

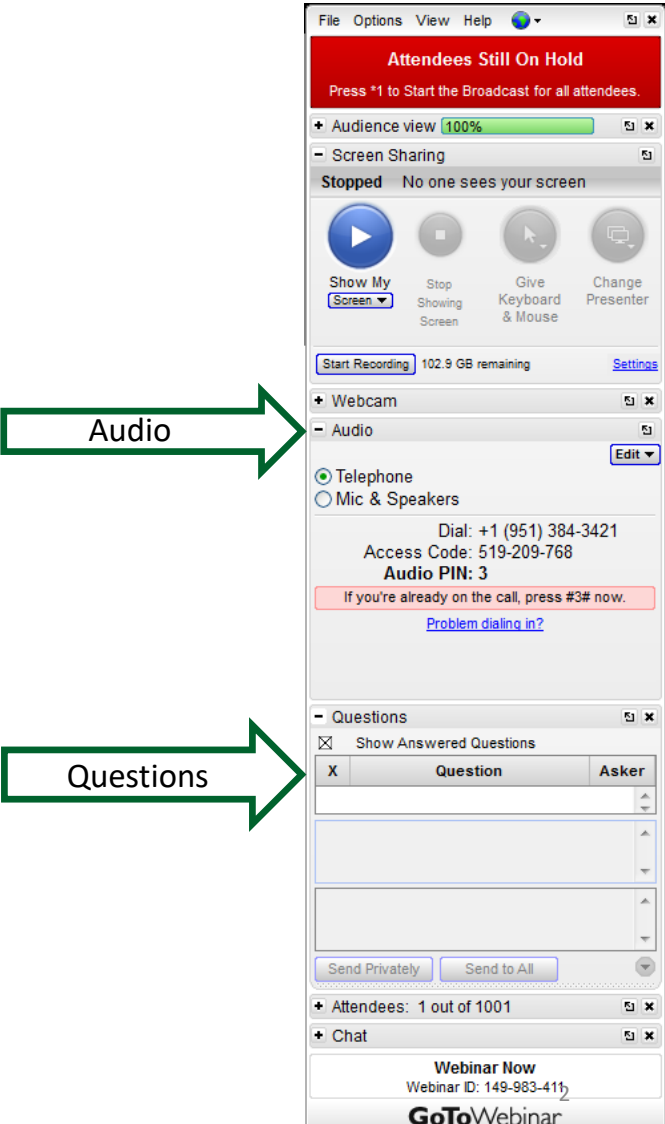
# Wood Chip Heating Fuel Quality Standard for the U.S.

Biomass Thermal Energy Council Webinar  
June 6th, 2018

Adam Sherman  
Jean Walsh  
Jim Dooley

# Quick Notes

- Two Audio Options: Streaming Audio and Dial-In.
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# About BTEC

**The national trade association for the modern wood heating industry.**

- Engage in technical codes and standards development, public advocacy, and education.
- **60+ members and associates across the US and Canada:**
  - Fuel Producers
  - Manufacturers
  - Sellers
  - Installers
  - Service Providers
  - Universities
  - Non-profits & NGOs
  - Government agencies



## For More Information:

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# Presentation Outline

- Background on the need for a standard
- Players involved
- Standard development process
- Summary of the final standard
- Discussion of putting the standard to work

# Project Partners



**BERC**  
Biomass Energy  
Resource Center



# Grant Support from U.S. Forest Service, Wood Education Resource Center



## Thank You!



# Context

- Commercial woodchip heating/CHP represents ***significant growth opportunity*** in various regions of the US
- For woodchip heating/CHP to become mainstream energy choice, ***it must be clean and efficient, with high reliability and consistent, predictable performance***



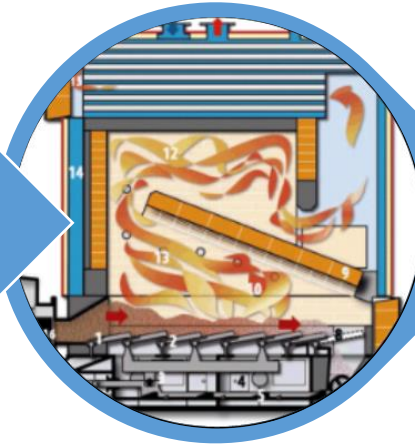
# Elements of Success



Know-how to  
produce given  
grades of fuel



Fuel that  
consistently meets  
the specs.



