

Case Study Number 9-1

Estimating PM₁₀ Emissions from Residential Wood Combustion

Exercise Objective

This exercise will test your ability to apply the methodology used to estimate PM₁₀ emissions from residential wood combustion.

Directions

- Review the background information and data provided.
- Convene groups of 4-5 people.
- Answer the questions in the “Problem” section. These will guide you in your thinking to organize the data and then using it to estimate emissions.
- You will have 20 minutes to complete these tasks before the class reconvenes for discussion. Each group will be assigned specific questions and asked to present its results. Other groups will be asked if they agree or disagree with the findings.

Background

This case study involves the development of a PM₁₀ emissions inventory for a hypothetical county. In developing this inventory, the preferred method of using a residential wood combustion survey was employed. The purpose of this case study is to require the student to review the survey data that was collected to calculate wood consumption and then PM₁₀ emissions.

The hypothetical county is classified as urban since more than 50 percent of the population is located in cities and towns. The latest Census data indicates that the county has a population of 1.3 million people living in 380,000 homes. The survey was sent to 500 homes in the county.

The hypothetical county is located in the Mid-Atlantic region and the number of heating degree days falls between 5,500 and 7,000.

Available Data

The following table shows a summary of the data that was obtained as a result of a survey that was conducted in the county.

Data Obtained From the Residential Wood Combustion Survey

Number of homes with a fireplace without an insert	110
Number of homes with a fireplace with an insert	30
Number of homes with a wood stove	40
Average number of cords of wood burned in fireplaces without an insert	1/4
Average number of cords of wood burned in fireplaces with an insert	1/4
Average number of cords of wood burned in wood stoves	1/8

The data on the number of cords of wood burned are for an average winter week. The survey also asked respondents to estimate how many weeks during the year they used their fireplaces or woodstoves as well as the amount of wood that was burned during the non-winter weeks in which they used their fireplaces and woodstoves. However, the data on the temporal usage of wood was determined to be invalid.

Problem

You have been tasked with developing an annual PM₁₀ emissions inventory for residential wood combustion within a hypothetical county. It is suggested that you approach the problem in the following manner.

1. What PM₁₀ emission factors are applicable to residential wood combustion?

2. What is the methodology for estimating PM₁₀ emissions from residential wood combustion?

Notes

- Assume that the entire county is located in the same climate zone.
- Assume different types of wood are burned with an average density of 23.9 pounds per cubic feet
- Conversion factor: 1 cord = 128 cubic feet
- PM₁₀ emission factor for residential fireplaces without inserts is 23.2 pounds per ton dry wood burned.
- AP-42 PM₁₀ emission factor for residential fireplaces with inserts is 30.6 pounds per ton dry wood burned.
- AP-42 PM₁₀ emission factor for residential woodstoves is 34.6 pounds per ton dry wood burned.
- Assume each season is 13 weeks long.
- Assume a Rule Effectiveness of 100%
- Assume a Rule Penetration of 75%