DEPARTMENT OF THE AIR FORCE
75TH CIVIL ENGINEER GROUP (AFMC)
HILL AIR FORCE BASE UTAH

18 August 2017

Michelle L. Cottle
Chief, Environmental Branch
75th CEG/CEIE
7290 Weiner Street
Hill Air Force Base Utah 84056-5003

Mr. Marty D. Gray
Manager – New Source Review Section
Utah Division of Air Quality
P.O. Box 144820
Salt Lake City Utah 84114-4820

Dear Mr. Gray

Hill Air Force Base (AFB) is pleased to submit this addendum in response to the Utah Division of Air Quality (UDAQ) July 19th "Additional Information for BACM analysis" request letter regarding Hill AFB's Best Available Control Measures (BACM) analysis that was submitted on April 28, 2017.

In response to the request letter, Hill AFB has updated the BACM analysis using potential to emit (PTE) emissions, included language regarding the Combined Heat and Power project, as well as providing additional information on future steam operations at Hill AFB. Per the clarification request letter and subsequent verbal direction, Hill AFB has concentrated on updating information related to boilers. Specifically Hill AFB has focused on "grandfathered" boilers and those boilers rated at greater than 30 MMBTU.

The attached provides an addendum to the analysis of section 3 of HAFB's original BACM analysis. If you have any questions or would like to discuss this issue further, my point of contact is Dr. Erik Dettenmaier 75 CEG/CEIEA, at (801) 777-0888 or erik.dettenmaier.1@us.af.mil.

Sincerely

for
MICHELLE L. COTTLE, NH-03
Chief, Environmental Branch
75th Civil Engineer Group

One Attachment:
1. BACM Analysis Addendum

Addendum to Section 3 of BACT Analysis

Table 3-1 has been updated to focus on all grandfathered boilers as well as boilers over 30 million British Thermal Units per hour (MMBTU/hr).

Table 3-1. Hill AFB Boilers

Source ID (AQUIS)	Capacity (MMBTU/hr)	Fuel Type(s)	Existing Control Technology and/or Emission Rate Limit	Boiler Category
3507	87.5	Dual fired with diesel or natural gas	Low NO_x burners and 0.09 lb/MMBtu	Subject to NSPS Dc
3508	87.5	Dual fired with diesel or natural gas	Low NO_x burners, 0.09 lb/MMBtu	Subject to NSPS Dc
3501	80	Dual fired with diesel or natural gas	0.09 lb/MMBtu	Not subject to NSPS Dc
3502	80	Dual fired with diesel or natural gas	0.09 lb/MMBtu	Not subject to NSPS Dc
3519	60	Dual fired with diesel or natural gas	0.09 lb/MMBtu	Not subject to NSPS Dc
3514	60	Dual fired with diesel or natural gas	None	Grandfathered
3515	60	Dual fired with diesel or natural gas	None	Grandfathered
3516	60	Dual fired with diesel or natural gas	None	Grandfathered
3503	50	Dual fired with diesel or natural gas	None	Grandfathered
3504	50	Dual fired with diesel or natural gas	None	Grandfathered
3505	50	Dual fired with diesel or natural gas	None	Grandfathered
3506	50	Dual fired with diesel or natural gas	None	Grandfathered
3520	40	Dual fired with diesel or natural gas	None	Grandfathered
3521	40	Dual fired with diesel or natural gas	None	Grandfathered
3510	7.1	Dual fired with diesel or natural gas	None	Grandfathered
3511	7.1	Dual fired with diesel or natural gas	None	Grandfathered

In accordance with Utah Division of Air Quality (UDAQ) request, the following BACT analysis is based on potential to emit (PTE) emissions. PTE emissions for each boiler were calculated using either the emission limit of 0.09 lb/MMBTU or 8,760 hours and their design heat input. Emissions of NO_x were calculated using emission factors from Table 1.4 from AP-42. Table 3-4 has been updated to reflect these emission changes. Actual emissions were retained in Table 3-4 for reference.

