Oregon National Guard

RENEWABLE THERMAL ENERGY

UMATILLA BIOMASS DISTRICT HEAT
AGENDA

1. BIOMASS INSTALLATIONS
2. FUEL DELIVERY & STORAGE
3. SAFETY & MAINTENANCE
4. EMISSIONS EQUIPMENT O&M
5. INTEGRATION & OPTIMIZATION
6. Q & A
CENTRAL OR UNIT EQUIPMENT & TRAINING SITE

- **Building Area**: 17,060 square feet
- **Pellet Boiler**: Solagen 630 MBH output (185 kW)
- **Options**: Pneumatic tube-cleaning; Automatic de-ash
- **Safety Equipment**: Rotary valve; Drench valve
- **Emissions Equipment**: Multi-cyclone
- **Thermal Storage**: Hanson Tank 2,300 gallon
- **Pellet Silo**: Scafco (30-ton capacity)
- **High-Bay**: Sterling radiant hydronic ceiling panels
- **Fuel Use**: 34 tons per year (replace 6,500 gallons LPG)
PELLET BOILER SAFETY

RECOMMENDATIONS

1) Rotary Valve (burn-back protection)
2) Drench Valve (burn-back protection)
3) Temperature monitoring cable (early alarm)
4) Carbon monoxide detector (early alarm)
5) Nitrogen injection port (inert silo)
6) Ground strap (discharge static electricity)
7) Load Cell (continuous weight monitor)
SAFETY EQUIPMENT

The Thermostatic Valve BVTS is designed for protection of boilers and fire stoves. It prevents overheating by discharging water from heat generator, condensing coil or heat exchanger. The BVTS valve is used also to prevent backburning in the fuel store of biomass boilers by flooding the fuel in case of excessive temperature. The BVTS is self-acting, i.e. it operates without supply of auxiliary energy such as electricity or compressed air.

Versatile Load Cell for Dry to Wet Applications
Due to its low cost and high performance, this load cell is suitable for applications ranging from bulk dry solids to sanitary washdown or corrosive environments.

Figure 3.16 Internal drawing of a rotary valve

Rotary valve
Mains water drench valve

Figure 11
Fuel feed safety devices: rotary valve and mains water drench valve (RBAN).

STOR MAX TEMPERATURE CABLE

Communicates to the PC by wired and/or wireless connection

Monitors
- Temperature Sensing
- Moisture Sensing
- Insector, Insect Detection

Alarms for
- High limit
- Rate of rise
- System Status

Interface Options
- On-site, PC-based
- Internet-based

Alarm Output Options
- On-screen
- On-site (audible or visual)
- Text messaging
- Email

OMD Installations Division “Supporting the Best”
SILO FIRE - HAZARD RESPONSE

OXYGEN LIMITING AND MODIFIED OXYGEN LIMITING SILO FIRE DECISION TREE

Confirm Oxygen limiting or Modified Oxygen limiting silo

Close and latch silo unloader chute door

Climb silo to close (do not latch) top silo hatch. If not already closed

Heavy smoke and/or rumbling observed at silo, anchor side of silo hot to touch?

Yes

Stay off silo

No

Instruct farmer to keep silo closed for 3 weeks. Observe periodically for smoke or heat.

Inject CO2 or liquid Nitrogen per recommendations in NRAES-18, Table 4.1 or according to manufacturers directions.

Is smoke or heat still present?

Yes

Silo may need to be unloaded unless farm owner is sure that the majority of silage is of good quality.

No

PRECAUTIONARY STATEMENTS

- NEVER INJECT WATER OR FOAM INTO AN OXYGEN LIMITING OR MODIFIED OXYGEN LIMITING SILO
- NEVER COMMIT PERSONNEL TO ENTER A BURNING OR PARTIALLY BURNING OXYGEN LIMITING OR MODIFIED OXYGEN LIMITING SILO
- PROTECT ADJACENT STRUCTURES BY CUTTING AWAY ANY STRUCTURES THAT ARE TOUCHING THE BURNING SILO
- DO NOT ATTEMPT TO COOL THE EXTERIOR OF A BURNING OR HOT SILO
- ONLY TRAINED INDIVIDUALS SHOULD ATTEMPT TO INJECT GASES INTO OXYGEN LIMITING SILOS

PELLET SILO SPONTANEOUS IGNITION (temperature vs time)

