

Tailpipe Teachers Project Guide



THE PEGGY NOTEBAERT
NATURE MUSEUM
The Museum of the Chicago Academy of Sciences



PROJECT NAME: Tailpipe Teachers

PROJECT FOCUS: Conducting an anti-idling campaign

INTRODUCTION: The layers of gases surrounding Earth make up our atmosphere. Their purpose is to provide protection from UV rays and to maintain a suitable temperature range for life on the planet. One of the gases in the atmosphere is carbon monoxide (CO). Even though its amount is small compared to some of the other gases, its impact on the temperature of the Earth is great. Vehicle exhaust from idling school buses and other vehicles contains CO. High levels of these and other related small particles can intensify asthma and allergies, cause respiratory problems, and lead to lung damage. Idling cars, SUVs (sport utility vehicles) and light trucks present less of a health threat than idling buses, but they do contribute to air pollution.

CO emitted from tailpipes does not last long in our atmosphere. Due to natural reactions, it will oxidize (gain an oxygen atom) into carbon dioxide (CO₂). CO₂ and other greenhouse gases stay in the atmosphere far longer and trap heat near the Earth, contributing to human-induced global climate change. Because of these issues, the Chicago Public Schools contract with bus companies regulates how long school buses are allowed to idle in front of schools.

Because CPS is doing something about idling, so can your C3 team. Club members will become Tailpipe Teachers as they complete an idling audit on school grounds and nearby streets. Club members will target the highest idling times, during drop-off and pick-up, as the window for recording observations. Next, you will calculate how much fuel the idling vehicles use and how much pollution they generate. Your Club will use this information to launch a school-wide Tailpipe Teaching campaign to reduce the amount of idling that takes place around your school.

MATERIALS:

General C3 Club Action Project supplies:

- 4 packs of low-odor markers
- 1 ream of assorted recycled paper (8.5" x 11")
- 10 recycled-paper posterboards
- 2 rolls of tape
- C3 Club Network Supplies (*distributed at Kickoff Meeting on 9/9 or 9/17*)

Project-specific materials (provided):

For Phase I:

- "Magic School Bus Gets Cleaned Up" books
- Stopwatches
- Safety vests
- 12 lb. bag of charcoal briquettes (use scale to make a 5 lb. bag)
- Trash bag
- 2, 10" squares of hardware cloth with duct tape around edges
- Pipe cleaners

For Phase II:

- Permanent anti-idling signs

For Phase III:

- Anti-idling promotional materials

For Phase IV:

- Stopwatches
- Safety vests

Materials provided by teacher:

- Additional art supplies
- Calculators

OBJECTIVES:

1. Perform at least two idling audits at your school, and share the results with students, parents, and administrators.
2. Research and calculate data on vehicle emissions, fuel price, and consumption rate.
3. Measure CO content in the air near the school.
4. Educate the community on the facts and myths about idling and the importance of the issue.
5. Create and collect anti-idling pledges signed by drivers, including a specific, measurable action the driver will take.
6. Install anti-idling signs at target areas in your school, and create an indoor waiting area for bus drivers.
7. Reduce the amount of wasted fuel and carbon dioxide that is emitted as a result of vehicle idling in front of your school.

PERFORMANCE MEASURES:

The success of your project will be tracked with several performance measures. These measures are designed so that you will have quantitative successes to report at the end of your project. Part of Phase I: (“Learn”) is to audit the current situation of these measures at your school, then to set goals to accomplish by the end of the year. In Phase IV (“Thinking Back & Looking Ahead”), you will re-assess the situation to track the difference that your project has made.

	Performance Measure	Current Amount (measure during Phase I)	End-of-the-Year Goals (set during Phase I)	Final Amount (measure during Phase IV)
1	Pounds of CO ₂ emitted as a result of driver and/or school bus idling (based on audits)			
2	Number of pledges signed by drivers			
3	Pounds of CO ₂ not released as a result of signed pledges			
4	Number of students actively involved in your C3 Club			
5	Number of anti-idling signs installed at school			

PROJECT TIMELINE, MILESTONES, AND REPORTING:

This timeline is designed to give you milestones to guide you in your project development, implementation, and evaluation. At the end of each project phase, you will submit an online report (4 total reports), where you will sign off on having completed each of the milestones below. Remember that this timeline is just a starting point to plan your project, which you will tailor to address the needs of your individual school community.

To fill out your online report, sign in to the “C3 Teachers” section of the blog at www.chicagoconservationcorps.org. Please be sure to submit your report on time, even if you have not yet completed all of the milestones. Remember that teacher stipend checks are contingent on the timely completion of reports. Due dates are listed for each phase.

