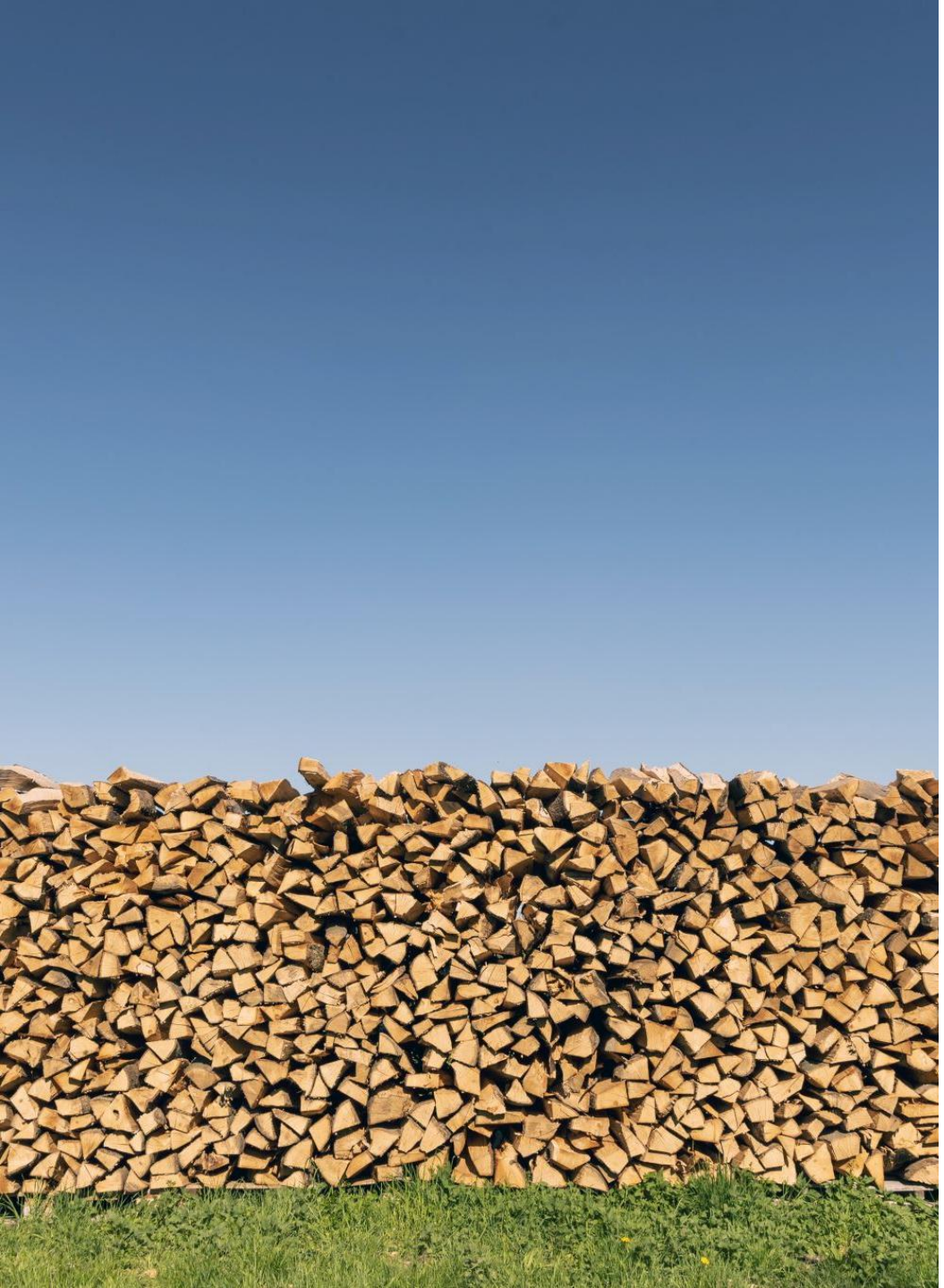


NATIONAL RESIDENTIAL HEATING Task Force

Independent Assessment of Residential Heating Appliances

June 17, 2025

Agenda

Project Objectives

- Certification and the role of certification data; Nick Czarnecki, ADEC
- Analysis of change-out data; Dr. Nora Traviss, NESCAUM
- Role of new test methods; Dr. Ellen Burkhard, NYSERDA

Project Governance - Nick Czarnecki, ADEC, NRHTF Chair

- EPA grant guidance
- National Residential Heating Task Force
- Development of project workplan

Project Overview; Lisa Rector, NESCAUM, Project Manager

- Appliance selection
- Appliance testing
- Data processing
- Data review
- Data availability

Q&A

Project Genesis

- Certification and the role of certification data
- Issues with certification data
- Analysis of change-out data
- Role of new test methods

Why the need for this Project?