Table 3-4. Hill AFB Boiler PTE Emissions

Source ID (AQUIS)	Capacity (MMBTU/hr)	Actual or Projected NO_x Emissions (tons)	PTE NO_x Emission (tons)	Boiler Category
3507	87.5	5.8	18.8	Subject to NSPS Dc and >50 MMBTU/hr
3508	87.5	5.8	18.8	Subject to NSPS Dc and >50 MMBTU/hr
3501	80	5.8	34.4	Not subject to NSPS Dc
3502	80	5.8	34.4	Not subject to NSPS Dc
3514	60	1.0*	25.8	Grandfathered
3515	60	1.0*	25.8	Grandfathered
3516	60	1.0*	25.8	Grandfathered
3519	60	6.0	25.8	Not subject to NSPS Dc
3503	50	1.4	21.5	Grandfathered
3504	50	1.5	21.5	Grandfathered
3505	50	1.5	21.5	Grandfathered
3506	50	1.5	21.5	Grandfathered
3520	40	1.0	17.2	Grandfathered
3521	40	2.4	17.2	Grandfathered
3510	7.1	1.0*	3.0	Grandfathered
3511	7.1	1.0*	3.0	Grandfathered

*Represents a boiler inactive since 2010. One ton of NO_x was assigned to these units for evaluation on a per ton basis.

Select BACT

In an effort to provide additional clarity and granularity in response to UDAQ's request relating to current and future operations, the boiler specific BACT analysis and associated table 3-5 have been updated to provide additional detail on an individual boiler basis and incorporates pollution cost reductions based on PTE emission calculations.

Flue Gas Recirculation (FGR) is generally not recommended in retrofit situations (UDAQ, 2017). FGR significantly impacts the fuel to air ratio control and combustion efficiency of the burner and thus is technically infeasible on boilers not originally designed to incorporate the use of the technology. There are no boilers in Hill AFB's existing inventory having the proper mechanical construction to accommodate FGR. Furthermore, FGR is primarily used in combination with low-NO_x or ultra-low NO_x burners and thus not technically feasible as a standalone control. FGR is considered technologically infeasible for Hill AFB's boilers (see table 3-5).

To evaluate the technical feasibility of low NO_x and ultra-low NO_x burner retrofits, Hill AFB has been working with local boiler sales company Servco. As part of this evaluation it was determined that space constraints made low NO_x and ultra-low NO_x burner retrofits technically infeasible (see attachment 1). Low NO_x or ultra-low NO_x burners require staged combustion and are significantly longer than currently installed burners. It was determined that there is not enough room to accommodate the additional length for this technology. Specifically, grandfather boilers in building 260 (AQUIS IDs 3503, 3504, 3505, and 3506) face burner to burner with only minimal room for current maintenance operations. There is no space available for additional equipment. The remaining non-grandfathered boilers (AQUIS ID's 3501, 3502, 3507, and 3508) in building 260 have comparable spacing issues due to their proximity to the building walls. In buildings 825 and 1286, boilers (AQUIS ID's 3514, 3515, 3516, 3519, 3520, and 3521) have a similar proximity situation with exterior walls that are less than 10 feet from the face of the burner. In all of these situations, there isn't enough room for a low NO_x or ultra-low NO_x burner installation without substantial building modification. Although not specifically evaluated by Servco, Hill AFB has determined that boilers in building 519 (AQUIS IDs 3510 and 3511) are impacted by the same size constraints, relative position of the burners and building structure. In addition to space constraints, a low NO_x or ultra-low NO_x burner retrofit requires the firing rate of the boiler to be reduced which makes it difficult to get complete combustion of the fuel in the second stage. The amount of unburned fuel or carbon monoxide in the exhaust gas is often increased as a result of incomplete combustion, and could result in the secondary formation of PM2.5 (de Nevers, 2000). Therefore, low NO_x or ultra-low NO_x burner retrofits are considered technologically infeasible for Hill AFB's boilers.

Selective catalytic reduction (SCR) requires exhaust gas temperature in a range of 500 to 1,200 degrees Fahrenheit (Cleaver Brooks, 2010). This temperature range is above the designed exhaust temperature of the existing boilers at Hill AFB. As with low and ultra-low NO_x burners, current boiler configuration and spacing makes installation and implementation of this technology infeasible. Therefore, SCR is considered infeasible as a control technology for Hill AFB boilers.

