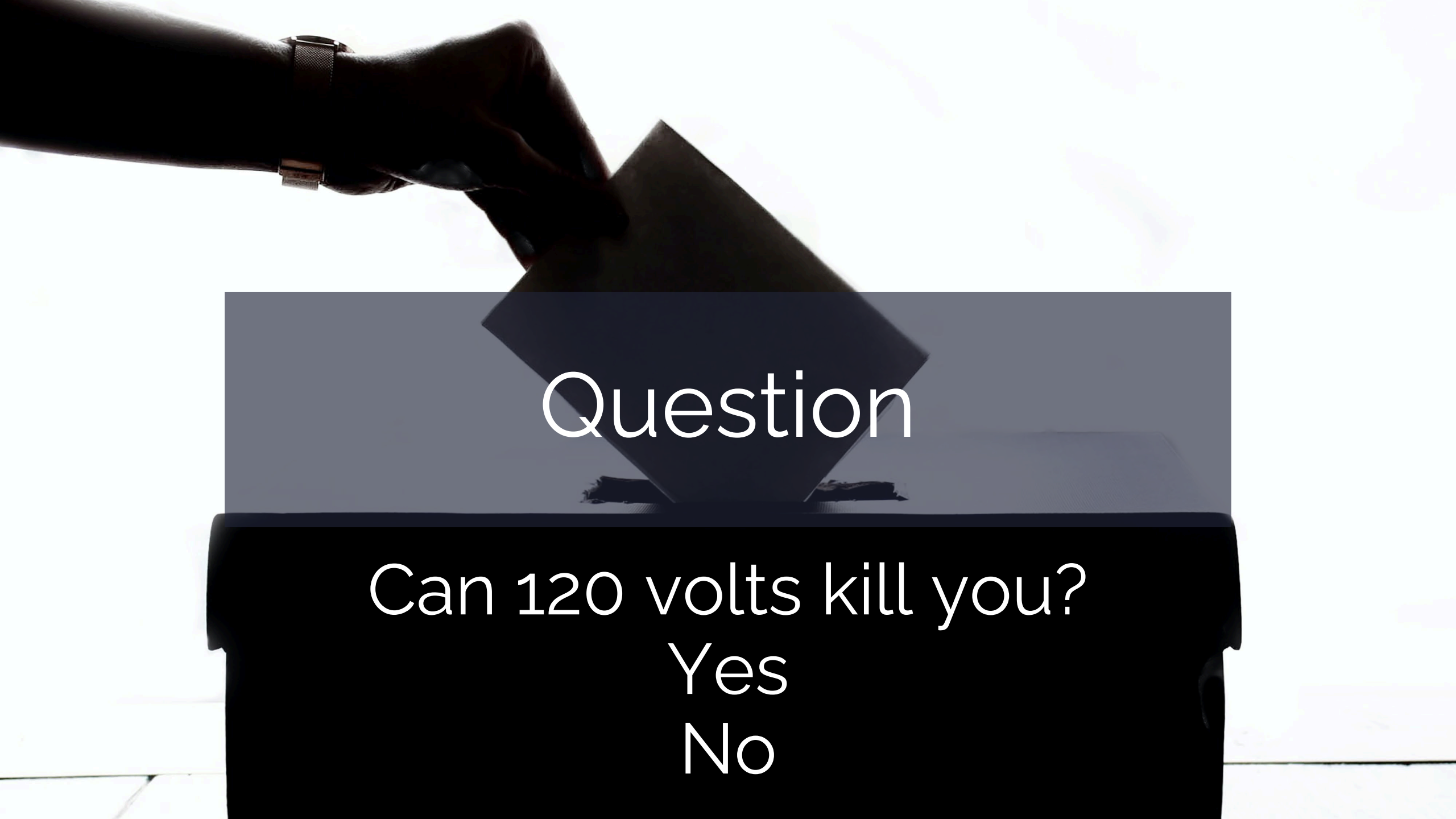
- A) Personal protective equipment
- B) Elimination**
- C) Substitution
- D) Administrative controls

Electrical Hazards



- ⚡ Transformers
- ⚡ Starters
- ⚡ Motors
- ⚡ Instrumentation
- ⚡ Control Panels



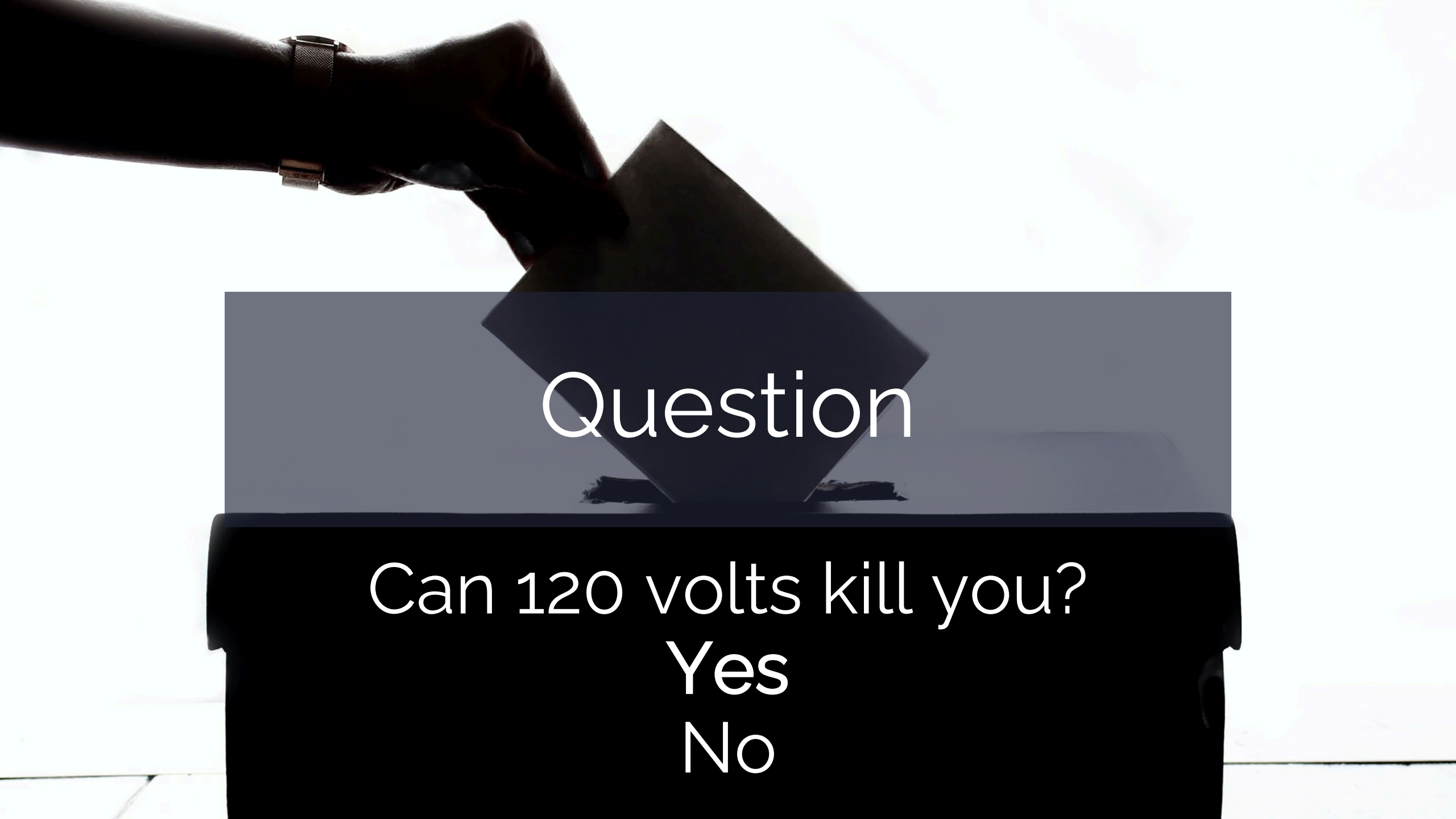
A hand with a watch is shown from the top left, placing a white ballot into a dark grey ballot box. The box has a slot on top and a dark front panel. The background is a bright, slightly cloudy sky.

Question

Can 120 volts kill you?

Yes

No

A close-up photograph of a hand dropping a white ballot into a dark grey ballot box. The hand is wearing a dark metal watch. The background is a bright, slightly blurred outdoor scene. A semi-transparent dark grey rectangle is overlaid on the image, containing the text.

Question

Can 120 volts kill you?

Yes

No

120 volts
can kill you.

