PM$_{2.5}$ SIP Evaluation Report – Nucor-Vulcraft

UTAH PM$_{2.5}$ SIP SERIOUS

Salt Lake City Nonattainment Area

Utah Division of Air Quality

Major New Source Review Section

July 1, 2018

DAQ-2018-007203

$PM_{2.5}$ SERIOUS SIP EVALUATION REPORT
ATK LAUNCH SYSTEMS INC.

1.0 Introduction-Purpose

The following is an updated version of the original RACT evaluation that was completed on October 1, 2013 as a part of the Technical Support Documentation for Section IX, Parts H.11, 12 and 13 of the Utah SIP; to address the Salt Lake City $PM_{2.5}$ and Provo, Utah $PM_{2.5}$ Nonattainment Areas.

1.1 Facility Identification

Name: ATK Launch Systems Inc. (ATK)
Address: Promontory
9160 N Hwy 83
Promontory, UT 84302-0689
Owner/Operator: ATK
UTM coordinates: 380,864 m Easting, 4,611,415 m Northing

1.2 Facility Process Summary

The ATK Promontory site involves the manufacture and testing of: solid rocket motor propulsion systems, explosives, flare illuminants, and composite materials. Reclamation activities are also conducted for the reuse of excessed rocket motor components and propellant. $PM_{2.5}$ and precursor emissions at the site are generated from the following sources: boilers, operations using VOC compounds, production testing, rocket motor testing and open burning/open detonation (OBOD). The Promontory site is located in a rural area of Box Elder County approximately 20 miles northwest of Brigham City, Utah.

As part of the quality assurance program, the products require testing to verify the manufacturing process. Testing is conducted during the manufacturing process to verify that each component meets specifications. Testing of completed products is also conducted to verify that the completed product meets performance standards. Testing involves combustion which generates $PM_{2.5}$ emissions. Test quantities range from 75 grams up to 1.4 million pounds. Tests are conducted for both private and government customers for products manufactured by ATK and other manufacturers.

The Promontory facility is located in a rural area of Box Elder County approximately 24 miles northwest of Brigham City, Utah. The facility is a manufacturer of propellants, explosives, flares and related specialty products. $PM_{2.5}$ and precursor emissions at the facility are generated from the following sources: (1) boilers, (2) emergency generators and similar internal combustion engines, (3) operations using VOC compounds, (4) testing and (5) open burning.

The site contains 19 natural gas and 19 fuel oil fired boilers. Fuel oil boilers use ultra-low sulfur (< 15 PPM) fuel, and are located in areas where natural gas is not available. Equipment identified on this list uses ultra-low sulfur fuel exclusively, and is maintained and operated in accordance with 40 CFR Part 60, Subpart IIII and 40 CFR Part 63, Subpart ZZZZ requirements.

VOC sources include paint booth operations, chemical process solvents, and miscellaneous cleaning operations. Other VOC emissions are associated with fuel consumption from boilers, mobile sources and engines.

Energetic materials are tested during the manufacturing process to verify reactivity characteristics. Completed products are also tested to verify performance standards are met. Direct $PM_{2.5}$ emissions and NO_x are the most likely emissions contributed from energetic material testing. Test quantities range from 75 grams up to 1.4 million pounds. Open burning is the method used to treat the majority of reactive waste produced at the site. The process is regulated by the Utah Division of Waste Management and Radiation Control through a Subpart X hazardous waste treatment permit. Permitted operations and treatment quantities are derived from the results of a human health risk assessment designed to evaluate potential impacts to nearby receptors. Air emissions related to open burning are direct $PM_{2.5}$, NO_x, and VOC.

The site has 65 dust collection systems which control emissions from a variety of manufacturing operations. $PM_{2.5}$ emissions from these collection systems are generally low due to the effectiveness of newer filtration material to remove fine particulate.

1.3 Baseline Emissions

Plant-wide 2016 Actual Emissions (tons/yr)

$PM_{2.5}$	SO_2	NO_x	VOC	NH_3
60.59	1.04	46.49	20.79	0.45

1.4 Facility Criteria Air Pollutant Emissions Sources

ATK has several AOs that cover different operations at their site that allows them to manufacture rocket motors.

