The Maryland Fire and Rescue Institute of the University of Maryland is the State’s comprehensive training and education system for all emergency services.

The Institute plans, researches, develops, and delivers quality programs to enhance the ability of emergency service providers to protect life, the environment, and property.
Student Performance Objective

- Given information from discussion, handouts, and reading materials, the student will be able to compare operational levels of swiftwater rescue and relate those levels to zones of a swiftwater incident.

Overview

- Water Rescue Standards
- Water Rescue Philosophy
- Zones of an Incident
Water Rescue Standards

• Stakeholder Organizations
  – OSHA
  – FEMA
  – DHS
  – ASTM
  – ANSI
  – State Legislations
  – Local Jurisdictions

Water Rescue Standards

• NFPA
  – Generally Accepted Standards
  • NFPA 1670—Guidelines for organizations or agencies
    – Awareness  – Operations  – Technician
  • NFPA 1006—Personnel Performance Guidelines
    Level 1 and II
    – Awareness  – Operations  – Technician

Water Rescue Philosophy

• Elements of Successful Rescue
  – Training
  – Practice
  – Experience
  – Judgment
Water Rescue Philosophy

- Rescue Priorities
  - Self
  - Team
  - Victim

Water Rescue Philosophy

- Phases of a rescue
  - Locate
  - Access
  - Stabilize
  - Transport

Zones of an Incident

- Hot Zone
- Warm Zone
- Cold Zone
Student Performance Objective

• Given information from discussion, handouts, and reading materials the student will be able to compare operational levels of swiftwater rescue and relate those levels to zones of a swiftwater incident.

Review

• Water Rescue Standards
• Water Rescue Philosophy
• Zones of an Incident
Lesson 2-1: NIMS/ICS

Student Performance Objective

- Given information from discussion, handouts, and reading materials the student will be able to compare the functions of the National Incident Management System (NIMS) and the Incident Command System (ICS).

Overview

- The National Incident Management System
- The Incident Command System
The National Incident Management System

- NIMS was developed to facilitate mutual aid between jurisdictions
- NIMS training is mandated for all first responders by DHS
- NIMS mandates the use of the Incident Command System

The Incident Command System

- Defines specific roles and positions that are responsible for pre-assigned jobs or duties
- Can be used for single- or multi-jurisdictional incidents

The Incident Command System

- Uses several components
  - The Core Team
    - Incident Commander
    - Incident Safety Officer
    - Single Resource Boss or Team
  - Additional Positions
    - Assistant Safety Officer
    - PIO
    - Liaison Officer
The Incident Command System

- Uses several components
  - Additional Positions
    - Operations Section Officer
    - Logistics Section Officer
    - Planning/Intelligence Officer
    - Finance/Administration Officer
    - Branch Director
    - Division/Group Supervisor
    - Strike Team/Task Force Leader

The Incident Command System

Safety Officer
Asst. Safety Officer
Logistics Officer
PIO
Liaison
Rigging Group
Rescue Group
EMS Group
Staging / Equipment Group

Student Performance Objective

- Given information from discussion, handouts, and reading materials the student will be able to compare the functions of the National Incident Management System (NIMS) and the Incident Command System (ICS).
Review

- The National Incident Management System
- The Incident Command System
Lesson 2-2
Communications and PPE Overview

Student Performance Objective
- Given information from discussion, handouts, and reading materials the student will be able to utilize all means of communication and personal protective equipment during a swiftwater incident.

Overview
- Communications
- Personal Protective Equipment
- Team Equipment
Communications

- **Hand Signals**
  - One hand on the top of the head = "Okay!"
  - One hand extended waving = "Distress!"
  - One hand pointing = "Move in that direction!"
  - One hand rotating above the head and then pointing = "Eddy out in that direction!"
  - Both arms crossed in front of the chest = "Needs medical attention!"
  - Palm out = "Stop!"
  - Both hands raised = "Stop!"

Communications

- **Whistle Blasts**
  - 1 blast = Stop or attention
  - 2 blasts = Attention upstream or move upstream
  - 3 blasts = Attention downstream or move downstream
  - 3 blasts repeated = Emergency or Rescue

Personal Protective Equipment

- Review all personal equipment
Personal Protective Equipment

- **Drysuits**
  - Must protect the wearer from the water
  - Must protect the wearer from water-borne pathogens
  - Must have an integral sock
  - May have integral boots

Personal Protective Equipment

- **Wetsuits**
  - Trap a layer of water between an individual's skin and the suit material
  - Offer no protection from hazardous materials
  - Must have long sleeves and cover the legs to the ankle according to the NFPA

Personal Protective Equipment

- **Personal Flotation Devices (PFDs)**
  - Some PFDs are designed to assist rescue personnel
    - Type III—designed for boat-based activity in calm, inland waters
    - Type V—designed for special uses and work purposes
    - Type III/V—designed to be multi-purpose and is a combination type III and type V
  - PFDs will function properly if the fit is good
  - Some PFDs are inflatable
Personal Protective Equipment

- Personal Flotation Devices (PFDs)
Personal Protective Equipment

- **Helmets**
  - Must be used in accordance with NFPA 1952
  - Must protect the head from impact
  - Must be designed to allow water to flow instead of retaining water
  - Must have a strong strap system and be corrosion-resistant

- **Footwear**
  - Can be a compromise
  - Recreational waters shoes have thin soles
  - Water boots take abuse from contaminated water and rough terrain
  - Hiking boots offer grip and support on rough terrain
  - Does not have to be waterproof