12 volts can
injure you



Current and Voltage

Ohms Law:

$$\textit{Current} = \frac{\textit{Voltage}}{\textit{Resistance}}$$

Or:

$$\textit{Amps} = \frac{\textit{Voltage}}{\textit{Ohms}}$$

Resistance in the Body

Ear-to-Ear ~ 100 Ohms

Hand-to-Foot ~ 500 Ohms

Dry Skin ~ 300,000 Ohms

Wet Skin ~ 1000 Ohms

Resistance in the Body

Ear-to-Ear ~ 100 Ohms

Ohms Law: $\frac{Voltage}{Ohms} = Amps$

$$\frac{120 Volts}{100 Ohms} = 1.2 Amps$$

Outcome: instant death

Resistance in the Body

Hand-to-Foot ~ 500 Ohms

$$\frac{120 \text{ Volts}}{500 \text{ Ohms}} = 0.24 \text{ Amps} \text{ (or 240 miliAmps)}$$

Outcome: Severe burns, possible death

Basic Electrical Safe Practices

- Do proactive maintenance to identify performance and safety issues
- Use non-conductive tools when working around electricity
- Don't use electrical equipment with worn or frayed cords
- Permanent wiring should be installed with conduit or armored cable by an electrician

Basic Electrical Safe Practices

- Replace connections with worn or thinning insulation
- Ground equipment with three-pronged plugs
- Be alert for overheating equipment or “tingling”
- Electrical units operated in areas exposed to flammable vapors should be explosion proof
- Work in pairs to service, repair or troubleshoot electrical equipment

Lockout and Tagout Programs

OPERATING INSTRUCTIONS

TO OPERATE SWITCH:
1. PULL DOWN LOCK AND RETRACT
2. PULL DOWN LOCK AND RETRACT
3. PULL DOWN LOCK AND RETRACT
4. PULL DOWN LOCK AND RETRACT

TO OPERATE LOCK:
1. PULL DOWN LOCK AND RETRACT
2. PULL DOWN LOCK AND RETRACT
3. PULL DOWN LOCK AND RETRACT
4. PULL DOWN LOCK AND RETRACT

TO OPERATE SWITCH AND LOCK:
1. PULL DOWN LOCK AND RETRACT
2. PULL DOWN LOCK AND RETRACT
3. PULL DOWN LOCK AND RETRACT
4. PULL DOWN LOCK AND RETRACT

TO OPERATE SWITCH AND LOCK:
1. PULL DOWN LOCK AND RETRACT
2. PULL DOWN LOCK AND RETRACT
3. PULL DOWN LOCK AND RETRACT
4. PULL DOWN LOCK AND RETRACT

TO OPERATE SWITCH AND LOCK:
1. PULL DOWN LOCK AND RETRACT
2. PULL DOWN LOCK AND RETRACT
3. PULL DOWN LOCK AND RETRACT
4. PULL DOWN LOCK AND RETRACT

OPEN

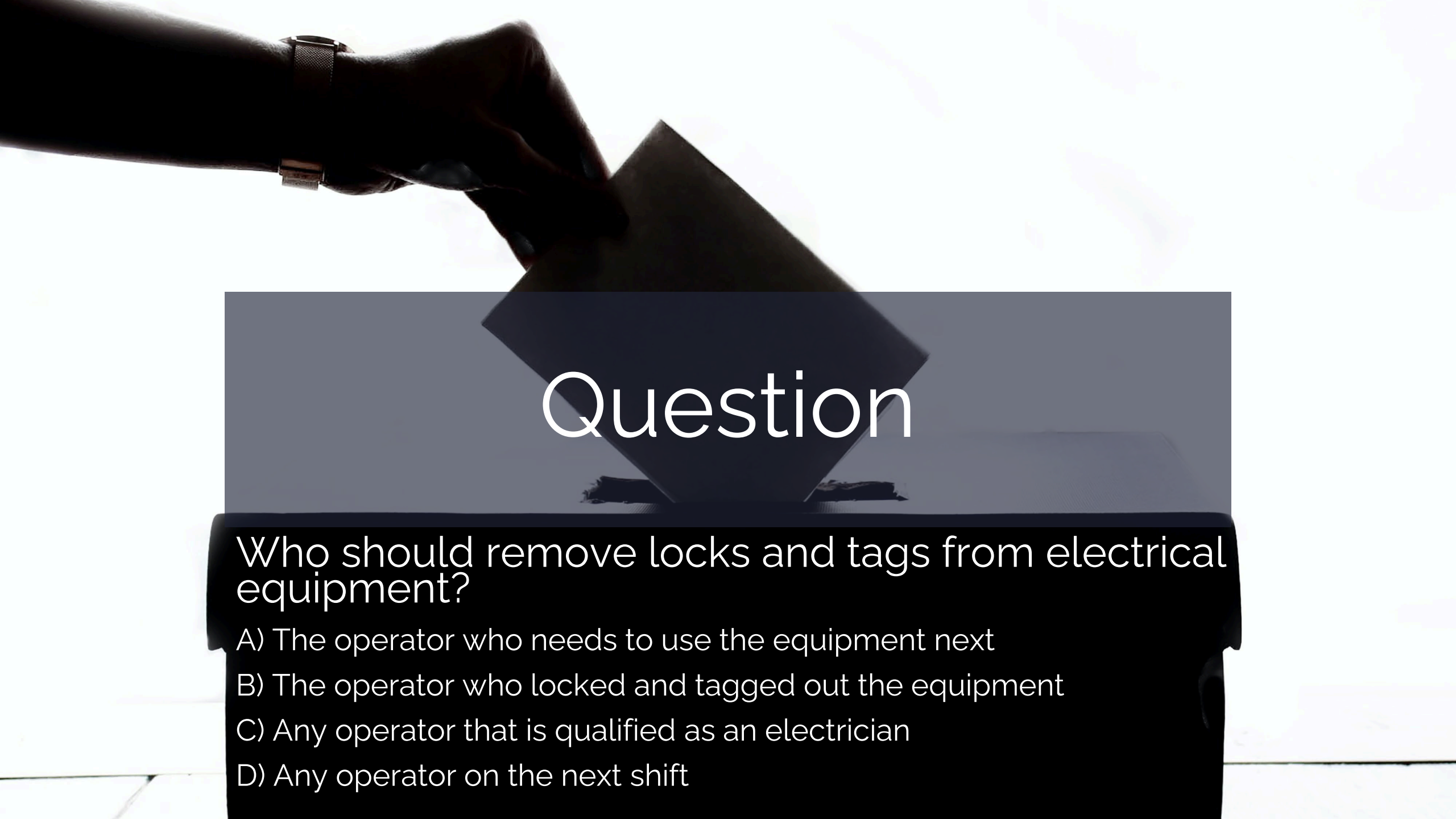


Lockout and Tagout Basics

- Notify affected employees that the lockout/tagout procedure will be used and why
- Shut down equipment using normal shut down procedures
- Isolate the equipment from energy sources and ensure stored energy is dissipated
- Lockout and tagout the energy isolating device with the assigned individual lock and tag

Lockout and Tagout Basics

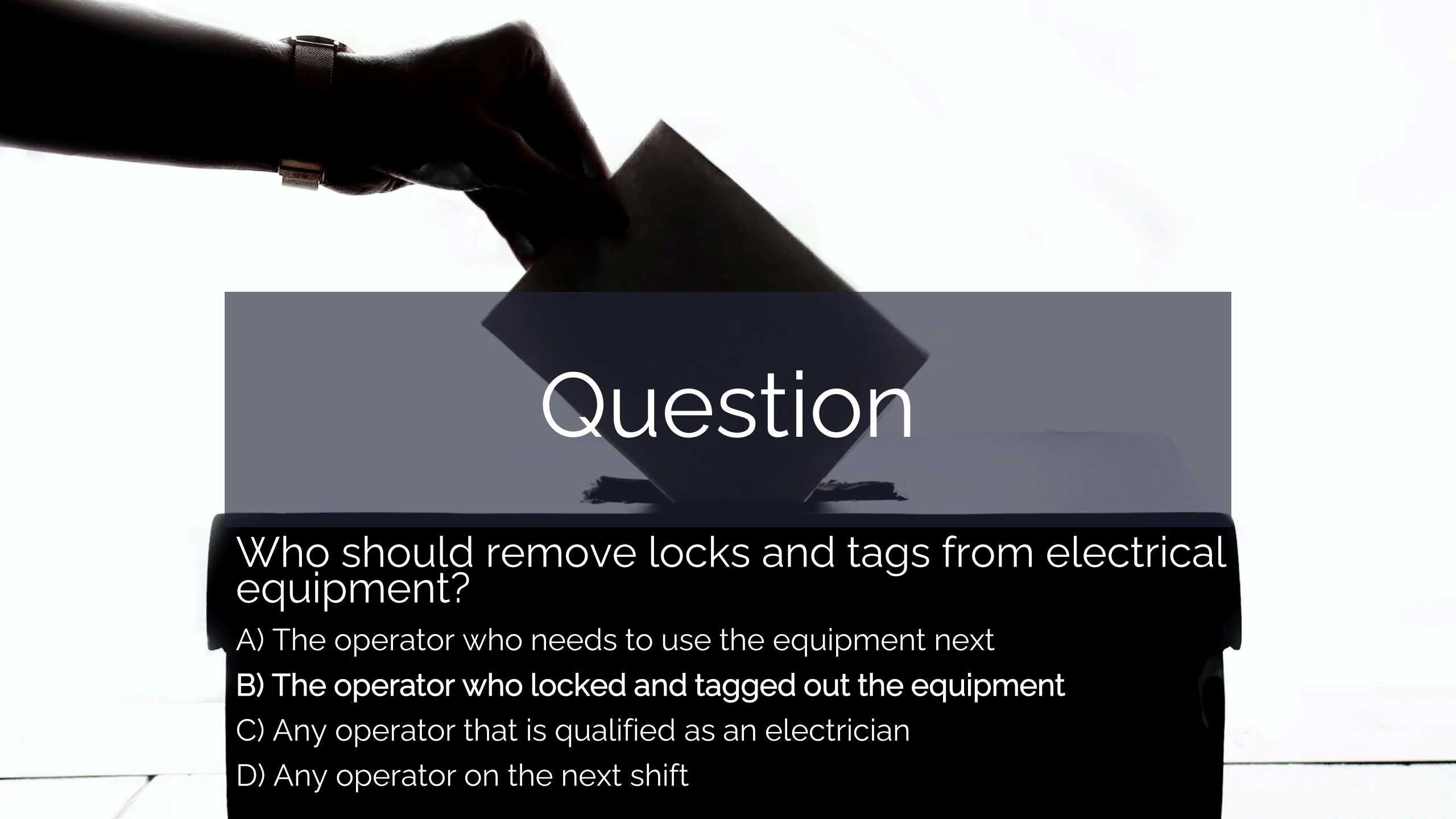
- Confirm the circuit is dead. Ensure energy source is disconnected after ensuring no personnel are exposed.
- **NOW, work can begin**
- After work is complete, tools are removed and everything is returned to working order, ensure all employees are clear then remove lockout and tagout devices
- Then notify affected employees that lockout and tagout have been removed and restore power to the equipment.

A hand wearing a watch is holding a dark, triangular object against a bright background. The hand is positioned in the upper left corner, and the object is held diagonally across the frame. The background is a bright, slightly textured surface.