State of the art  
combustion technology  
engineered to burn  
specific fuel



Optimal system  
performance (low  
emissions, high  
efficiency, & minimal  
O&M)

***Market and Regulatory Confidence and Trust***

# The Current Problem

- **No widely adopted, fully recognized woodchip fuel standard in U.S. market today**
- **Every other major heating fuel, except wood chips,** subject to unambiguous fuel standards certified by recognized agency
  - Heating oil
  - Propane
  - Natural gas
  - Pellets (PFI, ENPlus, ISO)
- **Failure to act could lead to regulators (e.g. EPA) taking matters into their own hands**

# Contributing Factors

- Increased regulation
  - Boiler MACT
  - New Source Performance Standards
  - New particulate non-attainment thresholds
- Greater awareness of particulate issues from wood fuels, especially among state regulators
- Fossil heating fuels against which wood competes are getting cleaner (e.g. ULS #2 heating oil, Bioheat blends)
- Public expectation that wood fuels must be as clean as possible (backlash from OWBs)
- Public health officials increasingly taking dim view of wood
- Sophisticated consumers of fuel insisting on verifiable standard

# No Common Terminology for Woodchips as Heating Fuel!

- “Hog fuel”
- “Dirty chips”
- “Clean chips”
- “Grindings”
- “Whole tree chips”
- “Paper chips”
- “Screened chips”
- “Bole chips”
- “Microchips”
- “Semi-dry chips”
- “Precision dry chips”
- “Refined dry chips”





# Benefits of Fuel Quality Standards

1. Right Fuel > Right Boiler
2. Consumer Confidence
3. Clear Guidance to Producer, Consistency
4. Simplifies Trouble-Shooting with Combustion System
5. Increased Confidence, Quality Assurance leads to....

## GROWTH IN MARKET



# Getting Started

- Formed 15 member advisory committee
- Built website: [www.woodchipstandard.org](http://www.woodchipstandard.org)
- Built stakeholder list: now over 400 (sign up on website!)
- Introduced project at conferences across the U.S.
- Exposure in *Biomass Magazine*

# Stakeholder Categories

- USDA Forest Service
- Boiler manufacturers
- Chipping and grinding equipment manufacturers
- Forestry officials (state and local)
- Consultants
- University
- NGOs
- Air quality regulators
- Boiler safety experts
- Mechanical/ agricultural engineers

# Advisory Committee: Fundamental Questions

- *Develop new standard for U.S. market?*
- *Adopt existing standard?*
- *Adopt existing standard with modifications for U.S. Market?*





# We Reviewed Existing Standards

- EN 3505 & 14961
- ISO 17225-4
- ONORM M7133
- Can/CSA (ISO)
- Regionally adopted specs
- Default boiler vendor specs

Parameter	ISO	EN 14961	ONORM M7 133
Origin	A1/A2/B1/B2	1.1/1.2/1.3/1.4	
Particle Size (mm)	P16S/P31S/P45S	P16A/P16B/P45A/P45B/P63/P100	G30/G50/G100/G120/G150
Moisture Content	M10/M25/M35 (for B1)	M10/M15/M20/M25/M30/M40/M45/M55/M55 +	W20/W30/W35/W40/W50
Ash Content	A1.0 (for A1)/A1.5 (for A2)/A3.0 (for B)	A0.5/A0.7/A1.0/A1.5/A2.0/A3.0/A5.0/A7.0/A10.0/A10.0+	A1/A2
Bulk density	BD150/BD200/BD250/BD300 (for A2)	BD150/BD200/BD250/BD300/BD350/BD400/BD450/BD450+ (if traded by volume)	S160/S200/S250
Nitrogen	N1.0 (for grade B)	N0.3/N0.5/N1.0/N2.0/N3.0/N3.0+ (for 1.2.2, 1.3.2)	
Chlorine	Cl0.05 (for grade B only)	Cl0.02/Cl0.03/Cl0.07/Cl0.10/Cl0.10+ (for 1.2.2, 1.3.2)	
Sulfur	S0.1 (for grade B only)		
Arsenic	<=1 (for grade B only)		
Cadmim	<=23.0 (for grade B only)		
Chromium	<=10 (for grade B only)		
Copper	<=10 (for grade B only)		
Lead	<=10 (for grade B only)		
Mercury	<=0.1 (for grade B only)		
Nickel	<=10 (for grade B only)		
Zinc	<=100 (for grade B only)		
Net energy content	MJ/kg or kWh/ m <sup>3</sup> l	(LHV)) as MJ/kg or kWh/m <sup>3</sup> l	