The Boiler Emissions Guide (Cleaver Brooks, 2010) indicates that post combustion methods such as selective non-catalytic reduction (SNCR) are generally not used on boilers with inputs of less than 100 MMBTU/hr. Hill AFB does not own or operate any boilers larger than 100 MMBTU/hr. Additionally, the guide also indicates that SNCR is difficult to add on to boilers that modulate frequently due to the location of temperatures in the desired range for the technology (1,400 to 1,600 degrees Fahrenheit) constantly changing. As Hill AFB does not operate its boilers at a constant rate for any extended period of time, SNCR is considered infeasible as a control technology for Hill AFB boilers.

Table 3-5. Technical and Economic Analysis of Add-On Control Feasibility

Source ID (AQUIS)	Capacity (MMBTU/hr)	Building Number	Control Technology	Annualized Cost ($)*	$/Ton Controlled
3507	87.5	260	Flue Gas Recirculation	NA –Units are equipped with LNB, a control that provides comparable NO_x reduction	
			Low NO_x Burners	NA –Units are equipped with LNB	
			Ultra-low NO_x Burners	Technically Infeasible	
			Selective Catalytic Reduction	Technically Infeasible	
			Selective Non-Catalytic Reduction	Technically Infeasible	
			Boiler Replacement(1)	$373,800	$13,500
3508	87.5	260	Flue Gas Recirculation	NA –Units are equipped with LNB, a control that provides comparable NO_x reduction	
			Low NO_x Burners	NA –Units are equipped with LNB	
			Ultra-low NO_x Burners	Technically Infeasible	
			Selective Catalytic Reduction	Technically Infeasible	
			Selective Non-Catalytic Reduction	Technically Infeasible	
			Boiler Replacement(1)	$373,800	$13,500
3501	80	260	Flue Gas Recirculation	Technically Infeasible	
			Low NO_x Burners	Technically Infeasible	
			Ultra-Low NO_x Burners	Technically Infeasible	
			Selective Catalytic Reduction	Technically Infeasible	
			Selective Non-Catalytic Reduction	Technically Infeasible	
			Boiler Replacement(1)	$363,400	$14,400
3502	80	260	Flue Gas Recirculation	Technically Infeasible	
			Low NO_x Burners	Technically Infeasible	
			Ultra-Low NO_x Burners	Technically Infeasible	
			Selective Catalytic Reduction	Technically Infeasible	
			Selective Non-Catalytic Reduction	Technically Infeasible	
			Boiler Replacement(1)	$363,400	$14,400
3514	60	825	Flue Gas Recirculation	Technically Infeasible	
			Low NO_x Burners	Technically Infeasible	

Table 3-5. Technical and Economic Analysis of Add-On Control Feasibility

Source ID (AQUIS)	Capacity (MMBTU/hr)	Building Number	Control Technology	Annualized Cost ($)*	$/Ton Controlled
			Ultra-Low NO_x Burners	Technically Infeasible	
			Selective Catalytic Reduction	Technically Infeasible	
			Selective Non-Catalytic Reduction	Technically Infeasible	
			Boiler Replacement[1]	$329,400	$16,000
			Flue Gas Recirculation	Technically Infeasible	
			Low NO_x Burners	Technically Infeasible	
			Ultra-Low NO_x Burners	Technically Infeasible	
3515	60	825	Selective Catalytic Reduction	Technically Infeasible	
			Selective Non-Catalytic Reduction	Technically Infeasible	
			Boiler Replacement[1]	$329,400	$16,000
			Flue Gas Recirculation	Technically Infeasible	
			Low NO_x Burners	Technically Infeasible	
			Ultra-Low NO_x Burners	Technically Infeasible	
3516	60	825	Selective Catalytic Reduction	Technically Infeasible	
			Selective Non-Catalytic Reduction	Technically Infeasible	
			Boiler Replacement[1]	$329,400	$16,000
			Flue Gas Recirculation	Technically Infeasible	
			Low NO_x Burners	Technically Infeasible	
			Ultra-Low NO_x Burners	Technically Infeasible	
3519	60	1286	Selective Catalytic Reduction	Technically Infeasible	
			Selective Non-Catalytic Reduction	Technically Infeasible	
			Boiler Replacement[1]	$329,400	$17,400
			Flue Gas Recirculation	Technically Infeasible	
			Low NO_x Burners	Technically Infeasible	
3503	50	260	Ultra-Low NO_x Burners	Technically Infeasible	
			Selective Catalytic Reduction	Technically Infeasible	

