Wood Pellet Manufacturing and Use:

An overview of pellet fuel quality control and stove testing as it relates to federal air quality regulations

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Wood pellets for home heating.

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Wood pellet manufacturing process

1

Residual wood products acquired from local suppliers (lumber mills, hardwood flooring manufacturers, etc.)

2

Residuals can be in the form of chips, sawdust or shavings and are stored until material is processed

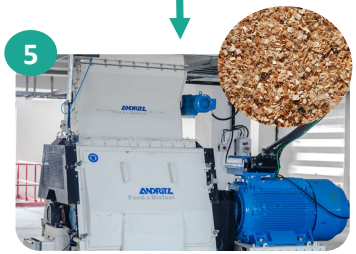
3

Residuals are stored in an outdoor pile, indoor storage or trailers

4

Material is dried from “green” state (~40% moisture) to desired moisture content (~10 - 15%)

5



Material is hammermilled to desired particle size distribution

6

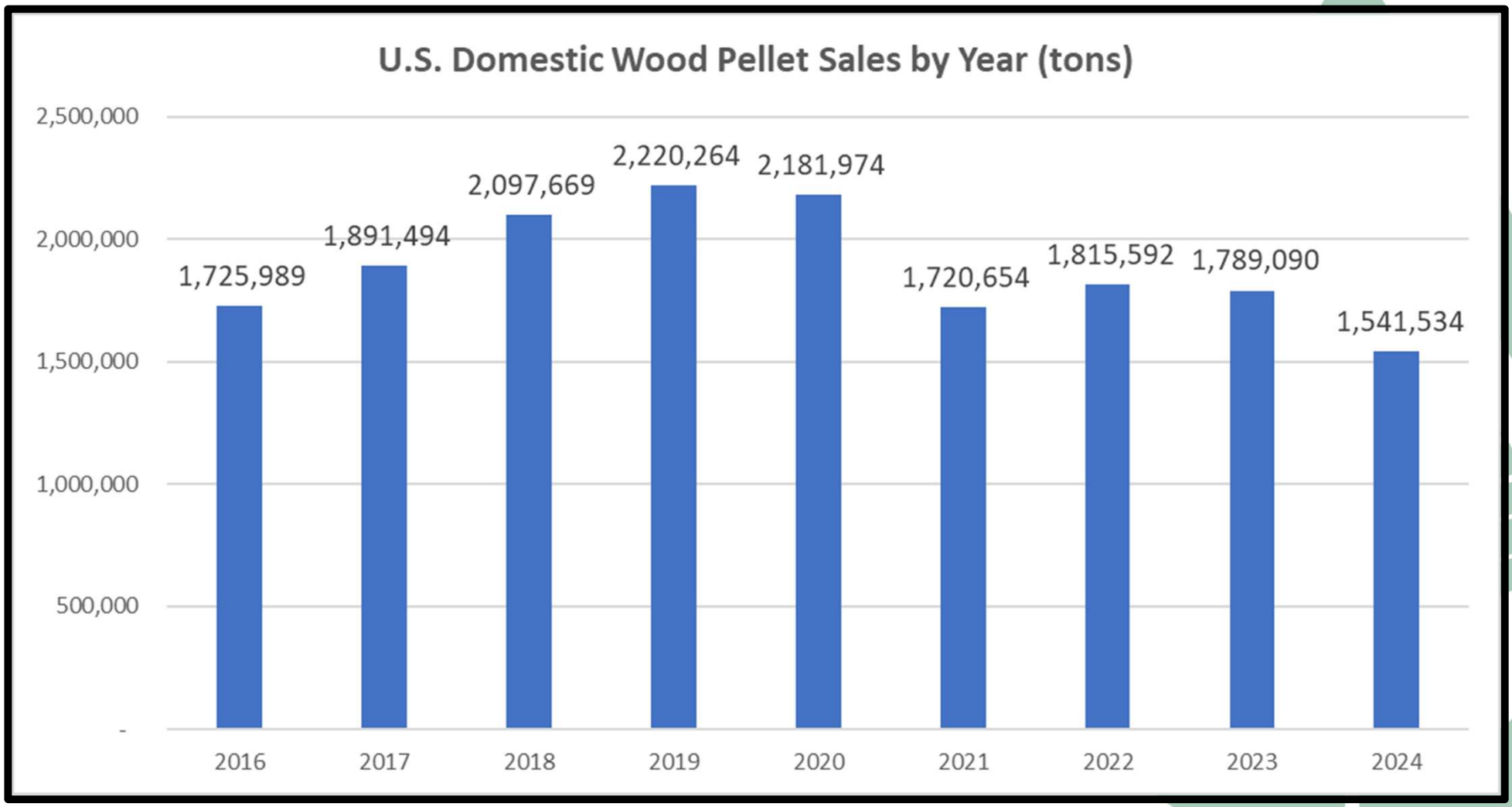
Sized and dried material is processed through a pelletizer using rotating rolls and dies to form the pellet