Question

Who should remove locks and tags from electrical equipment?

- A) The operator who needs to use the equipment next
- B) The operator who locked and tagged out the equipment
- C) Any operator that is qualified as an electrician
- D) Any operator on the next shift

A hand wearing a watch is holding a dark, rectangular object, possibly a lock or tag, against a bright, overexposed background. The hand is positioned in the upper left corner, and the object is held diagonally across the frame.

Question

Who should remove locks and tags from electrical equipment?

- A) The operator who needs to use the equipment next
- B) The operator who locked and tagged out the equipment**
- C) Any operator that is qualified as an electrician
- D) Any operator on the next shift

Never remove lockout and
tagout equipment that
someone else installed!

Chemical Hazards

Chemical Hazards

- ⚠ Burns
- ⚠ Respiratory Damage
- ⚠ Eye Damage
- ⚠ Rashes
- ⚠ Skin Damage
- ⚠ Headaches
- ⚠ Death

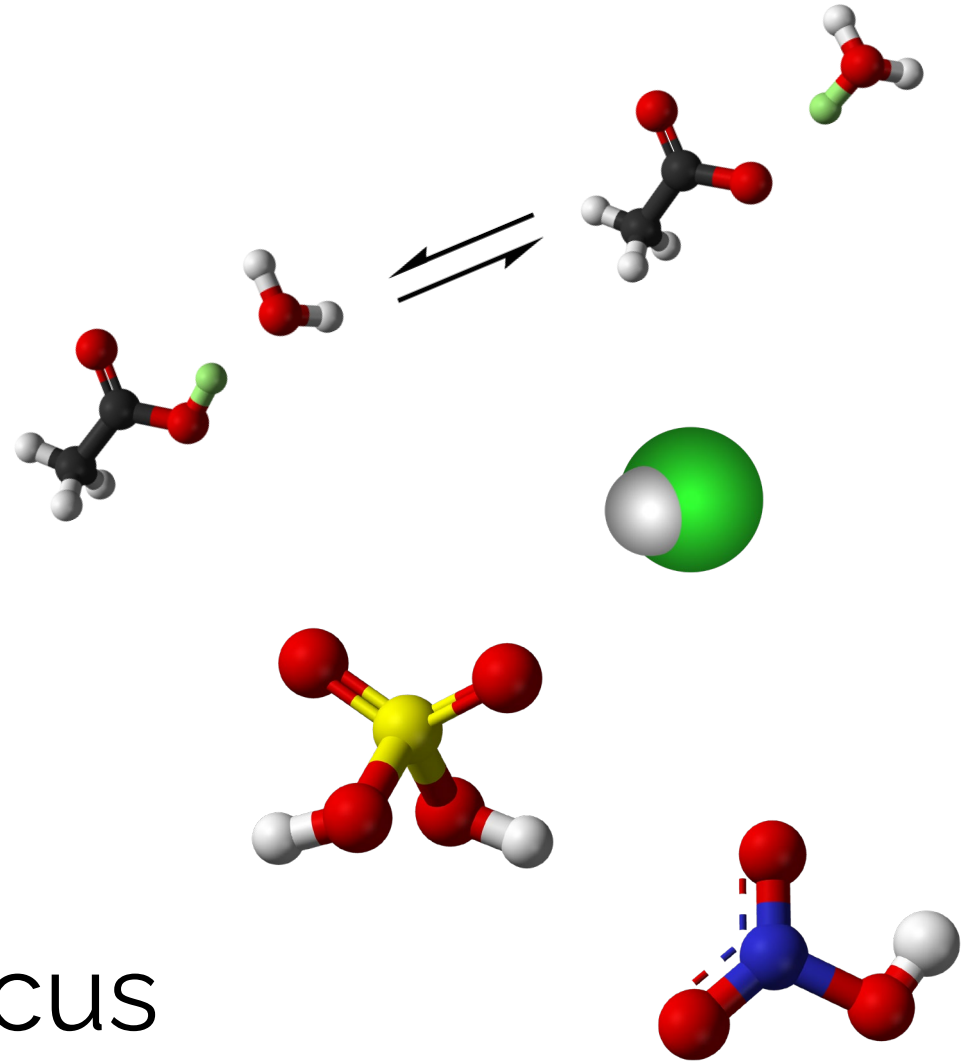
Acute vs Chronic Effects

Acute: Short-term effects occur with contact and usually resolve when no longer in contact or with medical treatment.

Chronic: Long-term effects that may not appear immediately or after a single exposure. May or may not be reversible.

Acids and Bases

- Corrosive
- Hazards:
 - Chemical burns
 - Toxic
 - Fire
- Harmful to tissue and mucus membranes



Hazard Communication

“Fire Diamond” or
“Safety Square”

NFPA 704:
Standard System
for Identification of
Hazards of
Materials for
Emergency
Response

HEALTH HAZARD

4 DEADLY
3 EXTREME DANGER
2 HAZARDOUS
1 SLIGHTLY HAZARDOUS
0 NORMAL MATERIAL

FIRE HAZARD

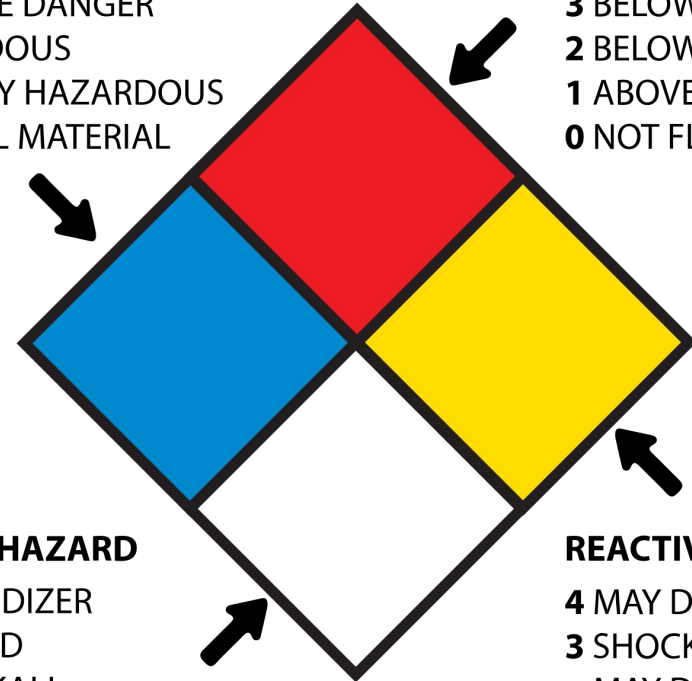
4 BELOW 25 °C
3 BELOW 37 °C
2 BELOW 93 °C
1 ABOVE 93 °C
0 NOT FLAMMABLE

SPECIFIC HAZARD

OXY OXIDIZER
ACID ACID
ALK ALKALI
CORR CORROSIVE
 RADIOACTIVE
 USE NO WATER

REACTIVITY

4 MAY DETONATE
3 SHOCK + HEAT
MAY DETONATE
2 VIOLENT REACTION
1 UNSTABLE IF HEATED
0 STABLE



Hazard Communication

HCS Pictograms and Hazards



Hazard Communication Standard Pictogram

The Hazard Communication Standard (HCS) requires pictograms on labels to alert users of the chemical hazards to which they may be exposed. Each pictogram consists of a symbol on a white background framed within a red border and represents a distinct hazard(s). The pictogram on the label is determined by the chemical hazard classification.

Health Hazard  • Carcinogen • Mutagenicity • Reproductive Toxicity • Respiratory Sensitizer • Target Organ Toxicity • Aspiration Toxicity	Flame  • Flammables • Pyrophorics • Self-Heating • Emits Flammable Gas • Self-Reactives • Organic Peroxides	Exclamation Mark  • Irritant (skin and eye) • Skin Sensitizer • Acute Toxicity (harmful) • Narcotic Effects • Respiratory Tract Irritant • Hazardous to Ozone Layer (Non-Mandatory)
Gas Cylinder  • Gases Under Pressure	Corrosion  • Skin Corrosion/ Burns • Eye Damage • Corrosive to Metals	Exploding Bomb  • Explosives • Self-Reactives • Organic Peroxides
Flame Over Circle  • Oxidizers	Environment (Non-Mandatory)  • Aquatic Toxicity	Skull and Crossbones  • Acute Toxicity (fatal or toxic)

Safety Data Sheets



SAFETY DATA SHEET

Creation Date 12-Nov-2010

Revision Date 24-Dec-2021

Revision Number 9

1. Identification

Product Name Sulfuric Acid (Certified ACS Plus)

Cat No. : A300-212; A300-225LB; A300-500; A300-612GAL; A300-700LB; A300C212; A300C212EA; A300P500; A300S212; A300S212EA; A300S500; A300SI212;

Synonyms Hydrogen sulfate; Vitriol brown oil; Oil of vitriol

Recommended Use Laboratory chemicals.

Uses advised against Food, drug, pesticide or biocidal product use.

Details of the supplier of the safety data sheet

Company
Fisher Scientific Company
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

CHEMTREC®, Outside the USA: 001-703-527-3887

2. Hazard(s) identification

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Corrosive to metals	Category 1
Skin Corrosion/Irritation	Category 1 A
Serious Eye Damage/Eye Irritation	Category 1
Specific target organ toxicity (single exposure)	Category 3
Target Organs - Respiratory system.	

Label Elements

Signal Word
Danger

Hazard Statements
May be corrosive to metals
Causes severe skin burns and eye damage

Sulfuric Acid (Certified ACS Plus)

Revision Date 24-Dec-2021

May cause respiratory irritation



Precautionary Statements

Prevention

Do not breathe dust/fume/gas/mist/vapors/spray
Wear protective gloves/protective clothing/eye protection/face protection
Wash face, hands and any exposed skin thoroughly after handling
Use only outdoors or in a well-ventilated area
Keep only in original container

Response

Immediately call a POISON CENTER or doctor/physician

Inhalation

IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing

Skin

IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower

Wash contaminated clothing before reuse

Eyes

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing

Ingestion

IF SWALLOWED: Rinse mouth. DO NOT induce vomiting

Storage

Store locked up
Store in a well-ventilated place. Keep container tightly closed

Disposal

Dispose of contents/container to an approved waste disposal plant

Hazards not otherwise classified (HNOC)

None identified

WARNING: Cancer - <https://www.p65warnings.ca.gov/>.

