Update on Wood Heater Emission Standards

Presentation to
Fairbanks North Star Borough (FNSB) Assembly
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Overview

- Background – Why are wood heater emission standards important?
- EPA Certification Process
- DEC Certification Report Review Findings
- DEC and FNSB Actions to Address Concerns

Why are wood heater emission standards important to the FNSB?

- PM2.5 issue ongoing for over 12 years
- Community has made significant progress, but is still twice the standard
- The plan in place to reach attainment by 2024 relies heavily on wood smoke controls
- Accelerated wood stove turnover to cleaner appliances a critical piece of control strategy
  - EPA's certification process is the foundation on which wood stove control strategies are built

Understanding Wood Stove Certification and Alaska's Approved Device List

- During FNSB Serious SIP development we faced a choice: to meet "Best Available Controls," either implement a pellet-only wood heater program or find another way to ensure an equivalent program.
- Wood heating devices must meet more stringent requirements to be on the DEC Approved Device List to be eligible to be sold for installation in the nonattainment area.
- List is based on EPA certification program
  - First check is for devices to meet EPA certification, then state emission standards applied, then underlying test data reviewed for acceptance.
- DEC has been reviewing the underlying certification test results to verify certification values as part of the state approval process.

What is the issue?

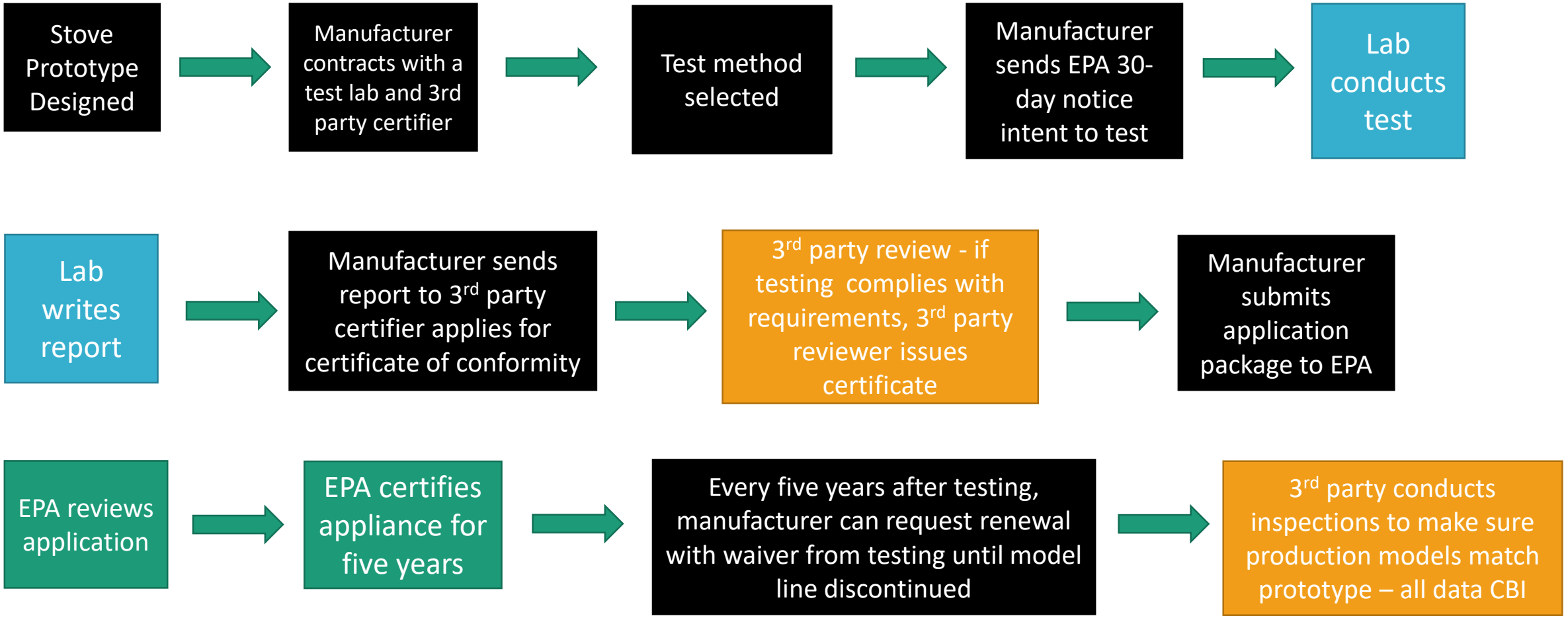
- DEC's review of wood heater emission certification tests found systemic errors in EPA's certification review program
- If new wood heaters are not cleaner than those they replace, emission benefits are not achieved as planned
  - May impact attainment projections
  - Has implications for other PM2.5 sources as additional controls may be required over time
- EPA has the responsibility to provide state and locals the tools to bring areas into attainment
  - Has failed to meet its responsibilities with respect to emissions from new wood heaters

