Biomass Boiler Heating Systems

Pellet Boilers

Chip Boilers

Cord Wood Boilers

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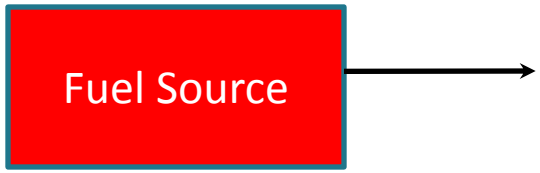
Types of Systems

- Residential / Commercial Systems
- Individual Facilities, Central Boilers with Distribution System
- Cord Wood, Hog, Pellet, or Wood Chip

Key Components and System Considerations

Fuel Source



Fuel Source

Wood Chip /Pellet Quality and Delivery

- Verify the quality of available fuel (different wood has different BTU)
- Verify available quantity of fuel (for individual users and community)
- Fuel quality and moisture content is directly related to boiler efficiency
- Assess the availability of fuel for long term
- Local wood supply creates local jobs
- Barley grown in Delta Junction / Fort Greely area

Pellet Specifications -Pellet Fuels Institute

PFI Pellet Quality Standards

	Super Premium	Premium	Standard	Utility
Bulk Density (lbs/ft^2)	40.0 - 46.0	40.0 - 46.0	38.0 - 46.0	38.0 - 46.0
Durability Index	>97.5	>97.5	>95.0	>95.0
Fines (% at mill gate)	<0.50	<0.50	<0.50	<0.50
Inorganic Ash Content (%)	<0.50	<1.0	<2.0	<6.0
Moisture	<6.0	<8.0	<8.0	<10.0
Chloride (PPM)	<300	<300	<300	<300
Heating Value (Btu/lb)	>8,000	>8,000	>8,000	>8,000

Source: http://www.woodpellets.com/Pellet-Fuel-Standards.aspx

Wood Chip Delivery & Storage

Tree Delivery, Chip Maker - Tok

Wood Chip Delivery

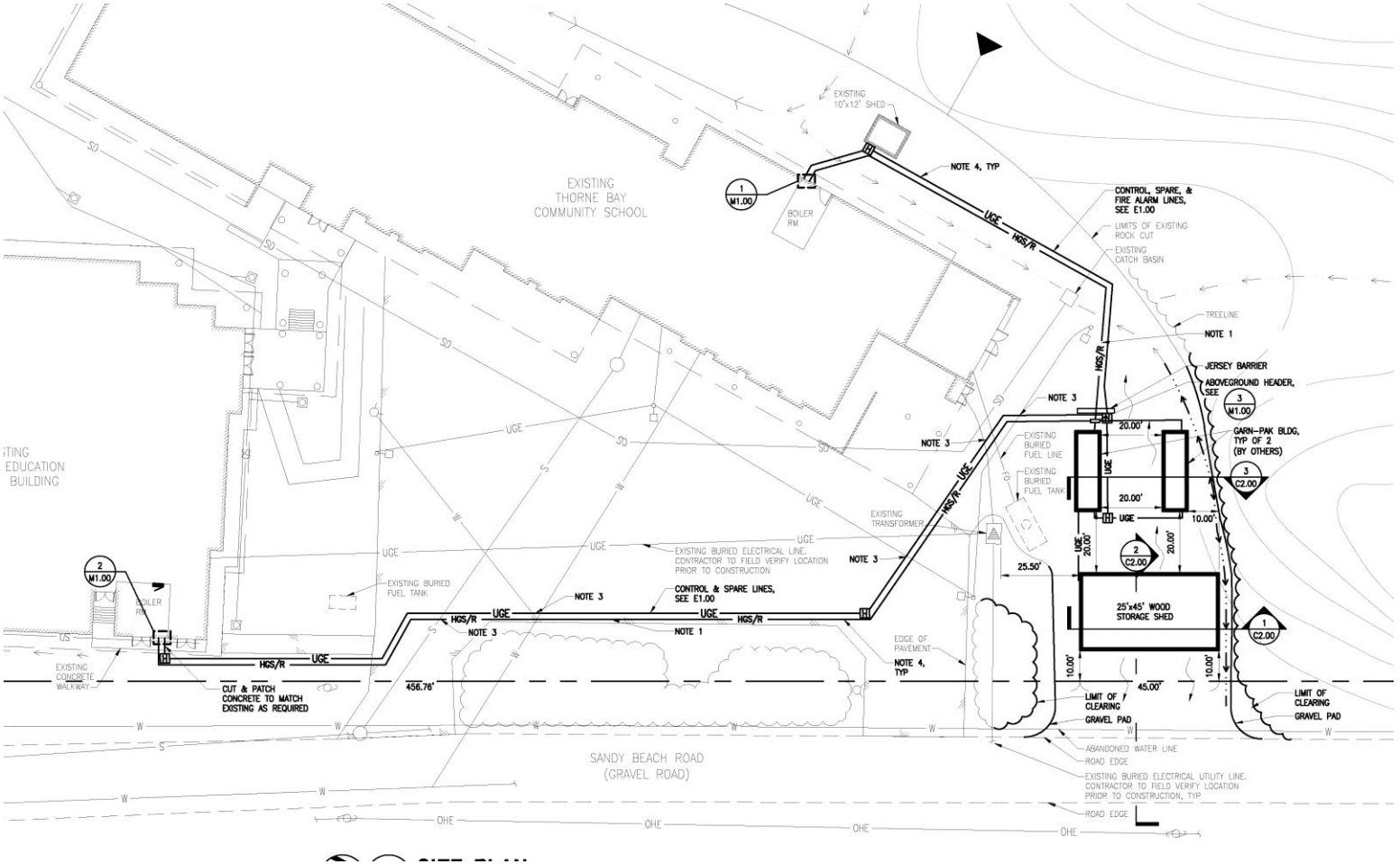
- Determine type of trucks that will be used to deliver chips
  - Walking floor, conveyor floor, dump style, heated, larger semi trailers, or standard dump trucks
- The truck type impacts the approach to the storage building and bulk delivery to the boiler
- Chip storage
- Onsite drying with perforated floor inside storage area

