Western Regional Boiler Association Conference

Minutes

March 15-17, 2011 Conference

Eugene Hilton Hotel
Eugene, Oregon

Opening

The 43rd annual conference of the Western Regional Boiler Association (WRBA) was called to order at 12:17 pm, March 15, 2011 by this year's conference Chairman Jack Hinman. Jack began by introducing the steering committee members: Ray Karcher, John Boyd, Dave Swenson, Ron Gaston, Paul Prescott, Greg Higgins, Ron Vandenberg, and Robin Styers. Welcomed to this year's attendees and associates.

Financial Report – 1st of year $4500. Expenditures $1800 on prizes - $44,000 at end of meeting as of 3/15/2001 - $52,500.

Tuesday, March 15th

Presentation #1: WCTI/Mark Plafcan
Water Conservation/Elimination of Continuous Tower Blow down

Mark has 3-4 yrs with WCTI he discovered and invented True Blow down – water chemistry fixed limits – system dealing with reporting styles at Weed, CA facility. WCTI official research and development started in 2003. Continuing WCTI – 6 patents belong to 3rd party. WCTI has website dealing with corrosion protection.

Cooling tower technology – water chemistry. Compatible with most designs high TDS – white deposit. Green technology for the last 3-4 months.

Traditional chemistry treatment – water treatment corrosion operating is expensive. Hold inside tower 450 ppm – blow down main cooling power making sure chemicals are doing their job. Set point – normal limits – variable – conditions with set points – limits hit first – divide 225 = 2. Concentration make up varies in different part of countries than 225 divided by 5 = make up quality.

Starting point – graph blow down – home for water – sewer chemical in system. Higher cycle better off in program.

Blow down or make up – reverse osmosis, demineralizers, and evaporations.

Take out of water. Make up or portions expensive to install and need right requirements. WCTI technology different from traditional chemistry not limited to cooling tower – calcium, magnesium and silica increase cycle of concentration elimination. 50 chemical water softener replace with 50 calcium, magnesium left in system – highly soluble ions. Water chemical in tower – high efficiency of softener. To stop blow down – no chemical except for small fundamental change in silica. Calcium, magnesium ions – create alkaline in water. 50 ions – 50 carbonate creates 25% concentration basically react 50 carbonates. Sulfates form highly soluble compounds silica bad nasty hard sale. For into WCTI .2 or .2 ppm – TDS rise about 50/80 cause behaving pH – natural base forming higher concentration 7.6 – 9 and 10/9.4 and 9.6 – cycle change beyond green area – seeks naturally start high TDS 9-10 silica starts to react Polimer chain – no crystals – chemistry of WCTI Program.

Sodium salts – soluble pose no problem ions calcium and magnesium controlling 30 ppm – beneficial corrosion protection.

Softener removes ions – function properly – 100,000 ppms – data center Northern California two weeks ago. Ammonia 4 years in July. No evidence. Silica in program – up to 9-10 pH start to react – makes corrosion inhabitation.

Boiler tubes – make silica behave WCTI tech do this work. Silica high concentration – basically latent corrosion coupon study – 3 months – 2080 = 300 in water 310-320 well water – 1 year in program. Copper nothing galvanize 1.776 mechanic mounts hold coupon – metal bolt clear high technical nylon fishing line tramp corrosion. Galvanize coupons 10,000 – 100k coupon.

Cold – hot tub – high TDS galvanize 1-2 mil a year. pH above 9.0 or higher falin potential. 10-15,000 TDS algae isn't dependant. Picture no growth – agar solution red points living in water. Chemical progress facing south – bright green algae sunlight 26 day brownish black rub off TDS.

Roseburg Forest Products – w month timeline chalk board – boiled down notes – set of two months cogen project details – need to have 0 discharge locations – high in silica alkalinity and hardness blow down concentration environment friendly green tech elimination 0 discharge – fire pone water high in silica is visible.

WCTI – no blow down on cooling tower – green eliminating. Stilth tower two cones on top. Installation sediment and dirt out of tower going down turbine. Two sets of 90 gallon system 160 pm 91 or 92 pm fire pond water mixed media right 150-gpm handling up 300 gallon per minute.

LAKOS separators – critical operations – difficult to clean – cooling tower wash basin loosening water 12" header feeds inward 6" header in middle blows water LAKOS research pump.

Presentation 2: Resin Tech. - Frank DeSilva – Start time 1:05 pm
Optimizing the Performance of Demineralizers

Silicone is in water. Calcium and magnesium are hardeners. Sulfur dioxide and chloride cause deionization. Hydrogen chloride remove . Resin Tech – optimize deionization. Demineralize systems – biophase I – 20 years systems. Engineers get samples and design systems. In 20 years no real big changed – they are different now than when they were designed on.

Monitor – detective work – steady trending. Operational equipment exists – most are economically smart purchasing decision. Operational costs – your most economically fire water – store water in catchall holding pond. Service cycle – deionized water. Operational costs – frequency of regeneration – monitoring softener – watch for hardness. Older softener – timer wasting salt. Salt produce makes water high. Rain water good assembly people don't outlaw softener – worse it could be end point not time event.

Caustic – really expensive. Acid is also expensive. Switch caustic supply – be careful – iron minerals won't behave well. Storage in and out of doors. Regeneration waste – compliance cost – not too high – gallon of water save on 2 gallon of water – price goes up.