Table 3-5. Technical and Economic Analysis of Add-On Control Feasibility

Source ID (AQUIS)	Capacity (MMBTU/hr)	Building Number	Control Technology	Annualized Cost ($)*	$/Ton Controlled
			Selective Non-Catalytic Reduction	Technically Infeasible	
			Boiler Replacement(1)	$347,900	$20,300
3504	50	260	Flue Gas Recirculation	Technically Infeasible	
			Low NO_x Burners	Technically Infeasible	
			Ultra-Low NO_x Burners	Technically Infeasible	
			Selective Catalytic Reduction	Technically Infeasible	
			Selective Non-Catalytic Reduction	Technically Infeasible	
			Boiler Replacement(1)	$347,900	$20,300
3505	50	260	Flue Gas Recirculation	Technically Infeasible	
			Low NO_x Burners	Technically Infeasible	
			Ultra-Low NO_x Burners	Technically Infeasible	
			Selective Catalytic Reduction	Technically Infeasible	
			Selective Non-Catalytic Reduction	Technically Infeasible	
			Boiler Replacement(1)	$337,500	$19,600
3506	50	260	Flue Gas Recirculation	Technically Infeasible	
			Low NO_x Burners	Technically Infeasible	
			Ultra-Low NO_x Burners	Technically Infeasible	
			Selective Catalytic Reduction	Technically Infeasible	
			Selective Non-Catalytic Reduction	Technically Infeasible	
			Boiler Replacement(1)	$337,500	$19,600
3520	40	1286	Flue Gas Recirculation	Technically Infeasible	
			Low NO_x Burners	Technically Infeasible	
			Ultra-Low NO_x Burners	Technically Infeasible	
			Selective Catalytic Reduction	Technically Infeasible	
			Selective Non-Catalytic Reduction	Technically Infeasible	
			Boiler Replacement(1)	$319,000	$23,200
3521	40	1286	Flue Gas Recirculation	Technically Infeasible	

Table 3-5. Technical and Economic Analysis of Add-On Control Feasibility

Source ID (AQUIS)	Capacity (MMBTU/hr)	Building Number	Control Technology	Annualized Cost ($)*	$/Ton Controlled
			Low NO_x Burners	Technically Infeasible	
			Ultra-Low NO_x Burners	Technically Infeasible	
			Selective Catalytic Reduction	Technically Infeasible	
			Selective Non-Catalytic Reduction	Technically Infeasible	
			Boiler Replacement(1)	$319,000	$23,200
3510	7.1	519	Flue Gas Recirculation	Technically Infeasible	
			Low NO_x Burners	Technically Infeasible	
			Ultra-Low NO_x Burners	Technically Infeasible	
			Selective Catalytic Reduction	Technically Infeasible	
			Selective Non-Catalytic Reduction	Technically Infeasible	
			Boiler Replacement(1)	$138,600	$56,800
3511	7.1	519	Flue Gas Recirculation	Technically Infeasible	
			Low NO_x Burners	Technically Infeasible	
			Ultra-Low NO_x Burners	Technically Infeasible	
			Selective Catalytic Reduction	Technically Infeasible	
			Selective Non-Catalytic Reduction	Technically Infeasible	
			Boiler Replacement(1)	$138,600	$56,800

Notes:
*Includes initial capital, installation, and annual operating costs. Replacement cost assumes 40 year life of boiler (UDAQ,2017)
1. Cost evaluated based on pricing letters from Servco, attachments 1 and 2. Cost includes $600,000 for abatements and infrastructure modifications.

On close examination using a site specific analysis, currently no available control technology is technically feasible when applied to Hill AFB's existing infrastructure. Hill AFB recommends that best management practices of good combustion practices, pipeline quality natural gas with use of alternate fuels limited to the minimum amount required to meet Air Force readiment requirements in AFI 32-1068 except during periods of natural gas curtailment be selected as BACT.