Pellet Delivery

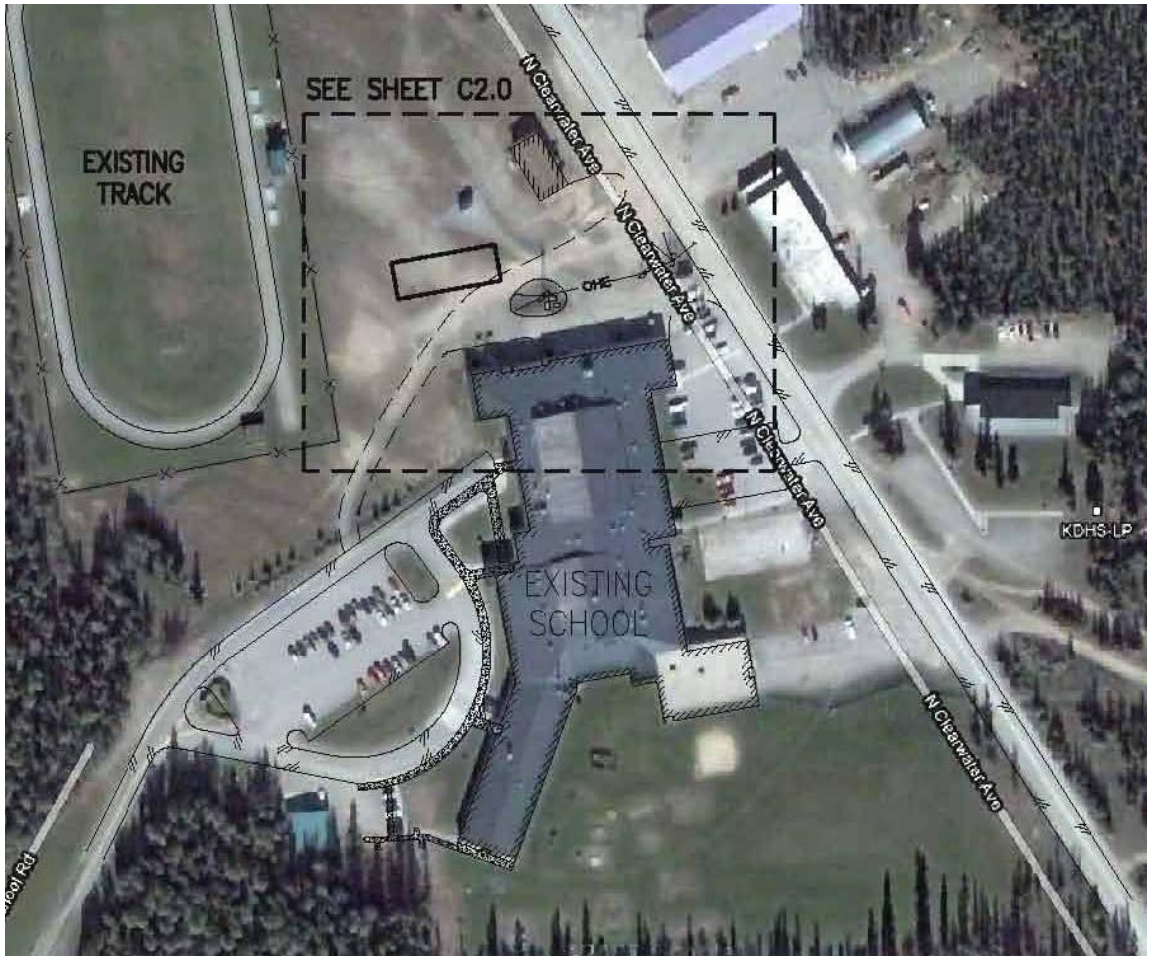
Bulk Delivery Advancements

- ❑ Use of pneumatic systems
- ❑ Reduced pellet breakage during delivery!!!
- ❑ Dust control systems for indoor storage bins are essential
- ❑ On-board scales = accurate measure of every delivery