EPA Woodstove Certification Process

NSPS Background/Terminology

- EPA Residential Wood Heater NSPS
  - First promulgated in 1988, reviewed in 1998, updated 2015
    - EPA required to review every 8 years
    - Long delay in review periods are common
  - Standards based on BSER – Best System of Emission Reduction
  - Next review should commence in 2023
  - Anticipate EPA changing test methods in the next 2 to 3 years
  - EPA information located at https://www.epa.gov/residential-wood-heaters
- Wood Heater Technology
  - Pre-NSPS: *older than 1988, never certified*
  - 1988 Phase 2 NSPS: *certified after 1992 but before 2015*
  - 2015 Step 1 NSPS: *certified 2015, emissions <4.5 g/hr*
  - 2015 Step 2 NSPS: *certified 2015, emissions <2.0 g/hr for crib and pellet tests, <2.5 g/hr for cordwood*
  - 1988 exempt: *only variable air cordwood stoves were subject to 1988 NSPS, almost all other appliances exempt.*
  - 2015 exempt: *smaller universe of exempt appliances*

Overview of the 2015 NSPS Certification Process



EPA/Third-party Review System for Certifying Step 2 Performance under the 2015 Residential Wood Heating New Source Performance Standards (NSPS)

2015 RWH NSPS

- Implemented new system to review results of certification testing
  - International Organization for Standardization (ISO) accredited & EPA approved labs
  - ISO-accredited third-party certifiers review the reports, certify results, and issue certificates of conformity
  - Application package submitted to EPA
  - EPA review and certification
- ISO implements audit and quality assurance program
  - Details of plans are Confidential Business Information (CBI)
  - Company audit programs are CBI
  - Results of inspections not publicly available

Testing Wood Stoves

- Single test on a prototype is used to certify an entire model line for a minimum of five years
  - Manufacturer can request renewals every five years and submit a waiver for testing
  - Compliance audit testing can be requested from EPA
    - Since 1988, no compliance audits have been conducted
- Testing protocol include:
  - Emission measurement protocols
  - Conditioning requirements
  - Fuel requirements
  - Appliance Operation requirements