- **Gloves**
  - Neoprene gloves with reinforced palms offer warmth and protection from sharp objects
  - A dry glove offers protection from hazmat but makes swimming and handling ropes difficult
Personal Protective Equipment

- **Whistles**
  - Must continue to work after being immersed in water
  - Can be used to attract attention, especially in night operations

Personal Protective Equipment

- **Knives**
  - Need to be very sharp, easily available and secure
  - Can be tied to a lanyard and attached to a PFD

Personal Protective Equipment

- **Throwbags**
  - Should be carried at all times when within 10 feet of moving water
  - Come in various lengths
  - Must be able to float
  - Should use rope that is made of polypropylene or other ropes that have high melting points
Personal Protective Equipment

- Lights
  - Lights should be waterproof and be the hands-free type
  - LED bulbs provide a pure white light and extended battery life
  - Glow sticks should only be used to mark equipment or if personnel lights fail

Personal Protective Equipment

- Swim fins
  - Can increase a rescuer’s speed
  - Can be difficult and tiring to use
**Personal Protective Equipment**

- **Eye Protection**
  - Is typically not used in a swiftwater environment
  - Should be used when additional risks are present

**Personal Protective Equipment**

- **Buoyant Aids**
  - Are used primarily by lifeguards to assist in rescue
  - Are used to distance the rescuer and the victim

**Team Equipment**

- Review all team equipment
Team Equipment

- Inflated Fire Hose
  - Allows for many rescue options
  - Is inflated to between one and three Bar

Team Equipment

- Boats
  - Inflatable rescue boats
    - Are smaller than other rescue boats
    - Have a raft-like construction
    - Can be rolled up for transportation
    - Have semi-rigid floors

Team Equipment

- Boats
  - Inflatable rescue boats
    - Are maneuverable in whitewater
    - Can be handled without the motor
    - Are popular with emergency services
Team Equipment

- Boats
  - Rigid Hull Crafts
    - Can have flat bottoms or deep V’s
    - Can be made of aluminum, wood, or plastic
    - Can have built-in buoyancy compartments
    - Can have more “freeboard”
    - Need a trailer and a slipway to launch

- Boats
  - Rigid inflatable boats
    - Have a combination of a rigid hull and keel with inflatable tubes
    - Can use more powerful engines
    - Have good directional stability
    - Need a trailer and slipway to launch

- Boats
  - Personal water crafts
    - Have been used for surf rescue
    - Have good power, speed, and maneuverability
    - Have no prop or fuel to injure victims
    - Need a trailer and slipway to launch
Team Equipment

- **Boats**
  - Whitewater rafts
    - Are constructed with a material called Hypalon or PVC
    - Are easily loaded in shallow water
    - Can range from 10 feet to 18 feet in length
    - Use paddles to power the raft

- **Inflatable rescue crafts**
  - Are extremely maneuverable
  - Can only be used by trained personnel
  - Have a limited capacity
  - Are built for easy victim retrieval
  - Can be used on unstable surfaces
Team Equipment

- **Boats**
  - Kayaks
    - Are extremely maneuverable
    - Can only be used by trained personnel
    - Have a very limited capacity
    - Are good for hasty searches

- **Boats**
  - Canoes
    - Can only be used by trained personnel
    - Have a limited capacity

- **Boats**
  - Rescue boards and sleds
    - Come in a variety of designs
    - Work in conjunction with personal water crafts
    - Are useful when supporting swimming rescues
Student Performance Objective

- Given information from discussion, handouts, and reading materials the student will be able to utilize all means of communication and personal protective equipment during a swiftwater incident.

Review

- Communications
- Personal Protective Equipment
- Team Equipment
Student Performance Objective

- Given information from discussion, handouts, and reading materials the student will be able to define hydrology as it relates to swiftwater rescue, and relate those definitions to river dynamics.

Overview

- Moving Water
- Channel Characteristics
- Force of Water
- Transportation of Loads
- Swiftwater Hydrology
- Flow Types
- Current Vectors
- Swiftwater Features
- Hydraulics
- Low Head Dams
- Swiftwater and Flood Hazards
Moving Water
- Powerful
- Relentless
- Predictable

Channel Characteristics
- Volume of Water Flowing
  - Volume for swiftwater rescue purposes is measured in cubic feet per second
  - Knowing the measurement of a channel at a given spot, it is possible to calculate the flow volume

Channel Characteristics
- Volume of Water Flowing
  - Volume can be expressed in other terms
    - One cubic foot of water equals eight gallons
    - 250 gallons of water equals one ton
    - 1,000 cubic feet of water per second equals 8,000 gallons per second
    - 8,000 gallons of water per second equals 32 tons of water per second
**Channel Characteristics**

- Channel gradient is the main determining factor of water speed
- Channel gradient is a critical factor
  - 100 feet over 1 mile could be a uniform slope with a high water speed
  - 100 feet over 1 mile could be a series of slow-moving pools divided by waterfalls

**Channel Characteristics**

- Smooth sided, man-made drainage channels can result in very uniform flows and little entrapment risk
- Straight running drainage channels will have much higher water speeds than a natural river channel of the same gradient
- Natural river beds vary greatly depending on the rock type and the forms and structure of the rocks

**Channel Characteristics**

- Water Speed
  - Water speed is determined by volume, gradient, and formation of the rocks in channel beds and banks
  - Water speed can be increased by constrictions
    - The water depth or speed will increase
    - Constrictions can occur in natural river channels and flood situations
Channel Characteristics