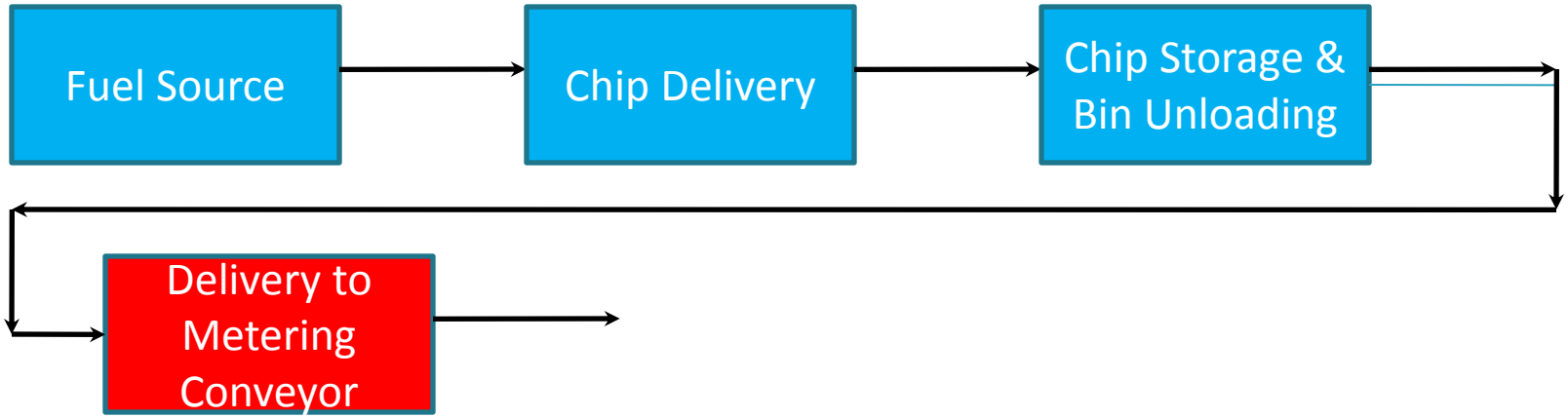
Typical Layout – Thorne Bay



Typical Layouts – Delta Greely



Chip/Pellet Handling

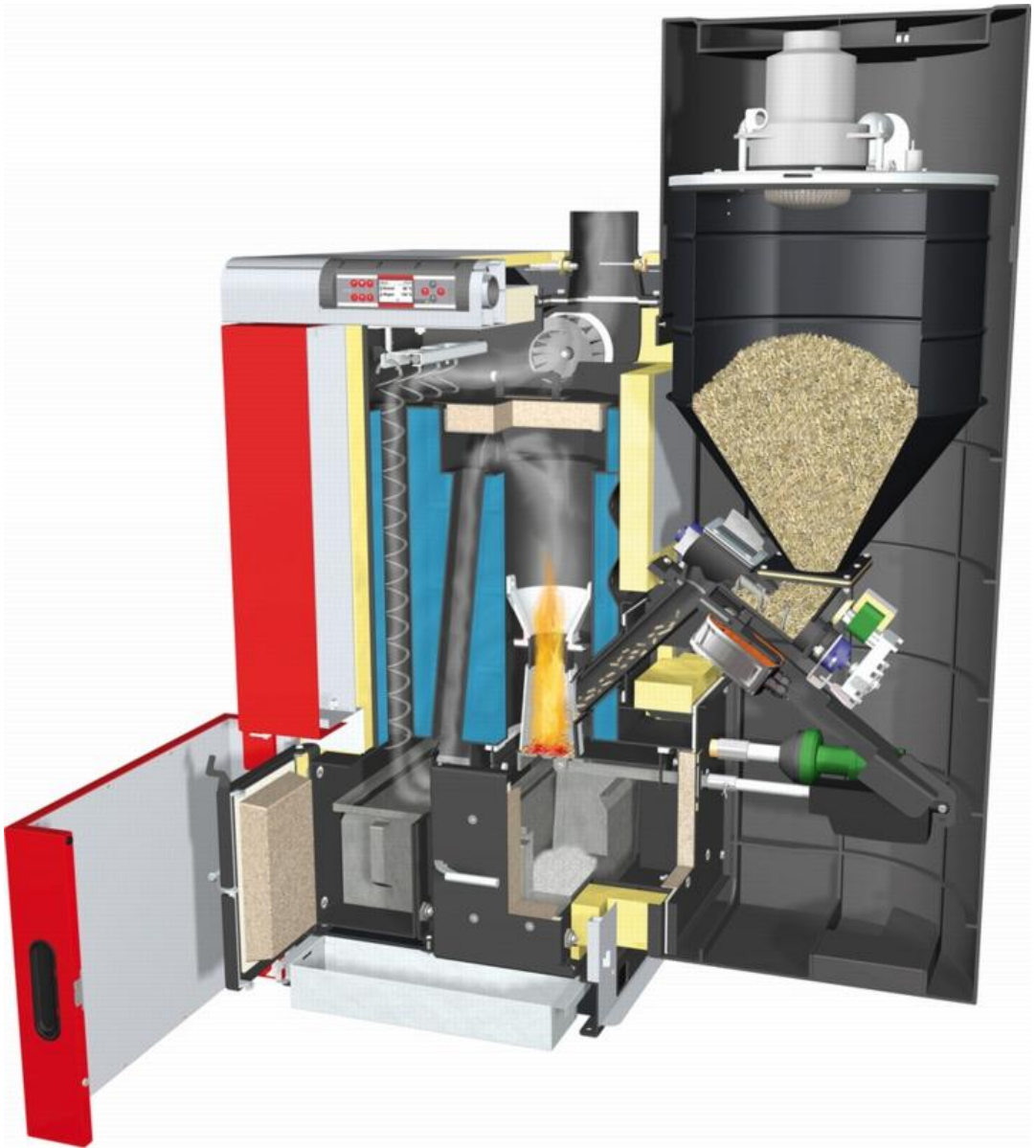


Conveyor Systems Bulk