DEC Wood Heater Certification Review

Assessment of Certification Test Reports

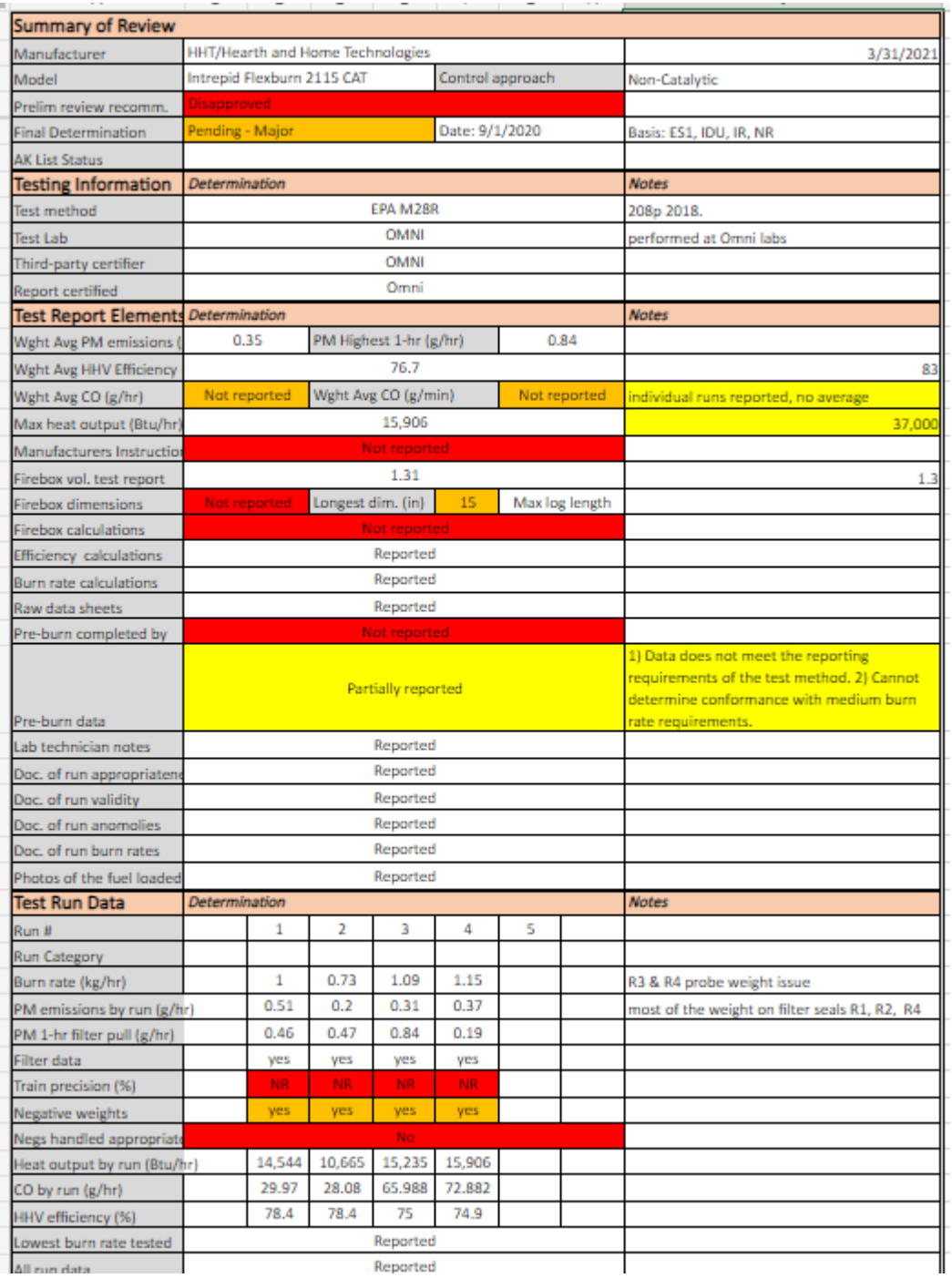
Wood Stoves – Removed from AK List

ADEC Emission Threshold Statistics				
	2.0 g/hr Avg	6.0 g/hr 1-hr	Both	Total
ASTM E3053	1	23	7	31
EPA M28R	1	21	1	23
Not reported	0	0	0	0
Total	***2***	***44***	***9***	***55***

Pellet Stoves – Removed from AK List

ADEC Emission Threshold Statistics				
	2.0 g/hr Avg	6.0 g/hr 1-hr	Both	Total
Other (ATM)	0	0	0	0
ASTM 2779	0	3	0	3
Not reported	0	0	0	0
Total	***0***	***3***	***0***	***3***

- As of May 1, 2020, EPA had certified for Step 2 compliance:
  - 148 Cordwood stoves
  - 101 Pellet stoves
  - 3 furnaces
  - 31 hydronic heaters
- DEC, NESCAUM (NE States), and other states reviewed certification test reports for:
  - 132 Cordwood stoves
  - 96 Pellet stoves
  - 3 furnaces
  - 26 hydronic heaters
- Moving forward, DEC is reviewing new certification test reports upon request for inclusion on the Alaska Approved List
- In applying the State emission standards for the area:
  - 55 wood stoves and 3 pellet stoves were removed from the Approved List in September 2020
  - Working now on deficient test reports