# Pros and Cons of Different Approaches

	Using an Existing Standard	Modifying an Existing Standard	Creating a New Standard
Facilitated Trade with other Countries (primarily Canada)	Yes, if ISO standard	Yes, if closely resembles ISO standard	No
Allows for Relatively Easy Adjustments of Standard, Prior to or Post Implementation of Standard	No, would require engagement in the ISO process and engagement of ISO stakeholders	Yes, through ASABE	Yes, through ASABE
Present Absolute Values, Independently Verifiable by Labs and/or Producers	Yes, using existing, standardized measurement protocol	Detailed measurement protocol may need to be determined and published for each criteria modified	Detailed measurement and verification protocol will need to be determined and published for each criteria (equipment to use for measurement, procedures, level of precision, etc.)
Require Producers to Purchase Additional Equipment to Grade their Product	Yes, sieves	Yes, sieves	Likely, sieves. Possibly others
Require Producers to do additional Work to Grade their Product	Yes: sieve, oven dry	Yes: sieve, oven dry	Likely: sieve, oven dry. Possibly others.
Supply Chain and Quality Assurance Protocol Established	Yes	Yes, may need to be modified	Will need to be defined
Legal Obligation to Meet the Standards	Not until the market matures enough	Not until the market matures enough	Not until the market matures enough
Facilitates Woodchip Boiler Manufacturers' Specification of the Proper Fuel	Yes, if ISO, for all European or Canadian	Yes, if closely resembles ISO standard, for all European or Canadian	No, manufacturers will have to understand the new standard for the US market and provide specifications tailored to the US market in addition to the EU and Canadian market
Vulnerability to Void Manufacturer Warranty or Legal Action if Chips do not Meet Grade Advertised	Potentially	Potentially	Potentially
Requirements to Have the Fuel Tested on a Set Schedule or by a Third Party	No	Can be required	Can be required
Offers a Simple, Easy to Understand Standard that Greatly Simplifies the Evaluation and Purchase of a Highly Variable Wood Fuel	Limited	Limited	Potentially
Offers a Detailed, Comprehensive Standard that Classifies Woodchips into a Matrix Covering a Range of Characteristics	Yes	Yes	Potentially

# Advisory Committee Opts to Adapt ISO Standard for U.S. Market

- Widely adopted in Europe
- Adopted by Canadian Standards Association without deviation
- Focused on:
  - Allowance for any processing method as long as resulting fuel can meet specification
  - Chip size classifications more consistent with U.S. market (English measure)
  - Moisture content classifications reflecting diversity of boiler engineering in U.S. market

# Adopting a Standard is Process Intensive

- Advisory Committee becomes voting body, reviewed all comments
- Two ballots
- Two rounds of stakeholder input
- Formal ASABE process to adopt ISO standard with modifications, now registered with American National Standards Institute (ANSI)
- Formally adopted in February, 2018



# Standard Approved

## **ANSI/ASABE AD17225-4**

Solid biofuels – Fuel specifications and classes -  
Part 4: Graded wood chips

# Qualitative Parameters

- Source of wood fuel
- Particle Size
- Moisture content
- Ash content
- Bulk density
- Elemental composition

# Wood Fuel Sources

- Forests, plantations, and other virgin wood including the following:
  - Whole trees without roots
  - Stemwood
  - Logging residues (tops and limbs)
- By-products and residues from wood processing industry, including the following:
  - Chemically untreated wood residues

*(Deviation to ISO standard = Source does not automatically dictate the overall grade of chips.)*



# Particle Size

Main fraction a (minimum 60 w-%),		Fines fraction	Coarse fraction	Max. length of particles b, mm	Max. cross sectional area of the coarse fraction
<b>P9.5S</b>	1/8 in < P ≤ 3/8 in	≤ 15 %	≤ 6 % > 3/4 in	≤ 1-1/4 in	≤ 0.2 in <sup>2</sup>
<b>P16S</b>	1/8 in < P ≤ 5/8 in	≤ 15 %	≤ 6 % > 1-1/4 in	≤ 1-3/4 in	≤ 0.3 in <sup>2</sup>
<b>P25S</b>	1/8 in < P ≤ 1.0 in	≤ 15 %	≤ 6 % > 1-1/4 in	≤ 1-3/4 in	≤ 0.3 in <sup>2</sup>
<b>P38S</b>	1/8 in < P ≤ 1.5 in	≤ 10 %	≤ 6 % > 1-3/4 in	≤ 6.0 in	≤ 0.6 in <sup>2</sup>
<b>P50S</b>	1/8 in < P ≤ 2.0 in	≤ 10 %	≤ 10 % > 2-1/2 in	≤ 8.0 in	≤ 1.0 in <sup>2</sup>