- Water Speed

Force of Water

- Force is measured in Newtons
  - The mass of 1 kilogram (2.2 lbs) with the force of gravity will exert a force of 10 N on the surface it’s resting upon
  - The force on a person’s legs in water moving at 3 mph is the equivalent to the mass of 16.5 lbs
- The relationship between the speed of moving water and the force it exerts is not a linear one

Force of Water

- The force of water affects people
  - Water flowing at 7.2 mph can wash people off their feet in a depth of 9 to 10 inches
  - Water flowing at 4 mph can wash people off their feet in a depth of 3 feet
  - Water flowing at 2.2 mph can cause difficulty for people trying to retain their balance in 3 feet (36 inches)
Transportation of Loads

- Top Load or Surface Load
  - Kayaks
  - Rafts
  - Floating debris
  - Swimmers and victims with PFDs
- Suspended loads
  - Debris that has been waterlogged
  - Dead bodies

Transportation of Loads

- Bottom load
  - Boulders
  - Cars
- Dissolved load
  - Hazardous materials
  - Anything that mixes with the water

Swiftwater Hydrology

- Upstream—the direction from which the water is flowing
- Downstream—the direction in which the water is flowing
- River right—the right side of the channel when looking downstream
- River left—the left side of the channel when looking downstream
Flow Types

• Laminar Flow
  – Layers of water in contact with the channel bed and sides are slowed by the effects of friction
  – The water in the middle is slowed by the friction against the slower water beside it
  – The fastest water is in the center just below the surface

Flow Types

• Helical flow
  – The bank slows the water at the edge of the river
  – Helical flow is unusual in natural channels unless the channel is completely full and traveling at maximum speed
  – Helical flow can push a victim and river debris away from the bank and into the center of the river
Current Vector

- Moving water flows in a straight line until it hits an object or obstacle
- Moving water creates high-pressure areas where it impacts the outside of bends in the river and
  - Causes erosion on the outside of the bends
  - Creates low pressure areas on the inside of the bends
  - Can also lead to a buildup of sand or gravel and shallow water on the inside of the bends
Swiftwater Features

- Eddy—a common river feature when water hits an obstacle and is deflected away from it
- Eddy Line—a boundary "line" between the main flow in a river and an eddy
Swiftwater Features

• Cushion Wave—created when water hits an object it cannot pass through

Swiftwater Features

• Standing Wave or Wave Train—created by water passing over or around an object
Swiftwater Features

- Upstream "V"—formed when water hits an obstacle and forms cushion or standing waves
- Downstream "V"—created when the water is pushed between two objects

Swiftwater Features

- Strainers—anything that allows water to pass through it, but not solid objects
  - Debris
  - Boats
  - Swimmers
  - Fences
  - Guardrails

Hydraulics

- Hydraulics
  - Have different names
    - Stoppers
    - Holes
    - Pour-overs
  - Have many shapes
    - Smiling
    - Frowning
    - Straight
  - Have dangerous recirculation or reverse flows
Hydraulics

- Hydraulics have specific characteristics
  - Big backwash
  - Irregularity
  - Wide Width
  - Unusual power
  - Closed ends
  - Open ends
  - Varying water levels

Hydraulics

- Hydraulics can be escaped by
  - Swimming to the surface
  - Swimming aggressively to the sides
  - Getting to the flowing water under the recirculation
  - Staying calm
  - Not giving up

Low Head Dams

- Low Head Dams
  - Are identical to hydraulics
  - Are also called “weirs”
  - Are man-made
  - Are either open or closed on the sides
Swiftwater and Flood Hazards

- Utility hazards
  - Electricity
  - Natural gas
  - LPG or oil tanks

Swiftwater and Flood Hazards

- Chemical and biological hazards
  - Urban
  - Rural
- Physical hazards
  - Undercuts
  - Manhole covers
  - Bridges
  - Strainers

Student Performance Objective

- Given information from discussion, handouts, and reading materials the student will be able to define hydrology as it relates to swiftwater rescue, and relate those definitions to river dynamics.
Review

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- Swiftwater and Flood Hazards
Student Performance Objective

- Given information from discussion, handouts, and reading materials the student will be able to identify the medical conditions and illnesses related to swiftwater rescue victims and how to provide initial treatment.

Overview

- Drowning
- Hydrostatic Shock
- Mammalian Diving Reflex
- Common Medical Conditions in the Water Environment
- Waterborne Illnesses
- General First Aid in Moving Water
Drowning

- Definitions
- Outcomes
- Global and National Statistics
- The Process

Hydrostatic Shock

- Hydrostatic shock
  - Occurs when a victim is immersed in water for a long period of time
  - Reduces blood flow, causing blood to pool
    - Victims must be rolled horizontally out of the water to prevent loss of consciousness and cardiac arrest
    - Prone position is the best for transport

Mammalian Diving Reflex

- Warm-blooded animals are able to optimize their respiration when diving under the water
  - The diving reflex is exhibited primarily in aquatic mammals
  - Humans have a diving reflex but it is not as strong as that of the aquatic mammals'
Mammalian Diving Reflex

- The diving reflex is triggered when cold water contacts the face
  - The diving reflex is more dramatic in young people
  - A full understanding of the reflex is unknown
  - Key factors include vascular constriction and bradycardia
  - Blood shunting and shifting is also a factor

Mammalian Diving Reflex

- The diving reflex is triggered when cold water contacts the face
  - Blood vessels constrict in parts of the body that can tolerate oxygen deprivation and still work
  - The body slows and will eventually stop blood supply to these areas
  - The brain and heart are the last to be cut off from blood supply
  - The heart works less when circulation is decreased in parts of the body