3. Composition/Information on Ingredients

Component	CAS No	Weight %
Sulfuric acid	7664-93-9	90 - 98
Water	7732-18-5	2 - 10

General Advice

Show this safety data sheet to the doctor in attendance. Immediate medical attention is required.

Eye Contact

Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Immediate medical attention is required.

Skin Contact

Wash off immediately with plenty of water for at least 15 minutes. Remove and wash contaminated clothing and gloves, including the inside, before re-use. Immediate medical attention is required.

Inhalation

Remove to fresh air. If breathing is difficult, give oxygen. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device.

Safety Data Sheets

Sulfuric Acid (Certified ACS Plus)

Revision Date 24-Dec-2021

Immediate medical attention is required.

Ingestion
Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Call a physician or poison control center immediately.

Most important symptoms and effects
Causes burns by all exposure routes. Product is a corrosive material. Use of gastric lavage or emesis is contraindicated. Possible perforation of stomach or esophagus should be investigated. Ingestion causes severe swelling, severe damage to the delicate tissue and danger of perforation.

5. Fire-fighting measures

Suitable Extinguishing Media CO₂, dry chemical, dry sand, alcohol-resistant foam.

Unsuitable Extinguishing Media DO NOT USE WATER

Flash Point Not applicable
Method - No information available

Autoignition Temperature No information available

Explosion Limits No data available

Upper No data available

Lower No data available

Sensitivity to Mechanical Impact No information available

Sensitivity to Static Discharge No information available

Specific Hazards Arising from the Chemical

Thermal decomposition can lead to release of irritating gases and vapors. The product causes burns of eyes, skin and mucous membranes.

Hazardous Combustion Products

Sulfur oxides, Hydrogen.

Protective Equipment and Precautions for Firefighters

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear. Thermal decomposition can lead to release of irritating gases and vapors.

NEPA

Health

Flammability

Instability

Physical hazards

6. Accidental release measures

Personal Precautions Ensure adequate ventilation. Use personal protective equipment as required. Evacuate personnel to safe areas. Keep people away from and upwind of spill/leak.

Environmental Precautions Should not be released into the environment.

Methods for Containment and Clean Up Soak up with inert absorbent material. Keep in suitable, closed containers for disposal.

7. Handling and storage

Handling Wear personal protective equipment/face protection. Do not get in eyes, on skin, or on clothing. Use only under a chemical fume hood. Do not breathe mist/vapors/spray. Do not ingest. If swallowed then seek immediate medical assistance.

Storage. Keep containers tightly closed in a dry, cool and well-ventilated place. Keep away from water or moist air. Corrosives area. Incompatible Materials. Water. Organic materials. Strong acids. Strong bases. Metals. Alcohols. Cyanides. Sulfides.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH	Mexico OEL (TWA)
Sulfuric acid	TWA: 0.2 mg/m ³	(Vacated) TWA: 1 mg/m ³ TWA: 1 mg/m ³	IDLH: 15 mg/m ³ TWA: 1 mg/m ³	TWA: 0.2 mg/m ³

Legend

ACGIH - American Conference of Governmental Industrial Hygienists

OSHA - Occupational Safety and Health Administration

NIOSH IDLH: NIOSH - National Institute for Occupational Safety and Health

Engineering Measures Use only under a chemical fume hood. Ensure adequate ventilation, especially in confined areas. Ensure that eyewash stations and safety showers are close to the workstation location.

Personal Protective Equipment

Eye/face Protection Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin and body protection Wear appropriate protective gloves and clothing to prevent skin exposure.

Respiratory Protection Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

9. Physical and chemical properties

Physical State	Liquid
Appearance	Clear, Colorless to brown
Odor	Odorless
Odor Threshold	No information available
pH	0.3 (1N)
Melting Point/Range	10 °C / 50 °F
Boiling Point/Range	290 - 338 °C / 554 - 640.4 °F
Flash Point	Not applicable
Evaporation Rate	Slower than ether
Flammability (solid, gas)	Not applicable
Flammability or explosive limits	
Upper	No data available
Lower	No data available
Vapor Pressure	< 0.001 mmHg @ 20 °C
Vapor Density	3.38 (Air = 1.0)
Specific Gravity	1.84
Solubility	Soluble in water
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	No information available
Decomposition Temperature	340°C
Viscosity	No information available

10. Stability and reactivity

Safety Data Sheets

Sulfuric Acid (Certified ACS Plus)

Revision Date 24-Dec-2021

Reactive Hazard	Yes
Stability	Reacts violently with water. Hygroscopic.
Conditions to Avoid	Incompatible products. Excess heat. Exposure to moist air or water.
Incompatible Materials	Water, Organic materials, Strong acids, Strong bases, Metals, Alcohols, Cyanides, Sulfides
Hazardous Decomposition Products	Sulfur oxides, Hydrogen
Hazardous Polymerization	Hazardous polymerization does not occur.

11. Toxicological information

Acute Toxicity

Product Information

Oral LD50

Based on ATE data, the classification criteria are not met. ATE > 2000 mg/kg.

Dermal LD50

Based on ATE data, the classification criteria are not met. ATE > 2000 mg/kg.

Vapor LC50

Based on ATE data, the classification criteria are not met. ATE > 20 mg/l.

Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Sulfuric acid	2140 mg/kg (Rat)	Not listed	LC50 = 0.375 mg/L (Rat) 4 h
Water	-	-	-

Toxicologically Synergistic Products

No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation

Causes severe burns by all exposure routes

Sensitization

No information available

Carcinogenicity

The table below indicates whether each agency has listed any ingredient as a carcinogen. Exposure to strong inorganic mists containing sulfuric acid may cause cancer by inhalation.

Component	CAS No	IARC	NTP	ACGIH	OSHA	Mexico
Sulfuric acid	7664-93-9	Group 1	Known	A2	X	A2
Water	7732-18-5	Not listed	Not listed	Not listed	Not listed	Not listed

IARC (International Agency for Research on Cancer)

Group 1 - Carcinogenic to Humans
Group 2A - Probably Carcinogenic to Humans
Group 2B - Possibly Carcinogenic to Humans
NTP: (National Toxicity Program)
Known - Known Carcinogen
Reasonably Anticipated - Reasonably Anticipated to be a Human Carcinogen

NTP: (National Toxicity Program)

ACGIH: (American Conference of Governmental Industrial Hygienists)

A1 - Known Human Carcinogen
A2 - Suspected Human Carcinogen
A3 - Animal Carcinogen

Mexico - Occupational Exposure Limits - Carcinogens

ACGIH: (American Conference of Governmental Industrial Hygienists)
Mexico - Occupational Exposure Limits - Carcinogens
A1 - Confirmed Human Carcinogen
A2 - Suspected Human Carcinogen
A3 - Confirmed Animal Carcinogen
A4 - Not Classifiable as a Human Carcinogen
A5 - Not Suspected as a Human Carcinogen

Mutagenic Effects

No information available

Reproductive Effects

No information available.

Sulfuric Acid (Certified ACS Plus)

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Developmental Effects	No information available.
Teratogenicity	No information available.
STOT - single exposure	Respiratory system
STOT - repeated exposure	None known
Aspiration hazard	No information available
Symptoms / effects, both acute and delayed	Product is a corrosive material. Use of gastric lavage or emesis is contraindicated. Possible perforation of stomach or esophagus should be investigated. Ingestion causes severe swelling, severe damage to the delicate tissue and danger of perforation
Endocrine Disruptor Information	No information available

Ecotoxicity

This product contains the following substance(s) which are hazardous for the environment. .

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Sulfuric acid	-	LC50: > 500 mg/L, 96h static (Brachydanio rerio)	-	EC50: 29 mg/L/24h

Persistence and Degradability No information available

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and

DOT

UN-No UN1830
Proper Shipping Name Sulfuric acid
Hazard Class 8
Packing Group II

TDG

UN-No UN1830
Proper Shipping Name SULFURIC ACID
Hazard Class 8
Packing Group II

IATA

UN-No UN1830
Proper Shipping Name SULFURIC ACID
Hazard Class 8
Packing Group II

IMDG/IMO

UN-No UN1830
Proper Shipping Name SULFURIC ACID

15. Regulatory information

Safety Data Sheets

Sulfuric Acid (Certified ACS Plus)

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United States of America Inventory

Component	CAS No	TSCA	TSCA Inventory notification - Active-Inactive	TSCA - EPA Regulatory Flags
Sulfuric acid	7664-93-9	X	ACTIVE	
Water	7732-18-5	X	ACTIVE	-

Legend:

TSCA US EPA (TSCA) - Toxic Substances Control Act, (40 CFR Part 710)

X - Listed

- - Not Listed

TSCA 12(b) - Notices of Export Not applicable

International Inventories

Canada (DSL/NDSL), Europe (EINECS/ELINCS/NLP), Philippines (PICCS), Japan (ENCS), Japan (ISHL), Australia (AICS), China (IECSC), Korea (KECL).

Component	CAS No	DSL	NDSL	EINECS	PICCS	ENCS	ISHL	AICS	IECSC	KECL
Sulfuric acid	7664-93-9	X	-	231-639-5	X	X	X	X	X	KE-32570
Water	7732-18-5	X	-	231-791-2	X	X	X	X	X	KE-35400

KECL - NIER number or KE number (<http://ncis.nier.go.kr/en/main.do>)

U.S. Federal Regulations

SARA 313

Component	CAS No	Weight %	SARA 313 - Threshold Values %
Sulfuric acid	7664-93-9	90 - 98	1.0

SARA 311/312 Hazard Categories See section 2 for more information

CWA (Clean Water Act)

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Sulfuric acid	X	1000 lb	-	-

Clean Air Act

Not applicable

OSHA - Occupational Safety and Health Administration

Not applicable

CERCLA

This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Sulfuric acid	1000 lb	1000 lb

California Proposition 65

This product contains the following Proposition 65 chemicals.