*(Deviation from ISO standard = minor adjustments to ranges and use of US imperial units.)*

*Particle size designation does not impact overall chip grade.*

# Moisture Content

A1	A2	B
M13 ≤ 13		M13 ≤ 13
M25 ≤ 25		M25 ≤ 25
M30 ≤ 30		M30 ≤ 30
M35 ≤ 35		M35 ≤ 35
M35 +		M35 +
M50 ≤ 50		

*(Deviation from ISO standard = minor adjustments to ranges + increased allowance for MC in A1 and A2 grades)*

# Ash Content

A1	A2	B
$\leq 1.0\%$	$\leq 1.5\%$	$\leq 3.0\%$

*(No deviation from ISO standard)*

# Bulk Density

Moisture content on wet basis		8% to 18%	18% to 25%	25% to 35%	35% to 45%
<b>Bulk density for conifer species</b>	Pounds per cubic yard (loose volume)	461 to 519	519 to 576	576 to 648	648 to 778
	Property class	BD150	BD150	BD200	BD200
<b>Bulk density for deciduous species</b>	Pounds per cubic yard (loose volume)	648 to 720	720 to 807	807 to 922	922 to 1095
	Property class	BD200	BD250	BD250	BD300

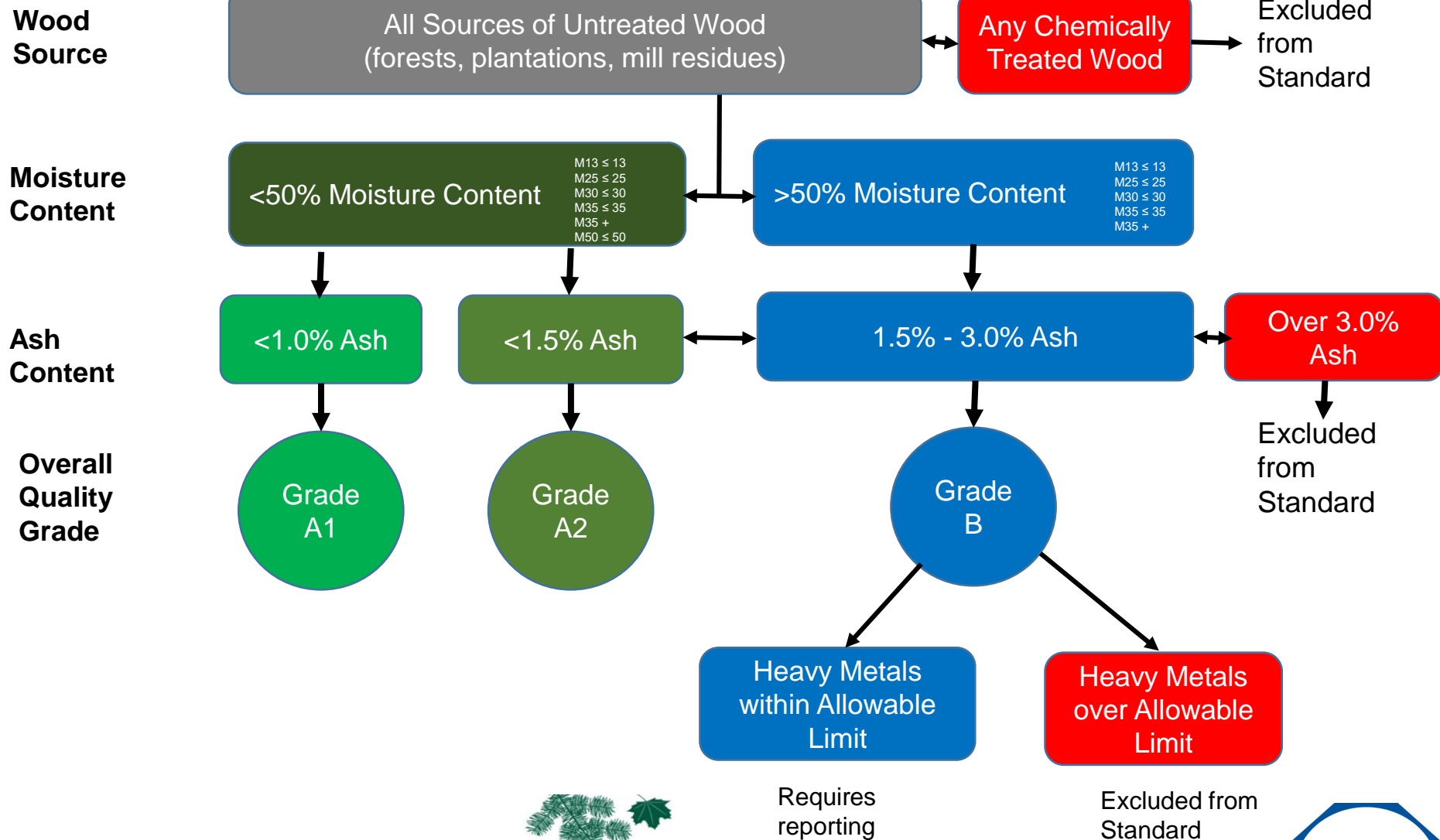
*(No variation from ISO standard.)*

# Elemental Composition

	Measure	Threshold
Nitrogen	% dry	$\leq 1.0$
Sulfur	% dry	$\leq 0.1$
Chlorine	% dry	$\leq 0.05$
Arsenic	mg/kg dry	$\leq 1$
Cadmium	mg/kg dry	$\leq 2.0$
Chromium	mg/kg dry	$\leq 10$
Copper	mg/kg dry	$\leq 10$
Lead	mg/kg dry	$\leq 10$
Mercury	mg/kg dry	$\leq 0.1$
Nickel	mg/kg dry	$\leq 10$
Zinc	mg/kg dry	$\leq 100$