Common Medical Conditions in the Water Environment

- Hypothermia
  - Hypothermia is best defined as the body not being able to maintain a core temperature of 98.6° F
  - Heartbeat irregularities occur at a body temperature about 82.4° F
  - Heartbeats cease at 64.8° F
Common Medical Conditions in the Water Environment

- Hypothermia
  - Early stages of hypothermia include
    - Chills and shivering
    - Lack of fine motor skills
    - Loss of judgment
  - Severe hypothermia includes signs of altered mental status and no shivers

- Hypothermia can be treated in several steps
  - Remove or protect the victim from a cold, wet, or windy environment
  - Remove wet clothing and insulate with thermal layers
  - Treat in position of comfort with the exception of severely hypothermic patients
  - Always attempt to re-warm

- Hyperthermia
  - Is best defined as when the body can no longer dissipate enough heat to maintain the core temperature of 98.6°F
  - Can cause heat cramps
    - Sudden onset of cramps in legs or abdomen
    - Low blood pressure
    - Nausea
    - Rapid pulse
    - Pale, moist skin
    - Normal core body temperature
Common Medical Conditions in the Water Environment

- Hyperthermia
  - Can cause heat exhaustion due to dehydration
    - Headaches
    - Weakness/fatigue
    - Rapid shallow breathing
    - Pale skin and sweating
    - Muscle cramps
    - Dizziness
    - Nausea

- Hyperthermia
  - Can be prevented by the following steps
    - Remain hydrated
    - Take steps to cool down
      - Remove the victim from the hot environment
      - Provide fluid replacement by mouth if the victim can tolerate it
      - Remove clothing, if practicable
      - Apply cold compresses

- Hyperthermia
  - Can cause heat stroke which is characterized by a very high core body temperature
    - Hot, reddish, dry skin
    - Rapid, strong pulse that becomes weaker
    - Deep breathing initially that becomes shallow and weak
    - Mental confusion
    - Headache
    - Nausea or vomiting
    - Convulsions
    - Sudden collapse
Common Medical Conditions in the Water Environment

- **Traumatic Injuries**
  - **Major Fractures**
    - The most serious of all fractures are to the femur
    - If the femur is fractured then one must suspect other injuries

- **Traumatic Injuries—Bleeding**
  - Oozing—not a serious concern and can be treated with simple bandages
  - Flowing—can be a serious concern and can be easily controlled
  - Spurting—is a serious concern and must be controlled quickly or the patient will die from blood loss

- **Traumatic Injuries—Shock**
  - Is defined as inadequate tissue perfusion
  - Can be determined by signs and symptoms:
    - Low blood pressure
    - Hyperventilation
    - Weak, rapid pulse
    - Cyanosis
    - Altered mental status
  - Can be treated by keeping patients warm and giving them fluids
Waterborne Illnesses

- Leptospirosis
  - Is a bacterial infection caused by leptospires
  - Can be undetected in some patients
  - Can only survive a few hours in salt water
  - Can infect a wide variety of animals
  - Can occur worldwide

Waterborne Illnesses

- Leptospirosis
  - Enters the body through breaks in the skin
  - Cover cuts and broken skin with waterproof plasters
  - Wear PPE
  - Wash hands prior to eating or drinking
  - Shower after immersion in open water
  - Decontaminate on-site after PPE removal

Waterborne Illnesses

- Leptospirosis
  - Has an incubation period of four to fourteen days
  - Flu-like symptoms (Phase I)
  - Meningitis (Phase II)
  - Can be treated if caught early
Waterborne Illnesses

- **Hepatitis A**
  - Is a virus present in feces
  - Enters the body through the fecal-oral route
  - Has an incubation period of 15–50 days
    - Can be mild
    - Can progress into a severely disabling disease
  - Can be prevented

Waterborne Illnesses

- **Blue Green Algae**
  - Is also known as cyanobacteria and is found in fresh water
    - The algae multiplies and forms blooms on the water surface
    - The blooms may look like jelly or paint and are blue-green in color
  - Enters the body through the skin while swimming or wading

Waterborne Illnesses

- **Blue Green Algae**
  - Can elicit many signs and symptoms
    - Dermatitis
    - Eye irritation
    - Gastroenteritis
    - Joint and muscle pain
    - Pneumonia
    - Liver damage
    - Neurological conditions
Waterborne Illnesses

- Other gastrointestinal illnesses
  - Salmonella
  - Campylobacter
  - Escherichia Coli
  - Listeria
  - Cryptosporidium

General First Aid in Moving Water

- Rescuer safety
  - Hazard assessment
  - Team Safety
  - Body substance isolation

- Initial Assessment
  - Check level of consciousness
  - Scan for mechanism of injury

- ABC Assessment
  - Airway
  - Breathing
  - Circulation
General First Aid in Moving Water

- Neurological Assessment
  - Alert: Is the victim alert and able to converse?
  - Verbal: Does the victim respond to verbal stimuli?
  - Painful: Does the victim respond to painful stimuli?
  - Unresponsive: Is the victim completely unresponsive?

- Injury and Exposure
  - Physical assessment
    - Start at the head
    - Compare injured limbs to uninjured limbs
  - Body temperature
  - History (SAMPLE)
  - Patient Packaging and Evacuation

Student Performance Objective

- Given information from discussion, handouts, and reading materials the student will be able to identify the medical conditions and illnesses related to swiftwater rescue victims and how to provide initial treatment.
Review

- Drowning
- Hydrostatic Shock
- Mammalian Diving Reflex
- Common Medical Conditions in the Water Environment
- Waterborne Illnesses
- General First Aid in Moving Water
Student Performance Objective

- Given information from discussion, handouts, and reading materials the student will be able to define the 15 Absolutes of swiftwater rescue, conduct a size-up of a swiftwater rescue incident, and conduct a pre-plan of a swiftwater rescue incident.

