


Job Hazard Analysis

Operation Description: Water Rocket Launch (Aquapod Bottle Launcher)	
ODD: Schools, OCIP STE Facility: Secondary Schools (8 th Grade) Location: Secondary Schools Job Title(s): Science Teacher	Date Conducted: 05/02/16 Conducted By: SSP (P. Park, L. Lyons) Approved By: OCIP STE (B. Bowman, J. Jefferson)
Required safety equipment: <ul style="list-style-type: none"> Personal Protective Equipment (PPE) for launch operator and all observers: <ul style="list-style-type: none"> Impact-resistant ANSI Z87.1 safety glasses or goggles (eye glasses are not sufficient) Air pressure gauge, preferably integral to air pump 	
Notes: <ul style="list-style-type: none"> Only science staff are permitted to assemble and pressurize the launcher system or clear malfunctions. The launcher must be securely staked to soft ground (grass, dirt) and pointed to launch straight up. No one other than the operator may be within 30' (30 feet) of the launcher while the bottle is pressurized or being pressurized. No one may place any object or body part above the bottle while it is mounted to the launcher. The launch site may not be within 50' of any building, utility line, tree, road, inaccessible property, bystanders not involved with the activity, or any other potentially hazardous structures or locations. Launches must be performed in clear weather with above-freezing temperatures 	

Step 1: Launch Site Selection, Scheduling	
Performed by: science staff, school staff	
	Steps: <ul style="list-style-type: none"> Select a clear, accessible launch site location Launch site must be on soft ground (grass, dirt) Site must be at least 50' in all directions away from: <ul style="list-style-type: none"> buildings utility lines trees roads inaccessible or potentially hazardous locations bystanders not involved with the activity Schedule a launch date Hazards: None expected Controls: None expected

Step 2: Pre-launch Inspection

Performed by: launch operator (science teacher); supervised students may assist



Steps:

- Inspect launcher for damage or deterioration:
 - dry, cracked, stretched, or distorted O-ring
 - cracks or broken joints in plastic components
 - frayed or deteriorated launcher string or strap
 - launch string shorter than 15'
 - loose launch string knot
 - obstructed overpressure slots in front leg
 - damaged U peg
- Inspect launch vehicle (2-liter plastic bottle) for:
 - cracks
 - dents
 - discoloration
- Inspect air pump and air pressure gauge for damage

Hazards:

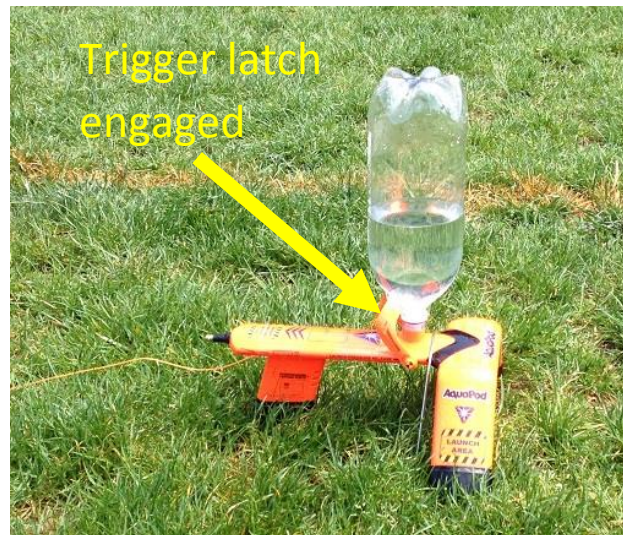
- Puncture, cut by damaged components
- Puncture, cut by U peg points

Controls:

- Handle components carefully
- Wear cut/puncture-resistant gloves, if needed

Step 3: Assemble Launcher System

Performed by: launch operator (science teacher); supervised students may assist



Steps:

- Fill the empty bottle with clean water (approx. 1/3 capacity)
- Hold the launcher upside down above the bottle
- Firmly press the bottle mouth over the launch tube, fully covering the O-ring, until it won't go any further
- Turn the launcher and bottle over and place on level soft ground, oriented to launch bottle straight up
- Ensure trigger latch securely engages bottle neck lip
- Stake the launcher to the ground with U peg
- Gently pull the launch string out to its full length of 15' along the direction of the long leg of the launcher tripod
- Lay the launch string on the ground, clear of other objects

Hazards:

