Progress Energy

CT Operations – CT Services

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To: Wilson Hicks

From : Andy Allen

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Subject: **University of Florida (U of F)**
Desired Features of New #4 Package Boiler

The following is intended as a guiding document for U of F's consulting engineer in defining Progress Energy's desired features in a new package boiler to replace unit #4.

Assumed Capacity & Design Conditions:
PE assumes that the following steam and water conditions are the basis of the design. If U of F and their engineer are evaluating extentions to the campus steam header, or future steam turbine modifications or upgrades, these could be affected:

Parameter	**Quantity**	**Units**
Maximum Continuous Steam Flow	150,000	Lbs/hr
Operating Steam Pressure	250	Psig
Operating Steam Temperature	500	Degrees F
Incoming Feedwater Temperature	212	Degrees F
Boiler Efficiency (Natural Gas)	80 (min)	%
Boiler Efficiency (#2 Oil)	84 (min)	%
Design Ambient Temperature	59	Degrees F

Emissions Control Equipment:
PE recommends that U of F include a Low NOx Burner with induced flue gas recirculation (IFGR) in the supply of the boiler. We feel it is necessary to consider both present operational flexibility and potential future emission reductions with regards to NOx. IFGR can be added to a new boiler at a small incremental cost (larger FD fan, burner ,FGR duct, and damper) as opposed to a later retrofit of a forced flue gas recirculation system on a boiler that is already built without the flue gas recirculation incorporated into the design. (Requires separate FGR fan, motor, electrical modifications, and can result in a boiler performance and capacity loss.)

Reasonable expections of guaranteed emissions performance are as follows:

	Natural Gas Firing		#2 Oil Firing*	
Equipment	NOx (lbs/mmBtu)	CO (lbs/mmBtu)	NOx (lbs/mmBtu)	CO (lbs/mmBtu)
Low NOx Burner without IFGR	0.100	0.074	0.153	0.074
Low NOx Burner with IFGR	0.036	0.074	0.115	0.078

*#2 oil < 0.04% N assumed

Boiler Construction Detail:
The boiler needs to be shop assembled "D type" constructed to ASME Section 1 & NFPA 8501 requirements and include an economizer to obtain the highest efficiency, lowest emissions and lowest firing rate possible for the needed steam output. The boiler & burner package needs to be shop assembled to the maximum extent possible. The furnace walls need to be welded membrane construction for forming the gas tight seal. (older methods of "tangent tube" construction not allowed). U of F should consider including a welded membrane front wall in lieu of a refractory wall. Although refractory maintenance has been an infrequent expense, it can be avoided through this type of design. The superheater needs to be a fully drainable design to avoid internal corrosion issues, startup stresses and start up ramping limitations. Gas side pressure drop should be limited to not more than XX in wg, to avoid excessive fan power consumption. Steam quality needs to be specified consistent with the PE/Uof F contract steam quality requirements

Stack:
A larger stack may be needed, due to the increased capacity of the boiler. The engineer will have to investigate this. The stack needs to be equipped with the proper emissions test ports and access to them.

Burner:
The burner needs to be a low NOx burner of rugged industrial construction and adjustable to optimize combustion and minimize emissions. Turndown needs to be a minimum of 10:1 on gas and 4:1 on oil. Oil firing should be steam atomized. The ignitor needs to be rated for continuous or intermittent service, and capable of holding the boiler in standby, at full pressure with a throttled vent. Ignitor and oil gun needs to be serviceable by removing from the burner front without entering the furnace.

Fan:
The combined forced draft/induced flue gas recirculation fan needs to be controlled by a variable inlet guide vane damper to minimize fan power consumption. A design with a control damper on the outlet side of the fan should be avoided for this reason. It needs to be equipped with an inlet silencer to meet noise requirements. The air inlet to the fan needs to draw from outside the building to avoid ASHRAE boiler trip requirements from the refrigerant equipment sharing the room??? Preferred fan supplier is Chicago Blower.

Pipe Train & Trim Components:
The following component suppliers should be specified to provide maximum redundancy with exiting unit #5 equipment:

Component	**Supplier**
Gas & Oil Trip & Vent Valves	Maxon
Pilot Gas Trip Valves	Asco
Gas & Oil Pressure Regulators	Fisher Control
Gas & Oil Comb. Control Valves	Fisher Control
Gas Flow Meter	Foxboro Vortex Type

Oil Flow Meter	Foxboro
Oil Accumulator	Young Engineering (10 gal)
Atomizing Steam Trip Valve	Elomatic/Marpac
Atomizing Steam Regulator	Jordan
Gages	Ashcroft
Switches	SOR
Transmitters	Rosemount Smart Transmitters

Controls:
Maximum compatibility & redundancy with the existing unit #5 controls is desireable for minimizing spare part needs and maximum operating staff familiarity. This should include:

- Flame Safeguard PLC – The flame safeguard system needs to comply with NFPA 8501, and be programmable logic controller based. Allen Bradley SLC Model 5/03
- Flame Scanners (1 pilot, 1main flame) – Peabody Engineering Smart Scan IR/UV type
- Automatic Blowdown System – Rosemount Analytical Uniloc Model 98-02
- Stack oxygen analyzer

The existing combustion control system contained in the plant Foxboro I/A series DCS (full metering system) needs to be retained. An oxygen trim system needs to be added within the DCS to maximize efficiency and minimize emissions over the control range and during modulation of the firing rate to meet the steam demand.

Suppliers:
PE suggests the following suppliers be included in the quotation and evalution process due to their history of supplying quality equipment:

Boiler Manufacturers- Babcock & Wilcox, Nebraska Boiler, Rentech Boiler
Burner Manufacturers – Coen, Faber, Nat-Com

Suggested specifications from boiler and burner suppliers addressing more detail are attached for U of F's reference in preparing their specification.

Other issues for engineering investigation:
U of F's engineer will need to investigate the supporting feedwater, natural gas and oil systems to determine their ability to support the additional 110,000 pounds per hour of uprated steaming capacity. This needs to include feed pumps, deaerator, and fuel piping and pumps.