Overview

- 15 Absolutes
- Developing a Pre-Plan
- Size-up of Flood and Swiftwater Rescues
- Activity 4-1-1
- Activity 4-1-2
15 Absolutes

1. Keep it simple
   - Use minimal equipment set up time
   - Use equipment known to the entire rescue team

2. Be-proactive
   - Use pre-plan
   - Use public education tools
   - Use public notification systems
   - Use containment strategies for the scene
   - Use critical thinking strategies

3. Prioritize Rescue
   - Self-rescue
   - Teammates’ safety
   - Victim management

4. Always wear a personal flotation device (PFD)
   - Anyone that is at risk of entering water should wear a PFD
   - The type of PFD worn is determined by the incident

5. Use the right equipment
   - Never use inappropriate or unsafe equipment
   - Never improvise any equipment
   - Never use equipment that does not meet all the applicable standards

6. Do not use a fire helmet for water rescue operations
   - There is a huge potential for injuries to the neck
   - There are a wide variety of helmets approved for swiftwater environments
15 Absolutes

7. Always deploy upstream spotters
   – Above the location of the incident
     • Can warn rescuers of potential debris and other hazards
     • Can warn other river users to the incident in progress
   – On both sides of the river

8. Always have appropriate downstream backup
   – Throwbags and inflated fire hoses are ideal; however, they are not absolute
   – Any backup is better than no backup

9. Always have a backup plan
   – Think critically
   – Use additional resources

10. Never tie a rope around a rescuer
    – Personnel have died being pulled underwater by a rope
    – Rope should be tied to a quick release harness on a PFD

11. Never tension a rope at right angles to the current
    – The current will push a person downstream
    – The rope will form a “V” with the rescuer downstream unable to move
15 Absolutes

12. Never stand inside a loop of rope on the upstream side
   - Standing inside a loop will put a person at risk for being trapped by a rope
   - Standing inside a loop of rope with mechanical advantage (MA) will put a person at risk for injury if the MA system fails
   - Standing on the upstream side allows for rescuers to stay clear of objects as they move downstream and not be knocked down by the rope or object

13. Never put your feet down if you are swept away
   - Can be fatal
   - Can cause foot entrapment
   - Can cause entrapment underwater

14. Never count on victims to help in their own rescue
   - Victims will be terrified
   - Victims’ abilities will be diminished

15. Never lose the victim once he/she is contacted
   - Remember self-rescue first, team safety, then victim rescue
   - Make every effort to avoid losing contact with the victim
Developing a Pre-Plan

- Assess hazards
  - Utility hazards
    - Electricity
    - Natural Gas
    - LPG or oil tanks
  - Chemical and Biological hazards
    - Urban
    - Rural
    - Physical hazards

Developing a Pre-Plan

- Assess hazards
  - Physical hazards
    - Undercuts
    - Siphons or sieves
    - Inspection “manhole” covers
    - Bridges
    - Debris
    - Strainers
    - Cold Water

Developing a Pre-Plan

- Assess previous incidents
  - Recent
  - Historic
  - Rainfall
  - River level data
Developing a Pre-Plan

• Assess management
  – Incident commander
  – Leaders of rescue teams

• Assess personnel
  – Core team of rescuers
  – Leaders of core team

Developing a Pre-Plan

• Assess personnel training
  – Is this person adequately trained for swiftwater rescue?
  – Is this person trained to make recommendations?

• Assess equipment
  – Appropriate type of equipment
  – Sufficient amount of equipment

Developing a Pre-Plan

• Assess the basics of the incident
  – Communications
  – Mutual Aid
  – Welfare
  – Shelter
  – Transportation
Developing a Pre-Plan

- Complete a site plan
  - Location
  - Maps and plans
  - Access routes
  - Communication issues
  - Specific risks
  - Special equipment requirements
  - Specialist training requirements
  - Team response plan

Size-up of Flood and Swiftwater Rescues

- Size-up of flood and swiftwater rescues
  - Is everyone’s responsibility, not just the incident commander’s
  - Affects the overall outcome of the incident, whether good or bad
  - Enhances situational awareness

Activity 4-1-1
Activity 4-1-1

• Background Information: Red River
  – Red River is known to be used for fishing during the summer months.
  – Main Street runs along the river and is heavily used.
  – Note the rocks along the river bed and in the river towards river left.

Activity 4-1-1

• Background Information: Red River
  – About .5 miles upstream is a factory directly on the river bank.
  – Previous incidents have occurred here, mostly minor. One major incident: a 12-year-old female had severe head trauma and fell into the water. This major incident was 15 years ago.

Activity 4-1-2
Activity 4-1-2

• Complete a size-up of the following incident:
  – On July 22, at approximately 2 p.m., a call comes in to the 911 center for an injured person at the Red River bank at Main Street. The victim is a 22-year-old male and he is face down on the rocks at the edge of the river. The caller advises that the male is unresponsive. You are the first unit to arrive on scene and you give the communications center a size-up.