- Non-attainment areas need to identify lowest emitting stoves to keep cordwood heating as an option for homeowners
- Cannot use certification data to identify best performing stoves... why?
  - Different test methods
    - ATMs
    - M28
    - ASTM 3053 based methods
  - Variability in firebox measurements
  - Variability in dilution tunnels
  - Substitution of data (entire test runs) for efficiency values
- 2012 HPBA commissioned study* relationship between lab testing and in-field performance:
  - *Analysis revealed that **rank orders of woodstoves based on their certification scores did not predict rank orders** for the same woodstoves based on their **in-home performance**: woodstoves with low certification scores sometimes performed more poorly in the field than woodstoves with higher certification scores, and vice versa.*



**James E. Houck, Ph.D,. "A Comparison of Particulate Emission Rates from the In Home Use of Certified Wood Stove Models with USEPA Certification Emission Values and A Comparison Between In Home Uncertified and Certified Wood Stove Particulate Emissions"*

Inspector General Report

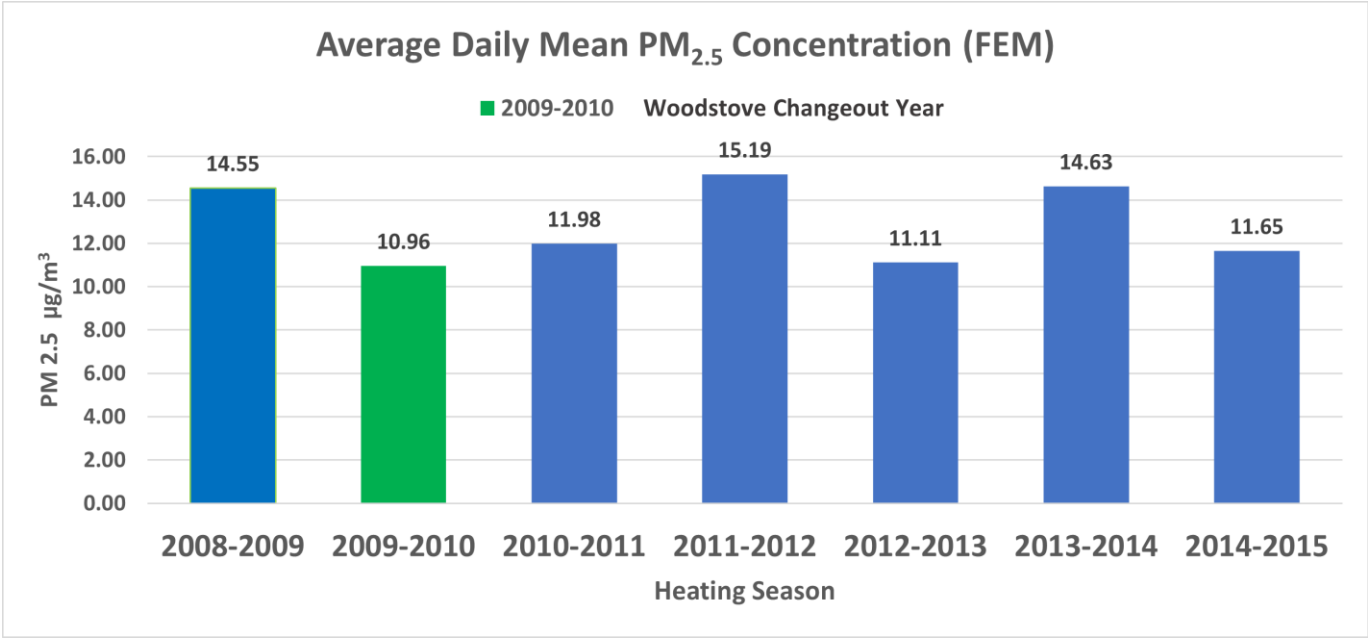
- 2023 report assessed the 2015 Residential Wood Heater NSPS program.
- Conclusion: "***Because of the flawed test methods*** *and the EPA's lack of effective oversight,* ***state regulators and the public cannot rely on the wood heater program to ensure that wood heaters reaching consumers comply with emission standards.***"
- Relevant IG Report recommendations:
  - "*Develop and implement a plan to demonstrate whether residential wood heaters certified using the test methods based on ASTM E3053 comply with the New Source Performance Standards for residential wood heaters.*"
  - "*Develop and adopt an EPA cord wood test method that is supported by data to provide the public reasonable assurance that certified appliances meet emission standards.*"

https://www.epaoig.gov/reports/evaluation/epas-residential-wood-heater-program-does-not-provide-reasonable-assurance