Component	CAS No	California Prop. 65	Prop 65 NSRL	Category
Sulfuric acid	7664-93-9	Carcinogen	-	Carcinogen

U.S. State Right-to-Know Regulations

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Sulfuric acid	X	X	X	X	X

Sulfuric Acid (Certified ACS Plus)

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Water	-	-	X	-	-
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U.S. Department of Transportation

Reportable Quantity (RQ): Y

DOT Marine Pollutant N

DOT Severe Marine Pollutant N

U.S. Department of Homeland Security

This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade No information available

Authorisation/Restrictions according to EU REACH

Component	REACH (1907/2006) - Annex XIV - Substances Subject to Authorization	REACH (1907/2006) - Annex XVII - Restrictions on Certain Dangerous Substances	REACH Regulation (EC 1907/2006) article 59 - Candidate List of Substances of Very High Concern (SVHC)
Sulfuric acid	-	Use restricted. See item 75. (see link for restriction details)	-

<https://echa.europa.eu/substances-restricted-under-reach>

Safety, health and environmental regulations/legislation specific for the substance or mixture

Component	CAS No	OECD HPV	Persistent Organic Pollutant	Ozone Depletion Potential	Restriction of Hazardous Substances (RoHS)
Sulfuric acid	7664-93-9	Listed	Not applicable	Not applicable	Not applicable
Water	7732-18-5	Listed	Not applicable	Not applicable	Not applicable

Component	CAS No	Seveso III Directive (2012/18/EC) - Qualifying Quantities for Major Accident Notification	Seveso III Directive (2012/18/EC) - Qualifying Quantities for Safety Report Requirements	Rotterdam Convention (PIC)	Basel Convention (Hazardous Waste)
Sulfuric acid	7664-93-9	Not applicable	Not applicable	Not applicable	Annex I - Y34
Water	7732-18-5	Not applicable	Not applicable	Not applicable	Not applicable

16. Other information

Prepared By

Regulatory Affairs
Thermo Fisher Scientific
Email: EMSDS.RA@thermofisher.com

Creation Date

12-Nov-2010

Revision Date

24-Dec-2021

Print Date

24-Dec-2021

Revision Summary

SDS sections updated: 2.

Disclaimer

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text

End of SDS

Let's Talk About Chlorine



You DON'T want chlorine here

Or here...



Mishandling chlorine can kill you



Chlorine Exposure Effects

ppm in Air by Volume	Health Effect
1	Slight Symptoms after several hours' exposure
0.3 to 3.5	Detectable Odor
5	Noxiousness
15	Throat Irritation
30	Coughing
40	Dangerous after 30 minutes
1000	Death after a few deep breaths



Know your safety equipment

Where it is, how and when to use
it, and how to maintain it

Respirator
with
cartridges:
For escape
purposes
only



If O₂ level
drops
below 12%,
there's not
enough
oxygen to
sustain you.

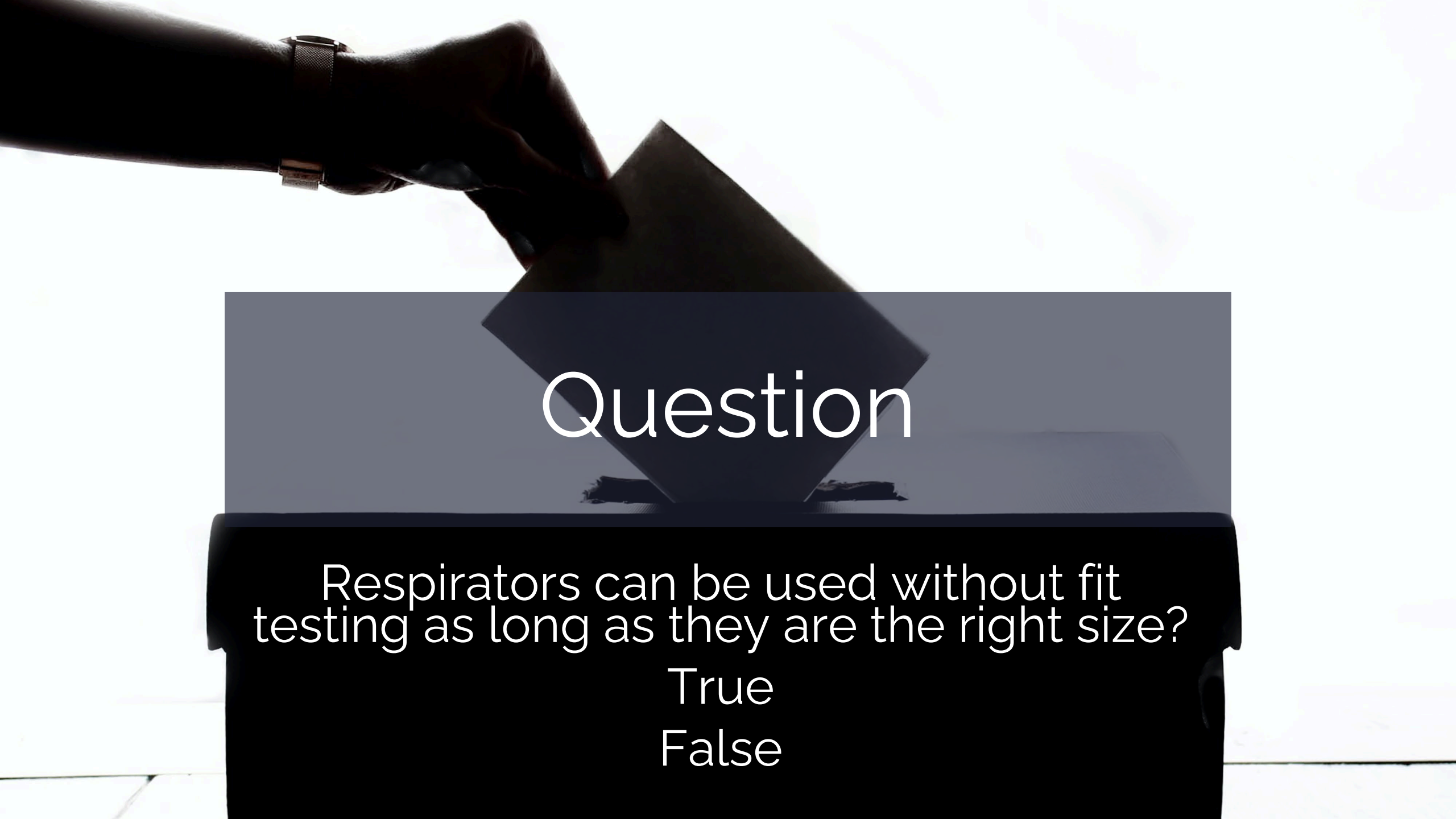


SCBA System: Self Contained Breathing Apparatus



SCBA System:
Requires training to
use properly



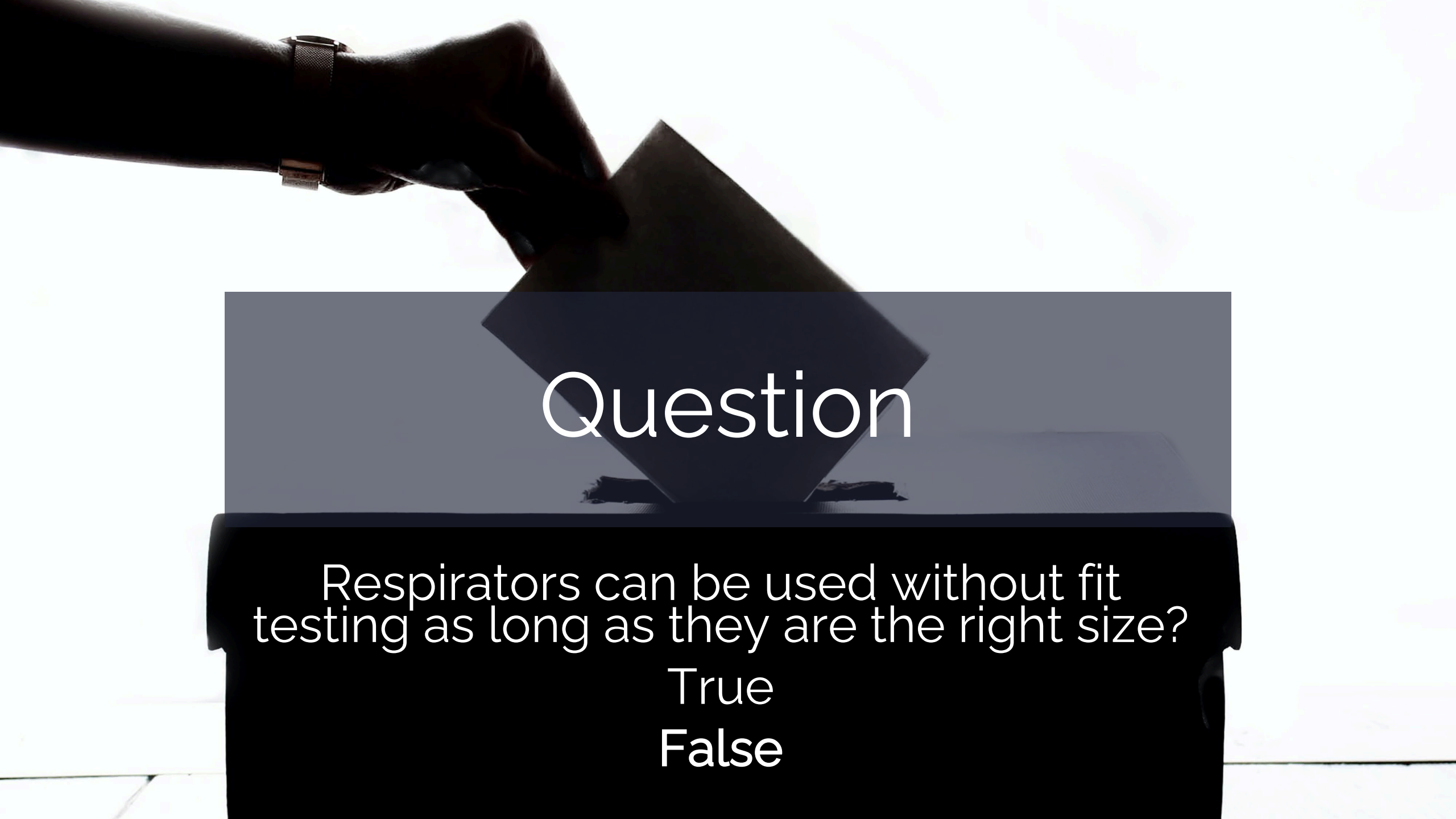
A hand wearing a watch is shown dropping a ballot into a ballot box. The background is a bright, slightly blurred outdoor scene. The ballot box is dark, and the ballot is a light color.