*(No variation from ISO standard.)*

# Woodchip Heating Fuel Quality Classification Diagram

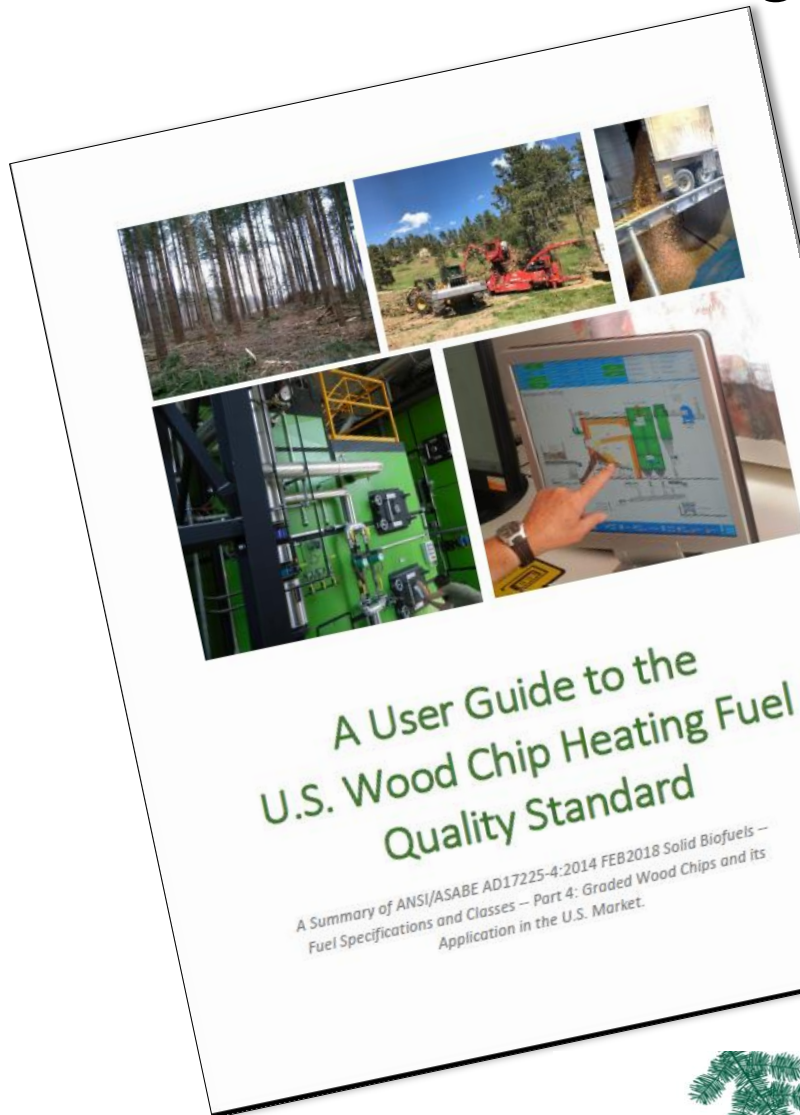


# Standard only as good as its adoption and use!

- Education and outreach effort in 2018
- Published guidance handbook
- Promote use of standard with all stakeholders
  - ✓ Approach boiler and wood chip fuel processing, conveying and storage equipment to reference standard
  - ✓ Consumers/Fuel Buyers
  - ✓ Air quality regulators, other stakeholders



# Comprehensive User's Guide and Two-Page Pocket Summary





# Strategies for Producing Chips to Desired Standard

Quality Parameter	Production and Transportation
Particle Size	<b>Keep it consistent in size:</b> <ul style="list-style-type: none"> <li>• Limit introduction of fines and dirt</li> <li>• Maintain equipment and outlet screens</li> <li>• Feed chipper with uniform diameter material to have more uniform chips and fewer stringers</li> <li>• Invest in screening equipment.</li> </ul>
Moisture Content	<b>Keep it dry:</b> <ul style="list-style-type: none"> <li>• Use rigid top trailers rather than open top trailers that collect snow and rain</li> <li>• Keep rain and snow off the log and chip piles.</li> </ul>
Ash Content	<b>Keep it clean:</b> <ul style="list-style-type: none"> <li>• Exclude stump and roots</li> <li>• Keep trailers clean</li> <li>• Avoid dragging wood over muddy ground, harvest in winter over frozen ground or snow</li> <li>• At roadside or log landing, avoid pushing snow or dirt into the chip pile.</li> </ul>
Elemental Properties	<ul style="list-style-type: none"> <li>• Use only untreated wood of traceable origin</li> <li>• There is more nitrogen in green leaves than wood, exclude leaves and needles to keep N concentration low.</li> </ul>
Calorific Value	<ul style="list-style-type: none"> <li>• Chip sound wood - rotten wood has lower calorific value</li> <li>• Species influences the calorific value but moisture content has a much greater influence.</li> </ul>