Long-term look at Keene, NH Change-out

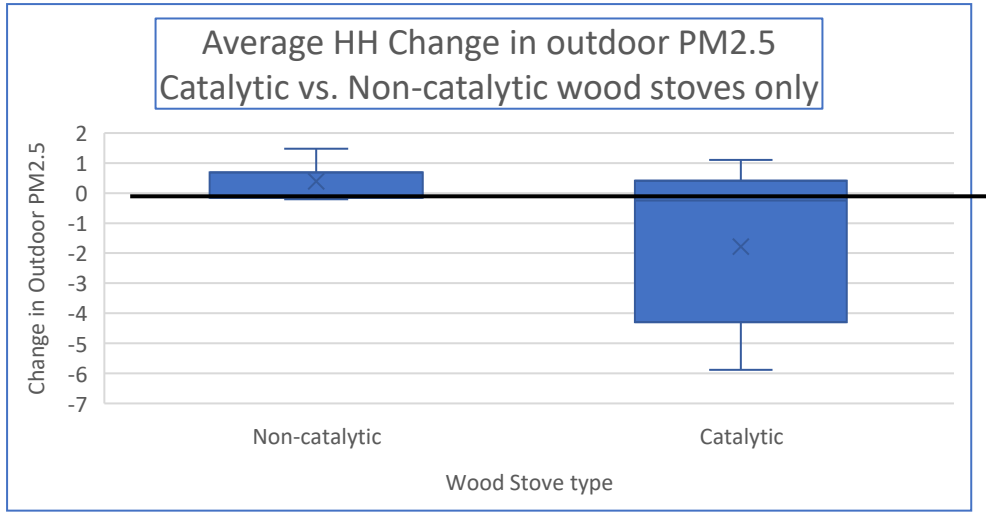
- Keene implemented a woodstove changeout program in 2009/2010
- Winter ambient PM values **increased** for 5 years after the 2009/2010 changeout
- Indicates wood stove change-out did not impact PM airshed values
- Note that the winter 24-hour (daily) average is < 16 µg/m^3, but 8-to-16-hour averages are highly elevated in the evening (6 pm to 10 am)



Other Change-out Programs

- Portola, CA
  - Designated nonattainment for the annual 12 µg/m^3 PM2.5 NAAQS
  - Attainment strategy relied on change-out program
    - Assumed new stoves would result in 50% emission reduction
    - Changed out more stoves than models deemed necessary to attain the standard
    - Area failed to attain PM standard by deadline
  - Analysis indicates that change-outs only reduce emissions by 25%
- Libby, MT
  - Portola findings comparable with Libby where complete change out only reduced ambient emissions by 20%, which included fuel switching change-outs

- Oregon*
  - Measured ambient air for 30 days before and after change-out
  - Indoor Air PM: all appliances except heat pump increased indoor PM levels
  - Ambient PM
    - **<u>Ambient PM emission increase for all the non-catalytic changeouts</u>**
    - Mixed results for a catalytic appliances, but some emission reductions



https://doi.org/10.15760/etd.7455.

Limited Analysis of the Impacts of Change-out Programs

Conventional Wisdom: changing technologies = emission reductions

Old EPA guidance assumed 90% reduction when changing out old stove to new stove

New EPA information – old stoves emit 15-30 g/hr, new stoves emit 4.5 g/hr = 70-85% reduction*

Scientific studies do not support emission reduction claims

Assessment of wood stove change-out typically looks at Federal Emission Monitor (FEM) values

Other activities may impact FEM values beyond change-out programs

EPA has not conducted any studies on short or long-term efficacy of wood-to-wood change-outs at individual homes by technology type

**https://www.epa.gov/burnwise/choosing-right-wood-burning-stove*

NYSERDA Integrated Duty Cycle (IDC) test methods



IA project using IDC test methods for testing



Innovation in technology performance can only be promoted by challenging the technology under conditions representative of those the appliance must respond to once installed in the home



Current ASTM approach of fueling and operation procedure is more than 40 years old