Emission Unit	Potential to Emit (tons/year)				
	$PM_{2.5}$	NO_x	SO_2	VOC	NH_3
DAQE-802-94	0.0	0.0	0.0	7.05	11.35
DAQE-389-96	0.0	0.0	0.0	5.00	
DAQE-012-00	0.0	13.01	0.0	30.00	
DAQE-	374.0	41.50	0.0	56.10	

AN0009105-05					
DAQE-AN100090124-14	15.85	4.55	4.51	15.02	
DAQE-AN100090134-17	7.47	0.12	0.01	75.00	
DAQE-AN100090130-16	0.41	0.77	0.14	5.40	30.12
DAQE-AN100090132-16	4.86	53.18	0.45	3.10	
DAQE-AN100090133-16	3.59	51.89	3.52	6.67	

AO DAQE-802-94 is for two waste water treatment plants E-541 and M-422. Building E-541 will collect and treat the water/sewage being discharged from buildings located in and around Air Force Plant 78 (the Northwest section of Promontory Plant). Building M-422 will collect and treat the water/sewage from the remainder of Promontory Plant.

AO DAQE-389-96 is for all Safety-Kleen degreasers located at ATK's Promontory Point operations.

AO DAQE-012-00 is for the production of various energetic materials for use in explosives manufacturing. The building will be used to conduct process research from bench-top to pilot-scale to production of energetics. The energetic materials will be produced using a process where a feed stock, usually obtained from off-site, is nitrated using an acid mixture. This nitration process emits NO_x. Some of the energetic manufacturing processes will emit VOCs and HAPs.

AO DAQE-AN0009105-05 is for the testing of larger rocket motors at Test bays T-24 and T-96, and the two burning grounds, M-136 and M-225. This AO set the minimum meteorological conditions required to limit when the larger rocket motors could be tested.

AO DAQE-AN100090124-14 is for the Promontory testing operations. This AO covers all testing at the ATK Promontory site except the test sites covered under AO DAQE-AN0009105-05.

AO DAQE-AN100090134-17 is for the Main Plant -- Groups 1-10 and S503 Burn-off oven. It includes Paint Booths, Grit and Soda Blasters, Burn and Bake Off Ovens, Dust Collectors, and Cyclones

AO DAQE-AN100090130-16 is for the waste water treatment plant in Building M-705. It primarily covers VOC and ammonia emissions from reclamation activities

AO DAQE-AN100090132-16 is for all of the boilers at the ATK Promontory Site. It covers both fuel oil-fired and natural gas-fired boilers.

AO DAQE-AN100090133-16 is for the emergency generators located at the ATK Promontory site.

The following emission units are not source specific. A separate BACT analysis has been conducted on these common emission units. The technical support for these sources is located in the $PM_{2.5}$ Serious SIP – BACT for Small Source document ("PM2.5 Serious SIP – BACT for Small Sources.," 2017).

Cold Solvent Degreasing Washers
Diesel-Fired Emergency Generators (size)
Natural Gas-Fired Boilers (<30 MMBTU)
Baghouses
Cyclones
Paint Booths

2.0 BACT Selection Methodology

The general procedure for identifying and selecting BACT is through use of a process commonly referred to as the "top-down" BACT analysis. The top-down process consists of five steps which consecutively identify control measures, and gradually eliminate less effective or infeasible options until only the best option remains. This process is performed for each emission unit and each pollutant of concern. The five steps are as follows:

1. Identify All Existing and Potential Emission Control Technologies: UDAQ evaluated various resources to identify the various controls and emission rates. These include, but are not limited to: federal regulations, Utah regulations, regulations of other states, the RBLC, recently issued permits, and emission unit vendors.

2. Eliminate Technically Infeasible Options: Any control options determined to be technically infeasible are eliminated in this step. This includes eliminating those options with physical or technological problems that cannot be overcome, as well as eliminating those options that cannot be installed in the projected attainment timeframe.

3. Evaluate Control Effectiveness of Remaining Control Technologies: The remaining control options are ranked in the third step of the BACT analysis. Combinations of various controls are also included.