Resin/plastic analysis breaks, fouls, oxidizes – over time. Resin cleaning – on resin, anion resin attacks organics make large big slow moving molecules in weeks/months. High organic region organic cleaning oxidation, fallacious, consuming power/lower pressure. Softeners through put falling off – age, loss resin, backwash – cold better – because less denser – 10 or 20° losing backwash bed height.

Training and certification – effluent monitoring. Pressure gauges shouldn't be plugged up, channeling resin breaks, cracks, swells – oxidizing – pushing on resins. Run lengths gallons, amount of salt – out of salt – longer than normal to rinse.

Demineralizers – feedwater condition – could cause an alarm which is caused by contamination. High condition alarm – feedwater, variances, seasonal. Efficient contition – most people preference of minerals highly cation is sodium is left. Silica less strongly held anion. Need to regulate silica = silica monitor. Differential pressure – mineralizer than softener semiconditioned – based on silica. Run large gallon logs – episode, operate.

Working capacity verses Theoretical – sulfate generate through put – dosages good why not optional. Regenerate short runs 1,000 gallons of reduced water. Highest price = acid and caustic change dramatically. Rinse water in gallons helpful demineralizer. Monitor the silica. Vessels goes for years. Valves – hegons lope – few mostly 70/80s concept 1,000 low resident move in slugs – valves on/off all day – eat resin.

Piping/Pumps. Ion exchange resin – chemical dosage. Superficial slow rate – kinetic flow rate back wash fuel rate – resin type, temperature, diameter vessel 5 gal/min sq ft surface area. Free board – cation 50% freeboard. Make purchases that improve efficiency. Current operating conditions – equipment have caustic use anion resin – strong base type 1, 2 – deionizer systems. Type 1 porous – type 2 – better more efficient – alkaline, sulfate, chloride. Type 2 12/15 more cu ft benefit in year below 25/50. Chemical cheaper not always better – caustic iron, chloride, and silica.

Replacement parts – softener – intervals - #1 what made of whenever you got shut down – time in rebed. Chloride/chlorine – plastic/water Styrofoam loves water. Softener CG8 – diabolic benzene.

Funds needed to dechlorinate older systems and distribution systems – add more chloride to reclaim water for demineralization? Not economical water TDS = 1,000 RO helps systems down below. Plummets way down membrane protection device.

Resin sampling – sample after regeneration – sodium caustic – 2-3 year of service fouling issue. Take sample from CORE.

Case Study 1 – High pH fouling elevated sodium resin cation resin. Less soluble so hydroxide caustic – double regeneration cation – inspect analyses problem solved.

Case Study 2 – Sulfate strongly sulfuric acid – sulfate constructed prohibit sulfate – didn't fix problem. Sulfate muilti balanced 2 – removing monabalance not di. End 2:07

Presentation 3: Tube Solve, Wade Blade Time 2:25
Induction Heat Tube Extraction

30 experience in induction heat tube extraction. One individual familiar with TS. Technology Wade ignitioned it – transmitting from CA evaluate it – good technician. Babcock & Wilcox 2004. Soft/hard rolling tech – tubing/sleeving/lining heat exchanges – toilers his prime expertise. Old company has been around 4 division – nuclear/power nuclear energy, B&W generation and fossil fuel. B&W has been around for 140 yrs.

Traditional stub removal – torch, cutting, gauging highly skilled/practiced – costly. Careful not to damage tube sheet. Also can extend schedule.

Coil put in tube stub 50-70 second roll area 800°C stub inserted in coil – heated expands yields plastic state – electronically controlled. Take about one hour to do – don't rub coil against stub – heat slow evenly. Never damaged drum seed hole.

Two methods – original and developed. CED and E&W boilers – have ½ seating rings – heat and shrink.

Heat and pull – drum shell touch below hole – initial set up 59 seconds – soft hydraulic pressure elongates extends – 45,000. Heat and pull independent rolling – stub heated same temperature – taken out 6" air lance – heater coil – heat faster than cooled. Constraint fail to electricity – turn in hole – outside.

Heat and shrink – hammer and punch. United States and Canada fall 2004 – 20,000 stubs. Field footage on jobs – heating from inside – lights up stub from heat demonstration – heat inside stick nozzle in pull in. Simson Comacraft and Potlach are some companies that use this.

Questionable on how long changing takes – sell technology out to customer sometimes on in central Wisconsin in 2 week time. End 2:50

Presentation 4: The Avogadro Group, LLO Craig Thirty Time: 2:55
Boiler MACT. The Latest Air Regulatory Changes that Can Impact Your Plant

Long term supporter paper in works. Toxic sampling large office if California. Limit sampling going well – more expensive – to do testing contract. 8th year at Avagardro.

The Who, How, When is determined by lawyers in different courts. Who – individual boiler MACT – NSHAP/ MACT (maximum achievement contacting technical).

Area – GAGT – generally available. Table shows continental United States. 187,000 small units – area source MACT – 10 m per year. Solid fuels – some went up- some down on emission limits.

Gas natural and refinery – work practical standards.

Legal food chain – no change. Major source whole factor.

California leader in air standards. Area source rule – new boilers copies – practical matter. Mercury and copper two elements of concern.

Tune up every 2 years. Save energy boiler rules – regulation efficient more efficient. Regulations by EPA – dive 800/1,000 pages to read. Numbers went up in CO. Non-continuous break. Yellow means not accurate – editing stage. Area sources mercury and copper.