- Only one fuel loading configuration
- Steady-state operation
- No replicates

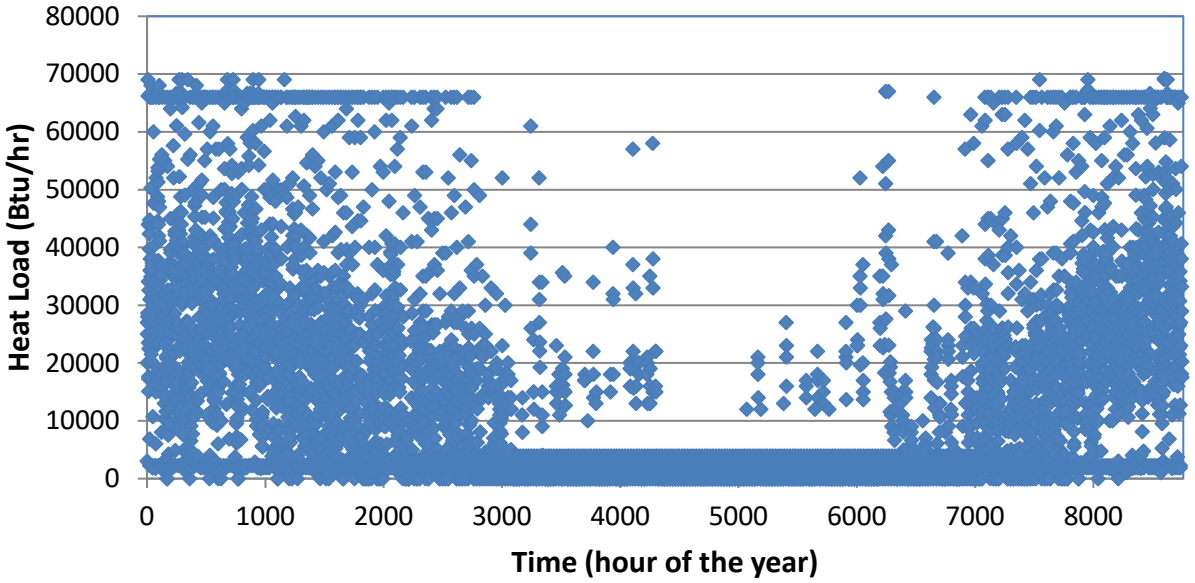


Need to level the playing field - lack of representative performance test methods creates significant market barriers and inequities



EPA announced intent to transition regulatory program to NYSERDA IDC test methods in 2020.

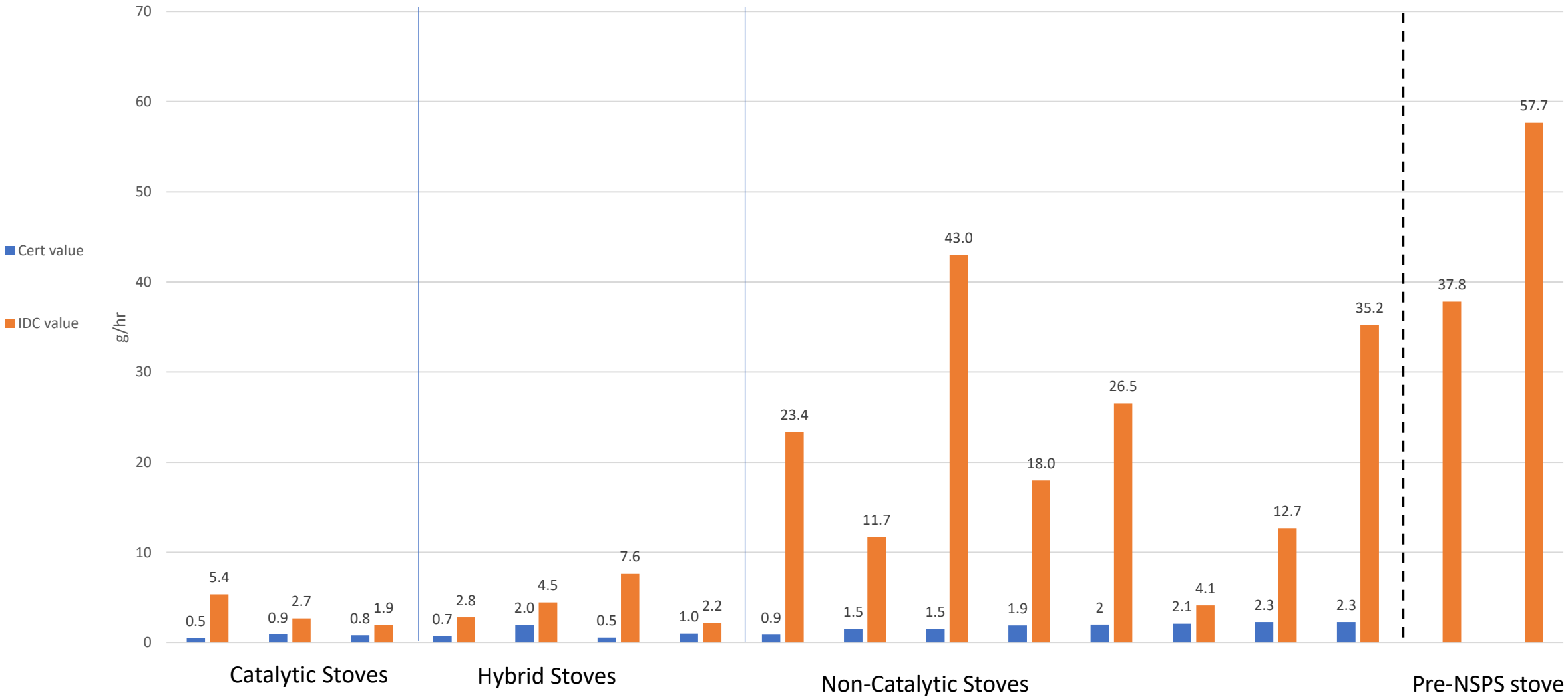
Why use IDC test methods?