Exclusion of Foreign Objects	<b>Keep it clean:</b> <ul style="list-style-type: none"> <li>• Make sure bolts are tightened to the disk on the chipper</li> <li>• When chipping, blow it directly into delivery truck, avoid using a front-loader as it is an extra step that could introduce foreign objects.</li> </ul>

# Keeping Heating Fuel Chips to Standard in Storage and Conveying

Quality Parameter	Storage and Conveyance
Particle Size	<ul style="list-style-type: none"><li>• Install simple in-line equipment to screen oversized and undersized material out.</li></ul>
Moisture Content	<ul style="list-style-type: none"><li>• Protect pile from wind, snow, or flooding</li><li>• Ensure proper drainage of the storage area</li><li>• Encourage passive drying during storage and as the fuel is being conveyed between the storage bin and boiler.</li></ul>
Ash Content	<ul style="list-style-type: none"><li>• Protect pile from contamination and foreign objects, such as blowing sand or dust.</li></ul>
Elemental Properties	<ul style="list-style-type: none"><li>• Protect pile from chemical contamination.</li></ul>
Calorific Value	<ul style="list-style-type: none"><li>• Avoid high pile temperatures</li><li>• Limit storage duration</li><li>• Utilize first-in, first-out utilization techniques rather than first-in, last-out.</li></ul>
Exclusion of Foreign Objects	<ul style="list-style-type: none"><li>• Avoid the introduction of foreign objects (e.g. unpaved storage area, unclean front loader bucket), use magnets to remove any metal that may have been introduced in the chips (e.g. bolts, etc.).</li></ul>

# Summary



Know-how to  
produce given  
grades of fuel



Fuel that  
consistently meets  
the specs.



State of the art  
combustion technology  
engineered to burn  
specific fuel



Optimal system  
performance (low  
emissions, high  
efficiency, & minimal  
O&M)

***Market and Regulatory Confidence and Trust***

# Thank you!

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