Alternative – more than one average – new units fits in break > or < coal emission limits 10% breaking point more than one - >90% flexibility beat standards – details he will go over later.

Source testing notes – every site test – condition create set of problems. Variable fuel content – type of fuel tests can't do in time. Testing method 5 – changed test next month different 202 changed defines pollutant – different results same method 202 and 5 – get educated on – cleaner units more trouble. Parametric monitoring – agency measure parameters – fuel variable. Less than annual basis 13 months extra month – less than 2 years 75% emission level. Pass by half except 2 every 3 years – 37 months. Less back to frequent testing copper >250. Particulate analyzer tricky – back street audit. Particulate matter doesn't pass – need to do over. Source owners submit all data in source test. Entered one cell at a time on EPA website. Had to enter all over again. Go with someone who knows. Specialize in it. Where when tested – operating limits – looking for something that ties in operation flexibility as you can test 2 in a row for second set of fuel. Format directly monitoring operating conditions.

Reporting regulations – any deviation must be reported tracked recorded. Co-generate special tables user friendly emission limits must meet follow manufacturer recommendations.

60 days for new boiler/3 years for existing boiler.

PM 2.5 – implementation rule – no sampling methods out of compliances. Back half changed. Ammonia sulfur – fake artificial emitted eliminate bias. Method 5 – change measure 2.5 sampling on top of particulate sampling. No answer at this time. NSR new source of review. SO_2 gas fired turbines – 2 ppm knocks – million cubic feet per million. Add another number can increase it – clean sources could be affected.

Regulatory – released yesterday (3/14/11) changes in air toxic. Green house gases might change over 4800 comments to congress. Could change things like biomass. Pacific Northwest might have changes wait and see. AP43 data – 187 no testing new definition metal test surrogates not all acrolin modified. End 3:30

Presentation 5: Ashland Hercules Water Technologies Michel Mace Time 4:07
Flow Accelerated Corrosion in Steam Generated Systems

12 years at Ashland

Flow accelerated corrosion (FAC) – dissolution pre-boil distribution – nuclear plants. FAC extensive research. Documentation seen it misdiagnosed – actual conditions. FAC – single 2-phase – wears down rupture – catastrophic failure. Water/vapor steam lower pH feed water circuit. Dissolved oxygen pre-boiler circuit. Dissolved oxygen good tenacious passive variable film – surface area. Highly reductive environment. Thinning failure in metal FAC – low alloy metal expensive high.

Flow excess 10' per second – high FAC potential. Sites FAC not good. Generate stream potential for FAC. Research over 28 years – factious erosion/corrosion – floor accelerated wastage 2" line – Mihama <.2". Catastrophic – ranges of temperature, pH and identify temperature 150-340. 150C/302° common factor – strong oxygen scavengers reducing agents. Mechanisms – no oxygen high reducing environment. FAC – need to increase alloys – correlations - < 5 ppb strong reducing agents. 150°C highest incidence. FAC – ideal for feedwater circuit. FAC – legislation management plan to address problem conditions that promote flow velocity, lower metal systems, mediate treatment levels. FAC high purity. Sodium – FAC is thinning of metal – no erosion. Turbulent flow occur in elbows.

Thick line can rupture. Feedwater lines maintenance in other areas affected. Failures to do thinning causes gauged bruised, cavitations metal examination. Flow turbulence exfoliating. See FAC – rapidly increase. Flow AC – 2 Phase cordages. Areas smooth – different – degrading. Roof 2 Phase FAC – water/vapor attack metal gauge4s.

Conditions – Oxygen in system – feedwater 9.2-9.6 – heat recovery 50% experience FAC. FAC 2 Phase metal oxide stripped away black – shiny deposit. Examples of single dip – 2 phase coughing.
Normal wear rates – wear rates – route cause for flow rate corrosion 482° weak pipes.

Feedwater wear down – normal wear rates temperature/metal/alloys. Temperature, pH, metal system – iron concentration FAC higher alloy lower wear rate.

Demineralize RO higher potential for FAC. Strip away porous it will lead to failure – metal passivation agent. Increase solubility – too much chemical in system. FAC – feed what you need. 100% metal oxygen in deep water circuit/boiler 1 ppm – combined metal oxygen technology. Metal passiated agent hard/less soluble. Continue air rating – caring <5 ppb O metal passivator – effected circuit performance improvements. Rapidly promotes protection. Journal art5icles correlates O treatment vs. MEKOR – low O in system – identical. Not adding O in system.

Summary – road map – FAC management program talk about it, recognize it, address it. FAC/SRD – 60 second period how much chromium alibian important. Address FAC performance and control porous mega not going to hurt in delineation process – 20 ppb available on site. Understand how to treat if got – don't have is how to prevent. Simple and inexpensive. Barrier film pattern O better protection. Membrane filters – coulter counter logs Millipore filter soluble in filter – test graphite furnace. Maintenance outage document it. Rough track them. End: 4:50

Wednesday, March 16th

Started day with well-prepared buffet breakfast. Jack touched base about tour of West Salem Machinery Manufacturing facility.

Presentation #6: Chem Treat, Inc. Michael Brenner Start 8:04
Flow Accelerated Corrosion: History, Symptoms, and Prevention

22 years experience as an east coast rep of entire US. Present additional information on corrosion.