Graphic created by Brookhaven National Lab, Analysis of heat demand in homes over a year

- Current test methods do not assess how stoves perform under variable conditions
- Real-world operation of appliances is highly variable
  - Home characteristics
  - Fuel available
  - Time of year
  - Fuel pricing
- The solution to assessing in home performance is building stoves that perform well under a variety of conditions
- IDC assesses appliance operation under a variety of variable conditions
  - Fuel loading volume
  - Number of fuel pieces
  - Size of fuel pieces
  - Air spacing between fuel pieces
  - Coal bed size
  - Repeatability of performance – requires replicate runs

Certification vs. IDC Results 2020 Certified Stoves



- Need representative test method to rank performance to promote technology
- Data supports Houck's 2012 conclusions

Project Governance

- EPA grant guidance
- National Residential Heating Task Force
- Development of project workplan

Overarching Project Goal



NRH Task Force wants to keep cordwood heating as option everywhere in the country



Numerous studies question the efficacy of change-outs

Need to find a way to ensure that taxpayer dollars are used wisely to achieve greatest emission reductions



Project goal - to identify cleanest stoves to use taxpayer dollars wisely to get greatest reductions

Need to know emission reductions at the device level

EPA Directives

- Grant Guidance – EPA published in November 2023
- Selected entity NESCAUM and the National Residential Heating Task Force (NRHTF)
- Project required to:
  - Develop Level 1 Quality Assurance Program Plan (QAPP) – most stringent level
  - Procure appliances, fuel, supplies, and services for lab testing
  - Conduct emissions testing and data analysis on wood heaters sold at retail outlets
    - Manual filter PM measurements
    - Use of EPA methods for CO (EPA Method 10) and CO2/O2 (EPA Method 3A)
    - Research or pilot new or experimental method for measurement and control of air pollution
  - Create a ranked list of appliance performance based on testing outcomes

Task Force Member Agencies

1. Alaska Dept of Environmental Conservation
2. California Air Resources Board
3. Connecticut Dept of Energy and Environmental Protection
4. Fairbanks North Star Borough
5. Idaho Dept of Environmental Quality
6. Massachusetts Dept of Environmental Protection
7. Maine Dept of Environmental Protection
8. Minnesota Pollution Control Agency
9. Monterey Bay Air Resources District
10. NESCAUM - facilitator
11. New Hampshire Dept of Environmental Services
12. New Jersey Dept of Environmental Protection (non-voting member)
13. New York State Dept of Environmental Conservation
14. New York State Energy Research and Development Authority
15. Nez Perce Tribe
16. Oregon Dept of Environmental Quality
17. Puget Sound Clean Air Agency
18. Rhode Island Dept of Environmental Management
19. Vermont Dept of Environmental Conservation
20. Washington Dept of Ecology
21. WESTAR

NRH Task Force Role



- Develop project framework
  - Create Independent Assessment Advisory Committee
    - Represents 10 of 20 task force agencies
    - Meets monthly
  - Generate recommendations for plans and activities, approved by full Task Force
- Provide input and approve project plans
  - Stove Prioritization Plan
  - Conditioning Plan
  - Testing Plan
  - Communication/Outreach Plan
- Provide oversight & recommendations
  - Regular updates at Task Force meetings
  - Provides direction to Steering Committee and NESCAUM

NRHTF/IAAC Work Plan

Goal: keep cordwood heating as an option in all areas of the country including non-attainment areas

Project funding mechanism is a grant, NOT coop agreement

- Once agreement signed must follow workplan and budget

NRHTF reached out to industry for input **before finalizing contract** workplan

- NESCAUM spent several days at 2024 Expo meeting with manufacturers and other industry stakeholders
- Drafted summary of feedback received and provided to HPBA for further input

Industry feedback

- Release of data should not occur until all certified appliances have been tested
- The ranking must be matched to size and power output
- Do not use crib methods for testing
- Conduct in-situ testing

Input reviewed by IAAC and Task Force

Adjusted workplan and other elements based on industry feedback to the extent allowable by grant guidance

Independent Project Testing Framework



Independent Testing Project



- Conduct standardized testing on appliances
  - Reporting elements
    - PM – g/hr, g/kg, lb/MMBtu
    - Efficiency
  - One test method - IDC
  - Standard procedures
    - Firebox measurement
    - Fuel use
    - Operational Instructions
  - One lab conditioning appliances
  - One lab conducting official tests
- Data separate from EPA certification, designed not to affect certification status
- Provide IDC data to industry at no cost to them
- Provide standardized data to state, local, tribal agencies
- Project scheduled to run through 2029
- Plan to test ~150 appliances