REMINDERS:
- LOCK OUT/TAG OUT SILO POWER
- RAISE UNLOADER OF CONVENTIONAL SILO DURING FIRE OPERATIONS
- RESTRICT AIR FROM ENTERING SILO DURING FIRE OPERATIONS
- RUN SILO BLOWER DURING RESCUE OPERATIONS

FOR TECHNICAL ASSISTANCE CALL PEMA EOC
800-424-7362

22 January 2014
29 April 2015
**FY 2015 PROJECT**

- **Building Area**: 144,904 square feet (11 buildings)
- **Biomass Boiler #1**: 4,625 MBH output (1,250 kW)
- **Biomass Boiler #2**: 1,800 MBH output (530 kW)
- **Options**: Pneumatic tube-clean; Automatic de-ashing
- **Safety Equipment**: Rotary valve; Drench valve
- **Emissions Equipment**: Multi-cyclone (0.1 lb/MBtu)
- **Thermal Storage**: ASME tank 9,000 gallons x 2 each
- **Fuel Storage**: Chip bunkers 140 cubic yards x 2 each

**FUTURE DEVELOPMENT**

- **Building Area**: 838,053 square feet (37 buildings)
- **Biomass Boiler #3**: 4,625 MBH output (1,250 kW)
- **Options**: Pneumatic tube-clean; Automatic ash
- **Safety Equipment**: Rotary valve; Drench valve
- **Emissions Equipment**: Ultra high-efficiency multi-cyclone (< 0.07 lb/MBtu)
- **Fuel Storage**: 3rd chip bunker 140 cubic yards
UMATILLA DISTRICT PIPING
**FUEL DELIVERY**

**PELLETS – Commercial Delivery**
- Typical 30-tons per load
- Auger boom to top of silo, or
- Pneumatic delivery option

Courtesy of Sandri LLC, Greenfield, MA

**WOOD CHIPS – Industrial Scale**
- Truck dump
- Need to manage many truck loads per day
- Typically used in large power plants

Courtesy of Sonoco, Hartsville, SC
**FUEL DELIVERY**

**WALKING FLOOR TRAILER**
- Typical 30-tons per delivery
- About 108 cubic yards
- Unload time 10-15 minutes
- Ag service (grain, grass seed)

Courtesy of Sullivan County, NH

**TWO-BAY CHIP BUNKER**
- Below grade
- 150-ton capacity
- Wood chips @ 40% MC
- Messersmith traversing auger feed system

Courtesy of Crotched Mountain Rehabilitation Center
FUEL HANDLING

TRAVERSING AUGER SYSTEM

- Chip storage bunker with truck bridge
- Traversing auger pulls chips onto conveyor
- Incline conveyor carries chips to metering bins

Courtesy of Crotched Mountain Rehabilitation Center
FUEL HANDLING

WALKING FLOOR SYSTEM

- Concept layout with two biomass boilers
- Below grade chip bunker
- Hydraulic cylinders actuate walking floor
- Walking floor pulls chips onto cross-feed auger
- Pipe auger transfers chips to double-conveyor
- Chips are transferred to boiler in-feed auger

Courtesy of Viessmann USA
TOP LOADER SYSTEM
- Scraper pulls chips onto transfer conveyor
- Sonar sensor surveys chip pile
- PLC controls “stacking” program

ADVANTAGES
- Above grade install, no overhead obstructions
- Lower installed cost
- Easy access for maintenance, low energy use
- Ability to monitor chip volume (low alarm)
- High capacity (up to 40 cubic meters per hour)

Courtesy of Javo USA
**Biomass Boiler O&M**

With pneumatic cleaning system, after approx. 600 operating hours; without pneumatic pipe cleaning system, after approx. 300 operating hours:

Open the heat exchanger door and clean all heat exchanger tubes with a wire cleaning brush.

Approx. every 300 operating hours:

Clean the air vents for the burner trough and remove remaining ash from the combustion chamber.

Approx. every 300 operating hours:

Clean the light barriers and inspection windows above the de-ashing auger (optional), and also opposite. Remove dust and ash deposits in the openings.

Approx. every 300 operating hours:

Clean the light barriers and inspection windows above the in-feed auger, and also opposite. Remove dust and ash deposits in the openings.

After each manual cleaning of the heat exchanger:

Use ash rake to draw ash to the front and remove.

After each manual cleaning of the heat exchanger:

Open lid on both sides and remove ash.

Approx. every 300 operating hours:

Open all the lids on the insertion side or across from the feed and remove ash.