4. Evaluate Most Effective Controls and Document Results: The fourth step of the BACT analysis evaluates the economic feasibility of the highest ranked options. This evaluation includes energy, environmental, and economic impacts of the control

option.

5. Selection of BACT: The fifth step in the BACT analysis selects the "best" option. This step also includes the necessary justification to support the UDAQ's decision.

Should a particular step reduce the available options to zero (0), no additional analysis is required. Similarly, if the most effective control option is already installed, no further analysis is needed.

The final BACT evaluations for the Promontory site were performed using data that ATK submitted (Jason Wells, 2017), comments received from Techlaw on the ATK Promontory BACT submittal, comments received from EPA, comments received from individuals, AOs, and the Title V permit.

2.1 Emission Unit (EU) and Existing Controls

2.1.1 Controls for Open Burning Energetic Waste

Description:

As a manufacturer of propellants, explosives and pyrotechnics (PEP), ATK plays a vital role in supporting the nation's defense and space programs. Waste disposal processes create safety challenges unique to this industry; where employee safety is the prime concern. Minimizing employee exposure to PEP materials is a core safety philosophy. This philosophy is carried out by limiting the amount of PEP waste stored for extended periods of time. Open burning energetic waste limits quantities onsite and ensures reduced exposure to employees.

ATK completed an open burning risk assessment under the direction of the Division of Waste Management and Radiation Control (DWMRC) to satisfy requirements for a treatment permit under 40 CFR Part 264, Subpart X. Open burning limits are the direct result of the risk assessment process to protect human health and the environment.

Pollutant [$PM_{2.5}$, NO_x, VOC and NH_3]

Control Options:

Transport waste to a commercial disposal facility outside the SLCNAA
Develop a treatment process with add-on controls to reduce emissions
Enhanced waste minimization efforts

Transport waste to a commercial disposal facility outside the SLCNAA

Transporting waste to a commercial disposal facility outside the SLCNAA was evaluated to reduce emissions. A limited number of facilities are available in the country to accept energetic wastes. However, the facilities that can receive the type of waste generated at

ATK Launch Systems do not have enough capacity to treat all of the material.

Develop a treatment process with add-on controls to reduce emissions.

The option of developing a process to treat energetic compounds using a process with add-on controls to minimize emissions was evaluated. Types of energetic materials requiring disposal include bulk Class 1.1 and Class 1.3 propellants, flare illuminants, military-grade high-explosives and developmental energetic compounds. These energetic compounds may contain metal powders, oxidizers, and a variety of high explosive compounds.

The Department of Defense (DOD) has developed the technology to deactivate military munitions which are appropriately sized to be treated in a controlled process using add-on controls. This process is also available commercially with limited capacity. The energetic compounds typical disposed using this option are manufactured articles containing limited quantities of energetic compounds which do not exceed the treatment process limits.

Enhanced waste minimization efforts

ATK maintains a pollution prevention and waste minimization program to reduce open burning. Open burning has been reduced by implementing process changes, and by employee generated efforts to reduce the quantity of waste generated. Additional efforts to reduce open burning include process changes to reduce batch sizes to minimize scrap quantities, and to segregate waste by PEP contamination level.

Technological Feasibility:

A Technical Feasibility study was conducted for the technologies of Transporting Waste, add on controls and waste minimization (Jason Wells, 2017), (Kris H. Blauer, 2018).

Transport waste to a commercial disposal facility outside the SLCNAA.

The option to transport waste to commercial disposal facilities outside the non-attainment area was evaluated. Similar to transporting waste to an OBOD facility outside the SLCNAA, this option requires DOT approval to ship waste energetics on public roads. Bulk shipments may not be possible, resulting in manufacturing delays and employee safety concerns. In addition, commercial facilities in operation do not have capacity to treat all of ATK's energetic waste as it is generated. Therefore, it is likely that waste would be stored for longer periods of time while waiting for shipment. This markedly increases risk to facilities and personnel. Due to capacity limitations at commercial facilities and the limited ability to ship bulk energetic waste on public roads; this option is considered technically infeasible.