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Project Overview



Plans

NRHTF forms Advisory Committee

Develop and receive NRHTF approval for the following:

-Stove Prioritization Analysis/Results

-Conditioning Plan

-Testing Plan

-Outreach Plan

Method Development

Operation & Fueling

-Revised IDC protocols

PM

-Real-time PM protocol

-SOP for Alt Method 5G

Gases

-SOP for Alt Method 3A

-SOP for Alt Method 10

Run validation criteria

Data Management

Level 1 QAPP

Develop data flow

-Standard raw data workbook

-Automated processing of raw data

-Standard report template

-Standard report review tool

-Documentation for all calculations used in process

Testing

Conditioning stoves

-One lab

-Standard conditioning for all appliances

-Standard firebox measurement approach

-Instructions for testing

-Manufacturer input

Official Testing

-Test ~150 appliances

-Generate data

Data Analysis/Report

Implement QAPP procedures

Thorough review of data prior to release

-3 levels of internal QA/QC review

-EPA 60 days to review report/data before finalizing

Data Availability

EPA

-NESCAUM required to submit data to EPA via ERT

-EPA may chose to publish ERT data in webfire

NESCAUM

-Website for data publication (reports and summary data)

-Internal database for State/Local/Tribal agencies

Appliance Testing Plan

- 297 appliances certified as of 6/16/25. Not enough funds to test everything
  - Stoves – 256 appliances certified
    - 155 cordwood stoves
    - 101 pellet stoves
  - Central heaters – 41 certified appliances
    - 7 furnaces
    - 34 hydronic heaters
- Need to prioritize what appliances are tested under the project
- Task Force prioritization approach: ranked appliances based on:
  - First group of appliances testing stoves only
  - Emissions and efficiency performance using certification data: organized into quartiles, better performance = more points
  - Firebox size: larger fireboxes = more points
  - Test method used: cordwood test = more points
  - Years left on certification: more years = more points
  - Task Force Agency priority appliance: more agencies = more points
  - Currently certified stoves on hand from previous projects





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NRH Task Force Plans

Outreach Plan

- Provides direction to NRHTF members about requests for project information
- Provides direction for development of project website and data release
- Final communication plan for public release not yet completed, still under discussion within Task Force

Conditioning and Testing Plan

- Provides directives from NRHTF for conditioning and testing stoves
- Comports with QAPP
- Provides framework for database to support agency ranking process
- Provides instructions to NESCAUM and labs about processes and overarching framework for project testing
- Provided direction for lab RFP

Independent Testing Project Method Development

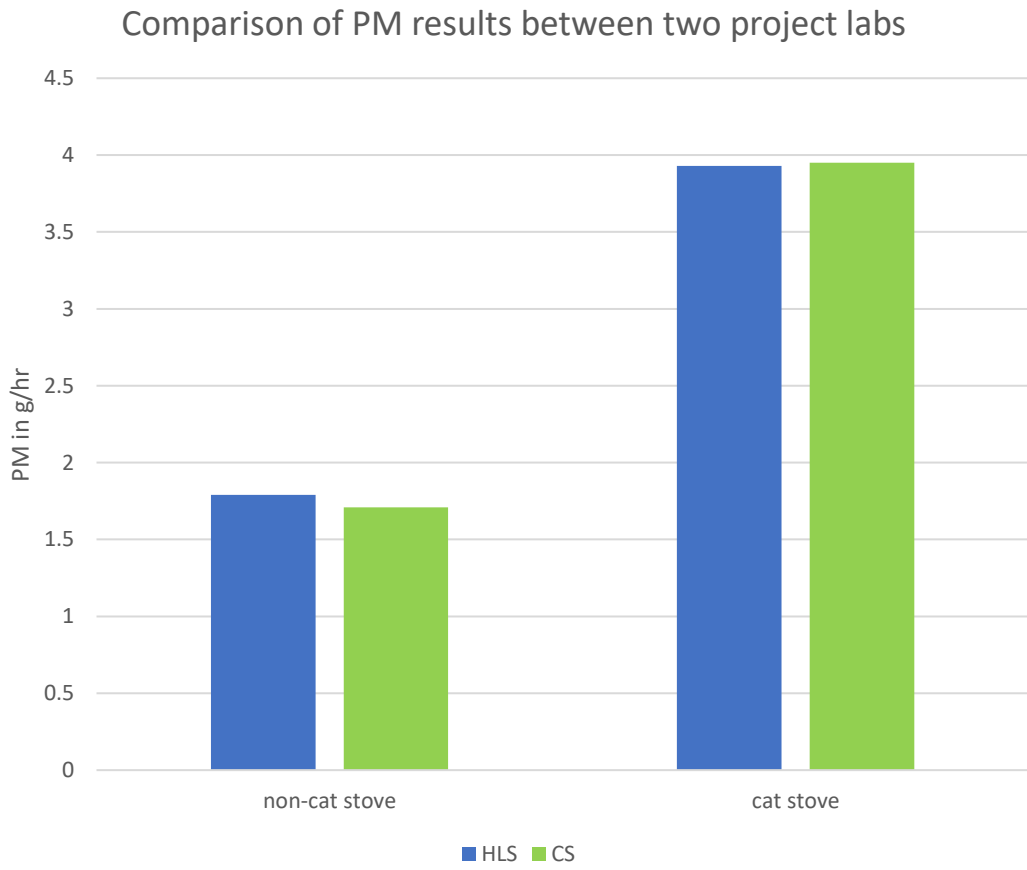
Test Methods- 6 new test methods revised/developed for project