Activity 4-1-2

• Remember IDEAL P
  – Identify your unit
  – Describe the incident
  – Explain your actions
  – Assume a sector or command
  – List instructions for other units
  – Provide progress reports

Student Performance Objective

• Given information from discussion, handouts, and reading materials the student will be able to define the 15 Absolutes of swiftwater rescue, conduct a size-up of a swiftwater rescue incident, and conduct a pre-plan of a swiftwater rescue incident.
Review

- 15 Absolutes
- Developing a Pre-Plan
- Size-up of Flood and Swiftwater Rescues
- Activity 4-1-1
- Activity 4-1-2
Lesson 5-1
Personal and Team Equipment

Student Performance Objective
- Given information from discussion, handouts, and reading materials the student will be able to describe all personal and team equipment used during a swiftwater incident.

Overview
- Personal Equipment
- Team Equipment
Personal Protective Equipment

- Review all personal equipment

Personal Protective Equipment

- Drysuits
  - Must protect the wearer from the water
  - Must protect the wearer from water-borne pathogens
  - Must have an integral sock
  - May have integral boots

Personal Protective Equipment

- Wetsuits
  - Trap a layer of water between an individual’s skin and the suit material
  - Offer no protection from hazardous materials
  - Must have long sleeves and cover the legs to the ankle according to the NFPA
Personal Protective Equipment

- Personal Flotation Devices (PFDs)
  - Some PFDs are designed to assist rescue personnel
    - Type III — are designed for boat-based activity in calm, inland waters
    - Type V — are designed for special uses and work purposes
    - Type III/V — are multi-purpose, a combination of type III and type V
  - PFDs will function properly if the fit is good
  - Some PFDs are inflatable
Personal Protective Equipment

- Personal Flotation Devices (PFDs)

Personal Protective Equipment

- Helmets
  - Must be used in accordance with NFPA 1952
  - Must protect the head from impact
  - Must be designed to allow water to flow instead of retaining water
  - Must have a strong strap system and be corrosion-resistant

Personal Protective Equipment

- Footwear
  - Can be a compromise
    - Recreational waters: shoes have thin soles
    - Water boots take abuse from contaminated water and rough terrain
    - Hiking boots offer grip and support on rough terrain
  - Does not have to be waterproof
Personal Protective Equipment

- Gloves
  - Neoprene gloves with reinforced palms offer warmth and protection from sharp objects
  - A dry glove offers protection from hazmat but makes swimming and handling ropes difficult

Personal Protective Equipment

- Whistles
  - Must continue to work after being immersed in water
  - Can be used to attract attention, especially in night operations

Personal Protective Equipment

- Knives
  - Need to be very sharp, easily available and secure
  - Can be tied to a lanyard and attached to a PFD
Personal Protective Equipment

- **Throwbags**
  - Should be carried at all times when within 10 feet of moving water
  - Come in various lengths
  - Should use rope that is made of polypropylene or other ropes that have high melting points
  - Must be able to float

- **Lights**
  - Lights should be waterproof and be the hands-free type
  - LED bulbs provide a pure white light and extended battery life
  - Glow sticks should only be used to mark equipment or if personnel lights fail
Personal Protective Equipment

- Swim fins
  - Can increase a rescuer’s speed
  - Can be difficult and tiring to use

Personal Protective Equipment

- Eye Protection
  - Is typically not used in a swiftwater environment
  - Should be used when additional risks are present

Personal Protective Equipment

- Buoyant Aids
  - Are used primarily by lifeguards to assist in rescue
  - Are used to distance the rescuer and the victim
Team Equipment
- Review all team equipment

Team Equipment
- Inflated Fire Hose
  - Allows for many rescue options
  - Is inflated to between one and three Bar

Team Equipment
- Boats
  - Inflatable rescue boats
    - Are smaller than other rescue boats
    - Have a raft-like construction
    - Can be rolled up for transportation
    - Have semi-rigid floors
**Team Equipment**

- **Boats**
  - Inflatable rescue boats
    - Are maneuverable in whitewater
    - Can be handled without the motor
    - Are popular with emergency services

- **Boats**
  - Rigid Hull Crafts
    - Can have flat bottoms or deep V's
    - Can be made of aluminum, wood, or plastic
    - Can have built-in buoyancy compartments
    - Can have more "freeboard"
    - Need a trailer and a slipway to launch

- **Boats**
  - Rigid inflatable boats
    - Have a combination of a rigid hull and keel with inflatable tubes
    - Can use more powerful engines
    - Have good directional stability
    - Need a trailer and slipway to launch
Team Equipment

- Boats
  - Personal water crafts
    - Have been used for surf rescue
    - Have good power, speed, and maneuverability
    - Have no prop or fuel to injure victims
    - Need a trailer and slipway to launch

Team Equipment

- Boats
  - Whitewater rafts
    - Are constructed with a material called Hypalon or PVC
    - Are easily loaded in shallow water
    - Can range from 10 feet to 18 feet in length
    - Use paddles to power the raft

Team Equipment

- Boats
  - Inflatable rescue crafts
    - Are extremely maneuverable
    - Can only be used by trained personnel
    - Have a limited capacity
    - Are built for easy victim retrieval
    - Can be used on unstable surfaces
Team Equipment

- Boats
  - Inflatable rescue crafts

Team Equipment

- Boats
  - Kayaks
    - Are extremely maneuverable
    - Can only be used by trained personnel
    - Have a very limited capacity
    - Are good for hasty searches

Team Equipment

- Boats
  - Canoes
    - Can only be used by trained personnel
    - Have a limited capacity
Team Equipment

- Boats
  - Rescue boards and sleds
  - Come in a variety of designs
  - Work in conjunction with personal water crafts
  - Are useful when supporting swimming rescues

Student Performance Objective

- Given information from discussion, handouts, and reading materials the student will be able to describe all personal and team equipment used during a swiftwater incident.