Phase I: Learn

October 12 -December 4

Online Report Due: Friday, December 4

- MILESTONE #1: Get **permission** from the principal to conduct the audit.
- MILESTONE #2: **Organize** the club for the idling audit.
- MILESTONE #3: Conduct the **idling audit**.
- MILESTONE #4: Fill out **performance measure amounts** for “Current Amount” and set numbers for “End-of-the-Year Goals.”
- MILESTONE #5: **Meet with administration** to update them on the project plans and goals, and to ask for their support.
- MILESTONE #6: **Complete Online Report:** Due December 4.

Phase I Procedures

- Read through the steps outlined for Phase I, and contact C3 with any questions. Please note: These milestones can be adapted so that they most effectively meet the needs of your individual school community; however, please communicate any major changes to C3 staff early on in the process.**

**MILESTONE #1: Get permission from the principal to conduct the audit.
(1 meeting)**

- Describe the procedure for the idling audit to the appropriate members of your administration.**
- Choose a date and location to conduct the audit and submit for approval to administration.** Since most idling will likely occur around drop-off and pick-up times, plan to conduct the audit during one of these times. The audit should last 20-30 minutes. The audit should be conducted in school drop-off/pick-up zones and surrounding streets, if necessary. See “Idling audit Options” in the Appendix for modifications and/or extensions for conducting the audit.
- Explain the idling audit to any school/CPS/city personnel who monitor the school grounds and surrounding streets before/after school.** They should be aware that students will be moving around school grounds (and surrounding streets, if applicable) to collect data on the day of the idling audit. If necessary, modify the “Sample Memo” or “List of Key Talking Points” (see Appendix) for ideas of topics to cover in this meeting. Students may wish to question these individuals in an attempt to find out more information about idling trends around the school grounds.

MILESTONE #2: Organize the Club for the idling audit. (1-2 meetings)

- Send permission slips home if necessary.** Document permission from Club members’ parents or legal guardians for the idling audit (see Appendix).
- Read “Magic School Bus Gets Cleaned Up” books.** These books can be used to introduce students to environmental concepts related to the anti-idling project. They can also be used later on in your project as an education tool for other students. Consider having your Club teach younger students about idling and pollution using these books.
- Complete “Seeing CO₂” and “Trapped” activities (see Appendix) to introduce students to CO₂ emissions and the greenhouse effect.** Lead a discussion about how these demonstrations relate to the anti-idling project.

- Decide what specific areas the idling audit will cover, and place students in pairs to cover these areas.** Students may wish to observe the drop-off and pick-up areas surrounding the school property in an effort to determine the most popular idling zones before making the final decision. Parking lots and/or bus stops should be considered. Also, identify zones that are particularly busy, and assign multiple pairs of students to conduct the audit in these locations.
- Decide on a specific time frame for conducting the audit.** If students will be conducting the idling audit after school (and students are available), they may choose to begin the audit 15-20 minutes before school dismisses in an effort to record information about waiting vehicles.
- Students should meet with their partners to finalize their roles and familiarize themselves with the “Idling Audit Data Worksheet” (see Appendix).** One student in the pair can be the timer, and the other student can be the recorder.
- Assign one or more students (depending on the size of the Club) to collect data about the general circumstances (e.g., weather, special school events) during the time of the audit.**
- Coach students on safety procedures.** Procedures include, but are not limited to:
 - Wear safety vests.
 - Conduct audit from sidewalks or yards. Do not stand in the street.
 - Do not approach the drivers of any vehicles during the audit.
 - Stand a safe distance from all vehicles during the audit.
 - Wear clothing appropriate for the weather.

MILESTONE #3: Conduct the idling audit. (1 meeting)

- Conduct a final audit preparation check.** The day of the audit, make sure that students have all necessary materials for conducting the audit. Review locations and time frames for conducting the audit.
- Record data about idling vehicles.** All data should be recorded on the “Idling Audit Data Worksheet.” Vehicle location should be recorded for *every* vehicle. This will allow students to monitor trends and guide future audits.
- Take photos, if possible.** Photos can be used to enhance the “Take Action” projects that students will be working on at a later date.