By the end of 2018 Hill AFB has plans to retire several old boilers that have been inactive since 2010. These boilers are listed in Table 3-6. As the boilers are decommissioned, Hill AFB will submit notification

letters to UDAQ to officially remove the boilers from the Hill AFB's Consolidated Boiler Approval Order (AO) and the Main Base Title V Operating Permit.

Table 3-6 Inactive Hill AFB Boilers

Source ID (AQUIS)	Capacity (MMBTU/hr)	Building Number	Boiler Category
38300	12.6	519	Not Subject to NSPS
3510	7.1	519	Grandfathered
3511	7.1	519	Grandfathered
3514	60	825	Grandfathered
3515	60	825	Grandfathered
3516	60	825	Grandfathered
3527*	16.74	1624	Not Subject to NSPS
3526*	10.5	1624	Not Subject to NSPS
34388	25	1703	Subject to NSPS
3430	16.74	1904	Not Subject to NSPS
3426	10.5	1904	Subject to NSPS
3531	8.4	1904	Not Subject to NSPS

* Being replaced with a smaller electric boiler

Hill AFB continues to support projects to update its aging infrastructure and support the State's effort with respect to PM 2.5 nonattainment status. Several projects are currently under consideration for removing and replacing boilers at various locations. These include replacement of all eight boilers located in building 260 as well as the three boilers in 1286 (see table 3-7). In building 260, the plan is to reduce the total number of boilers to six while all three will be replaced in 1286. A detailed BACT determination will be made at the time of replacement, however funding requests as well as the analysis provided in table 3-5 are based on incorporation of ultra-low NO_x burners (i.e. ~ 9 ppm). Due to the cost associated with these projects, they are dependent on AF Headquarters approval and congressional funding. Although these projects are currently underway with a 10 year phased replacement target, the timeline for completion is subject to those approvals as well as operational constraints.

Table 3-7 Proposed Replacement of Hill AFB Boilers

Source ID (AQUIS)	Capacity (MMBTU/hr)	Building Number	Boiler Category	Proposed Update
3501	80	260	Not Subject to NSPS	Replacement
3502	80	260	Not Subject to NSPS	Replacement
3503	50	260	Grandfathered	Replacement

Table 3-7 Proposed Replacement of Hill AFB Boilers

Source ID (AQUIS)	Capacity (MMBTU/hr)	Building Number	Boiler Category	Proposed Update
3504	50	260	Grandfathered	Replacement
3505	50	260	Grandfathered	Replacement
3506	50	260	Grandfathered	Replacement
3507	87.7	260	Subject to NSPS	Removal
3508	87.7	260	Subject to NSPS	Removal
3519	60	1286	Not Subject to NSPS	Replacement
3520	40	1286	Grandfathered	Replacement
3521	40	1286	Grandfathered	Replacement

Combined Heat and Power Plant

Hill AFB is proposing a combined heat and power (CHP) plant which would consist of a 3 megawatt (MW) Solar Centaur 40 natural gas fired turbine paired with a heat recovery steam generator (HRSG) with a duct burner along with ancillary equipment (black start engine and associated storage tank). The HRSG would utilize the hot exhaust gas from the turbine to heat water and generate steam. The steam would be used in industrial processes at Hill AFB and to provide building heat. The system is designed to handle the entire heat load of building 260 during summer operations.

Hill AFB submitted a BACT Analysis to UDAQ on 18 May 2017. The analysis identified good combustion practices, SoLoNO_x for the turbine, low NO_x duct burners, and use of pipeline quality natural gas as BACT. However, in a letter dated 27 June 2017, UDAQ stated that the Hill AFB BACT analysis did not address existing EPA-Accounting for CHP in output-based regulations including those under South Coast Air Quality Management District Rule-1110.2, Texas Commission on Environmental Quality-Air Quality Standard Permit for Electric Generation Units, and existing UDAQ permit limits found in approval orders DAQE-AN105720026-11 (Kennecott Utah Copper) and DAQE-AN103540025-13 (University of Utah). Hill AFB has determined that in order to meet the standards in the referenced documents for NO_x and CO, the addition of SCR and CO Catalyst will be required.