7

Pellets are bagged by an automated form, fill and seal machine in either 10, 20 or 40 pound bags

8

Bags are automatically palletized (robot or dedicated palletizer)


U.S. Domestic Wood Pellet Sales by Year (tons)
2,500,000
2,000,000
1,500,000
1,000,000
500,000
-
1,725,989
1,891,494
2,097,669
2,220,264
2,181,974
1,720,654
1,815,592
1,789,090
1,541,534
2016
2017
2018
2019
2020
2021
2022
2023
2024

Residual Purchases from wood pellet manufacturers

7.1 million tons of sawmill residuals ($35.91/ton) or **$257 million**
228,430 tons of wood product manufacturing residuals ($41.12/ton) or **$9.3 million**

Source: EIA Monthly Densified Biomass Fuel Report

Final Requirements for Pellet Fuel Burned in Residential Wood Heating Devices

The 2015 RWH NSPS requires owners of wood heating devices that are certified to burn pellet fuels to burn only pellets that have been specified in the owner's manual and graded under a licensing agreement with a third-party organization approved by the EPA. The Pellet Fuels Institute (PFI), ENplus, and CANplus are the current EPA-approved third-party organizations for this purpose (additional organizations may apply to the Administrator for approval).

See the pellet fuel requirements stated in 40 CFR 60.532(e) and 40 CFR 60.5474(e). Based on these requirements, the EPA concluded that a certified pellet fuel heater's performance in a consumer's home would be consistent with the heater's performance in the laboratory using the EPA's certification test methods. Under the provisions of the 2015 RWH NSPS, a pellet manufacturer is not obligated to produce pellets that meet the pellet fuel requirements, but operators and manufacturers of pellet fuel heaters in the United States are prohibited from using pellets that do not meet the pellet fuel requirements. The pellet fuel requirements, in addition to ensuring consistency with certification testing, were intended to safeguard against emissions hazardous to human health and the environment when the pellets are burned in pellet fuel heaters operated in the home by consumers.

https://www.federalregister.gov/documents/2020/04/02/2020-05961/standards-of-performance-for-new-residential-wood-heaters-new-residential-hydronic-heaters-and#h-15

PFI Standards Program: Guaranteeing Pellet Fuel Quality

- Voluntary
- 3rd party inspected, tested and audited
- Based on ISO 17065 product certification platform
- Producers conduct <u>at least</u> 2 internal quality tests per shift
- **31** producing facilities in PFI program
- **536** 3rd party tests completed in 2024
- **923,470** tons 3rd party certified in 2024

Fuel Property	PFI Premium
Bulk Density (lb./cubic foot)	40 - 48
Inorganic ash %	< 1.0
Moisture	<8.0

https://pellet.memberclicks.net/joining-the-pfi-standards-program

Pellet Hearth Appliance Market

- Whitfield was generally the first commercially-available pellet stoves (1980s)
- Harman and Quadrafire, two brands now owned by Hearth & Home Technologies (HHT), entered the pellet market in 1990 and 1991
- HHT sells about 20 different pellet stoves and inserts across three brands: PelPRO, Harman and Quadrafire
- The EPA certified list shows about 100 certified pellet appliances currently for sale

The Appliances and Relation to NSPS

- Pellet stoves are inherently clean-burning
  - They burn small amounts of very dry fuel – much drier than cordwood – in a high-temperature chamber, achieving over 99% combustion efficiency
- The original 1988 NSPS did not have a dedicated pellet stove method, nor did it have an emissions limit
  - Until the 2015 NSPS, pellet stoves were considered non-affected facilities and were mostly tested to prove they operated above a 35:1 Air to Fuel ratio
- Pellet stove emissions testing became a part of the 2015 NSPS and a dedicated ASTM standard was developed for testing them