MILESTONE #4: Fill out performance measure amounts for “Current Amount” and set numbers for “End-of-the-Year Goals.” (1-2 meetings)

- Calculate results using the Idling Audit Calculations Sheet.** Each student team should complete their own Idling Audit Calculations Sheet based on their Idling Audit Data sheet. Walk through the step-by-step process to calculate the total time idled per school year, fuel consumed by idling, money spent on idling, and greenhouse gas emissions as a result of idling.
- Combine the data from each of the student teams’ Idling Audit Calculations Sheet on the Idling Audit Club Totals Worksheet.** This information will give you the totals per year for your school.
- Discuss the results with the Club.** Ask a student to take notes during the discussion. The following are some questions that can be used to stimulate discussion:
 - What was the most common type of vehicle found idling during the audit? Did this vary by location?
 - What was the most common amount of time that each vehicle spent idling during the audit?
 - Did you notice many vehicles that were sitting with the engine off?
 - What are some alternatives to idling a vehicle while waiting outside the school? What impact would factors like weather have on these alternatives?
- Develop a Top 10 list.** Based on what the Club members learned about idling vehicles during the *Learn* phase of this project, develop a list of the Top 10 key findings and/or priorities for reducing idling. Have one student record the list and prepare it for presentation to the school administration.

MILESTONE #5: Meet with administration to update them on the project plans and goals, and to ask for their support. (½ meeting or outside of meeting time)

- Invite guests to your next Club meeting.** Have Club members present the idling audit and the Top 10 List of interesting findings from the audit and/or priorities for reducing idling that they have identified so far. Ask for reactions, feedback, and ideas from staff.

OR

- Update the administration and staff about your progress.** If administration and staff are unable to attend a Club meeting, pass on the key findings from the idling audit to keep them updated about the Club’s progress.

MILESTONE #6: Complete online report for Phase I, due Friday, December 4.

Phase II: Act

December 7 – February 26

Online Report Due: Friday, February 26

- MILESTONE #7: Write an **anti-idling pledge**.
- MILESTONE #8: Plan for an **anti-idling campaign**.
- MILESTONE #9: Establish space inside the school for bus drivers to wait.
- MILESTONE #10: **Write a story** for the school newspaper.
- MILESTONE #11: Plan educational **outreach activities** to increase school understanding of the impact of idling on the environment.
- MILESTONE #12: **Complete Online Report:** Due February 26.

Phase II Procedures

- Read through the steps outlined for Phase II, and contact C3 with any questions. Please note: These milestones can be adapted so that they most effectively meet the needs of your individual school community; however, please communicate any major changes to C3 staff early in the process.**

MILESTONE #7: Write an anti-idling pledge. (½ meeting)

- Decide on the information that needs to be gathered on the pledges.** Keep in mind that the students need to *quantify* the amount of CO₂ *not* released as a result of the signed pledges. This requires students to gather information about how much time the driver spends idling *initially* and the driver's goal for idling reduction. The pledge should also include a section in which each driver records the kind of vehicle he/she usually drives to the school when dropping off/picking up student(s).
- Write the anti-idling pledge.** Students may also wish to include an introduction to the pledge on the top of the pledge paper. This introduction can include an overview of the project and interesting/significant facts related to idling and its effects.
- Determine the best way to distribute pledges to drivers.** Consider the feasibility/safety of directly approaching vehicles outside the school. Also consider

the practicality of sending the pledges home with students to be signed by parents/guardians. Determine the best time of day to distribute pledges to bus drivers.

- Determine the best way to collect signed pledges.** Consider if your pledge is meant to indicate the driver's *intention* to meet a goal or if they will turn in a signed pledge after *meeting* their goal. This distinction will impact whether your Club chooses to collect the pledges immediately or wait until a later date.

MILESTONE #8: Plan for an anti-idling campaign. (3 meetings or more)

- Plan a presentation for the school administration about what your school can do to reduce idling.** Develop your ideas for enforcing the school bus company's anti-idling agreement. (Under CPS regulations, school buses serving CPS schools abide by an anti-idling agreement). Research alternate locations for vehicle and bus "waiting zones" to keep vehicles away from the school building's air intake vents. Research facts that can be used to support your arguments for making changes to reduce idling around the school.
- Gather and prepare materials for the presentation.** Include information sheets that the administration can use after the presentations to make final decisions about which projects your Club can pursue. Prepare any visual aids that you plan to use during the presentation.
- Practice the presentation with the Club.** Review which team member will be responsible for sharing each proposal or fact with the administration.
- Make the presentation to the administration.** Find a time when Club members and administration are available to meet and discuss the Club's goals for the anti-idling campaign.
- Work out an agreement with the administration to address the concerns presented in your presentation.** Request permission to implement your ideas regarding anti-idling enforcement. Decide on a "waiting space" for bus drivers who arrive early.
- Decide how you will disseminate print information to students, staff, and surrounding community members.** Options include, but are not limited to:
 - Making signs to hang up in the school to publicize the campaign.
 - Creating fliers to hand out to parents and other drivers at school events (sports games, meetings, conferences, etc.).
 - Creating bumper stickers promoting the anti-idling campaign.
 - Making signs for bus drivers to display inside the buses.
 - Making buttons to give to those people who sign anti-idling pledges.
 - Using the materials provided by C3!