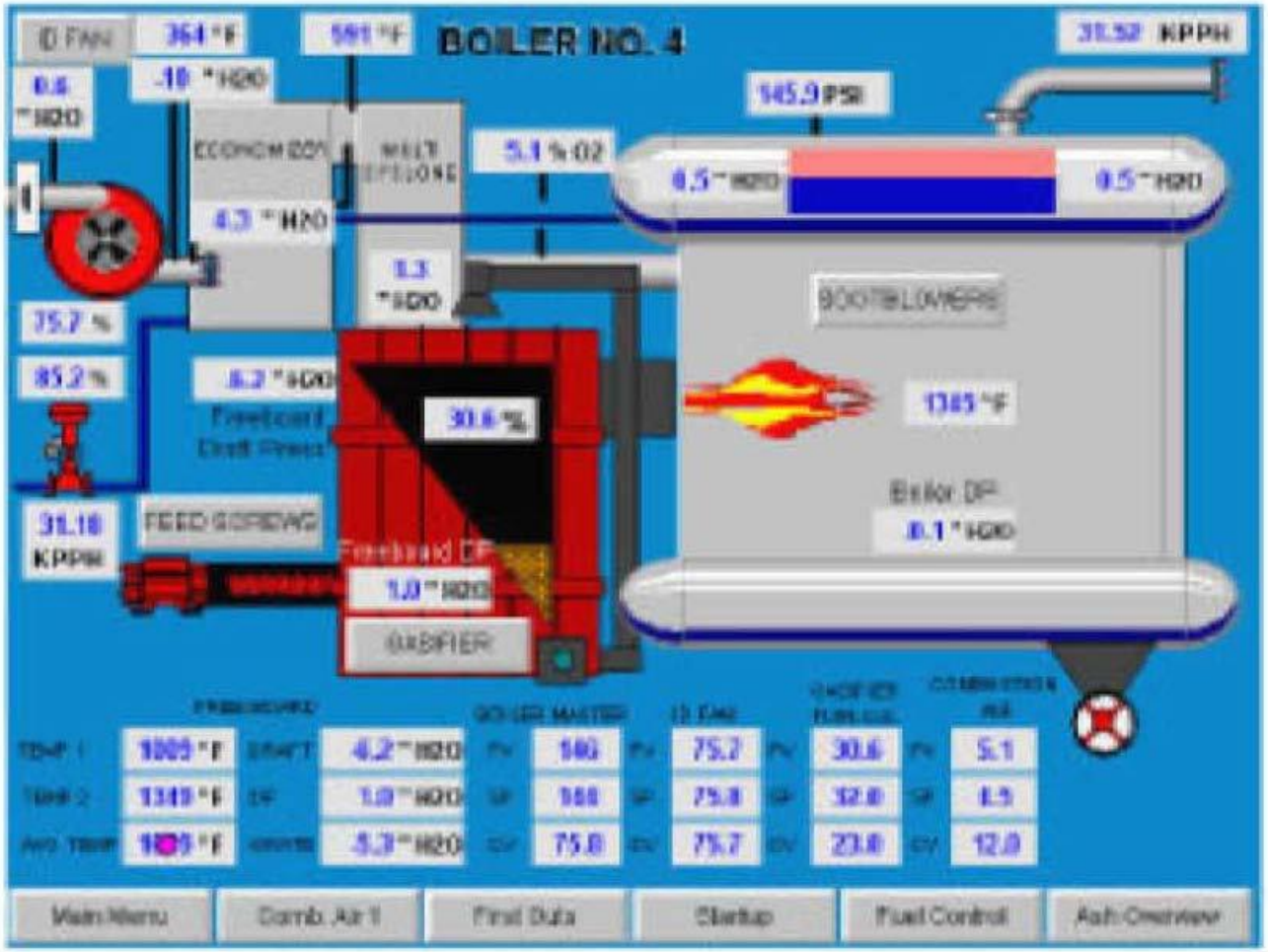
Options:

1. Bulk delivery by sliding chain/bar conveyor
2. Belt conveyor to a shaker screen for removal of large chips (if required)
3. Screw conveyors for delivery to the fire grate