New issues in power individual frustrations – plants identify difficult to management and future effects. EPR – research projects changing as we speak. Rapid metal loss, lower temperature and pressure. Ignored areas – single phase as opposed to 2 phase. Leading cause of failure occurs in areas with personnel housing conditions and feed times. Design issue changing alloys velocity geometry. Scalping flow acceleration corrosion in North Ante in Virginia in 1996. Industry

experience problem – OSHA FAC hazard identified. In 2005 EPRI modified to cycle chemical model design. The 2005 chemistry guidelines flow accelerate. Factors identify sweeps/design. Cycle chemistry adjust oxygen. Flow AC failures in bends – tubes intercept headers. Fluid has to be high velocity on outside. Headers – enters high velocity FAC scallop – LP/IP/HP – steam leaves ammonia – pH de air rotor – steam leaving pH, iron transport – red/black piles of iron in hot well. Control by FE^{+3} FE_20_3 +2 and +3 varying FE_2 FE_20_3 Oxygen environment. After years and years it turns to gun metal gray color. Hematite gray reddish color. Magnetite FAC – pH of 8.75 lower pH iron levels peak 300^o slowly – lower temperature. Medium temperature porous – fell in pores stable 9 system – no sufficient change.

pH elevation NH_4OH – expensive rise quickly and ammonia in steam. Losing steam lower pH water. Ammonia low level of pH. System with copper need to watch O scavengers with copper. Caustic solids – can't use it. Reducing environment and access O scavenger. Tight system – no air end leakage pulling in CO_2 – pump discharge. Ignore mix copper in system – may reduce O scavenger not with copper. Single phase – low temperature. 2 Phase water/steam mixture – iron in feedwater/concentrate state. Monitor iron – iron lower to 2ppb – measure reliability in power plant – 6 hours after start up should show difference of 10 ppb/2ppb. Plants aren't lab – open up valve black/red – reliable sample. Measuring iron ultra levels. 6 Hour period massive level of iron. Check your system.

FAC preventation 250-400 geometry. Connect to headers – hot spots non-destructive – post to current. Map out area – issues there. Change cycle chemistry – above 9 – isolate reasonable number 10ppb- 7/2 no difference.

Future work – evaluate time frames – critical time mowing around system. Chemical lay up process like Chemtrack Co. Particle monitor iron is particulate sensitive. EPRI amine/ammonia steam leaving. Amine stay behind pH decreases at 600^oF part of research.

Particle count – 0-50 particles at start up in 2 day period. Duct metal expanding contracting particles of iron – red dots – matched up well. 10ppb line good job after start up. Total iron not soluble. Verify no particle not iron. Before iron moving around system 600 particles – elevated pH changes system when start up drum levels add heat dump water but not as much water. Chemistry at start up – 600 now 50 after changes made down below 10 ppb – low changes other inorganic influence? Not a lot of time spent on this – no answer. Feedwater corrosion – wide pH swings condenser leak. Increase phosphate work done. Chlorine calcium. Threshold operational system pressure FAC more acute? Saturated phenomenon most of solubility temperature range. 6 causes – 4 engineering design plants break point design improve/worse – skip materials? How plants operated – housing units temperature stresses factors base loaded

1950-1970 0 operating thing opened up in AM down – noon than open again in PM. Mid-80s design improvements – sweeps better. Operational points. Familiar Millipore testing? Value of water .45 micro. Good qualitative test. Different than qualitative test. End 8:42

Presentation #7: Factory Sales & Engineering, Inc./James "Bo" Thibaut Start – 8:44
Boiler Energy and Efficiency

25 Biomass System – never done before. Power House Superintendent. Boiler system fan optimization in 1935 when company started it. Rehabilitation of existing system and amount of boiler efficiency. Discuss impacted facts. Parasitic loads – revised case scenario. Boiler primary/secondary specification written horse power savings. Has a radial tip design located hot location pressure booster fan with 40% excess air in flue gate. Final flue gas temperature collected heat. Can be lower due to right consideration from point emission controls - 50^{o} 1.81% efficiency.

Ambient temperature - 50^{o} air winter more improve duct of capturing combustion air – total saving 1.6% increase.

Fuel moisture content – greater effect fuel flex higher moisture – consuming more horsepower oxygen discharge spraying increase velocity. Recent mill in southeast fuel in yard not trying to blend. Organizing excess fuel and keeping best for themselves is a significant reduction in velocity. Better emissions more particulate NO_x CO_2 – 50% to 35%.

VFD – horse power consumption is excess air and does effect ID fans tramp air leakages boiler efficiency. Fan horse power combustion should not be burning hog feed with coal. Unburned carbon loss concern for fly ash burning historical 50' per sec most specified.

FT fan to air heater over fire air fan radial tip design scenario 2 – not sized w air heaters air heater 2 over fir 12% 15 is 60% of combustible air 60% horse power 1,000. Single FT fan all going through dampers to reduce. Currently recommend Scenario 5- justify savings.

Fan locations 1 and 2 flue gas – location – particulate in gas stream. Scenario 3 and 4 – savings reduces to 900 horsepower. Changing fan house selection. See savings potentially change in FT fan particulate. Installing ID fan downstream condensing economizer. Sized for lower larger fan recommend – large issue. Revised case scenario – 415,000. End 9:05.

Presentation #8: BRUKS Rockwood, Inc./Desmond Smith Start 9:40
Biomass Handling Challenges and Solutions

Working in this industry for many years. Won 3 purchasing awards while working at Rockwood Biomass.