- Create design templates for print information.** Include interesting facts about idling that are relevant to drivers in your area. Make the information eye-catching and visually appealing. State the positive impacts of change instead of focusing on the current negative situation. For example, a flyer might include the following statement: “If we join together to stop idling outside of our school building, we can reduce greenhouse gas emissions by 10,000 pounds this year!”
- Produce copies of the print information to hand out to students, parents, or drivers.** This print information will be distributed during Phase III of the project.
- If desired, create additional outdoor signs to place around the school to discourage idling.** Coordinate the number of signs with the performance measure goal for “Number of anti-idling signs installed at school.” Make signs convincing, easy to read, and durable.

MILESTONE #9: Establish space inside the school for bus drivers to wait. (1 meeting and ongoing)

- Based on the agreement reached with administration during Milestone #8, designate a space in the school for bus drivers to wait when they arrive early.** Mark the space with signs to let bus drivers know they are in the right place and to publicize the efforts of the Club’s campaign.
- Decorate the waiting zone so that bus drivers feel comfortable waiting there.**
- Inform office personnel of the location of the waiting area, and find out where/how the bus drivers should enter the school.** Decide if the bus drivers need a log book to record their time spent in the waiting area.
- Inform bus drivers of the waiting space.** Be sure to let them know how/where to enter the school.

MILESTONE #10: Write a story for the school newspaper. (1 meeting)

- Get permission from the school newspaper staff to run a story.** Also, find out information about deadlines, formatting issues, and publishing dates.
- Write the newspaper story.** Depending on the frequency of publication of the school newspaper, decide how many articles will be written. If only one article will be written, be sure to provide background information, results from the audit, goals, information about the anti-idling campaign, and, most importantly, how students can help with the campaign. If multiple articles will be written, you may choose to focus on only one of these topics in each article. You may choose to have different Club

members responsible for different aspects of the writing process (e.g., research, writing, editing). Check to ensure that the story meets all formatting guidelines presented by the newspaper staff.

MILESTONE #11: Plan educational outreach activities to increase school understanding of the impact of idling on the environment.

- To teach students about the relationship between CO₂ and the environment, plan mini-lessons of “Seeing CO₂” and “Trapped” (See Milestone #2) to teach around the school.** Review these activities, making sure that *students* can explain the activities and the importance of the lessons learned from the activities.

- Plan how/when/where the lessons will be delivered.** Some possibilities to consider:
 - Students can travel to classrooms around the school (times/durations arranged by classroom teachers) to teach the mini-lessons to other students.
 - Students can teach the mini-lessons as a presentation after school dismissal.
 - Students can teach mini-lessons to parents waiting for children after school.
 - Students can visit different homerooms to present the mini-lessons.

- Practice delivering the mini-lessons.** Students may work in pairs/groups to deliver the lessons. They should practice the lessons in front of the Club, and other Club members should question them about the topic to promote a deeper understanding.

- Gather necessary materials for teaching the mini-lessons.**

MILESTONE #12: Complete online report for Phase II, due Friday, February 26.

Phase III: Make a Difference

March 1 - April 23

Online Report Due: Friday, April 23

- MILESTONE #13: Have drivers and parents sign pledges.**

- MILESTONE #14: Conduct the Outreach Campaign.**

- MILESTONE #15: Complete Online Report: Due Friday April 24.**

Phase III Procedures

- Read through the steps outline for Phase III, and contact C3 with any questions. Please note: These milestones can be adapted so that they most effectively meet the needs of your individual school community; however, please communicate any major changes to C3 staff early in the process.

MILESTONE #13: Have drivers and parents sign pledges.

- Using the procedure developed in Milestone #7, distribute pledges to parents and drivers around the school. Collect signed pledges immediately, or instruct drivers where to turn signed pledges in at a later date.
- Keep a folder containing all signed pledges received. These pledges will be used to estimate the amount of CO₂ not released as a result of the campaign.

MILESTONE #14: Conduct the Outreach Campaign.

