Intermediate Science 5 E's Lesson Plan
Community LEAD-ers

Teacher: UH HICH & STEP	**Grade Level: 7th Grade (scalable for different ages)**	**~45 minutes**

Benchmark from the SSS for this question	
Essential Question:	How can science and policy affect community health?
Objective for Students:	**MS-ESS3-3.** Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
Note:	**ALL 5 E's WILL NOT BE DONE IN ONE DAY.**
Supplies and Technology Needed:	**For Entire Class** 1 jar Epsom salt 1 gallon distilled water *(negative water)* 1 gallon distilled water+3 tbsp washing soda *(positive water)* 3 bottles for filling and cleaning test tubes 6 cups each of positive and negative water to be handout out *Distilled Water not included in kit* **For 6 Groups** 6 Community Models *(All Lead, Lead+PVC, All PVC)* 4 "Half" Community Models Made of PVC 6 Sets of Test Tubes (*positive - red/pink caps; negative - blue/green/white caps)* 6 Droppers of Lemon Juice 6 Receiving Cups 6 Spoons 6 Risk/Financial Sliders 6 Community Profile Handouts Ballots/Exit tickets for each student
Engage: **Dates:**	Before Class: • For 6 groups, distribute pipe models, test tube racks, droppers, and community bios. Assess: How will you initiate interest, check students' background knowledge, and misconceptions for the unit of study? 1. **What are some hidden contaminants in water?** Bacteria, metals such as lead and pesticides. 2. **What could these contaminants do?** Bacteria causes infection. Lead is a neurotoxin. Pesticides causes varied adverse health effects.
Explore: **Dates:**	**Phase 1: Bacteria Testing** -Introduce the pipe models on tables. • Distinguish city lines vs. home lines**.** (*Some pipes are older than others*, lead pipes mentioned later) • Introduce the city and communities. • Introduce the new citywide initiative to test water for bacteria because of suspected contamination from water source.

	-Ask students to test for bacteria in their community by adding 5 drops of indicator to each test tube. Record positive results per group *(+ water will be yellow)* *(- water is clear; may be slightly cloudy)* -Watch video on chlorinating water and hand out financial sliders. -By community, vote on chlorinating entire city. *Each community would have to move up one $ level.* If community votes "no" to chlorinate, click "No" and state that EPA mandates action so city must chlorinate, and everyone still moves up one $ level. **Phase 2: Lead Pipes** -Introduce pipe models (lead, half lead, all pvc) -Introduction to lead poisoning -Watch video on Flint, Michigan & phosphate buffers. Hand out lead risk sliders. -Assign each group a lead risk level on their sliders. *All lead models (Communities 3&5): High risk* *Lead+PVC models (Communities 2&6): Moderate risk* *All PVC models (Communities 1&4): No risk* - From the video, we learned that chlorine increases the risk of lead corrosion in pipes. Lead Risk levels move due to chlorination making water acidic *All lead: up one level* *Lead+PVC: up one level* *All PVC: still at no risk* -Introduce the Lead Remediation propositions -By community, vote yes/no on each lead remediation proposition on the ballot. Mix & match allowed. **Phase 3: Testing for Lead Poisoning** Use quick guide on page 8 for new slider positions after the vote. Reconfigure models, as needed. *(Props 2 & 3, remove triple joint home pipes from lead models and attach to extra PVC pipes included in kit)* Distribute unmarked ½ cups of (-) and (+) water to each community according to their lead risk. *Extremely High Risk & High Risk: Always Positive* *Moderate & Some Risk: ½ Positive, ½ Negative* *Minimal & No Risk: Always negative* Pour sample through model and collect from spigot. Test for "lead" by mixing a ½ tsp of "lead indicator" (Epsom salt). Collect results of positive samples. *(Positive results will be cloudy; negative results will be clear)*
Explain: **Dates:**	Instructor should lead class in open discussion. **1. What impact does lead have on the human body?** Lead can irreversibly affect almost every organ and system in your body. Children under six are most at risk for absorbing lead. Other impacts: Lower IQ and hyperactivity, behavior and learning problems, slowed growth, hearing problems, and anemia.

	2. How can lead enter our bodies? Lead is absorbed through our skin or digestion. Lead can be found in all parts of our environment – the **air, the soil, the water, and even inside our homes**. Much of our exposure comes from human activities including the use of fossil fuels **including past use of leaded gasoline, some types of industrial facilities, and past use of lead-based paint in homes.** Lead and lead compounds have been used in a wide variety of products found in and around our homes, including **paint, ceramics, pipes and plumbing materials, solders, gasoline, batteries, ammunition, and cosmetics.** **3. What does today's model not show us about lead poisoning?** ● Not every city has lead pipes. There are other, more common, sources of lead like lead paint, lead dust, tainted imported products, or folk remedies like "azarcon" or "greta". ● Children most at risk for lead poisoning are under 6. ● Not every environmental quality decision that affects health is made by public ballot, or even by elected policy makers. ● Doesn't fully explain the role of regulatory agencies like the EPA who monitor and regulate clean air and water. ● What if your community is already polluted? What can you do about that?
Extend: **Date:**	**Have students fill out the exit ticket** **1. How does lead get into our homes?** *Flaking lead paint, lead dust from industries, leaded gasoline and soil, lead leeching into water supplies, jewelry and lead necklaces, lead paint on toys, lead glazing on imported jars and pots, lead in imported cosmetics, lead from folk remedies like "azarcon" and "greta"* **2. Based on the activity we did, what factors do city policy makers need to consider when thinking about protecting the community's environmental quality?** Possible Answers: Environmental impacts, community health, water quality, expert opinions, money… **This is the question we, as a project, are very interested in evaluating the responses to. Teachers, please share any interesting responses with us along with any feedback you might have on our website. See below. **3. How would your vote change if the cost of lead remediation was recurring and why?** Student may vote for the one time cost due to the accumulating cost that would exceed the more expensive, but one-time option. Students may also say they would vote for the recurring cost at a later date to minimize the total lead risk. ***Answers can be variable and unique.
Evaluate:	Other information on Flint, Michigan and environmental health is available at uhcommunityhealth.org Opportunities for student and parental engagement will be added into this piece soon.
Vocabulary:	lead poisoning; leaching; acidity; phosphate buffer; Flint, Michigan; infrastructure
Resources:	
Reflections on this Lesson:	

Question Bank

Teachers, these are additional discussion questions you can think about, ask or answer.