Corrosion boiler tube and example is if you drive out to the woods where it is coming from and see fuel yard management. Showed pictures and examples. Sourcing near delivered cost – quality when available. Received on availability bases and schedule process and timing storage. Quality BTU bulk density – dealt with size – little/big bark harvest 6" to 1" dust jet fuel in moisture boiler operations.

Contaminants – Polk logs = tree pruners. Citrus trees = ground/chips or wood chips. Bark generated rotary to barkers. Plates stringy bark – debarked by ring debarker. Pulp waste paper process not all can be used. Harvesting residue – left stems material ground to be burned – stems cut and distributed lose moisture – than chip and ground.

AG residues black walnut small farm. Told how walnuts shell when put in water can kill fish because nut hulls are amines. Power generation – grape vines.

Biomass processing – thinning friction smoke grinder. Waste grinding operation – sun/air – chipping operation. Mobile chipper – pushing blows in box can do along roadside and off road.

Timing – citrus 12 to 15 years fall off and need to replant. Area needs to be excavated in 3 months.

Fuel power – density – dye than pellet – 30 lbs CF 43 lbs CF – water 6% moisture while making pellets run through grinder suspension burner. Green house gas – accomplish that. It will be up and running first of year by coal company.

Moisture content – season species, age, condition in wet humidity from air – variable sensitive balance gasification process – damping process. Chipping/grinding better when dryer – lower requirements. Relative dry fir ball if not creates moisture storage times. Hot air pushed in from bottom. Hot air drum – dries out and goes out back end. Ambient air – where we want not uneconomic – air quality drying process 40 to 7% at the end. RTP expensive machine run drying that doesn't require 100^{o}C/200^{o}F below organic materials – low VOC.

Contaminants – skidder push rocks, metal, grit and sand. Screen the big items – shaker reject 4-5% flow rate – loss 4 ½ -4% in 24 hour operation – piles up – mulch after week not practice. 3 magnets take metal out. Except other metallic not get.

Storage characteristics – season issues 30-day of storage in a big pile – flow over surface with a fair bit of blending – tendency for fire – reduce temperature factor. In large circular pile – reclaimer zone oldest zone and first in first out rule (FIFO). Suitability end use – cook, burn pellets saw dust piles. Pellets regional in the west pellets are ½% and in the east pellets – wood produce are 1-1/2% - don't debark pellets stove ash contents. Torrified heat similar to coffee bean roasting – drive out – wood takes moisture out of air. Torrefied products starch sticky characteristics – binder to hold together. Torrified coal handling equipment – injectors an advantage and handle group of examples samples. Diagram of mill ne4ar Bakersfield, CA – coal fire operation. Turbines fuel guide – truck unloads goes through screening and hogging. Material out got to run it through in fuel bin. No 2nd storage reclaim pile. California has the highest renewal energy and is supposed to be the greatest in 2020. Open space for this plant was held up for 8 months because of kit fox. Had to buy 22 acres to accommodate the fox.

Germany 20 megawatt – logs that are received round wood use into bin biofuel base plant. Regional can be seen in Sweden/Finland.

Chipping out to fuel pile – sand delivered to dryer. Fuel pile, chipper, dryer pelletizing building RTP gas treatment. Savannah, GA transfer pile recirculation. No debarking reclaim area (BRUCKS in Sweden and Atlanta). End – 10:20

Presentation #9: Superheat FGH/Bob Turky Start 10:35
Post Weld Heat Treatment of P91 Materials

Process reach goals 90% of weld quality- stress preheating procedures prior to doing. Field heat treatment obsolete – 30 years EPRI – AWS how to apply themalcoupler and locations. Learning and achieving in field. Wall thickness 54% thinner weight 64% reduction less welding D10.10 methods for heat treatment viable – can't run through in furnace. Several nomenclature 3 kinds of wall thickness achieve temperature 1" need 20" 3" heat bank. A bank control thermocouple 8" top/bottom side soap band is different and takes more time and equipment. Data looks good application 1" gap/1" overlap – HTA. Normality how it is done 200" difference. Top ideal bottom not temperature on top ½ what temperature should be. Specific wr4aps may not work do it right 1st time.

Thermocouple – check temperature reading device standard procedure. 1/8" apart ideal 1" 30 degree difference proper distance work piece. PW 10 – recommend faster/cheaper weld heat treated properly. Group should be broken up vertical and horizontally to check ¼" – ¾" – wall

temperature. Follow recommendations more the merrier. Wrapping inspection every job/project mock up if necessary.

Priorities check for crack weld/apparent meet more 22nd century equipment. Wireless wraps using PCs, need more PC in control room to verify QA documentation. Digitally is critical. Improper wrapping started 3 years ago – in the EPRI program. Valves flanges preheat chart consistent. Preheat critical below 700° temperature sticks don't work. Smart light plus in temperature solid light to wield instant notification portable 480V top hat 9 point controls 25 kw generators. Instant email – generators voltages amperages dropped heater. Super management is important. Fit schedule track data and record back up. End 10:47

Presentation #10: Jansen Combustion and Boiler Technologies, Inc./Arie Verloop Start: 10:50
Boiler Upgrades to Increase In-House Power Generation

Has 30 years experience in industry – Marcel Berz, LaFond, Pethe

Boiler upgrades in biomass increases in-house boiler. Forest waste bi-product raising old standards and protecting forest upgrading boilers. Chemical recovery boiler – improve power. Accommodate improve steam turbine generator – ways to maximum manufacturing large quantities in house power electricity used to be cheaper in steam systems and economical. Change need steam 200-250 lbs range.