- IDC Cordwood Stoves
- IDC Pellet Stoves
- PM Manual Filter
- Real-time PM
- CO
- CO2

EPA Region 1 Project QAPP submitted, reviewed, and approved

Lab Selection for Conditioning & Testing

- RFP released in February 2025
  - Sent to all US labs
  - Grant requirements did not allow using a non-US lab
- Five NRHTF agencies reviewed bids individually and submitted to NESCAUM for tallying
  - Used ranking sheet
  - Reviewers provided their own review
  - NESCAUM did not participate as a reviewer
- NRHTF unanimous decisions awarded to the low-cost bidders for both conditioning and official testing
- NESCAUM analysis concluded comparability between conditioning and official testing lab <4% difference in g/hr results



Conditioning

- Stoves delivered to Hearth Lab Solutions (HLS) for conditioning
- Manufacturer consults
  - NESCAUM will contact manufacturers for initial consult
  - Provide any information we should know about the appliance
  - Answer questions regarding the process
  - Assess interest in coming to lab for a day Stoves undergoes 50 hours of burning
- Conditioning lab develops instructions that guide official testing

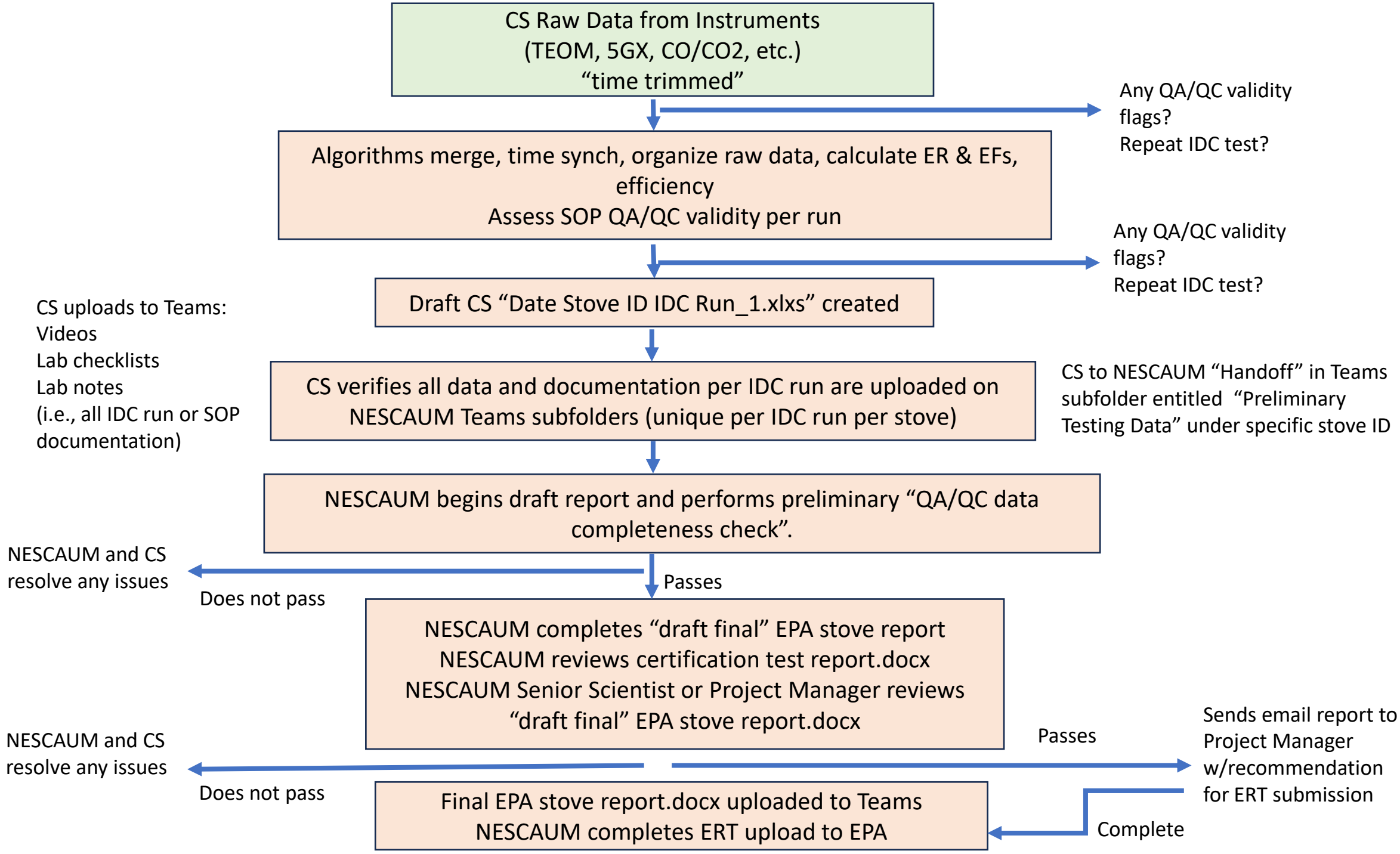
L1	
door cracked after lighting (yes/no)	
door closing time (up to 5 min)	
bypass operation, if applicable, must be open when door open	
L2	
bypass operation	
L3	
bypass operation	
L4	
door cracked after lighting	
door closing time	
bypass operation	