- Install anti-idling signs around the school to increase awareness of the anti-idling campaign. Install signs in areas that are visible to drivers around the school.
- Teach the “Seeing CO₂” and “Trapped” mini-lessons planned during Milestone #11. Students should tie the mini-lessons directly to the anti-idling campaign. Students may choose to teach the mini-lessons multiple times to varying audiences.
- Distribute print information to parents and drivers in accordance with the plan developed during Milestone #9. Inform parents and drivers of the Club’s goals for reducing greenhouse gases as a result of the anti-idling campaign.
- Enforce anti-idling regulations near the school in accordance with the agreement reached with the administration during Milestone #9. Drivers should be made aware of the increased enforcement *before* Club members begin this step.

MILESTONE #15: Complete online report for Phase III, due Friday, April 23.

Phase IV: Thinking Back & Looking Ahead

April 26 – May 28

Online Report Due: Friday, May 28

- MILESTONE #16: **Re-conduct idling audit** using the exact same procedures as the first audit.
- MILESTONE #17: **Calculate results.**
- MILESTONE #18: **Collect** pledge forms and **calculate** pounds of CO₂ not released.
- MILESTONE #19: Fill in **performance measure** amounts for “Final Amounts.”
- MILESTONE #20: **Reflect and plan** ahead for future projects.
- MILESTONE #21: **Complete Online Report:** Due Friday, June 5.

MILESTONE #16: Re-conduct idling audit, using the exact same procedures as you did at the beginning of the year.

MILESTONE #17: Calculate results based on your audit.

MILESTONE #18: Collect pledge forms and calculate pounds of CO₂ not released.

- Tally the total number of pledges received.** This information will be used as part of your performance measures.
- Use the pledges to calculate the amount of CO₂ not released as a result of the signed pledges.** Use research completed during Milestone #4 to calculate the amount of CO₂ each vehicle would have released without the anti-idling pledge. Compile the results for entry into the “Performance Measure” table.
MILESTONE #19: Fill in performance measure amounts for “Final Amounts.”
- Using information from previous milestones, calculate or tally final amounts for each performance measure.** Enter these amounts onto the Performance Measures table for comparison during Milestone #20.

MILESTONE #20: Reflect and plan ahead for future projects.

Compare performance measure “Current Amounts” to “Final Amounts.”

Consider the following questions:

- In which performance measure category did you see the greatest change?
- How might you have prompted even greater change?
- In which category did you see the least change?
- What factors may have contributed to this?
- What could you have done differently to increase the change?
- Out of performance measures 2, 4, 5, or 6, which one do you think had the greatest impact on the results of performance measures 1 and 3?
- What effect did the general circumstances (e.g., weather, special events) have on the results of each audit?

Compare performance measure “End-of-the-Year Goals” to “Final Amounts.”

Consider the following questions:

- In which categories did you achieve your goals?
- What single factor do you think was most important in helping you achieve these goals?
- Did you fall short of any of your goals?
- What factors prevented you from achieving these goals?
- What could you have done differently to help you reach these goals?
- Were your goals reasonable? Why or why not?
- Could you have reached more ambitious goals?
- Would you have had to change your procedures to do so?
- Were there any general circumstances (e.g. weather, special events) that positively or negatively impacted your ability to reach your goals?

Reflect on and plan for other aspects of the project.

Consider the following questions:

- How could this project be extended to reach more drivers?
- How could awareness of the anti-idling campaign be extended to the larger community?
- What goals do you have for reducing greenhouse gas emissions through a similar campaign?
- What worked well in the campaign?
- What aspects of the campaign could be changed to increase effectiveness?

MILESTONE #22: Complete online report for Phase IV, due Friday, May 28.

CLUB ACTION PROJECT WORKSHOPS*:

**Attendance is mandatory for at least one teacher representative per school. Dinner will be provided. Workshop Location: Chicago Center for Green Technology, 445 North Sacramento Blvd.*

- October 6, 4:30 – 7:30 p.m.
- December 8, 4:30 – 7:30 p.m.
- March 9, 4;30-7:30 p.m.
- April 27, 4:30 – 7:30 p.m.