Develop a treatment process with add-on controls to reduce emissions

Assuming the use of the current treatment technologies, treating energetic wastes using thermal treatment at the Promontory facility with add-on controls would require an overhaul in current manufacturing and handling procedures. Thermal treatment conducted in contained chambers requires the energetic material being treated to be of specific size and composition. In most processes at ATK, PEP is generated heterogeneously ranging from small amounts of PEP contamination to bulk propellant. Normalizing the waste stream would require employee handling to sort material. Furthermore, some materials would need to be reduced into quantities acceptable for treatment. Both would be labor intensive and significantly increase employee exposure compared to bulk open burning.

Due to the composition of energetic compounds produced at ATK, the requirement for air pollution control (APC) devices would be much greater than a typical incinerator or combustion chamber. APC devices would require the capability to treat combustion products generated from combusting metals, oxidizers, polymers and plastics. The heterogenic nature of the material makes it difficult to design controls effective for all pollutants.

Due to the nature of energetic compounds, there is a portion of wastes that could not be combusted in a closed chamber because of the explosive potential, and would require treatment by open burning or open detonation.

There are no known technologies available capable of treating the diversity of waste generated at the facility with sufficient throughput. The technology would need to be developed from operations that most resemble those at ATK. This option may not be technically feasible to treat all wastes generated at the facility.

Enhanced waste minimization efforts

A task force charged to minimize the amount of energetic waste generated and to find alternative paths to disposal could reduce the overall amount of waste that needs to be thermally treated. The task force would be required to develop appropriate, alternative technologies for particular waste streams that present low risk to employee safety and facilities. The effort could potential reduce energetic waste open burning by approximately 20%.

Economic Feasibility:

An economic feasibility study was conducted for the remaining feasible technologies of add on controls and waste minimization (Jason Wells, 2017).

Developing a treatment process with add-on controls to reduce emissions would cost $40,000,000 with an annualized cost of $3,000,000. It would reduce $PM_{2.5}$ emissions by 29.5 tpy and NO_x emissions by 2.9 tpy at a cost of $93,458 per ton. This process would not be economically feasible.

Uncertainty associated with developing these costs includes the potential for facility, manufacturing and process change requirements. These variables present a high level of uncertainty, and could prevent or delay full implementation. Costs for this option are based on combustion chambers built for other facilities in the country. In general, the facilities have steady, predictable waste streams. An additional 20% was added to the capital cost to account for uncertainty in developing an appropriate process. This process would not be economically feasible.

Initiating a waste minimization task force would require an expected annual investment of $200,000. The cost would cover development initiatives required to remove targeted waste streams from OBOD. However, only 20% of the energetic waste generated would be compatible with alternative processing without introducing increased risk to employee safety and facilities. This process would not be economically feasible at $31,000 per ton of material removed.

BACT Selection:

There are no available, feasible controls for open burning energetic waste at the Promontory site and there have been no new major developments in technologies. Therefore, the current operation meets BACT for emissions from open burning.

Implementation Schedule:

There is no implementation schedule for open burning of energetic waste.

Startup/Shutdown Considerations

There are no startup/shutdown operations to be considered for these sources.

2.1.2 Controls for Testing Energetic Material

Description:

These categories are associated with OBOD, rocket motor testing, and testing associated with production of propellants, explosives, and pyrotechnics (PEP). The PEP's are used in the nation's defense and space programs. Manufacturing, testing and waste disposal processes create safety challenges unique to this industry; employee safety is the prime concern. Manufacturing processes include extraordinary measures to minimize employee exposures to hazardous materials, and to reduce safety and reliability risks. Process change is regulated by ATK, NASA and the Department of Defense (DOD) safety requirements. Currently the emissions from these activities are controlled by open burning during favorable atmospheric conditions. These include weather and the atmospheric stability class restrictions. Materials cannot be tested when there are storms or high wind conditions. Static testing is prevented when the stability class is a Class E or F.

Pollutant [$PM_{2.5}$, NO_x, SO_2, VOC and NH_3]

Control Options:

Develop a new rocket motor testing site outside the SLCNAA
Test rocket motors at an existing facility located outside the SLCNAA
Provide add-on controls at the present location for rocket motor testing
Provide add-on controls for production testing

Develop a new rocket motor testing site outside the SLCNAA.