Summary of Review							
Manufacturer	HHT/Hearth and Home Technologies						3/31/2021
Model	Intrepid Flexburn 2115 CAT			Control approach			Non-Catalytic
Prelim review recomm.	Disapproved						
Final Determination	Pending - Major			Date: 9/1/2020			Basis: ES1, IDU, IR, NR
AK List Status							
Testing Information	***Determination***						***Notes***
Test method	EPA M28R						208p 2018.
Test Lab	OMNI						performed at Omni labs
Third-party certifier	OMNI						
Report certified	Omni						
Test Report Elements	***Determination***						***Notes***
Wght Avg PM emissions (	0.35		PM Highest 1-hr (g/hr)		0.84		
Wght Avg HHV Efficiency	76.7						83
Wght Avg CO (g/hr)	Not reported		Wght Avg CO (g/min)		Not reported		individual runs reported, no average
Max heat output (Btu/hr)	15,906						37,000
Manufacturers Instructio	Not reported						
Firebox vol. test report	1.31						1.3
Firebox dimensions	Not reported		Longest dim. (in)	15	Max log length		
Firebox calculations	Not reported						
Efficiency calculations	Reported						
Burn rate calculations	Reported						
Raw data sheets	Reported						
Pre-burn completed by	Not reported						
Pre-burn data	Partially reported						1) Data does not meet the reporting requirements of the test method. 2) Cannot determine conformance with medium burn rate requirements.
Lab technician notes	Reported						
Doc. of run appropriatene	Reported						
Doc. of run validity	Reported						
Doc. of run anomolies	Reported						
Doc. of run burn rates	Reported						
Photos of the fuel loaded	Reported						
Test Run Data	***Determination***						***Notes***
Run #		1	2	3	4	5	
Run Category							
Burn rate (kg/hr)		1	0.73	1.09	1.15		R3 & R4 probe weight issue
PM emissions by run (g/hr)		0.51	0.2	0.31	0.37		most of the weight on filter seals R1, R2, R4
PM 1-hr filter pull (g/hr)		0.46	0.47	0.84	0.19		
Filter data		yes	yes	yes	yes		
Train precision (%)		NR	NR	NR	NR		
Negative weights		yes	yes	yes	yes		
Negs handled appropriat	No						
Heat output by run (Btu/hr)		14,544	10,665	15,235	15,906		
CO by run (g/hr)		29.97	28.08	65.988	72.882		
HHV efficiency (%)		78.4	78.4	75	74.9		
Lowest burn rate tested	Reported						
All run data	Reported						

CERTIFICATION TEST REPORT REVIEW PROCESS

Obtained certification test reports from manufacturer websites.

Created an Excel review tool to standardize review of certification test reports.

Alaska and NESCAUM staff conducted reviews. Reviews are desk audits. They are not in-depth thorough reviews. Additional review may identify additional issues.

Summary sheets shared with Review Committee. Four state and local agencies reviewed findings from summary sheets.

Review based on RWH NSPS requirements and ADEC emission standards.

DEC allowed manufacturers to review summary sheets for errors to allow for corrections. Updating sheets as new information provided.