End boilers – natural gas in the east. Most boilers have higher pressure/temperatures back pressure and low pressure steam turbine generator.

Boiler modified to provide maximum steam production. New steam turbine not used. Create higher pressure – steam higher pressure detailed boiler education – different concepts modify turbine generator complete steam generator back small fuel costs.

Concepts analyses evaluation and quantify costs. Potential increasing boiler meet temperature not process steam 30% to 180 lbs. Pressure increases steam pressures back out reduced increases KW – higher levels. New steam turbine quantity – 31 MW not available earlier on.

Adding 30% super heater too small a service making modification – additional 30% steam existing lower than turbine mismatches according to two engineers in 20 years change in fuel mixture. Excess increase efficiency lower heat flue gas lose air. Larger steam flow generated steam temperature drop. 50 lbs decrease pre-upgrade vs design 50°F reduction power output – steam temperature ¼ mw steam temperature. More primary super heater filled in with new

elements 50^{o} - super heater in front redesigned pressure loss. Increases velocity changes reduced is detrimental.

Two tubes per element – much lower. Super heater more expensive solution. 50% 750,000 savings per years much better larger amount of payback better. Lower pressure oil or gas power generator fossil fuel fired burners.

Carbon losses in landfill. Economizer economical steam flow 4 fuel burners – mixing and improve updating air is beneficial.

You can use cardboard insert – before installation. Improving more efficiently/cleaning produce some stream and speed. Installation economize invest individual per boiler hog fuel fired. Flue gas 500^{o} through away energy 375^{o} substantial kilogram per second. Producing mw fuel input gain steam economizer 6 steam flow not increase 7.5% less.

Increase in steam flow in most boiler done. Circulation study pressure undertaken criteria boiler pressure to drum correlates operational pressure to drum and saturation driving force. Steam drum increasing efficiency steam temperature. Side effect of adding economizer 20-30^{o}F drop in steam by adding economizer. Consequence super heating replacement primary secondary steam temperatures goes up. Chosen to be better 925% steam temperature. Boiler E – LA SH tubes added/existing stainless steel plotting extra protection.

Boiler F – Tacoma higher steam temperature boiler put together 50mw

Conclusion options/concepts super heater reducing temperature drop steam flow exceeding modify increasing steam production. End: 11:30

Thursday, March 17th

Presentation #11: Direct Contact LLC/Bill Carson Start: 8:00
Boiler-Fueled Boiler/Turbine Generators Combined Heat Recovery and Acid Gas – Abatement Systems

35 years of engineering. Installation scrubbers absorbers – Talk recent system working different extract waste heat – saving energy passing extract waste heat – saving energy passing gases. New boiler system processing flue gas capturing energy and putting back 98% of acid gases . Direct connect technology at NIPPON contact makeup water works right. 1991 – substantial amount of hot gas heated water up to 60^{o} - 110. In 1985 heat recovery system – white water

ground vent - 200^{o} take into pulp mill – 50 m ppu per hour one unit 25 ppu in savings as a result. In 2003 HRS on hog fuel boiler stock of 400^{o} - pulp mill white processed water in system #8 shut down on standby when new turbine system is operational. Condition of oil tank 900 psi in boiler than turbine 1st second bleed goes to process extraction tap turbine condition steam is conditioned to HP bleed super heater. Pulp mill process steam condensed as in the second processor her causes two head losing pressure steam to DA on the steam pressure in the DA tank turbine exhaust pegging initially drying shows that in the instant now up pressure can make turbine extraction pass to conditional NIPPON constraint. 20 mw power less steam used savings in fuel increasing rank and cycle change see – quantify and mass it effects things linear waste HR heat rate. Oxygen about 85 bpu per condition 10.52 3% increase turbine efficiency. 2nd stage hot water circulating waste heat in pulp hot water circulating waste heat in pulp mill – no numbers of steam usage counting 20 bpu savings – 40 bpu savings. Turbine 4-5% more savings. Flue gas to indirect heater to connect with contract water – doing so loses energy and has to be transfer to heat sink mu water very humid at saturation zone. Scrubbing out acid gases 95% HCl out of systems SO_2 put problematic resist absolves from system basic material pH control constantly mutilate valve – most caustic SO_2 contribute to BD boiler 2,000 lbs of steam 10.5 range available caustic value. 9 up or down SO_2 taken out increase of above 9. Level control of reservoir take to dew point. Nature direct contact to sewer. Direct control generate considerate sodium sulfate no silica/iron. Miscellaneous use in process high pH site specific electronislic 3 fan discharges indirect killing coil flue gas levels to stack atmosphere 33’ 16’ in diameter. Lot of energy lose heat than recover it. Use force rep back side FRP vessel – chloride present 3/16 stainless steel corrosive resistance – fan 30 plus inches of water unit difficult increase in cost of vessel. Where fan is important. Push gas needs pressure – induction fan. Contactor – packed yes. Packing in it. 2nd circuit feeds bottom. Pulp mill heats up process. Packing in to enhance ability. Structural packing sections – smaller pump through big pump 750 thousands – caustic top highest pH very good scrubbing. Down still product power. Being used to absorb gases saves NIPPON money. Construction material? RFP liner typical payback? 90% running criteria 2nd year. Concerned dust 1st heat exchanger? Water wash about – will be washed and coat coil. End: 8:30