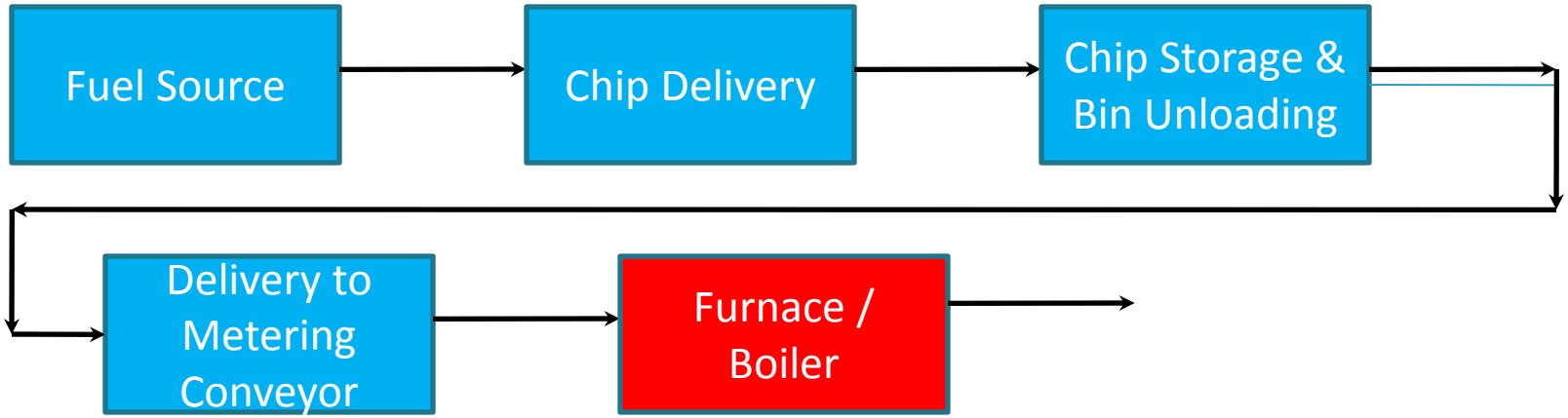
Pellet Delivery



Controls - Chiptec Screen HMI



Furnace / Boiler

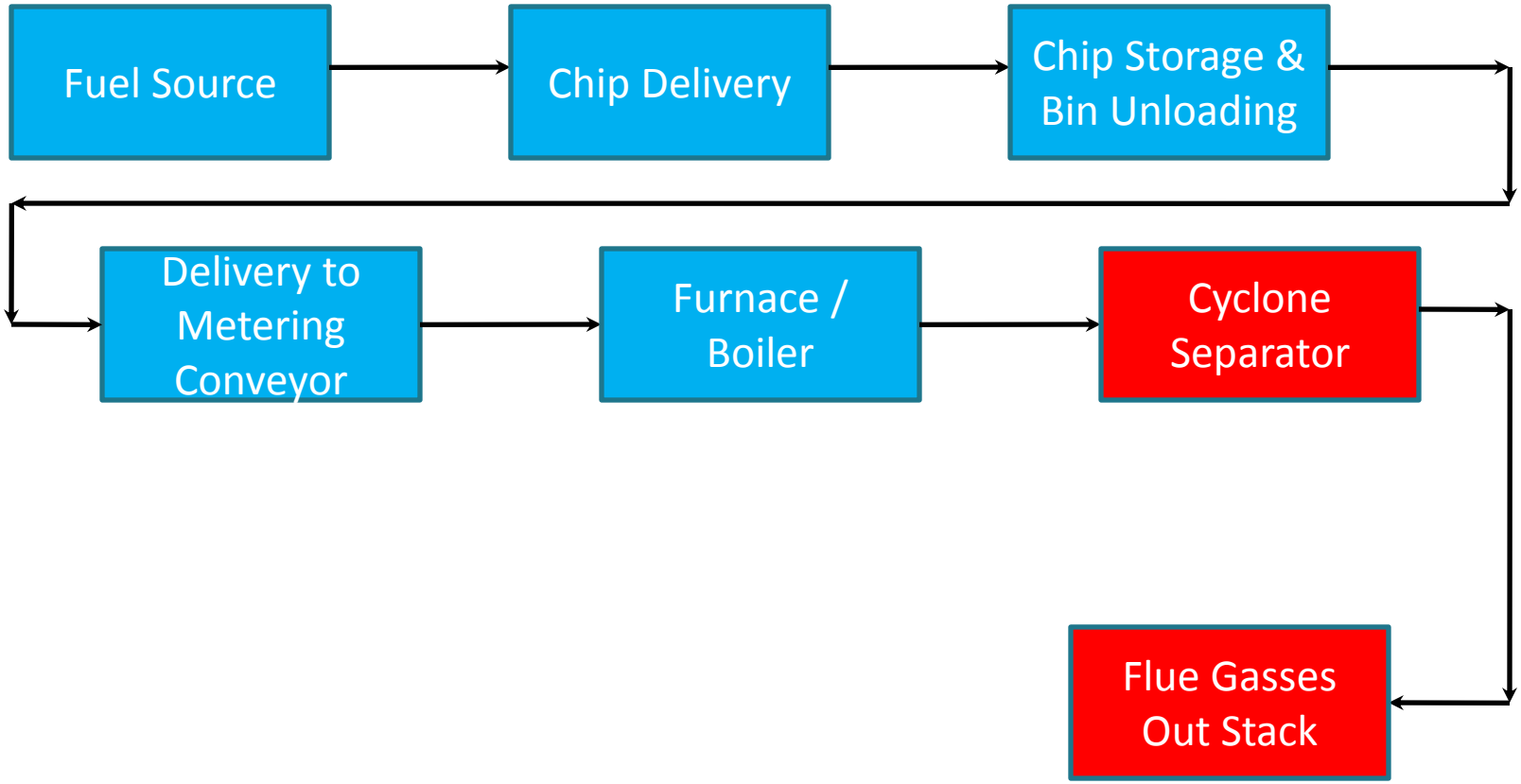


Boiler Systems

- Gasification System
- Boiler – fire tube, hot water, steam
- Garn with fire box inside water tank