1. Cities don't often replace pipes because improper removal could cause disturbances in the waters lines and release more lead into water than just leaving the pipes alone. Knowing this information, what action would you take? Would this have changed your vote?

2. Phosphate buffers are initially less expensive than replacing the pipes themselves. However, over time the yearly recurring cost of buffers would be equivalent to the one time cost of replacing pipes (approximately 5 years). What would be a more cost effective method of getting rid of lead within your community?

3. Taking in account the demographics and income of your communities (provided by the community profile page), does this impact the way you vote or the voting method itself?

4. How could the voting method be improved upon? Do you suggest another voting method?

5. Does knowing the surrounding communities' situation and statistics (provided by the community profile page) influence your vote? Your group's vote?

Ballot

Proposition 1: Build Buffer Treatment Plant for City Water Supply
Everyone in city moves down 2 risk levels for lead poisoning.
Everyone moves up 2 financial risk levels ($$)

Yes No

Proposition 2: Replace Lead Pipes in Community 3 & 5 (Pre 1950's homes)
Only Communities 3 & 5 move down 2 lead risk level.
Everyone moves up 1 financial risk level ($)

Yes No

Proposition 3: Replace Lead Pipes in Communities 2 & 6 (Post 1950's homes)
Only Communities 2 & 6 move down 2 lead risk level.
Everyone moves up 1 financial risk level ($)

Yes No

Exit Ticket

How does lead get into our homes?

What impact does lead have on the human body?

Based on the activity we did, what factors do city policy makers need to consider when thinking about protecting the community's environmental quality?

Community 1			
Props	**1**	**2**	**3**
Vote	Yes	Yes	Yes
	No	No	No

Community 1			
Props	**1**	**2**	**3**
Vote	Yes	Yes	Yes
	No	No	No

Community 2			
Props	**1**	**2**	**3**
Vote	Yes	Yes	Yes
	No	No	No

Community 2			
Props	**1**	**2**	**3**
Vote	Yes	Yes	Yes
	No	No	No

Community 3			
Props	**1**	**2**	**3**
Vote	Yes	Yes	Yes
	No	No	No

Community 3			
Props	**1**	**2**	**3**
Vote	Yes	Yes	Yes
	No	No	No

Community 4			
Props	**1**	**2**	**3**
Vote	Yes	Yes	Yes
	No	No	No

Community 4			
Props	**1**	**2**	**3**
Vote	Yes	Yes	Yes
	No	No	No

Community 5			
Props	**1**	**2**	**3**
Vote	Yes	Yes	Yes
	No	No	No

Community 5			
Props	**1**	**2**	**3**
Vote	Yes	Yes	Yes
	No	No	No

Community 6			
Props	**1**	**2**	**3**
Vote	Yes	Yes	Yes
	No	No	No

Community 6			
Props	**1**	**2**	**3**
Vote	Yes	Yes	Yes
	No	No	No

Lead Curriculum Quick Guide

STEP 1:

	INITIAL Slider Positions	
	Lead Risk	*Financial Cost*
PVC	None	No Cost
Lead	High	No Cost
Half	Moderate	No Cost

STEP 2:

	AFTER Chlorination	
	Lead Risk	*Financial Cost*
PVC	No Movement (None)	Up One (Minimal Cost To City)
Lead	Up One Level (Extreme)	Up One (Minimal Cost To City)
Half	Up One Level (High)	Up One (Minimal Cost To City)

STEP 3:

	Prop 1 (Phosphate Buffer)	
	Lead Risk	***Financial Cost***
PVC	No Movement	↑ Up Two
Lead	↓ Down Two	↑Up Two
Half	↓ Down Two	↑Up Two

Prop 2 (Lead Pipes For All Lead Homes)	
Lead Risk	***Financial Cost***
No Movement	↑Up One
↓ Down One	↑Up One
No Movement	↑Up One

Prop 3 (Lead Pipes For Half PVC/Lead Homes)	
Lead Risk	***Financial Cost***
No Movement	↑ Up One
No Movement	↑ Up One
↓ Down Two	↑ Up One

Lead Test Results

Extremely High Risk & High Risk: Always Positive
Moderate & Some Risk: ½ Positive, ½ Negative
Minimal & No Risk: Always negative

Pack List

- 2 gray PVC (“Lead”) kits
- 2 PVC kits
- 2 Half Gray-Half PVC kits
- 4 PVC “community pipes” (without spigot)
- 6 pipe stands

- Test Tubes (90)
- 6 test tube racks
- Lemon juice Bottle
- 3 wash bottles (positive, negative, wash)
- 1 jar Epsom salt
- 1 jar of Washing Soda

- 6 lemon juice droppers
- Cups (approx. 36)
- Plastic Spoons
- Pipettes to fill droppers
- 1 tube of grease
- Paperclips
- 6 funnels

- 6 Community Profiles
- 6 Community Hexagons
- 6 Hexagon Numbers (Optional)
- 6 Hexagons (Optional)

Not included:

- 1 Gallon Distilled Water
- 1 Gallon Distilled Water + 3 tbsp of Washing Soda