As stated in the Notice of Intent submitted to UDAQ on 9 August 2017, BACT for the CHP includes good combustion practices, use of pipeline quality natural gas for turbine and duct burner, use of low sulfur diesel for black start generator, SoLoNO_x technology for the turbine, low NO_x duct burner, and post combustion controls on the turbine and duct burner including SCR and CO catalyst.

References

Cleaver Brooks. *Boiler Emissions Guide, CB-7435*. 2010
de Nevers, Noel. *Air Pollution Control Engineering*. McGraw-Hill, 2000

UDAQ. "Draft Analysis of Boilers 10 to 30 MMBtu/hr". Received by David Hansell, 1 August 2017.

Attachment 1

www.holbrookservco.com

Proposal Number: 072717-EMC-JH
Proposal Date: 07/27/17
Expiration Date: 08/27/17

BUDGETARY PRICING LETTER

To: **Hill Air Force Base**
Kathryn Garrett
HAFB, UT
Kathryn.Garrett.ctr@us.af.mil

CC: **Megan Evans** – Megan.Evans.ctr@us.af.mil

Re: **Boiler & Burner Emissions Upgrade Options – Buildings 825, 1286, and 260**

Dear Kathryn,

Holbrook Servco would like to thank you for the opportunity to provide you with a **Budgetary Proposal** for the following boiler system upgrades per your request for quote for your submission to DEQ. Per your request, you are looking to reduce the emissions produced by several boilers at buildings 825, 1286 and 260. These boilers range in size from 7.1 MMBTU to 60 MMBTU, and you would like to look at options to reduce emissions on these boilers from their uncontrolled down to 9 PPM NOx.

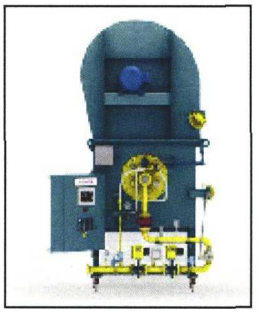
In order to reduce emissions, as was discussed on our phone call, there are three options to review which will allow you to reach those levels. These options are as follows:

1. Retrofit of the existing boilers with new Ultra Low NOx 9 PPM burners.
2. Replace the boilers with new Industrial Watertube or Firetube boilers with Ultra Low NOx 9 PPM technology.
3. Add SCR (Selective Catalytic Reduction) which is a post-flue gas treatment and can clean the exhaust stack to the 9 PPM NOx and below.

Each of the above options has it's benefits, however, there are some concerns which we discussed and we wanted to include in this letter for review.

1. Replacement Burner with Ultra Low NOx 9 PPM Technology – installation on existing boilers. With this option we have reservations and would recommend this only be considered at locations with ample space in front of each boiler. Ultra Low NOx burners will be longer than the standard burners that you have now at your buildings now. We have reviewed this at all three of the buildings in question when I visited your site a few months back and we know that we have space issues.

In Building 260 there are four boilers that face burner to burner and there will not be room for a new burner and then the space required in front for maintenance on those boilers.



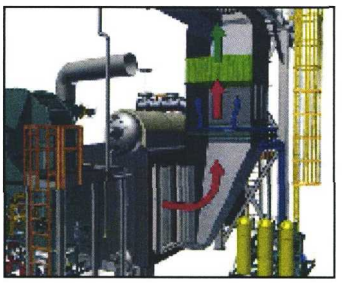
At Building 825 we have a wall in front of each boiler that is less than 10' from the front of the existing burners, and so with a longer low NOx option, we will not be able to maintain space in front for maintenance without re-sizing the room.

At Building 1286 in front of the boilers is a wall and the controller/operator office with also minimal space between the burner and that wall – less than 10'.

These physical constraints will need to be evaluated further to determine if a retrofit is possible with the current building layout for a new burner – also a concern is access into the building itself as most of these buildings have tilt up concrete walls, and modifications to provide the required access into the room for the installation of a new burner will be difficult if not impossible with the current building structure.

With these items in mind – and due to the age of these boilers being on average 40-50 Years old, we would not recommend the investment into boilers that may only have 10 more years at most usable life.