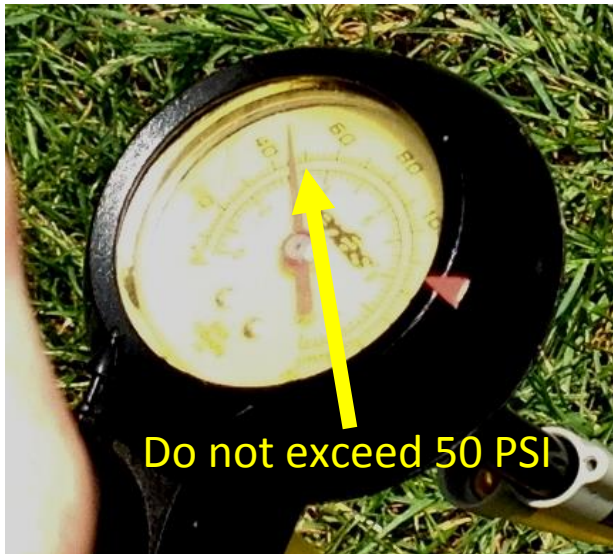
- Puncture, cut by U peg points
- Finger, hand pinch by bottle, launch tube

Controls:

- Do not place hands, fingers in pinch point between bottle and launch tube while installing bottle
- Keep hands, fingers clear of U peg points

Step 4: Fuel the Launch Vehicle

Performed by: launch operator (science teacher)



Steps:

- Ensure observers are at least 30' away from the launcher and bystanders are at least 50' away
- Connect air pump to launcher
- Install air pressure gauge (in accordance with manufacturer's directions), if not integral to pump
- Use pump to pressurize bottle – continuously monitor air pressure with pressure gauge
- Stop pumping at desired pressure (50 psi maximum)

Hazards:

- Strike by launcher or launch vehicle components
- Strike by damaged air pump components
- Exposure to compressed air

Controls:

- Wear safety glasses or goggles – operator and all observers
- Do not place anything, including body parts, above the bottle – stand clear of bottle while pumping
- Keep objects clear of the launcher and launch string
- Ensure air pump is securely attached to launcher
- Ensure trigger latch securely engages bottle neck
- Stop if observers enter the safety zone (closer than 30' to launcher) or bystanders approach closer than 50'
- Do not attach hard objects (plastic, metal, wood, etc.) to bottle
- Ensure fins, nose cone, and any other bottle attachments are securely installed
- Use only 2-liter plastic bottles
- Retire bottles after 10 launches or sooner, if damage suspected
- **Do not exceed 50 psi air pressure – launcher will not prevent over pressurization**

Step 5: Launch

Performed by: launch operator (science teacher)



Steps:

- Notify observers the bottle is ready to launch
- Grasp launch string
- Verify the safety zone is clear
- Announce launch and pull launch string (gentle, quick tug – do not yank)
- Observe flight – announce bottle location if it appears to descend towards observers

Hazards:

- Strike by launcher or launch vehicle components
- Strike by damaged air pump components
- Exposure to compressed air

Controls:

- Wear safety glasses or goggles – operator and all observers
- Do not place anything, including body parts, above the bottle – stand clear of bottle while pumping
- Keep objects clear of the launcher and launch string
- Ensure observers are at least 30' away from the launcher
- Ensure air pump is securely attached to launcher
- Ensure trigger latch securely engages bottle
- Stop if observers enter the safety zone or bystanders approach closer than 50'

Malfunction Clearance: Bottle Fails to Launch

Performed by: launch operator (science teacher)

Steps:

- Announce malfunction to observers
- Direct observers to continue to stay clear of launcher
- Hold trigger latch open, using launch string, for 30 seconds
- If bottle still fails to launch, release launch string to allow latch to re-engage bottle neck lip
- Loosen U peg from ground and tip the launcher – do not point bottle towards operator or observers
- Use a small screwdriver or similar tool (not a knife or any object with sharp edges or points) to push in valve stem pin to release air pressure
- After depressurizing, unlatch bottle and remove
- Inspect all equipment
- Attempt relaunch, if feasible

Hazards:

- Strike by launcher or launch vehicle components
- Strike by damaged air pump components
- Exposure to compressed air

Controls:

- Wear safety glasses or goggles – operator and all observers
- Do not place anything, including body parts, above the bottle – stand clear of bottle while pumping
- Keep objects clear of the launcher and launch string
- Ensure observers are at least 30' away from the launcher
- Stop if observers enter the safety zone or bystanders approach closer than 50'