Moving rocket motor testing to a facility developed by ATK outside the non-attainment area was evaluated. Costs for the hypothetical facility were based on purchasing 1280 acres in a remote area of Box Elder County. Site requirements include access roads, security, electrical power, water service and buildings. Site development would also be subject to completing New Source Review, Approval Order and possibly Title V Operating Permit requirements.

The ATK Promontory facility has a long history of static testing large rocket motors for both the National Aeronautics and Space Administration (NASA) and the DOD. The existing location has unique large motor testing capabilities that are not available at other locations in the United States. The current site is a national asset, and plays a vital role in developing and testing launch vehicles for both space exploration and national defense

Test rocket motors at an existing facility located outside the SLCNAA.

There are no existing facilities with the required capabilities to test large motors (100,000 to 1,400,000 lbs propellant) outside the SLCNAA. Therefore, a facility would need to be designed and constructed to meet testing requirements for large motors. In addition, there are limited facilities in the nation that can test medium size motors (10,000 to 100,000 lbs propellant). In most cases, those facilities are government owned and at capacity to fulfill the operating agency's needs. Other existing facilities are privately owned by competing manufacturers. The ATK test facility is an asset to provide testing for government customers as well as protect intellectual property.

Prove add-on controls at the present location for rocket motor testing.

No add-on controls exist for rocket motor sizes tested at the ATK facility.

Production testing with add-on controls

There are no readily available, proven add-on controls for capturing emissions from small-scale production testing

Technological Feasibility:

A Technical Feasibility study was conducted for the technologies of Relocating the OBOD facility, Transporting Waste, add on controls and waste minimization for energetic material (Jason Wells, 2017), (Kris H. Blauer, 2018).

Develop a new rocket motor testing site outside the SLCNAA.

To offer the same capacity as the current test facility, a new facility would need to have three rocket motor test stands and four production test facilities constructed. The implementation schedule to build the new test facility would be impractical. In addition, obtaining environmental permits for this facility could delay and possibly prohibit implementation altogether. An estimated implementation date of no earlier than 2027 is likely. Due to the combination of permitting and technical challenges, this option is technically infeasible.

Test rocket motors at an existing facility located outside the SLCNAA.

The existing location has been developed by NASA and the DOD, and has unique test capabilities for large motors that are not available at other locations in the United States. The site is a national asset, and plays a vital role developing heavy lift vehicles for both space exploration and national defense. There are no existing facilities with the required capabilities to test large motors outside the SLCNAA. The lack of existing facilities that can provide the same functionality as the current facility makes this option technically infeasible.

Prove add-on controls at the present location for rocket motor testing.

There are no existing add-on controls for rocket motor testing. An EPA study used to develop the National Emission Standards for Hazardous Air Pollutants: Test Cells/Stands concluded there is no viable emission control device for rocket motor tests. Refer to the Federal Register/Vol.67, No. 93/Tuesday, May 14, 2002/ Proposed Rules; page 34557. "A number of characteristics of the exhaust from rocket engine testing (extremely high temperatures, extremely high volumetric flow rates, and very short test durations) and the infrequent timing of testing raise a number of unique problems that must be resolved for an emission control device to be considered a viable option for reducing HAP emissions from test cells/stands used for testing rocket engines. Consequently, we could identify no candidate BACT technologies for analysis. Without a viable emission control device, we are unable to estimate the potential costs associated with it use. Similarly, we are unable to estimate the potential reduction in HAP emissions which might result from the use of such a device.

Thus, we concluded that BACT for existing sources is the BACT floor. Consequently, BACT for existing test cells/stands used for testing rocket engines is no reduction in HAP emissions."

Since the NESHAP evaluation in 2002, the status of add-on controls for test facilities for rocket motor testing has not changed. Therefore, this option is technically infeasible.

Production testing with add-on controls

Although production testing is typically done with small PEP quantities compared to full-scale tests, the testing is conducted in specific facilities with unimpeded ventilation.

Introducing add-on controls to the ventilation system introduces risks to the facility and personnel due to the exhaust rate needed to prevent back-pressure. This risk makes the option technically infeasible.