Review

- Personal Equipment
- Team Equipment
Student Performance Objective

- Given information from discussion, handouts, and reading materials the student will be able to describe how to conduct a search of a river or flood during a swiftwater incident.

Overview

- Searching Rivers and Floods at the Operations Level
- Searching Rivers and Floods at the Technician Level
- Searching Rivers and Floods at the Advanced Level
Searching Rivers and Floods at the Operations Level

- Foundation Knowledge
  - Locating the victim is always first priority

- Foundation knowledge
  - Searching is highly organized and rational
    - Natural river channels have a large number of hiding places
    - Limited access and fast-moving water make searching rivers and floods difficult and time-consuming
    - Many victims are not found for a considerable length of time
    - Searching can be done at night or in adverse conditions

- Personnel
  - Only personnel trained to the Technician or Specialist level are allowed in the Hot Zone with the proper equipment
  - Personnel with no swiftwater training must be managed carefully
Searching Rivers and Floods at the Operations Level

- Specialty Teams and Equipment
  - Specialist boat crews may be needed to assist in the search
  - Helicopters may be helpful but present limitations
  - Technical Rope teams may be of assistance
  - Search dogs may be highly effective

- Radio Communications
  - Radio communication is the preferred option
    - Radios should be protected from water
    - Radios should be put into dry-bags
  - Radio interoperability is key

- Lighting
  - Identifies search team members
  - Allows the searchers to see where they are going
  - Allows for searchers to search effectively
Search Methods
- Searchers must pretend they are in a cube
  - Look forward: far distance, middle distance, and near distance
  - Look left
  - Look right
  - Look backward
  - Look and up and down
- Searchers’ areas will overlap one another

Searching Rivers and Floods at the Technician Level
- Determine which of the three main situations is applicable
  - A rescue site where the team learns that someone was swept away
  - A rescue site where the team is requested by another agency
  - A rescue site where the team encounters large-scale flooding

Searching Rivers and Floods at the Technician Level
- Determine who you are looking for
  - Interview witnesses or family members for specifics on victim
  - Brief search teams with as much information as possible
- Establish a point last seen
  - The PLS is used as the upstream boundary for the search area
  - An effective timeframe with the time of the point last seen will also assist in search
Establish downstream containment
- After PLS and time frame are established, time elapsed and knowledge of the area will be helpful in determining downstream containment
- In flood situations it may be impracticable to establish downstream containment

Conduct a hasty search
- Use a small group of two to three personnel
- Conduct to find out information and report back to the search manager
- Have a team on each bank
- Conduct twice by different personnel

Determine the area of probability
- The hasty teams report back to the search manager on the areas where there is the highest probability of finding a victim
- Searchers need to have a good understanding of river and flood hydrology
Searching Rivers and Floods at the Technician Level

- Conduct a detailed search
  - Conduct a detailed search after the hasty team has completed its search
  - Utilize information from the AOP
  - Understand that a detailed search will sometimes require a body recovery instead of a rescue

Searching Rivers and Floods at the Advanced Level

- Prepare personnel and equipment
  - The search will depend on the amount of trained personnel
  - The appropriate equipment must be available

- Prepare personnel and equipment
  - The communications systems are key
    - Radio communication is ideal but not always available
    - Whistles, aerial flares, and smoke signals are all forms of communication that could be used in the event of an emergency
Searching Rivers and Floods at the Advanced Level

- Prepare personnel and equipment
  - Lighting could be the determining factor in finding the victim
    - Each rescuer should carry two electric lights
    - Each rescuer should carry a chemical light
    - Each rescuer should have reflective tape attached to the PFD and helmet
  - Specialized equipment may be necessary

- Initiate ICS
  - The incident commander should have enough experience and training to read the river
  - Incident commanders should use their knowledge to determine where and how to search for victims

- Identify the subject
  - Number of possible victims
  - Age
  - Sex
  - Clothing
  - Crimes committed
Searching Rivers and Floods at the Advanced Level

- Determine the search area
  - Establish boundaries
  - Identify the PLS and LKP
    - PLS is the last place where the victim was seen by eyewitnesses
    - LKP is the last place where there is evidence the victim had been

Searching Rivers and Floods at the Advanced Level

- Determine the search area
  - Conduct a physical search
    - The Hasty Team
      - Should be deployed as soon as possible
      - Should look for areas of probability

Searching Rivers and Floods at the Advanced Level

- Conduct a physical search
  - The Thorough Search
    - Is conducted after the hasty team has completed its search
    - Is extremely time-consuming and resource-intensive
    - Utilizes information from the AOP
    - Sometimes will require a body recovery instead of a rescue
Searching Rivers and Floods at the Advanced Level

- Conduct a physical search
  - The phases of a search: the Passive Phase
    - The Pre-Plan is activated
    - The reporting party is questioned
    - The IC is chosen
    - The reporting party is re-interviewed
    - The IC chooses whether or not to conduct a search

Searching Rivers and Floods at the Advanced Level

- The Passive Phase of a search (continued)
  - The IC and Command Staff determine whether or not to proceed
  - The IC gives the order to initiate the search
  - The PLS is secured
  - The hasty search begins from the PLS in the most obvious direction of travel

Searching Rivers and Floods at the Advanced Level

- The Passive Phase of a search (continued)
  - The perimeter is secured and confinement is established
  - The IC uses the media and law enforcement for a "welfare check" outside the area being searched
  - The IC gathers another "overhead" team to study topographical maps and areas of probability
Searching Rivers and Floods at the Advanced Level