Presentation #12: VA:W/Alan Werner
Boiler Plant Simulation for Wood and Gas Fuels: A Case History

Werner is a professional Engineer. Engineering auditor. Life member of AFME – Plum Creek

Operation results will show that 2 boilers gas fired/wood/gas RO filter all in model 300 psi saturated 75,000 lbs has 3 fans – stokers, pumps, wood fire blower. In Excel spreadsheet shows dual feed. Most important BC – 6-40% standard operating perimeters number of species

hemlock/fir – variations effect of operations. Explanation what the hog fuel 50% of MU – month of January SP spruce log varies day to day and monthly. Stoichrometer create heat, oxygen flue gas efficiencies model. Bases of calculation – calculation tabs 300 psi has certain antipathy balances – complete bubble around power plant. Batch process new – three model – 1 year 8760 rows of data. Portion of PC row – variation over max what you want to run. Total all incoming losses balances fuel water against losses involved >< 5% some things don't follow real time. Validation show on paper – period of time result 60/40% split – real life management consideration of what operations do. Combustion work certain effects costs – more fuel 6 species – model to model. Seven weeks of data – two time periods. Fuel mix in both. Fuel mix in both steam loads. Instrumentation didn't always occur. Excess air – set excess air norm data – variations different seasons – short period – model was normal. Combination variations – Sept more Jan less was a change.

MACT variations what to apply bench mark steaming consumption varied contributing factor – improvement adaptable. Chang in load – temperature O level intermix Co – O available CO_2 VOC temperature 0" Hg/HCl dust fuel off plywood resins natural fuels in bark – not that much 60/40 bark to dust. Not enough data. Cost – sander dust more or less fuel cost – free variation. NO_x 0-50% coincidence right/wrong? Amount dust effects burning factors – results 100K residual O goes up, boiler efficiency goes down – 100%. NOx rises as O increases – why it dips? Residual about >- working on. Some perimeters investigated cost more Ponderosa Pine less lost – unexplained spruce goes up – cost more.

VEA – modify great tool heating/cooling modify at college campuses inexpensive boiler economizer out file how plant was run – system eliminate composure for woods? Combust charcoal of species PC – fuel sampling. Dirt in fuel? No don't use it. End: 9:00

Presentation #13: Pan Global Training Systems/Bob Clarke Start – 9:35
New Directions in the Delivery of Thermal Energy Education

WRBI – 1990 – full time educator.

Power engineered boilers. Improving knowledge in Northwest and 2 in Canada – Alberta, British Columbia

Training system – publisher of training materials. Educate process – textbooks. Regulations, CEO highest quality. Books replace learning tool. Pan Global environmental support internet learners – access them. Centralia College is one of the colleges he does textbooks for. Has developed Entourage EDGE. Joint venture 1999-2000 STE 98 years. Individual great

skills/knowledge learning environmental focused on practice issue – 3 owners of power engrg. -2200 engineers. Six products – refrigerator product – customer development simple process licensed in US regulator/educator materials available course wear – operational within 100 students metric/us standards. Three languages – English, French and Spanish also has Australian version. Management system on line educator or student where and when.

Clients 8,000 learners – 7,000 on line – one is Seattle Steam group Michelin. Education largest distributor 10 college Rogue Community College uses them.

Jurisdictions required depth breath international core reviewed committee validating. Text book workbooks – free media on-line eBooks self assessment. Cities learner access fully test you. Educated sentries 75-80% to learner. Greater knowledge.

Authors contacted – historical reference – working professional people experienced. Two engineers who agree. Circumstance unique. Boiler system complicated – get right sometimes but also can get it wrong. Can establish review committee in 5 year review cycle – printed – reviewed every 5 years. Not that complicated 85 products. Review contact entirely concerns text added – open for review/comments. Corrosion important issue this year. Custom producer – US essentials and advance 3 and 4 class – topics units 4^{th} or 3^{rd} class unit. Power plant – broad base program/topic specific work with Pittsburgh, PA. Different levels maintain license each year.

Licensed on-line Centralia 2005 started five different – 10/12 different colleges. Regular concept – covers WA, OR, ID, MT, WY, and UT – and some catchall states. Skill panels needed to define individual regulations. Smart grid across US. Train people to be successful employable. Significant 80% on job data. May or may not be aware 4^{th} class level 65% colleges success 85%-50% of training. Distance training tools provided 30%. High success rate achieve elements partner don't deliver individual purchase have access to all features and be self assessment. College technical support anytime. Immediate response. Move on nuances Available to everyone.