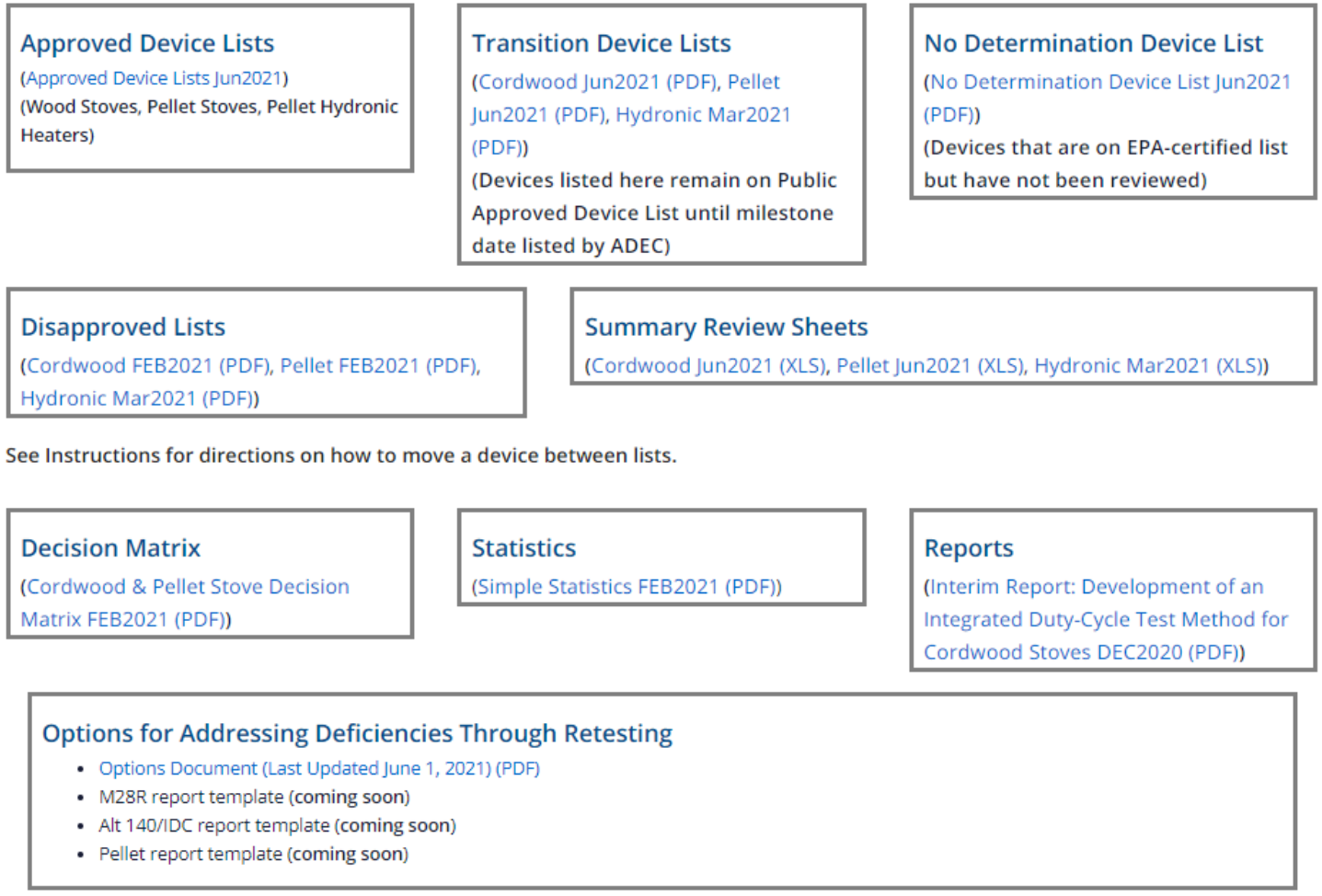
Review sheets publicly available: https://dec.alaska.gov/air/burnwise/manufacturers-vendors/

NESCAUM report available at: www.nescaum.org

DEC Materials to Support Programs

https://dec.alaska.gov/air/burnwise/manufacturers-vendors/

DEC Regulatory Basis Document: Summary sheets developed/revised based on document, available on the web site



Approved Device Lists
(Approved Device Lists Jun2021)
(Wood Stoves, Pellet Stoves, Pellet Hydronic Heaters)

Transition Device Lists
(Cordwood Jun2021 (PDF), Pellet Jun2021 (PDF), Hydronic Mar2021 (PDF))
(Devices listed here remain on Public Approved Device List until milestone date listed by ADEC)

No Determination Device List
(No Determination Device List Jun2021 (PDF))
(Devices that are on EPA-certified list but have not been reviewed)

Disapproved Lists
(Cordwood FEB2021 (PDF), Pellet FEB2021 (PDF), Hydronic Mar2021 (PDF))

Summary Review Sheets
(Cordwood Jun2021 (XLS), Pellet Jun2021 (XLS), Hydronic Mar2021 (XLS))

See Instructions for directions on how to move a device between lists.