Economic Feasibility:

No controls have been found that are technically feasible, therefore an economic feasibility study was not conducted.

BACT Selection:

There are no available, feasible controls for testing energetic material at the Promontory site. Therefore, the current operation meets BACT for emissions from energetic material testing.

Implementation Schedule:

There is no implementation schedule for testing.

Startup/Shutdown Considerations

There are no startup/shutdown operations to be considered for these sources.

2.1.3 Controls for Process Dust Collection

Description:

Currently, most process dust emissions are collected by fabric filter. In some cases, wet scrubbers are used to alleviate the risk of fire when strong oxidizing materials are involved. Two infrequently used cutting processes are controlled by single or tandem cyclones.

Pollutant [$PM_{2.5}$, NO_x, SO_2, VOC and NH_3]

Control Options:

Control technologies for particulate control include
Enhanced Fabric Filter
Cyclones
Scrubbers

A fabric filter with an enhanced membrane layer should be feasible in operations where dust loading is not a concern. The enhanced fabric filter will be evaluated for dust collectors with the highest estimated $PM_{2.5}$ emissions.

Wet scrubbers are used where strong oxidizing chemicals are processed. Wet scrubbers reduce the flammability risk compared to fabric filtration. Wet scrubbers used in these processes are approximately 90% efficient in removing fine particulate.

Stand-alone cyclones (not combined with fabric filter) are used in two operations. In both cases the process generates shavings that are effectively removed by the cyclone.

Technological Feasibility:

A fabric filter with an enhanced membrane layer should be feasible in operations where dust loading is not a concern. The enhanced fabric filter will be evaluated for dust collectors with the highest estimated $PM_{2.5}$ emissions.

Wet scrubbers are only implemented in areas where fabric filtration is not suitable. Otherwise, wet scrubbers are not considered a best available control for normal process dust.

Cyclones are not a best available control for most dust collection processes at the facility.

Economic Feasibility:

Enhanced fabric filtration is a technically feasible control that could potentially remove more $PM_{2.5}$ in processes where loading is not a limitation. An economic analysis was conducted to evaluate cost for using the control on dust collection systems that are responsible for most of the facility's direct $PM_{2.5}$ emissions.

The analysis is based on replacing 24 filter bags in each of four dust collectors used to control carbon fiber dust (M005-DC-01, M005-DC-02, M113-DC-01, and M113-DC-02). Annual emissions were estimated from PM_{10} values recorded in the 2014 air emission inventory. The replacement filter bags include a nanofiber membrane that would increase $PM_{2.5}$ filtration efficiency by approximately 25% (based on minimum efficiency rating value). The increased filtration efficiency would reduce direct $PM_{2.5}$ emissions by a total of 0.6 tons/year from the four dust collectors. The cost to install upgraded filters would be an estimated $3,120/dust collector. Fabric filters with a nanofiber membrane typically cost 30% more than standard filters. The total increase in cost to replace the filters annually is $2,880. The control is economically feasible as long as dust loading does not require more frequent filter changes.

BACT Selection:

Water sprays and enclosures are used to minimize particulate emissions from the slag concentrator, which were demonstrated to be very effective. The use of water sprays and enclosures to minimize particulate emissions represent the most stringent measure from the slag concentrator.

Replacing filter bags on the four dust collectors used to control carbon fiber dust (M005-DC-01, M005-DC-02, M113-DC-01, and M113-DC-02) (Kris H. Blauer, 2018).

Implementation Schedule:

The dust collectors will be replaced by December 1, 2019.

Startup/Shutdown Considerations

There are no startup/shutdown operations to be considered for these sources.

2.1.4 Upgrade Largest Boilers with NO_x Controls

The facility currently operates thirty eight (38) boilers at various locations on the 20,000 acre facility. Nineteen (19) boilers are located in the main manufacturing areas and operate on natural gas. Nineteen (19) boilers, located in remote locations where natural gas is not available, burn fuel oil. The four largest natural gas boilers were evaluated. One of the boilers is 71 MMBTU/hr input heat rating and is already controlled to a 9 ppm NO_x emission rate that meets BACT. A second 71 MMBTU/hr boiler is used in a backup capacity and is restricted to a 100,000 MCF rolling 12 month natural gas limit. Two other boilers are 25 MMBTU/hr and are uncontrolled for NO_x.

