ARIZONA COOPERATIVE EXTENSION
THE UNIVERSITY OF ARIZONA
College of Agriculture and Life Sciences

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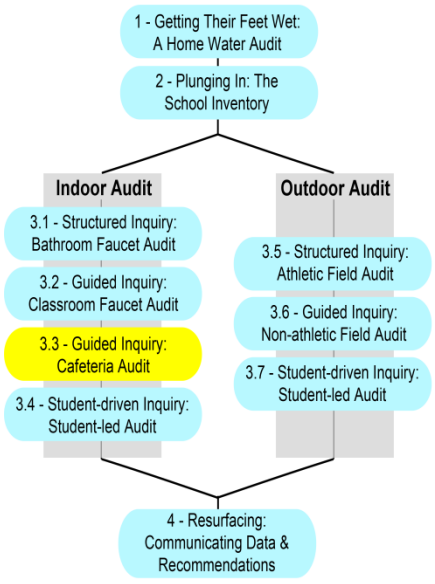
# 3.3 The School Water Audit - Indoor
# *Cafeteria Audit, Guided Inquiry*




### *Summary:*

Students will audit cafeteria water use by observing cafeteria processes, interviewing cafeteria personnel, and making direct measurements where possible. They will also examine their data, convert units, draw conclusions, and draft recommendations for ways to use water more efficiently.

### *Objectives:*

Students will:

- Observe operations and record in a systematic way
- Utilize data to develop an interview guide
- Devise a measurement procedure
- Measure water flow
- Convert data units
- Analyze data and draw conclusions
- Make recommendations for ways to use water more efficiently

### *Materials/Supplies:*

Per student group:

- 1000, 100 and 10 ml graduated cylinders
- Bowl with a spout
- Stopwatch
- Faucet aerators
- Pair of pliers
- Flagging (roll)
- Drip gauge
- 5 gallon bucket

Per student

- *General Data Collection Tools* (Appendix 3.3.A)
- Student-developed procedures and data sheets for measuring cafeteria water use
- Student-developed worksheets for converting cafeteria water use to gallons per year
- Clipboards
- Pencils
- *Other supplies may be needed for student-developed procedures.*

### *Background for Teachers:*

Water use technology is rapidly changing from high water use to more water and energy efficient use. The Environmental Protection Agency has launched their WaterSense Program which identifies and labels quality, water-efficient products for the consumer. A product cannot bear the WaterSense label unless it is tested by an independent third party. When independent testing confirms that a product meets EPA's specifications, it is certified and given the right to display the WaterSense label.

Pre-rinse spray heads are used to remove food from dishes prior to washing. The amount of hot water used to pre-rinse dishes is significant. By replacing old, high volume sprayers with a high-velocity, more efficient model, water can be conserved and money saved.

New, high-velocity sprayers use less hot water, as low as 1.6 gallons per minute, compared to 2 to 6 gallons per minute with standard valves. A standardized test at the Food Service Technology Center showed the average cleaning time is 8 percent less than for conventional pre-rinse valves. The added velocity helps to do a better job faster!

## *Preparation before the activity:*

- Brief cafeteria staff about water audit project
- Secure permission ahead of time to interview staff, and observe operations.
- Schedule a day to take measurements.
- Study data and worksheets for previous audits, Bathroom and Classroom Faucet Audits (Appendices 3.1.B-3.1.F and 3.2.B-3.2.D).
- This session involves making qualitative observations as a primary and stand-alone objective. Review, if necessary, the background regarding qualitative and quantitative observations and inferences from Unit 2: The Inventory.
- This guided inquiry session provides an opportunity for the teacher to differentiate instruction based on students' skill and knowledge levels.

## *Lesson Procedure:*

### Warm up:

Have the students write their answer to this question: *What does it take to figure out how much water the school uses in a year at classroom faucets?*

Draw a 3-column chart on the board or overhead with the following headings: Classroom Faucet Audit, what worked and what didn't work. Discuss these topics and write the students' answers into the chart.

***Example Bathroom Faucet Audit Chart***

| Classroom Faucet Audit | What worked | What didn't work |
|---|---|---|
| | | |
| | | |

### Activity:

Remember the focus question:

***How can we reduce water use or use water more efficiently at School?***

Introduce the next audit area: The Cafeteria.