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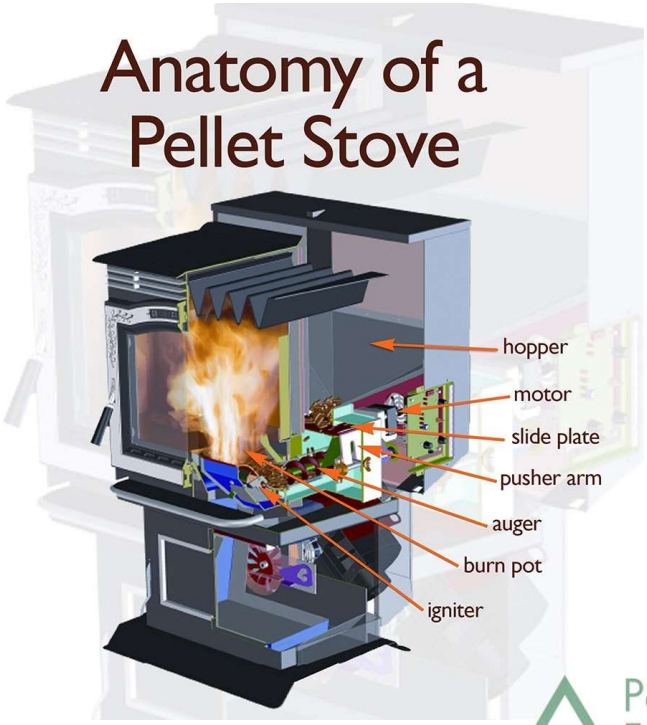
Pellet Stove Operation

- Although different technologies exist, the basic parts are the same on all models
- Feed system provides pellets from the fuel storage hopper
- Electronic controls regulate pellet feed, blower speeds and heat output
- Venting is typically 3 or 4' Type L or Type PL pipe



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Testing Procedure and Methods

- A dilution tunnel is used to capture the byproducts of combustion and measure an emissions rate
- Robust test methods for determining particulate emissions from pellet heaters
- Method is self weighting and produces daily results

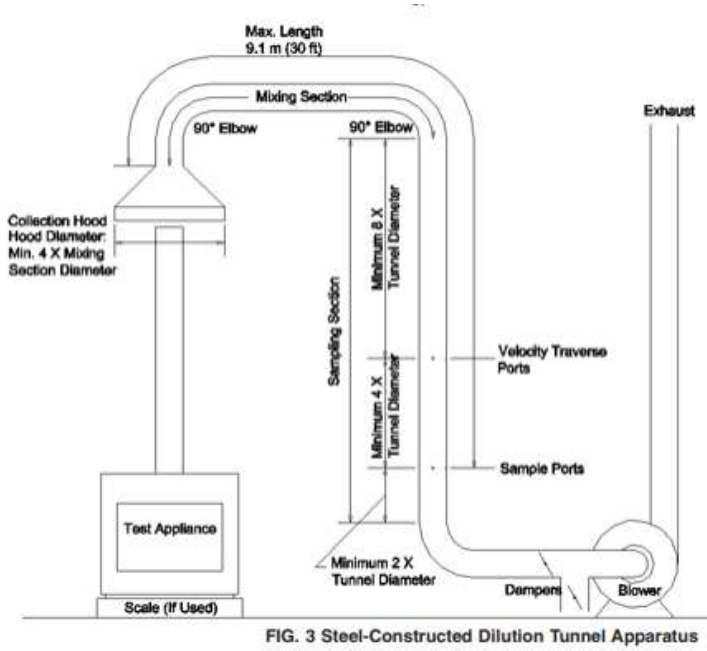

FIG. 3 Steel-Constructed Dilution Tunnel Apparatus

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Thank You.

Relevant Links:

EIA Monthly Densified Biomass Fuel Report
https://www.eia.gov/biofuels/biomass/

Pellet Fuels Institute Standards Program
https://pellet.memberclicks.net/joining-the-pfi-standards-program

Standards of Performance for New Residential Wood Heaters, New Residential Hydronic Heaters and Forced-Air Furnaces

https://www.federalregister.gov/documents/2020/04/02/2020-05961/standards-of-performance-for-new-residential-wood-heaters-new-residential-hydronic-heaters-and#h-15