Decision Matrix
(Cordwood & Pellet Stove Decision Matrix FEB2021 (PDF))

Statistics
(Simple Statistics FEB2021 (PDF))

Reports
(Interim Report: Development of an Integrated Duty-Cycle Test Method for Cordwood Stoves DEC2020 (PDF))

Options for Addressing Deficiencies Through Retesting

- Options Document (Last Updated June 1, 2021) (PDF)
- M28R report template (coming soon)
- Alt 140/IDC report template (coming soon)
- Pellet report template (coming soon)

Summary of Findings

- No reports complete
  - Regardless of device type, test method
- All contain defects that could trigger rule revocation elements
- On average 12-21 defects per report – after manufacturer review
  - Original value: 16-21 defects per report
- Most significant issues
  - Did not report/obtain first-hour PM values and/or CO emissions
  - Failed to follow test methods:
    - Fuel length/Fuel volume
  - Contradictory information between owner's manual and test reports
  - Testing at lowest emission rate
  - Aging (i.e., conditioning)

	Cordwood Stoves	Pellet Stoves	Central Heaters
Avg # of Revocation Criteria Flags per Report	8	7	9
Avg # of Audit Criteria per Report	8	5	12
Avg # of Missing Report Elements per Report	11	11	8

New Stove Design or Redesigned Testing?

Step 1 Model – Owner's Manual

Combustible:	Wood
Colors:	Flat Black
Flue Pipe Diameter:	6" (15.3cm)
Flue Pipe Type: (Standard Single Wall or Double Wall):	Black or Blued Steel 2100°F (650°C)
Minimum Chimney Height:	12' (3.7m)
Maximum Log Length:	22" (559mm)
Electrical:	None
Dimensions	
Overall (Depth x Width x Height):	33" x 18.5" x 23" (838mmX470mmX854mm)
Combustion Chamber: Width x Depth:	19" x 9" (482mmX229mm)
Volume: Cubic Feet:	1.2 cubic feet
Door Opening:	7.5 x 10.2 (191mmX259mm)
Pyroceramic Glass Door : (Viewing) Width x Height:	N/A
Weight (lbs):	140 lbs

Step 2 Model – Owner's Manual

Combustible:	Wood
Colors:	Flat Black
Flue Pipe Diameter:	6" (15.3 cm)
Flue Pipe Type: (Standard Single Wall):	Black or Blued Steel 2100°F (650°C)
Minimum Chimney Height:	12' (3.7 m)
Maximum Log Length:	19" (483 mm)
Electrical:	None
Dimensions	
Overall (Depth x Width x Height):	33" x 18.5" x 23" (838 mm X 470 mm X 854 mm)
Combustion Chamber: Width x Depth:	9" x 19" (229 mm X 482 mm)
Volume: Cubic Feet:	1.2 cubic feet
Door Opening:	7.5" x 10.2" (191 mm X 259 mm)
Weight (lbs):	140 lbs

Step 1 Model – Test Report

Testing Information	***Determination***		
Test method	EPA M28R		
Test Report Elements	***Determination***		
Wght Avg PM emissions (g/hr)	4.17	PM Highest 1-hr (g/	5.38
Wght Avg HHV Efficiency (%)	67.9		
Wght Avg CO (g/hr)	6792	Wght Avg CO (g/mi	113.2
Max heat output (Btu/hr)	26471		
Firebox vol. test report	1.25		
Appliance Fueling	***Determination***		
Fuel species	NR		
Log length (in)	14.5	14.5	14.5

Step 2 Model – Test Report

Testing Information	***Determination***		
Test method	EPA M28R		
Wght Avg PM emissions (g/hr)	1.75	PM Highest 1-hr (g/	2.37
Wght Avg HHV Efficiency (%)	67.4		
Wght Avg CO (g/hr)	112.2	Wght Avg CO (g/mi	1.87
Max heat output (Btu/hr)	29234		
Firebox vol. test report	1.145		
Appliance Fueling	***Determination***		
Fuel species	Douglas Fir		
Log length (in)	11.5	11.5	

Certification Test Report Review: Contradictory Information

132 certification test reports assessed

Firebox volume

- 46% report a different firebox volume in their materials than used in testing
- 43% materials matched

Heat output

- 75% do not match
- 22% match

Efficiency

- 28% do not match
- 65% match

Fuel Length

- 50% of M28R tests did not meet fuel length req.
- 68% of ASTM 3053 used shorter wood than recommended