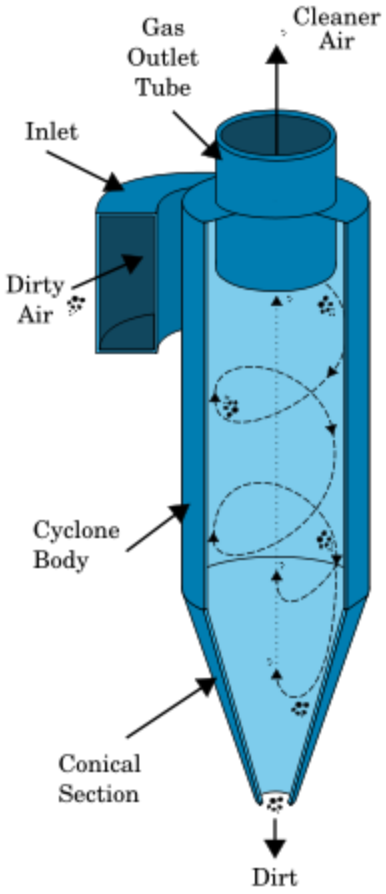
Photos: Left, Garn; Center, Delta Greely HS; Right, Sealaska

Furnace / Boiler

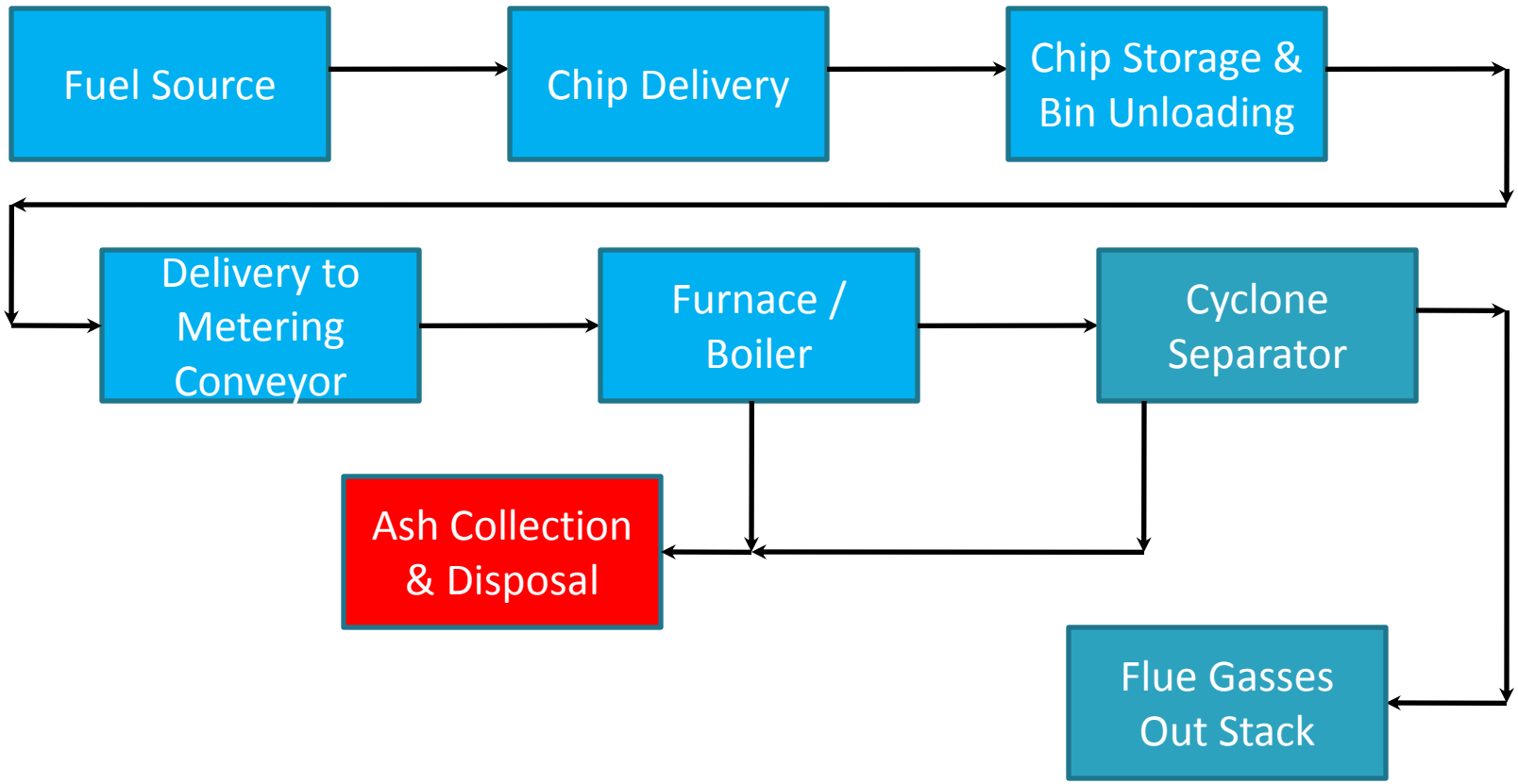


Flue Gasses

- Flue gasses will run through a cyclone separator or electrostatic precipitator
- Stack is usually 30 to 50+ ft tall and penetrates the roof
- Stack height is analyzed based on wind, other buildings and obstacles to determine the most efficient dispersion height



Furnace / Boiler



Ash

- Ash is collected for removal from the facility

  (very minimal due to almost complete combustion)
- Collection/removal may be automated or manual
- Disposal options:
  - Concrete mix
  - Soil mix
  - Dispose at the land fill
  - Garden soil additive

New Structures – Buried Piping

- Boiler, chip storage and trailer storage building
  - Pre-engineered metal building with insulated panels on a concrete slab

Interior Storage

- Wood Chip Storage
  - Concrete bunker with either a pre-engineered metal structure or fabric structure cover

Pellet Storage – Interior/Exterior

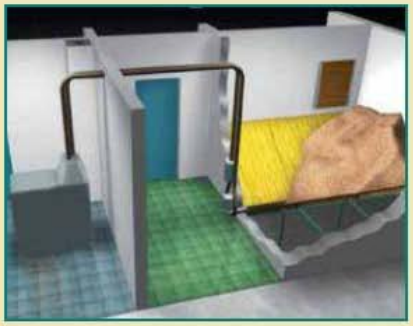
BERC

Bulk Pellet Storage Options

Outdoor grain silo bin