Question

Respirators can be used without fit testing as long as they are the right size?

True

False

A hand wearing a watch is shown dropping a ballot into a ballot box. The background is a bright, slightly blurred outdoor scene. The ballot box is dark, and the ballot is a light color.

Question

Respirators can be used without fit testing as long as they are the right size?

True

False

Confined Spaces



Confined Spaces

- Large enough and configured so that an employee can bodily enter and perform work
- Has limited or restricted means for entry and exit
- Is not designed for continuous occupancy
- Every entry into a confined space requires a confined space entry permit

Confined Space Hazards

- Air contamination:
 - Flammable
 - Explosive
 - Toxic
- Explosive chemical dust
- Oxygen enriched atmosphere (increases explosion risk)
- Oxygen deficient atmosphere

Oxygen Facts

- 20.9% oxygen: normal conditions
- <19.5% oxygen: potentially dangerous conditions
- 17% oxygen: shortness of breath
- 10% to 6% oxygen: rapid loss of consciousness
- <6% oxygen: death occurs in minutes

Oxygen Deficiency Causes

- Bacterial action using up available oxygen
- Displacement of oxygen by other gases
- Oxidation of metals or other materials depletes oxygen
- Absorption of oxygen into surfaces
- Combustion

Pits and Vaults

- Deadly gases can accumulate, or oxygen can be displaced.
- Atmospheric testing
- Adequate ventilation
- Corrosive gasses eat away at steps





Maintenance,
Repairs, etc.

Permits and Monitors



Confined Space Pre-Entry Checklist/Confined Space Entry Permit

Date and Time issued: _____ Date and Time Expires: _____ Job Site/Space I.D.: _____

Job Supervisor: _____ Equipment to be worked on: _____ Work to be performed: _____

Standby personnel: _____

1. Atmospheric Checks: Time _____ Oxygen _____ % Toxic _____ ppm
Explosive _____ % LEL Carbon Monoxide _____ ppm

2. Tester's signature: _____

3. Source isolation: (No Entry) N/A Yes No
Pumps or lines blinded, disconnected, or blocked () () ()

4. Ventilation Modification: N/A Yes No
Mechanical () () ()
Natural ventilation only () () ()

5. Atmospheric check after isolation and ventilation: Time _____
Oxygen _____ % > 19.5% < 23.5% Toxic _____ ppm < 10 ppm H₂S
Explosive _____ % LEL < 10% Carbon Monoxide _____ ppm < 35 ppm CO

Tester's signature: _____

6. Communication procedures: _____

7. Rescue procedures: _____

8. Entry, standby, and backup persons: Yes No
Successfully completed required training? () ()
Is training current? () ()

9. Equipment: N/A Yes No
Direct reading gas monitor tested () () ()
Safety harnesses and lifelines for entry and standby persons () () ()
Hoisting equipment () () ()
Powered communications () () ()
SCBAs for entry and standby persons () () ()
Protective clothing () () ()
All electric equipment listed for Class I, Division I, Groups A, B, C, and D, and nonsparking tools () () ()

10. Periodic atmospheric tests:
Oxygen: _____ % Time _____; _____ % Time _____; _____ % Time _____; _____ % Time _____;
Explosive: _____ % Time _____; _____ % Time _____; _____ % Time _____; _____ % Time _____;
Toxic: _____ ppm Time _____; _____ ppm Time _____; _____ ppm Time _____; _____ ppm Time _____;
Carbon Monoxide: _____ ppm Time _____; _____ ppm Time _____; _____ ppm Time _____; _____ ppm Time _____;

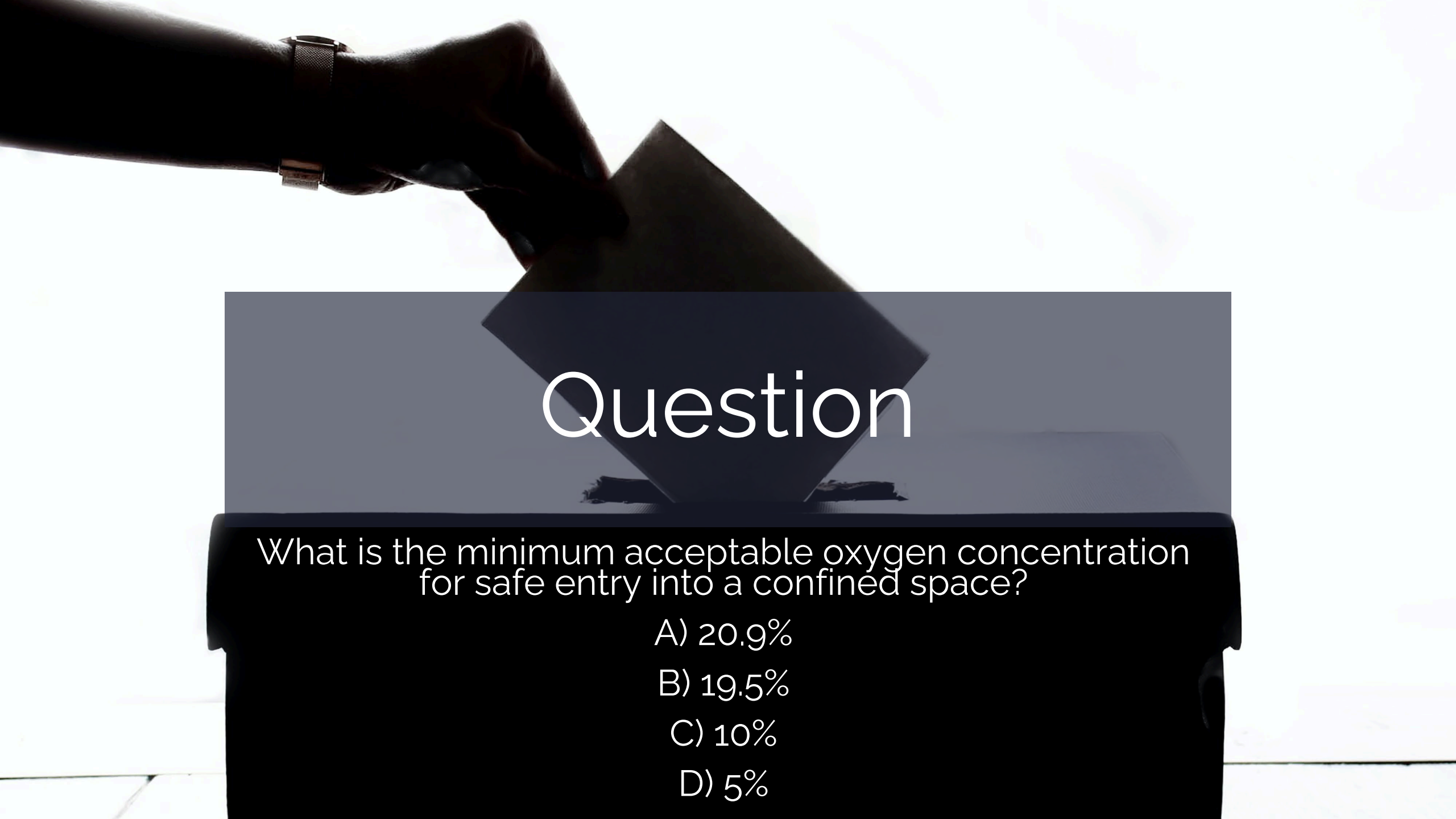
We have reviewed the work authorized by this permit and the information contained herein. Written instructions and safety procedures have been received and are understood. Entry cannot be approved if any brackets () are marked in the "No" column. This permit is not valid unless all appropriate items are completed.

Permit Prepared By: (Supervisor) _____ Approved By: (Unit Supervisor) _____

Reviewed By: (CS Operations Personnel) _____ (Entrant) _____ (Attendant) _____ (Entry Supervisor) _____

This permit to be kept at job site. Return job site copy to Safety Office following job completion.