ADDITIONAL RESOURCES:

C3 First Year Project Guides and Materials Relevant to This Project:

- “What Are You Waiting For?” Anti-Idling Project
- “Alternative Drivers Ed” Alternative Transportation Outreach Project
- EPA’s Idling Reduction Toolkit
- CPS School Bus Anti-Idling Policy

Online Resources:

- www.idlefree.utah.gov
- www.idlefreevt.gov
- <http://www.epa.gov/cleanschoolbus/antiidling.htm>
- <http://www.epa.gov/OMS/schoolbus/antiidling.htm#calc>
- <http://www.thehcf.org/antiidlingprimer.html>
- <http://www.cleanbuseshealthykids.org/idling.asp>
- www.epa.gov/air/urbanair

Project Appendix

Table of Contents

- Template Memo to Administration/Staff – p.17
- Permission Slip – p.18
- Idling Audit Options – p.19
- “Seeing CO2” Activity – p.20
- “Trapped” Activity – p.21
- Idling Audit Data Worksheet” – p.22-23
- Idling Audit Calculations Sheet – p.24
- Idling Audit Club Totals Worksheet – p.25

[Teachers: This is a template of a memo for you to revise and send to your principal, building engineer, custodial staff, other teachers, and/or other administration members. This memo is just suggested language - feel free to use/revise as you please.]

TO: Principal _____ and Building Engineer

FROM: Chicago Conservation Corps (C3) Student Club or [teacher] and [students]

DATE: _____

RE: C3 Student Club Vehicle Idling Survey and Campaign

We want to make you aware of the Vehicle Idling Survey and Campaign that our after-school Chicago Conservation Corps (C3) Student Club will be carrying out this quarter, and ask for your cooperation and feedback.

Every year, vehicle idling in Chicago and its metropolitan area adds nearly 300 tons of fine particle matter pollution to the air.¹ Not only does this pollution adversely affect the health of our children, it also wastes money and contributes to global warming and other environmental problems.

We want to tackle this issue at our school first by finding out how much idling happens in an average day, and by calculating how much money it wastes and how much pollution it is releasing. Our plan is to observe and record where and for how long buses and cars idle their engines outside of the school, and then to encourage buses, parents, delivery vehicles, and other drivers to reduce their idling. During the audit, students will be supervised by Club teachers for their safety.

We hope this survey will be a first step toward making our school a healthier and more environmentally-friendly learning environment. If you have suggestions or would like to assist with this project, we welcome the contribution and look forward to working together.

The guide we will be using for the idling survey is attached for your reference. Please let us know if you have any questions or concerns. Thanks in advance for your support of our C3 Student Club efforts!

¹ Source: American Lung Association

Permission Slip

On (date) _____ our C3 Student Club will be participating in a study of vehicle idling habits outside of the school, which will involve tracking the time spent by various vehicles in front of the school with their engines running. Students will be supervised at all times, will remain on sidewalks, and will be wearing brightly-colored safety vests. We will coach them in safety procedures, and every precaution will be taken to ensure your child's safety. We need your permission for your child to participate in this activity. If this meets your approval, please sign the statement below.

If you have any questions please contact _____ at school.

My child, _____ has my permission to participate in the school waste audit to be conducted at school.

Parent signature: _____ Date: _____

Please return this permission slip by _____, 200__ to _____.

Permission Slip

On (date) _____ our C3 Student Club will be participating in a study of vehicle idling habits outside of the school, which will involve tracking the time spent by various vehicles in front of the school with their engines running. Students will be supervised at all times, will remain on sidewalks, and will be wearing brightly-colored safety vests. We will coach them in safety procedures, and every precaution will be taken to ensure your child's safety. We need your permission for your child to participate in this activity. If this meets your approval, please sign the statement below.

If you have any questions please contact _____ at school.

My child, _____ has my permission to participate in the school waste audit to be conducted at school.

Parent signature: _____ Date: _____

Please return this permission slip by _____, 200__ to _____.

Idling Audit Options

The following options can be used to modify or extend the auditing procedures:

- Consider monitoring the pick-up zone up to 30 minutes before school is dismissed. This will allow Club members to monitor parents and bus drivers who arrive early.
- If time permits, conduct initial and final audits at several different times of day. If an initial audit is conducted at a certain time, the end-of-year final audit must also be conducted at the same time so that results can be compared.
- Considering conducting the audit at the same time of day several times throughout the year. Possible topics of discussion/investigation related to this idea:
 - Is there a steady decrease in idling during the campaign?
 - What effects do the seasons have on idling patterns?
 - Do the idling trends vary by day of the week?
 - How are the audit results affected when there are before- and after-school events held at the school?
 - What times of year seem to be “peak” times for CO₂ emissions around the school?
- Investigate a correlation between the amount of CO₂ emitted by the idling cars and the carbon monoxide readings. Is there a predictable relationship between the two?
- Attempt to find the idling “hotspots” at your school. Conduct audits several times (at the same time of day) in several different locations to try to identify trends. Note how close these “hotspots” are to the school’s intake vents.
- Consider expanding the audits to the surrounding streets. Investigate any differences in idling patterns and carbon monoxide readings at these different locations.