Refer to the inventory map and brainstormed list of water uses generated via the school tour. From those references, create a sub-list of all of the water fixtures in the cafeteria and their uses:

**Cafeteria Water Fixtures and Their Uses**

| Water Use | Fixture | Comments on Use |
|---|---|---|
| Making ice | Ice Machine | Water comes in through a hose, fills a little compartment; melted water drains from a spout into a floor drain constantly. |
| Rinse dishes before loading into dish washer | Pre-rinse Sprayer | Water runs from the nozzle in a hard spray to remove food from dishes prior to washing. |
| Floor mopping | | |
| Steam to heat food | | |

Discuss how water is used in the cafeteria and what kinds of things affect when, how, how long, and why the water is used. Via this discussion, fill in the comments column of the chart if possible. For instance, cafeteria uses include things like food preparation, worker sanitation, and meal clean up. Will the use of a fixture be consistent through multiple uses in a day? Do some meals require more clean up then others? How many times is the cafeteria used in a day? Are uses consistent from person to person? Make a list of all variables that could affect cafeteria water use.

Pose the Inquiry Question:

***How much water is used in the cafeteria in one year?***

Ask the students what other questions regarding water use in the cafeteria they would like to investigate.

***Brainstorm and Plan***

Reflecting back on the warm-up, what will it take to figure out how much water the school consumes in a year's worth of cafeteria use? Guide the students to generate a list of data-related questions or tasks similar to the following.

- How many days per week is the cafeteria used?
- How many times per day or hours per day is the cafeteria used?
- How many times in one task period (i.e. one lunch session) is each fixture used?
- What is the flow rate at each fixture?
- Which fixtures run water, even when the cafeteria isn't in use? How long do *they* run and what is their flow rate?
- Are there any leaks or misuse associated with any of the fixtures?

How will each of these questions be answered? Some, like "how

many days per week is the cafeteria used?" can be directly answered by cafeteria personnel or administration. Others, like "how many times in one task period is each fixture used?" can be answered by observation or interview. Others, like "what is the flow rate of a fixture?" can be measured. Turn this list of sub-questions into a chart, adding and filling in columns for data collection method and team responsible.

Divide the class into cooperative learning groups and assign each to appropriate questions. Be sure to balance the work load and level of difficulty between groups. Here is the opportunity to differentiate for those who need more challenging assignments and for those who need more support. If the number of fixtures is large, you may choose to target the water uses that consume the most water. One strategy is to assign one interview or observation task and one direct measurement task to each cooperative group.

***Generate Data Collection Tools Specific to the Task Assignments***

Give each group copies of the *General Data Collection Tools* (Appendix 3.3.A) to use as guides in developing their own task-specific tools.

If making observations, students will need to develop a table with prompts to systematically record their observations and to ensure that their observations are thorough. See *Observe Cafeteria Personnel* in Appendix 3.3.A for guidelines.

**Assign Questions to Cooperative Groups**

| Question | Method | Responsible Group |
|---|---|---|
| How many days per week is the cafeteria used? | Interview | |
| What is the flow rate of the ice machine drain? | Measurement | |
| Which fixtures are leaking? | Observation | |
| | | |

If conducting interviews, students will need to develop a list of interview questions and format them in a written interview guide. See *Interviewing Cafeteria Personnel* in Appendix 3.3.A for guidelines.

If making direct measurements of water use or flow, students will need to write good procedures, develop data-collection tables, and compose worksheets. See the *General Data Collection Tool* in Appendix 3.3.A for templates and examples. Use these to develop new procedures for cafeteria fixtures.

***Make Arrangements with the Cafeteria Manager and Staff***

Respect their time and the demands of their work by limiting interview and observation time.

1. Schedule interviews with cafeteria staff.
2. Ask permission to send small groups of students to observe and time water use at different, pre-scheduled times of the day. Supervising small groups of students in the cafeteria would be a good use of adult volunteer time.
3. Ask permission to measure the flow rates of cafeteria fixtures during off hours.