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Weekly
- Check for ash buildup in the firebox, clean if necessary
- Check ash cyclones and ash bins, empty if necessary
- Check fuel levels in bulk hoppers
- Check boiler alarm system and all control functions

Monthly
- Check boilers combustion chamber, ceramics and fireplace
- Check all sensors on boiler
- Check the fuel augers on the supply at the boiler, clean or empty if necessary
- Check ash bins, empty if necessary

Yearly
- Check measurement of combustion values and adjustment at startup
- Check wear on augers, conveyors and any other moving parts
- Check components such as gear boxes, grates if necessary
- Clean out fireplace and airways of ash
- Check for wear on ceramics
- Inspect all motors and sensors

Courtesy of Woodmaster

Approx. every 300 operating hours:

Clean the light barriers and inspection windows above the in-feed auger, and also opposite. Remove dust and ash deposits in the openings.
**Biomass Boiler O&M**

**Pneumatic cleaning system (optional)**

- Operation and maintenance of the compressor (optional) according to the manual that comes with the system.
- For a field supplied air compressor, the compressor has to be suited for continuous operation or be secured against continuous operation (e.g. timer for limiting running time).
- Continuous operation of the compressor indicates leakage in the air system. Check air supply line and valves for leakage.

Automatic de-ashing system
BIOMASS BOILER O&M

FUEL LOSS DUE TO SOOT

<table>
<thead>
<tr>
<th>Thickness of soot in firetubes</th>
<th>Loss of efficiency in firetubes</th>
<th>Average Fuel Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>0&quot;</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>1/32</td>
<td>9.5</td>
<td>2.9</td>
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<td>1/16</td>
<td>26.2</td>
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<tr>
<td>3/32</td>
<td>35.7</td>
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<tr>
<td>3/16</td>
<td>65.0</td>
<td>20.7</td>
</tr>
</tbody>
</table>

Putzmaus cleans tubes quickly and easily
- Precision quality engineered
- Powered by compressed air
- 4 models to choose from
- Self feeds and retracts
- Tubes are restored in mere seconds reducing fuel consumption and emissions
- Can be used on hot boiler
- No scratching or scarring
- Helps avoid costly tube replacement
- Easy to use

Courtesy of Putzmaus-America
EMISSIONS EQUIPMENT O&M

By exploring the agglomeration phenomenon in cyclones, a completely new line of cyclone geometries was developed, different from any other in the world. The added value of the MK for ACS is enormous:

- **Efficiency** – Emissions are 30-35% of those of a Hurricane HR, and 50% of those of a ReCyclone MH for the same pressure drop. It can compete with ESPs in certain applications. That is absolutely unthinkable for any other cyclone in the world.
- **Cost** – Despite being much bigger than an HR, an MK is smaller than a ReCyclone MH with 20% lower manufacturing costs.
- **Robustness** – Once installed, no after sales costs are expected.
- **Simplicity** – To assemble, to command, to install...
- **IP Protection** – Line of geometries is being patented in the whole world.
- **Scalability** – It can also be combined with mechanical and electrostatic recirculation, opening doors for new, unique and highly efficient systems.
INTEGRATION & OPTIMIZATION

BOILER CONTROLS & SYSTEM INTEGRATION

DISTRICT HEATING OPTIMIZATION
O&M LESSONS LEARNED

- Match boiler type with fuel quality & moisture content
- Time-saving Options: Pneumatic tube-cleaning; auto de-ashing
- Implement a disciplined preventive maintenance plan
- Regular tube-cleaning essential for efficiency & emissions
- Purchase good tube-cleaning equipment (time & fuel savings)
- Purchase an industrial grade vacuum unit
- Use respirators for tube-cleaning & ash removal
- Bag-house filters very maintenance intensive & costly
- Steam Systems – Annual O&M expense 2-3 percent of CAPEX for 24x7 continuously manned critical facilities
- LTHW Systems – Annual O&M expense 1 percent of CAPEX for regular shift, unattended facilities
QUESTIONS / CONTACT

Craig Volz, P.E.
Resource Efficiency Manager
Tetra Tech, Inc.
Tel: 503-584-3864
Email: craig.d.volz.ctr@mail.mil
URL: www.tetratech.com/markets/energy-efficiency.html

LTC Ken Safe, P.E.
Construction & Facilities Management Officer
Oregon Army National Guard
Tel: 503-584-3503
Email: kenneth.safe.mil@mail.mil
URL: www.oregon.gov/OMD/Pages/contact_us.aspx