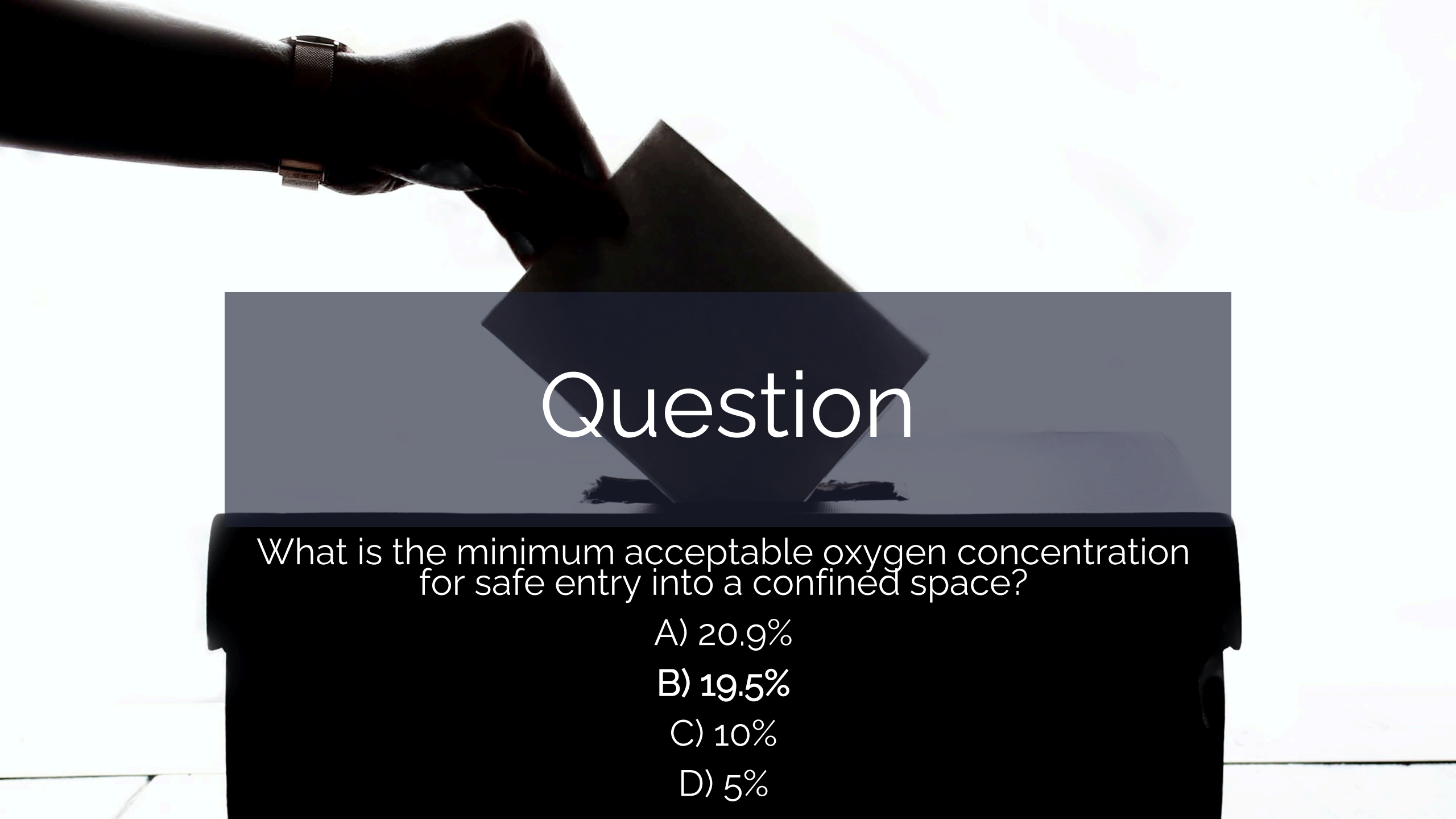
Figure 2.9 Confined space pre-entry checklist/confined space entry permit



Question

What is the minimum acceptable oxygen concentration for safe entry into a confined space?

- A) 20.9%
- B) 19.5%
- C) 10%
- D) 5%



Question

What is the minimum acceptable oxygen concentration for safe entry into a confined space?

- A) 20.9%
- B) **19.5%**
- C) 10%
- D) 5%

Excavation Hazards

When trenches without
adequate cave in
protection collapse
there is usually no
warning and no time to
escape.

OSHA requires protection
if an excavation is
5 feet or more in depth.

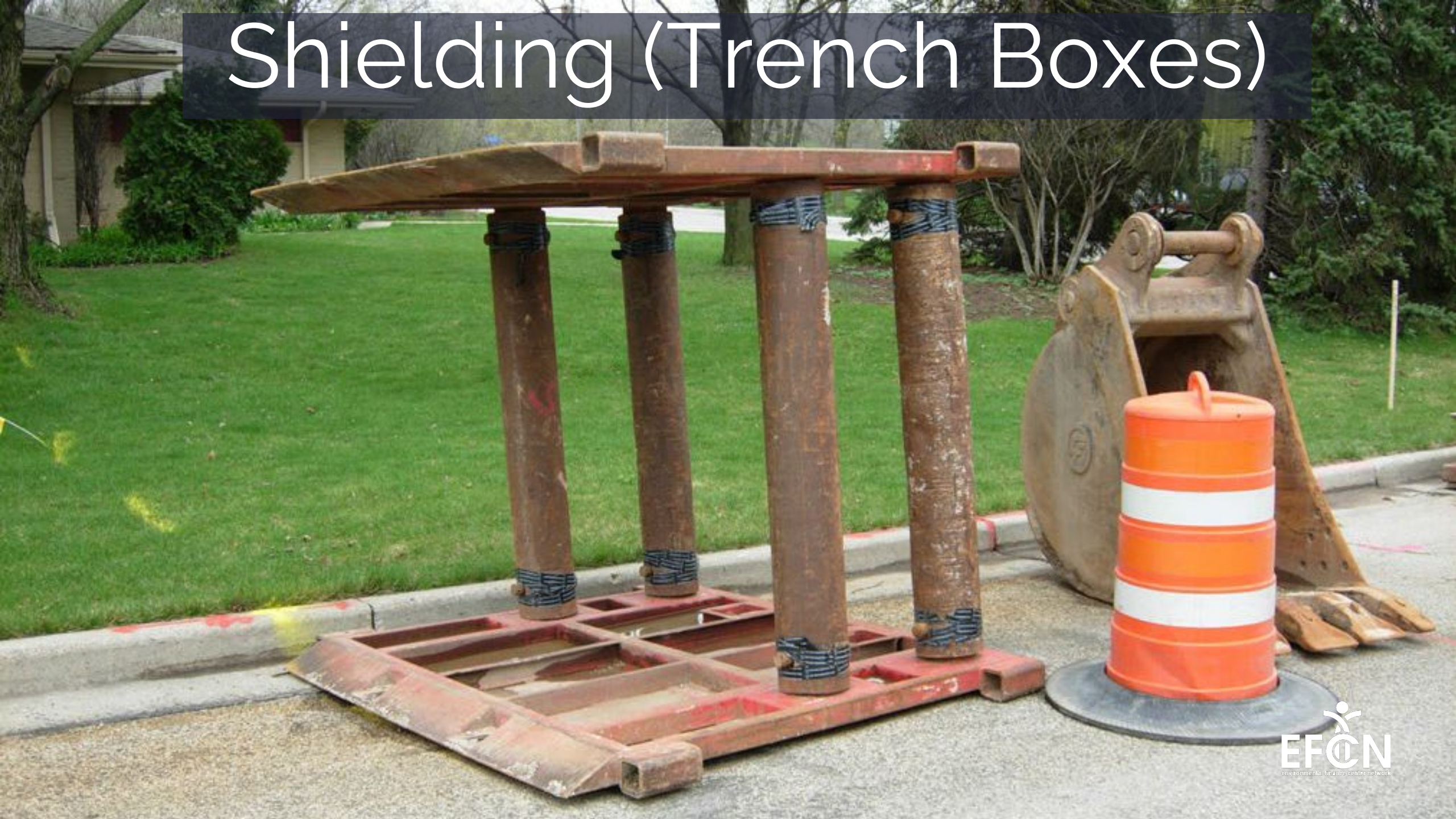
NMED recommends protection
if an excavation is
4 feet or more in depth.

Protection: Shoring, Shielding, and Sloping



Shoring

Shielding (Trench Boxes)



Shielding (Trench Boxes)



Sloping

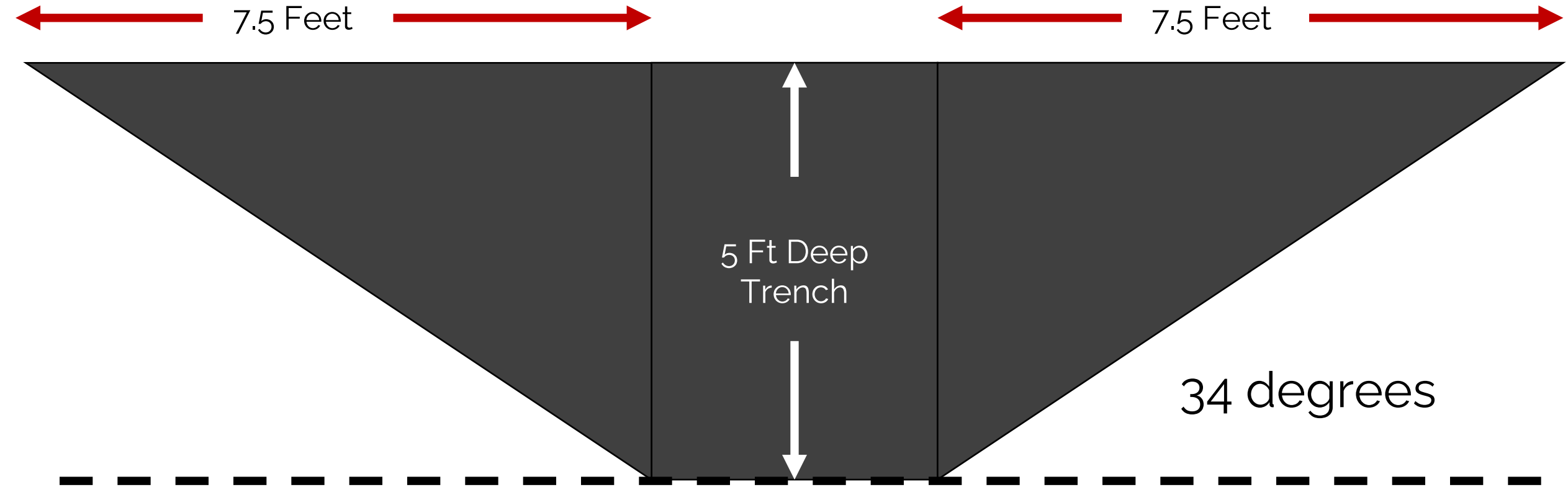


The acceptable slope angle:

- 34 degrees or
- slope of 1.5 : 1 (run over rise)

1.5 ft of horizontal excavation for every
1 ft vertical, on both sides of the trench.