- Conduct a physical search
  - The Active Phase
    - The hasty search is repeated
    - The thorough search or detailed search begins
    - The search will include the use of boats and swimmers to search deep eddies and pools of water
    - The search may include the use of helicopters

Searching Rivers and Floods at the Advanced Level

- The Active Phase (continued)
  - The search can use SCUBA, but only as a last resort
  - The search efforts should be reevaluated early and often
  - The search may require an expert in searching techniques

Searching Rivers and Floods at the Advanced Level

- Conduct a physical search
  - The Rules for Success
    - Pass on clear orders
    - Remember the span of control
    - Remember not to micro-manage
    - Lead with your mouth, not your hands
    - Remember to rehab
Searching Rivers and Floods at the Advanced Level

- The Rules for Success (continued)
  - Ensure the operations branch is thinking one step ahead
  - Ensure the flow of information continues
  - Know the area
  - Ensure safety is the number one priority

Student Performance Objective

- Given information from discussion, handouts, and reading materials the student will be able to describe how to conduct a search of a river or flood during a swiftwater incident.

Review

- Searching Rivers and Floods at the Operations Level
- Searching Rivers and Floods at the Technician Level
- Searching Rivers and Floods at the Advanced Level
Student Performance Objective

- Given information from discussion, handouts, and reading materials the student will be able to identify advanced rescue skills and techniques to use during a swiftwater incident.

Overview

- Vehicles in Water
- Animal Rescue in Water
- Helicopters
- Unstable Surface Rescue
- Canals and Locks
Vehicles in Water

- Hazardous Materials
  - Choose the proper PPE
  - Choose containment options if fluids are leaking from the vehicle
- Vehicle Specific Hazards
  - Electrical systems of a vehicle may still be active when immersed in water for a period of time
  - All safety systems in vehicles in water should be considered active

Vehicles in Water

- Vehicle Anatomy
  - The posts supporting the roof are identified alphabetically from the front of the vehicle to the back
  - The glass should be left in place if possible to prevent flooding in the vehicle
  - Toughened glass
  - Laminated glass
Vehicles in Water

- Vehicle Hydrology
  - All the same principles apply as if the car were a large rock in the water.
  - The high pressure area on the upstream side of the vehicle should be considered a hazard.

- Vehicle Behavior
  - The engine should come to a stop pointing upstream.
  - The stability of the vehicle depends on the type of surface underneath it.
  - The vehicle may roll downstream given enough water volume and force.
Vehicles in Water

- Vehicle Access
  - Break the windows if necessary to access the victim
  - Break the windows if necessary to access suitable anchor points
    - Posts
    - Wheels
    - Axles
    - Towing points

Vehicles in Water

- Vehicle Stabilization
  - Attempt to stabilize from both banks
    - Ensure there are suitable anchors on both banks
    - Ensure the anchors are well located in relation to the vehicle

Vehicles in Water

- Vehicle Stabilization
  - Attempt to secure back-up anchors
    - Combine several anchors to create a bombproof anchor.
    - Use load sharing anchors if the vehicle can be stabilized from both banks.
    - Use load distributing anchors if movement is still possible.
Vehicles in Water

- Vehicle Stabilization
  - Choose your equipment carefully
  - Rope—needs to be protected from edges and glass hazards
  - Dampering system—use to protect personnel from equipment failure

Vehicles in Water

- Patient Extrication
  - Gaining access
    - Open at least two windows for the vehicle to be stabilized.
    - Use the two opened windows for patient extrication.
    - Do not open anything on the upstream side.
      - Alters the vehicle stability
      - Creates the possibility that the victim could be washed out

Vehicles in Water

- Patient Extrication
  - Patient care
    - The number of patients must be determined—not all patients may be visible.
    - Patients should be told to remain as still as possible.
    - PFDs should be placed on victims.
    - Rescuers should use a firm grip when removing the patient from the vehicle.
**Animal Rescue in Water**

- Do not attempt an animal rescue in water unless you are trained to do so.
- Keep untrained persons away from the animal.
  - Keeps people from endangering themselves
  - Keeps people from endangering the life of the animal

**Helicopters**

- Helicopters
  - Can reduce the time taken in the deployment of rescuers and transportation of victims
  - Can create communication problems
  - Can only operate in ideal conditions
    - Stable weather
    - Good location
    - Certified pilot

**Unstable Surface Rescue**

- Ice
  - Understand that traditional techniques will not always work in ice situations.
  - Ensure the proper PPE is worn if a "go" rescue is necessary.
  - Tether the rescuers together, then approach the victim from different directions.
  - Once victims are removed from the ice, take caution when moving or handling them.
  - Use a dive rescue team if a victim is under the ice.
Unstable Surface Rescue

- Mud
  - Injecting compressed air into the mud may release a victim that is trapped.
  - Forcing water into the mud may release a victim that is trapped.
  - Digging in a mud rescue situation poses the largest risk to both the victim and rescuer.

Canals and Locks

- Sudden turbulence in the water occurs when the lock is opened.
- When the sluice gates are opened the rush of water could submerge victims and entrap them.
- Secure the gate controls to reduce the risk of unexpected water flow.

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- Given information from discussion, handouts, and reading materials the student will be able to identify advanced rescue skills and techniques to use during a swiftwater incident.
Review

- Vehicles in Water
- Animal Rescue in Water
- Helicopters
- Unstable Surface Rescue
- Canals and Locks