2. Selective Catalytic Reduction (SCR) – addition to the existing boilers/burners. There are three types of SCR systems available:
    a. Anhydrous Ammonia – NH_3
        - Pure ammonia liquefied under pressure
        - Suitable for smaller size applications
        - Most economical reducing agent system
    b. Aqueous Ammonia – NH_3+H_2O
        - Ammonia in 19-29% water
        - Easy and safe to handle
        - Requires storage tank and vaporization equipment



    c. Urea – $(NH_2)_2CO$
        - Powdered urea converts to ammonia prior to catalyst stage
        - Easiest to handle
        - Zero-contingency

This option would only apply to the larger boilers (40-60 MMBTU), however, as with the burner retrofit, we would be installing equipment on aged boilers.

In addition to the age of the boilers, this type of a system would require skilled operators and containment protocols to be in place in order to operate the Ammonia based systems. Please discuss this and review the attached brochure for more information.

BUDGETARY PRICING

BOILER REPLACEMENT OPTIONS					
Item No	**Description**	**Boiler Equipment Price**	**Installation Price***	**Qty**	**Total Price**
1	Cleaver-Brooks boiler model NB-200D-40 (pricing includes delivery to the jobsite – offloading by others) – 40,000 lbs/hr – 40,000,000 Btu/hr	$1,108,700.00	$950,000.00	1	$2,058,700.00
2	Cleaver-Brooks boiler model NB-200D-50 (pricing includes delivery to the jobsite – offloading by others) – 50,000 lbs/hr – 50 and 60,000,000 Btu/hr	$1,165,500.00	$980,000.00	1	$2,145,500.00
3	Cleaver-Brooks CBLE-200-200-150ST Firetube Boiler (pricing includes delivery to the jobsite – offloading by others) – 7,100,000 Btu/hr	$215,800.00	$185,600.00	1	$401,400.00
BURNER RETROFIT OPTIONS					
Item No	**Description**	**Boiler Equipment Price**	**Installation Price***	**Qty**	**Total Price**
1	Cleaver-Brooks Profire NTXL Burner with 9 PPM Low NOx Technology – 40,000,000 Btu/hr	Pricing will be available upon further review of site clearances and access	TBD	1	TBD
2	Cleaver-Brooks Profire NTXL Burner with 9 PPM Low NOx Technology – 50,000,000 Btu/hr	Pricing will be available upon further review of site clearances and access	TBD	1	TBD
3	Cleaver-Brooks Profire NTXL Burner with 9 PPM Low NOx Technology – 60,000,000 Btu/hr	Pricing will be available upon further review of site clearances and access	TBD	1	TBD
4	Cleaver-Brooks Profire LNV Series Burner with 9 PPM Low NOx Technology – 7,100,000 Btu/hr	$97,500.00	$28,650.00	1	$126,150.00

SCR RETROFIT OPTIONS					
Item No	**Description**	**Boiler Equipment Price**	**Installation Price***	**Qty**	**Total Price**
1	Anhydrous Ammonia SCR System	Pricing will be available upon further review of site requirements	TBD	1	TBD
2	Aqueous Ammonia SCR System	Pricing will be available upon further review of site requirements	TBD	1	TBD
			Total SCR Option		TBD

*Installation budget does not include new building construction or building alterations required for general construction. That would be provided by others. Pricing only includes the following:

- Mechanical installation related to equipment
- Electrical installation related to equipment
- Rigging related to equipment and for removal of old equipment
- Startup and commissioning

Other Comments or Clarifications:
Payment Schedule: TBD Based Upon Options Selected Projected Lead Times (upon receipt of approved submittals): ▪ Boiler Production – 38-42 Weeks ▪ Burner Production – 18-20 Weeks ▪ SCR Production – 20-26 Weeks

Thank you for the opportunity to work with you to provide this budgetary pricing. We look forward to working with you further and if you have any questions please contact me.

Thanks,

Jason Hansen
New Equipment Sales Manager
(801) 509-0918
jhansen@holbrookservco.com

Attachment 2

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Proposal Number: 080717-BR260-JH
Proposal Date: 08/07/17
Expiration Date: 09/07/17

BUDGETARY PRICING LETTER

To: **Hill Air Force Base**
Alden Brunson
HAFB, UT
Alden.brunson@us.af.mil

Re: **Building 260 Boiler Replacement**

Dear Al,

Holbrook Servco would like to thank you for the opportunity to provide you with a **Budgetary Proposal** for the following boiler replacement options as discussed at your facility today on 08/04/17. In this project, we would look to replace boilers 5 & 6 with a single new boiler.