***Conduct the Cafeteria Audit***

1. Student groups conduct the observation of cafeteria water use.
2. Student groups conduct the interview of cafeteria personnel.
3. Student groups conduct the measurement procedures that they have developed.
4. Compile the data – Data compilation may involve organizing qualitative observations as well as converting and organizing quantitative data.
   - Qualitative data: organize observations into categories either by fixture or by issue/concern as review of the observations starts to reveal consistent themes. Possible themes might be: methods of use, leaks, attitudes, etc. Be careful not to lose the connection between the fixture and observation statement if reorganizing into themes.
   - Quantitative data: convert flow-rate data to units of gallons per year; calculate the total water used per fixture per year.
5. Analyze the data.
   - Graph water use per fixture and total cafeteria water use.
   - Look for trends, outliers, and anomalies in the data.
   - Document or illustrate connections between qualitative data and quantitative data
4. Document conclusions.
5. Summarize the overall water use in the cafeteria.

***How much water can be saved each year in the cafeteria?***

6. Brainstorm as a class how to reduce or make the water use in the cafeteria more efficient. Solutions may include capture and re-use of water (as in the case of an ice machine drain). They may involve procedure, behavior, education, or attitude changes. They may include technology changes. You may require your students to conduct external literature research in order to identify and understand options.
7. Identify water efficient devices that may help conserve water at the fixtures in cafeteria**.** Possibilities include adding aerators to faucets and

implementing Arizona Department of Water Resources' Rinse Smart Program. Contact a UA representative to find out more about this program.

## Wrap-up

Allow students to vote to determine which water efficiency improvement idea(s) they will include in their final recommendation.

### *Assessment via Note-booking/journaling:*

Write a compare and contrast paragraph regarding the Bathroom Faucet Audit and the Cafeteria Audit.

Have each student share these observations with a partner.

### *Relevant Web sites*

**http://www.epa.gov/watersense/**

# Appendix 3.3.A
# *General Data Collection Tool*
## Observe Cafeteria Personnel

Observations of cafeteria work will inform the inquiry process and help to formulate questions for the survey/interview process.

1. Refer to your inventory of the school cafeteria.
2. Make a table with column one being the water use and column two being the fixture. Record all fixtures from your inventory in this column. Use this table as a starting point:
3. Column three should be wide and provide plenty of room for recording notes.
4. It may help to have the fourth and fifth column for start time and stop time, for any *time* measurements that can be recorded.
5. A sixth column that may be useful would be time of day.
6. Name, class period, date and team should be recorded on each data sheet.
7. All students in the observation group should record observations in their own words
8. Schedule a time for each small group to observe kitchen staff at work. Be prompt and respectful.
9. Do not discuss observations in the cafeteria. Use your senses, not your voice.
10. Leave time for the team to discuss their observations and create a master data sheet.

| Water Use | Fixture | Comments on Use | Start | Stop | Time Of Day |
|---|---|---|---|---|---|
| Making ice | Ice Machine | Water comes in through a hose, fills a little compartment; melted water drains from a spout into a floor drain constantly. | | | |
| Rinse dishes before loading into dish washer | Pre-rinse Sprayer | Water runs from the nozzle in a hard spray to remove food from dishes prior to washing. | | | |
| Floor mopping | | | | | |
| Steam to heat food | | | | | |

# Interviewing Cafeteria Personnel

Use the observations of cafeteria work to help formulate questions for the survey/interview process.

**Interview Guide Development Check List:**

1. **Logistical Information:**
   - ❑ Space for recording the interviewer's name is included.
   - ❑ Space for recording the interview location, date and time is included.

2. **Introductory Statements/Instructions:**
   - ❑ Written statements are included that establish your credibility, the purpose of the interview, how the data will be used, and approximate length of interview.
   - ❑ Written statements are included to encourage interviewee to respond honestly (e.g. no right or wrong answers, all answers are important).

3. **Questions:**
   - ❑ Questions are open-ended, allowing the interviewee to respond on his or her own terms.
   - ❑ Questions are clear.
   - ❑ Questions are specific and singular (one question asked at a time).
   - ❑ Questions are not leading (e.g., "Don't you think…?").
   - ❑ Questions are worded as "how" or "what" rather than "why." ("How" questions help explain without making the interviewee feel like they need to justify the response.)
   - ❑ Follow-up probes to elicit greater detail or clarify responses are included.
   - ❑ There is a concluding question asking the interviewee if there is anything else he/she would like to add or clarify.