Source of data	Manufacturer Marketing Materials	EPA Cert. Report
PM emissions (g/hr)	1.26	1.26
HHV efficiency (%)	78	70
Firebox volume (ft^3)	1.9	1.44
Max heat output (Btu/hr)	65,000	23,330
Log length (in)	18	16

Source of data	Manufacturer Marketing Materials	EPA Cert. Report
PM emissions (g/hr)	1.3	1.3
HHV efficiency (%)	60.3	60.3
Firebox volume (ft^3)	4.4	4.04
Max heat output (Btu/hr)	95,000	34,057
Log length (in)	24	16

Certification Test Report Review Results as of June 1, 2021

- Results will be updated as review continues
  - Working with manufacturers to obtain information
  - Working with EPA to determine most critical issues
  - Working on options for addressing deficiencies through retesting

Wood Stoves

Overall Summary Statistics						
	# of Reports Reviewed	Disapproved (emission threshold)	Disapproved (unable to verify)	No Determination (Report Issues)	Approved/ Pending	Approved w/ Flags
ASTM E3053	66	31	2	32	1	0
EPA M28R	62	23	4	5	30	0
Not reported	2	0	2	0	0	0
Total	***132***	***56***	***8***	***37***	***31***	***0***

Pellet Stoves

Overall Summary Statistics						
	# of Reports Reviewed	Disapproved (emission threshold)	Disapproved (unable to verify)	No Determination (Report Issues)	Approved/ Pending	Approved w/ Flags
Other (ATM)	2	0	0	0	2	0
ASTM 2779	83	3	5	34	41	0
Not reported	11	0	11	0	0	0
Total	***96***	***3***	***16***	***34***	***43***	***0***

Test Report Review Summary

- **CONCERNS ABOUT EPA RWH CERTIFICATION PROGRAM INTEGRITY**
  - Serious deviations from rule requirements not identified by EPA OECA review
    - Process is not identifying basic and easily identifiable issues
  - Issues are widespread across many labs and manufacturers
  - Issues will impact the emission performance of the appliance
  - Found no complete test reports
    - 100% contained elements that should trigger revocation hearings under rule requirements
  - Lack of compliance assurance activities
    - EPA has not completed a single compliance audit for emission test in 30 years
    - Litigation currently underway related to NSPS audit provisions
- **ASTM TEST METHODS DEFICIENT AND REQUIRE REPLACEMENT or MAJOR REVISIONS**
  - Reviewers identified significant deficiencies within all ASTM Methods (2515, 2779, 2618, and 3053) that allow testing to reduce PM via lab practices rather than improved technology
  - At Alaska's request, EPA recently adopted the Integrated Duty Cycle Cordwood Protocol as a Broadly Applicable Alternative Test Method (ATM) starting a pathway to cordwood test method improvement
  - A group of states, including Alaska, recently requested EPA revoke ASTM Method 3053 due to concerns

Test Report Review Summary

- **LACK OF TRANSPARENCY**
  - Certification test reports difficult to find
  - Public reports are inadequate to complete a full program assessment
  - Third-party oversight program data cannot be accessed
  - EPA broadly accepts data as Confidential Business Information
- **REPORT CONCLUSIONS**
  - ISO-accredited third-party certifiers and ISO-certified/EPA-approved labs are not following all rule requirements
  - States cannot rely on the federal program to identify cleaner appliances due to lax EPA oversight & ineffective test methods
- **EPA Acknowledgement - Letters to labs and third-party certifiers acknowledged "serious and systemic problems"**
  - https://www.epa.gov/burnwise/epa-approved-test-labs-and-third-party-certifiers-residential-wood-heaters

DEC and FNSB Actions to Address Concerns

- Concerns related to wood heater certification have impacts to AQ programs within the nonattainment area
  - At a critical juncture with accelerated stove turnover
  - Need to ensure that new stoves are performing better than those they replace
  - DEC is working to provide a list of stoves whose tests support that they meet emission standards
  - Borough AQ program is proactively managing the change-out program to achieve targeted emission reductions
  - DEC is engaged with EPA Headquarters to push them to address issues and fix the national program
- To meet our local air quality objective, we need a well-functioning national certification program
  - It will take time for EPA to address issues and we don't have time!
  - An option, still in the concept phase, is independent testing of appliances to validate emissions.

Questions?