“Seeing CO₂”

Purpose: This activity helps participants visualize how much carbon is being put into the atmosphere during a normal drive.

Materials Needed:

- 5 lb. bag of charcoal briquettes
**Note: You were provided with a 12 lb. bag. You will need to weigh out 5 lbs. using your hanging scale.*
- Trash bag

Background information:

- CO₂ is a transparent, colorless gas.
- Charcoal briquettes are made almost entirely of carbon.
- There are just over 5 lbs. of carbon *in each gallon of gasoline*, which combines with O₂ in the atmosphere to produce almost 20 lbs. of CO₂.

Procedure:

- Show students the bag of charcoal briquettes and ask them if they know what makes up the briquettes.
- Explain:
 - There are about 100 briquettes in the 5 lb. bag.
 - This means that these 100 briquettes are a good visual representation of the approximately 5 lbs. of carbon that make up one gallon of gasoline.
 - If a car travels at 25 miles/gallon, it is using about 4 charcoal briquettes worth of carbon per mile.
- To show a visual representation of this information, use audience participation to pile briquettes on the white trash bag according to how much carbon is released into the atmosphere during a normal drive.
**Note: For students' frame of reference, it might be useful to note that 8 city blocks = 1 mile.*
- Lead a discussion:
 - If people could see how much carbon they are releasing into the atmosphere when they drive, how might it impact their driving habits?

Adapted from:

Hovorka, S., Hotinski, R., Friedmann, S. (Eds.). (2005). Proceedings from Fourth Annual Conference on Carbon Capture and Sequestration C3/NETL: *Audience-Pleasing Physical Models to Support CO₂ Outreach*.

“Trapped”

Purpose: This activity helps participants visualize how CO₂ (and other greenhouse gases) trap heat in the atmosphere.

Materials Needed:

- 2, 10” squares of hardware cloth with duct tape around edges
- Pipe cleaners

Procedure:

- Explain that the hardware cloth is a representation of CO₂ in the atmosphere. There is only a little bit of wire in the hardware cloth, which corresponds to the fact there is only a little bit of CO₂ mixed with other gases in the atmosphere.
- The pipe cleaner represents radiation coming from the sun.
 - It might help if students think of “rays” from the sun. Rays → radiation.
 - Rays with a short wavelength are light. Rays with a long wavelength are heat.
- When rays enter our atmosphere from the sun, they have a short wavelength, represented by the small, horizontal “fuzzies” on the pipe cleaner.
 - Each pipecleaner has thousands of tiny rays from the sun on it.
- With one volunteer holding the hardware cloth (the representation of CO₂) horizontally, pass the pipe cleaner through the cloth. It easily goes through.
- Explain:
 - Light rays (short wavelength radiation) pass easily through our atmosphere.
 - Once the light travels through the atmosphere and hits the Earth, only some of it is reflected back up as light (show how the pipecleaner can pass back through the hardware cloth).
 - The rest of it is absorbed by the Earth and radiated as heat.
 - Think about how hot the ground feels on a sunny day.
 - Heat has a wavelength that is much longer than light’s wavelength.
 - Demonstrate by taking a pipe cleaner and bending it into a zig zagging spring.
 - These zig zags represent the longer wavelengths of heat.
- Keeping the hardware cloth (CO₂ in the atmosphere) horizontal, try to push the pipe cleaner spring through the cloth. The wavelength is much longer, so much of the heat gets trapped between the atmosphere and the ground.
- Discuss and experiment: If you add another piece of hardware cloth, is it easier or more difficult for the heat to escape? Why?
- What does this experiment show about the effects of extra CO₂ in the atmosphere?

Adapted from:

Hovorka, S., Hotinski, R., Friedmann, S. (Eds.). (2005). Proceedings from Fourth Annual Conference on Carbon Capture and Sequestration C3/NETL: *Audience-Pleasing Physical Models to Support CO₂ Outreach*.