Course screen – course, events, results – $4^{th}/3^{rd}$ tests – multiple choice. Higher level more written tests. Assignment solution – senior operator. Control certain level – rises. eBooks, media – 4 text books nice size textbook entourage EDGE. Has back light. Challenging interact – circulating. Reference books close up – no problem with eyes and eliminates paper. You can highlight text add links nice feature. Replacing textbooks. Safety cases access directly – important feature. Now a day's all on-line – websites, eBooks. Educators understand new technology – enable internet access all in one device. Journal application write on it. Available

in one device. April 2010 Amazon passed paper sales – 80% electronic. Trade individual disappear – cost of eReaders are coming down. Laptops you have to worry about battery dying – eReaders battery last longer. Canadian Chief examiners of power engineering developed education for member. Environmental pape4r because support profession – provide features delivered – publishers deal with education today. Focus individual better operation sign level of knowledge. End 10:21

Presentation 14: GE Energy – Environmental Services/Dave Chapin 10:25
Results from the Implementation of Impulse Cleaning System in Utility Boiler

Stronger cleaning system coal fire utility site. More biomass waste energy – different areas. Dry ash deposit – molten slug/muddy deposit beyond dew point. Impulse boilers are efficient. Efficiently boiler back pass outage driven. Draft limited on-line efficiency on-line cleaning – corrosion – too expensive coal fire – UB – 1/2 % improvement in coal savings emission savings – regulates coming through shock power system. Mounted permanent accessed door ways design of systems. Pressure way – create controlled duration fuel/air. Shock waves cross pollination clean equipment fuel/air in chamber ignite – shockwave boiler do again 10 pulses doing cleaning than rest. Emerging from system SW left to right – technical shadow graph. SH reflect flat surfaces unique to small surfaces tubes – reconnect non-line of sight. Clean leading trailing – non –erosive. Release dry deposit – no physical damage. Impulse Cleaning System – DCS – operating runout of fuel. Access network remote diagnosis. Problems – heat rate degradation plugged up installation layer.

Case Study 1 – PRB lower in Bituminous plus issues. Tech limited palliation super heating bundles. Outages DP issues 1/year criteria eliminate outages – November of each year. Air per heater – normalized per load – increasing with load sign drop 30% F across loads ¼ to 1/3% long term benefit. Preheater temperature decreased delta 2 hour oppose once a shift. More often with smaller volumes 200> cleaning outage primary/secondary

Case Study 2 – 100% PRB coal – benefit improve particular economizer collect ash plugged deliver – burn more efficiently. Acoustic cleaner – 1 day – 8 hour period flue gas exiting economizer temperature run cycle. Saw impulse cleaner 40% drop first hour ½% well above – savings. Outages 2010 clean boiler start – bake on tube – fully clean after outage tubular air leginancy ash blocked off tubes removed better.

Case Study #3 – same basically boiler heating – intense shock waves – replace augment. Small compact foot print. New system natural gas ethanol gas. Acoustic 3 decades where to apply were it will work best for you.

How much? 60-80K 25-35 years. Low temperature – higher less dense flue gas. End. 10:50

Presentation #15: NALCO/John Zora
A Shift in Powerhouse Water Treatment: Improved Automation and Control Using Fewer Resources

11 years in navy graduated from LSU. Power/chemical person business operation super team ALFA guys.

Introduced company – workers – Seattle, Eastern WA, and MT. Partner and individual evaluation boiler.

ROI electricity not hang out in boiler man power funding. Past working fine luck.

#2 corrosion/scale – replace pipe radiant heat zone – lose efficiency of boiler. Iron tubes – heat transfer efficiency iron off paper machines weight analyses miner scale. Iron deposition corrosion and O Carbon attack – low pH.

ASME guidelines – free important – fire tube water turbines feedwater – crappy boilers don't put crap in it. 25 parts zero hardness hart to remove.

Locomotives hardness added potatoes to reduce national Al Corporation dentition slug. Phosphates – Palma treatment sequester hardness. Phosphate treatment test – numbers control new guy sr. guy gone chemistry not right – sulfate average feed sulfate volatize go out. Sulfite get to do job.

3D boiler tech – change feedwater system flow meter – stainless steel monitor. Independent research – 9 level – solids measure iron once a shift or once a week. Corrosion rate – cool at temperature corrosion meter. EPRI no funding – probes analysis with EPRI recommended. Dave Dixon Trace R – thermal energy - smoke filled environment. Same effect as firefighters use. Trace R - inert chemical. Vintage since 1970 black light. Allows monitor real time – decision boiler water – downloaded WS look at perimeter – information on web – can provide feedback what can be different. Control boiler/costs 27/28 April – meeting at Coeur de Lane, ID – Utility supplier NALCO products. Understanding phone a lot – trends communication – at tempo pump problems. Single sensor system around for years – 17 years ago in paper individual ORP in line compare reading with performance. ORP graph reducing variation data paints – tighten up. Unit less change in corrosion rates – reduce variability changes layer sluffing iron. 3D taser – on-line

accessible no charge cellu8lar service Ethernet dial out alarm rings immediate > 90 days. Tank level monitoring usage day by day 4 boilers feedwater – add 4-20 signals condensate – remote pH monitoring collect process web take away when needed. DA stable sulfate problem day on-line. 3D data dash board cooling water level of detail more with less installation – assets unexpected 4,000 lbs/hour. Dedicated to people – 100K product – switching people limited operations system works. Key is measure to what your doing and treating at ASME standards – one way steam kiln and hardboard plant.

Two hardboard/kilning – feedwater pumps – coolers in place installation 3D tracer installation. Goal upgrades – no mistake integrated – expanding 150 away from feedwater – insulated measure temperature ORP probe data type control. Real steam 30-90 lbs per hour. Pump rate temperature dropped oxygen goes up add sulfate boiler sulfite nobody knows too much about system temperature minimal corrosion high ORP corrosion black liquid recovery unit. Taking out of service o scavenger increased ORP down. DA temperature shut off sulfite. Stop corrosion stop scale. Manpower shortages. FB control hand adjust touch and know operational staff – looking at machinery at temperature ORP best instrumental on west side. End – 11:40.

Drawing.