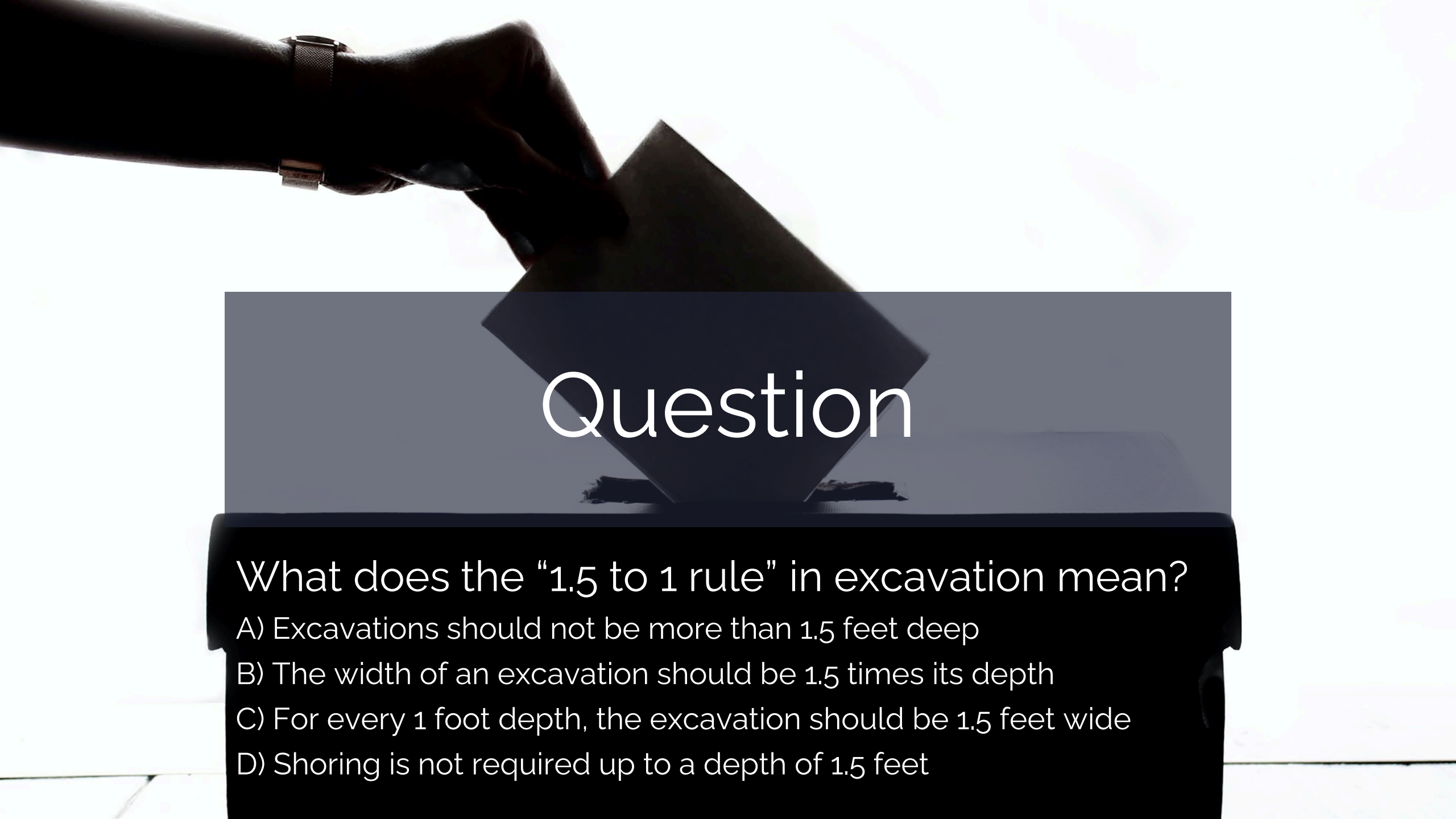
34° or 1.5 : 1 Slope (on both sides)



Ladders

- Are required every 25 lateral feet
- Must extend at least 3 feet above the excavation wall
- Must be placed on firm ground within the trench

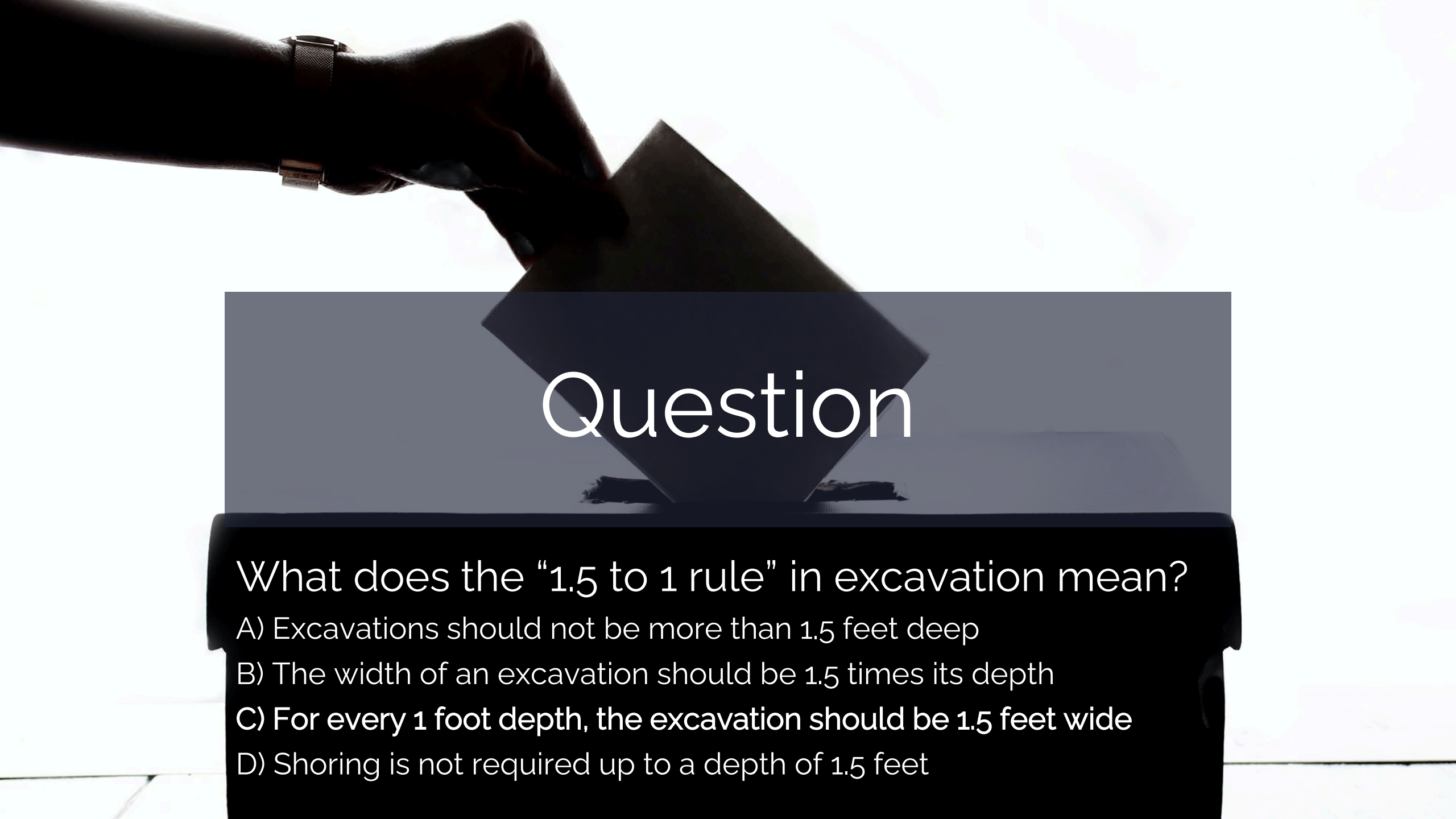


A hand wearing a watch is holding a dark rectangular block. The background is light with faint world maps. A dark semi-transparent rectangle is overlaid on the image, containing the word 'Question' in white.

Question

What does the “1.5 to 1 rule” in excavation mean?

- A) Excavations should not be more than 1.5 feet deep
- B) The width of an excavation should be 1.5 times its depth
- C) For every 1 foot depth, the excavation should be 1.5 feet wide
- D) Shoring is not required up to a depth of 1.5 feet

A hand wearing a watch is holding a dark, rectangular block. The background is light and features faint, stylized world maps. A dark, semi-transparent rectangular area is overlaid on the image, containing the text.

Question

What does the “1.5 to 1 rule” in excavation mean?

- A) Excavations should not be more than 1.5 feet deep
- B) The width of an excavation should be 1.5 times its depth
- C) For every 1 foot depth, the excavation should be 1.5 feet wide
- D) Shoring is not required up to a depth of 1.5 feet

Don't be the headline.

Fatality Summaries



[Worker struck by piece of frozen soil](#)

[Worker crushed in 7 foot deep excavation collapse](#)

[Worker buried by 10 foot deep excavation collapse](#)

[Worker crushed by 12 foot deep excavation collapse](#)

[Worker crushed by 8.5 foot deep trench wall collapse](#)

[Worker crushed in 8 foot deep excavation collapse](#)

[Worker buried in collapse of trench, varying from 15 to 22 feet deep](#)

[Worker crushed by collapse of 6.5 foot deep trench wall](#)

[Carpenter Dies When Eight-foot Trench Wall Collapses During Sewer Pipe Replacement](#)



There are other hazards that
we did not cover today.

Study available materials.

Follow your safety program.

Use your head.

CONTACT INFORMATION



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