Idling Audit Data Sheet

*Each team of students will use this worksheet
to record observations during the Idling Audit.*

Names: _____

Date: _____ Time: _____ Outdoor temperature (estimate): _____

Weather conditions: _____ Other special conditions: _____

Price of fuel on this date: regular unleaded (\$/gal): _____ diesel(\$/gal): _____
(see <http://tonto.eia.doe.gov/oog/info/gdu/gasdiesel.asp> for average pricing information)

#	A Vehicle Type <i>(car, minivan, SUV, light truck, bus, or large truck)</i>	B Vehicle Color <i>(to help you keep track of which vehicle is which)</i>	C Relative location <i>(to help you keep track of which vehicle is which)</i>	D Idling start time <i>(when the vehicle parks at the site but continues running)</i>	E Idling stop time <i>(when the vehicle is turned off or leaves)</i>	F Total time idled per school day <i>(E minus D, # of minutes)</i>
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

Idling Audit Calculation Sheet

Use this worksheet to calculate annual fuel costs and greenhouse gas emissions by idling vehicles at your school.

1. Different sized engines consume gas at different rates and produce different amounts of greenhouse gases (GHG) when they are idling. To account for this, sort all of the vehicles listed on your group's **Idling Audit Data Sheet** into one of the following three tables, based on its vehicle type: 1. car or minivan, 2. SUV or light truck (pickup), or 3. bus or large truck. List it on the appropriate table using the vehicle number (1-10).
2. Write the total number of minutes idled per school day (from column F on the **Idling Audit Data Sheet**) in column A.
3. Complete the calculations across the rest of each of the tables.

CARS and MINIVANS											
#	A Total time idled per school day in minutes	B Total time idled per school day in hours (A / 60)	C Total time idled per school year in hours (B x 180 days)	D Idle fuel consumption rate for this type of vehicle (gal/hr)	E Fuel consumed by idling in gallons per year (C x D)	F Cost of regular unleaded gas (see top of Data Sheet)	G Money spent on idling per year (E x F)	H GHG emissions rate for this vehicle in pounds per gallon of gas used	I GHG emissions in pounds per year (E x H)		
7	30	0.5	90	0.37	33.3	\$2.50	\$83.25	19.4	646.02		
TOTALS FOR THIS PAGE:			<input style="width: 80px; height: 20px;" type="text"/>		<input style="width: 80px; height: 20px;" type="text"/>		<input style="width: 80px; height: 20px;" type="text"/>		<input style="width: 80px; height: 20px;" type="text"/>		

SUVs and LIGHT TRUCKS

#	A Total time idled per school day in minutes	B Total time idled per school day in hours (A / 60)	C Total time idled per school year in hours (B x 180 days)	D Idle fuel consumption rate for this type of vehicle (gal/hr)	E Fuel consumed by idling in gallons per year (C x D)	F Cost of regular unleaded gas (see top of Data Sheet)	G Money spent on idling per year (E x F)	H GHG emissions rate for this vehicle in pounds per gallon of gas used	I GHG emissions in pounds per year (E x H)	
4	30	0.5	90	0.50	45	\$2.50	\$112.50	19.4	873	

BUSES and LARGE TRUCKS

#	A Total time idled per school day in minutes	B Total time idled per school day in hours (A / 60)	C Total time idled per school year in hours (B x 180 days)	D Idle fuel consumption rate for this type of vehicle (gal/hr)	E Fuel consumed by idling in gallons per year (C x D)	F Cost of regular unleaded gas (see top of Data Sheet)	G Money spent on idling per year (E x F)	H GHG emissions rate for this vehicle in pounds per gallon of gas used	I GHG emissions in pounds per year (E x H)	
9	30	0.5	90	0.50	45	\$2.00	\$90.00	22.2	999	

TOTALS FOR THIS PAGE:

Idling Audit Club Totals Worksheet

List each group's findings from the Calculations Worksheets under the appropriate column on this page. In other words, have each group tell you the total time idling, fuel consumed, money spent, and greenhouse gases emitted per year for ALL of the vehicles observed (buses, cars, SUVs, etc. added together), and write those numbers in the appropriate column. Once every group has reported their findings, add everything together to come up with totals for your whole school.

If you conduct more than one audit, complete a separate worksheet for each. This will allow you to compare across audits – for example, to compare the amount of idling that occurs before and after school.

Date and time of audit: _____

Total time idled per school year in hours <i>(see Column C Totals at the bottom of p.7 and 8)</i>	Fuel consumed by idling in gallons per year <i>(see Column E Totals on the bottom of p. 7 and 8)</i>	Money spent on idling per year <i>(see Column G Totals on the bottom of p.7 and 8)</i>	Greenhouse gas emissions in pounds per year <i>(see Column I Totals on p.7 and 8)</i>
TOTAL:			