After visiting the site, please see the attached dimensional layout drawing of the boiler plant and the space that we would have available to install a new boiler once the old units were removed. We have looked at sizing and can accommodate the following size Cleaver-Brooks CBND Style Industrial Watertube Steam Boilers into the space.

- 70,000 lbs/hr, model NB-300D-55-9PPM
- 80,000 lbs/hr, model NB-300D-65-9PPM
- 90,000 lbs/hr, model NB-300D-70-9PPM

Included with this pricing letter is the site dimensional layout showing existing equipment and the new boilers in their location with clearances and the location of a new 16' x 16' roll door on the East Side of the plant to allow access for removal and installation.

Please also refer to the following attached supporting documents:

- CBND Equipment Brochure
- CBND – 70,000 lbs/hr Sample Proposal for equipment sample scope of supply
- Installation Scope of Supply
- Mechanical and Electrical Engineering Scope of Supply
- 70,000 lbs/hr, model NB-300D-55-9PPM – Dimensional Diagram
- 80,000 lbs/hr, model NB-300D-65-9PPM – Dimensional Diagram
- 90,000 lbs/hr, model NB-300D-70-9PPM – Dimensional Diagram
- HAFB – Bldg 260 Boiler Layouts

BUDGETARY PRICING

70,000 LBS/HR Budgetary Pricing				
Item No	**Description**	**Unit Price**	**Qty**	**Total Price**
1	Cleaver-Brooks boiler model NB-300D-55-9PPM (pricing includes delivery to the jobsite – offloading by others and startup) – 70,000 lbs/hr	$1,425,600.00	1	$1,425,600.00
2	Installation of boiler per attached Installation Scope of Supply	$709,000.00	1	$709,000.00
3	Mechanical and Electrical Engineering – per attached Engineering Scope of Supply	$154,000.00	1	$154,000.00
			Total Budgetary Pricing	$2,288,600.00
80,000 LBS/HR Budgetary Pricing				
Item No	**Description**	**Unit Price**	**Qty**	**Total Price**
1	Cleaver-Brooks boiler model NB-300D-65-9PPM (pricing includes delivery to the jobsite – offloading by others and startup) – 80,000 lbs/hr	$1,534,040.00	1	$1,534,040.00
2	Installation of boiler per attached Installation Scope of Supply	$741,000.00	1	$741,000.00
3	Mechanical and Electrical Engineering – per attached Engineering Scope of Supply	$154,000.00	1	$154,000.00
			Total Budgetary Pricing	$2,429,040.00
90,000 LBS/HR Budgetary Pricing				
Item No	**Description**	**Unit Price**	**Qty**	**Total Price**
1	Cleaver-Brooks boiler model NB-300D-70-9PPM (pricing includes delivery to the jobsite – offloading by others and startup) – 90,000 lbs/hr	$1,584,265.00	1	$1,584,265.00
2	Installation of boiler per attached Installation Scope of Supply	$777,000.00	1	$777,000.00
3	Mechanical and Electrical Engineering – per attached Engineering Scope of Supply	$154,000.00	1	$154,000.00
			Total Budgetary Pricing	2,515,265.00

*Installation budget does not include moving the steam lines on the East Side of the plant to make accommodations for access into the plant. That would be provided by others. Please see the attached Scope Letters below for clarifications:

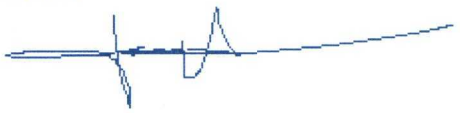
- Installation Scope of Supply
- Mechanical and Electrical Engineering Scope of Supply

Other Comments or Clarifications:
Payment Schedule: TBD Based Upon Options Selected
Projected Lead Times (upon receipt of approved submittals):

- Boiler Production – 38-42 Weeks
- Demolition & Concrete – 6 Weeks
- Installation – 12 Weeks

Thank you for the opportunity to work with you to provide this budgetary pricing. We look forward to working with you further and if you have any questions please contact me.

Thanks,



Jason Hansen
New Equipment Sales Manager
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