Rigid metal bins

Timber-framed fabric bins



V bottom rigid bin in storage room

Exterior Cord Wood Storage

Thank You - Questions?

Tony SlatonBarker, PE, Coffman Engineers

http://www.youtube.com/watch?v=lbO_AP2-sTE&list=PLDCC49BE1571A6E01&index=10&feature=plpp_video&noredirect=1

BACKUP SLIDES

Permits & ADEC

- Permit/ADEC – Data not current Garn

- Residential EPA cert. - 4.4 g/hr
- Garn WHS 1500 - 2.9 g/hr
- EPA PH2 Residential Woodstove - 2.1 g/hr
- Residential Pellet - 1.2 g/hr
- Central Maxim M250 - 1.6 g/hr
- Marine Energy Pellet – 1.0 g/hr

g/hr = grams per hour

Cost Savings (per year)

- Craig expects - $50,000 (displace 35,000 gallons of fuel)
- Thorne Bay - $30,000
- Dot Lake - $21,000 ($3.20 gal diesel)
- Kasilof (Ionia Village) - $14,000 (propane and diesel)
- Delta Greely – $275,000 ($4 gal diesel)

Construction Costs

- Craig - $1,000,000
- Thorne Bay - $600,000 (Tie two modules into two buildings plus wood storage facility)
- Dot Lake - $66,000
- Kasilof - $200,000
- Delta Greely - $2,800,000

Other Alaska Alternative Energy

- Wind Power
- Solar PV
- Solar Thermal
- Hydro Kinetics
- Ground Source Heat pumps