4. **Format/Sequencing:**
   - ❑ The font is legible and large enough to be read easily.
   - ❑ Background questions are asked at the beginning of the interview. These questions should put interviewees and focus group participants at ease with the interview topic and process.
   - ❑ Since the cafeteria staff's schedule is set by task, food prep, food service, food clean up, have interview questions follow in chronological order.
   - ❑ Questions are sequenced from general to specific and/or from easy-to-answer to hard-to-answer, where possible.

5. **Summary Statements:**
   - ❑ A written reminder for the interviewee to summarize any main points they'd like to convey (check for validity) is included.
   - ❑ A written reminder to thank the interviewee for his/her time and input is included.

# Example Measure Faucet Flow Rate (from 3.1 Bathroom Faucets)

**Objective:** To determine the average flow rate in ml/5 sec for a selected group of bathroom faucets.
**Materials:** 1000 ml graduated cylinder; bowl with a spout; stopwatch, faucet aerators; pair of pliers; flagging; 5 gallon bucket; masking tape; permanent marker; drip gauge.

**Procedure:**

1. Enter the identifying information at the top of the data sheet: student name, teacher name, class period, group #, date, bathroom location and the number of faucets in the bathroom.
2. Using masking tape and a marker, number each sink.
3. On a separate sheet of paper, make a simple sketch of the numbered sink locations for future reference.
4. Examine the type of faucet at each sink; draw a check-mark on the data sheet beside each metered (push-button) faucet.

*For each faucet in turn, complete the following steps.*

5. Examine the faucet for leaks:
    a. Look and feel around the faucet as well as under the sink along the drain pipe.
    b. Check the Leak? box on the data sheet if a leak is found.
    c. Mark any leaks with flagging.
    d. If possible, capture the leaking water in a drip gauge for 5 seconds.
    e. Record the leakage level and the associated gallons per year (gpy) in the comments field of the datasheet.
6. Measure the flow of water from the faucet for 5 seconds:
    a. Place the bowl with spout in the sink under the faucet.
    b. Timer: with one hand on the faucet and one hand operating the stopwatch, turn the water flow to full-on and start the stopwatch simultaneously.
    c. Timer: count aloud 1, 2, 3, 4, 5 in time with the stopwatch.
    d. Bowl holder: when the timer calls out "5," immediately remove the bowl from the flow of water *without spilling any of the water.*
    e. Turn the water off.
    f. Pour the water from the bowl into the graduated cylinder.
    g. Read the water level from the cylinder and record the measurement in milliliters (ml) per 5 seconds on the datasheet in Column C, *Baseline Flow*.
    h. Pour the water from the graduated cylinder into the 5-gallon bucket. This water will be poured over plants rather than down the drain at the end of class.
    i. Repeat steps a-h two more times for a total of three measurements if replicate measurements are being made.
7. Check for an existing faucet aerator and make note of its condition.
8. If an old aerator is on the faucet, remove it *(pliers may be needed)*.
9. Repeat steps 6. a-i, recording the data in Column D, *Flow Without Aerator*.
10. Install a new aerator
11. Repeat Steps 6. a-i again, recording the data in Column E, *Flow With New Aerator*.

*Repeat steps 5-11 to audit every faucet in your team's assigned location.*

12. Remove the numbered tape from every sink.
13. Pour the collected water over plants outside.

# Procedure and Data Sheet cont.

14. Calculate the total water loss due to leaks in gpy by adding all of the gpy values in Column F.
15. Calculate the average baseline flow for the faucets that your group evaluated. Calculate the average flow without an aerator, and the average flow with a new aerator.
16. Copy these numbers from the data table into the chart below.

    These numbers will be transferred to the *Water Use Calculations Worksheet*.

| **For Your Cooperative Group Only** | |
|---|---|
| Avg. baseline flow | |
| Avg. flow w/o aerator | |
| Avg. flow w/new aerator | |
| Total annual loss due to leaks | |

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**cals.arizona.edu/pubs/water/az1505.pdf**

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