l Firebox Calcuation			
	Side 1	Center	Side 2
width			
depth			
height			
Full firebox volume			



Official Testing

- Stoves moved from HLS to ClearStak
- ClearStak conducts three valid test runs per project test methods
  - IDC fueling and operation
  - PM
    - Real-time using TEOM protocol
    - Single filter pull – ASTM 2515 or equivalent
  - Gas measurements using Method 3A and 10
  - Efficiency measurements using TCC method contained in IDC
- Stoves held at lab until data finalized
- Raw data provided to NESCAUM who processes data and reports


CS Raw Data from Instruments
(TEOM, 5GX, CO/CO2, etc.)
"time trimmed"
Any QA/QC validity flags?
Repeat IDC test?
Algorithms merge, time synch, organize raw data, calculate ER & EFs, efficiency
Assess SOP QA/QC validity per run
Any QA/QC validity flags?
Repeat IDC test?
Draft CS "Date Stove ID IDC Run_1.xlxs" created
CS uploads to Teams:
Videos
Lab checklists
Lab notes
(i.e., all IDC run or SOP documentation)
CS verifies all data and documentation per IDC run are uploaded on NESCAUM Teams subfolders (unique per IDC run per stove)
CS to NESCAUM "Handoff" in Teams subfolder entitled "Preliminary Testing Data" under specific stove ID
NESCAUM begins draft report and performs preliminary "QA/QC data completeness check".
NESCAUM and CS resolve any issues
Does not pass
Passes
NESCAUM completes "draft final" EPA stove report
NESCAUM reviews certification test report.docx
NESCAUM Senior Scientist or Project Manager reviews "draft final" EPA stove report.docx
NESCAUM and CS resolve any issues
Does not pass
Passes
Sends email report to Project Manager w/recommendation for ERT submission
Final EPA stove report.docx uploaded to Teams
NESCAUM completes ERT upload to EPA
Complete

Data Reporting

What's in ERT data

- Full report
- Raw data
  - Lab data
  - Fuel calculator

Reported to:

- EPA via ERT for final review
- Video submitted separately due to size
  - Working with NRHTF and project team to determine if we can provide video of official test to manufacturers during EPA review period

Data Availability

- EPA will have data and could publish via Webfire
- NRHTF
- NESCAUM creating database that allows users to create ranking list
- Project website
  - Timing on release determined by NRHTF
  - Anticipate all data submitted to EPA will be available on the website



Review and Recap

Who

- Team effort across 21 partner agencies and two labs

What

- Standardized testing of residential wood heating appliances
- Piloting new operation and fueling protocols
- Assessing new measurement methods for PM, CO, and CO2
- Identifying opportunities to automate testing and report generation

Why are we doing this project

- Current certification program does not provide information for meaningful planning, modeling, and attainment
- Obtain data to keep cordwood heating as an option in all areas of the country, especially in non-attainment areas

When

- Testing starting soon
- Data available in late 2025 early 2026 for first group of appliances



Thank you for your time!

Any questions? Please enter them into the Q&A

Questions can also be emailed to Lisa Rector (lrector@nescaum.org) through the end of today (6/17/25) for Task Force review and response.

Funding provided to NESCAUM by US EPA Region 1

Recording available online

A recording of this webinar presentation is available on NESCAUM's website here:

https://www.nescaum.org/documents/Independent-Assessment-of-Residential-Wood-Heaters-Webinar-20250617.mp4