Pollutant [NO_x]

Control Options:

SCR
SNCR
FGR
LNB with good combustion practices
Good design and proper operation

Low NOx burner and Flue Gas Recirculation

This control technology is the most commonly used for boiler less than 100 MMBTU/hr heat input rating. It utilizes a specially designed burner that lowers combustion temperature to minimize NOx formation during combustion. In addition, a portion of flue gas is comingled with combustion air to reduce temperature and oxygen content.

Selective non-catalytic reduction (SNCR)

This control technology involves the injection of a NOx reducing agent, such as ammonia or urea, in the boiler exhaust gases at a temperature of approximately 1400-1600 °F. The ammonia or urea breaks down the NO_x in the exhaust gases into water and atmospheric nitrogen. Selective non-catalytic reduction technology is extremely difficult to apply to industrial boilers that modulate frequently. This is because the ammonia (or urea) must be injected in the flue gases at a specific flue gas temperature. In industrial boilers that modulate frequently, the location of the exhaust gases at the specified temperature is constantly changing. Thus, it is not technically feasible to apply selective non-catalytic reduction to industrial boilers that have high turndown capabilities and modulate frequently.

Selective catalytic reduction (SCR)

This control technology involves the injection of ammonia into the boiler exhaust gases with the presence of a catalyst. The catalyst allows the ammonia to reduce NOx levels at lower exhaust temperatures than selective non-catalytic reduction. For this technology the exhaust gases can be between 500°-1200 °F. Based on literature from the boiler manufacturer, this technology is typically not used for boilers with inputs less than 100 MMBTU/hr (Cleaver Brooks Boiler Emission Guide, November 2010, page 12). All boilers are below the 100 MMBTU/hr input rating.

Technological Feasibility:

Selective non-catalytic reduction (SNCR)

This control technology involves the injection of a NOx reducing agent, such as ammonia or urea, in the boiler exhaust gases at a temperature of approximately 1400-1600 °F. The ammonia or urea breaks down the NO_x in the exhaust gases into water and atmospheric nitrogen. Selective non-catalytic reduction technology is extremely difficult to apply to industrial boilers that modulate frequently. This is because the ammonia (or urea) must be injected in the flue gases at a specific flue gas temperature. In industrial boilers that modulate frequently, the location of the exhaust gases at the specified temperature is constantly changing. Thus, it is not technically feasible to apply selective non-catalytic reduction to industrial boilers that have high turndown capabilities and modulate frequently.

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This control technology involves the injection of ammonia into the boiler exhaust gases with the presence of a catalyst. The catalyst allows the ammonia to reduce NO_x levels at lower exhaust temperatures than selective non-catalytic reduction. For this technology the exhaust gases can be between 500°-1200 °F. Based on literature from the boiler manufacturer, this technology is typically not used for boilers with inputs less than 100 MMBTU/hr (Cleaver Brooks Boiler Emission Guide, November 2010, page 12). All boilers are below the 100 MMBTU/hr input rating.

All remaining control technologies are technically feasible.

Economic Feasibility:

Replace 71 MMBTU/hr boiler with low NO_x burner and Flue Gas Recirculation

Upgrading the second 71 MMBTU/hr boiler in Building M-576 would cost an estimated $861,000 capital cost to implement and result in a NO_x reduction of 4.4797 tons per year. A 20 year depreciation rate was used to calculate the cost per ton of potential NO_x emissions reduced. The $9,638 cost per ton is not economically feasible.

Replace both 25 MMBTU/hr boiler burners with low NO_x burner and Flue Gas Recirculation

Upgrading both 25 MMBTU/hr boilers in Building M-14 would cost an estimated $233,000 capital cost per boiler to implement and result in a potential to emit NO_x reduction of 4.00 tons per year per boiler (Kris H. Blauer, 2018). A 20-year depreciation rate was used to calculate the cost per ton reduction. The $2,913 cost per ton is economically feasible.

BACT Selection:

Replace the boilers in buildings M-14 and M-576 with low NO_x burners and flue gas return that provide a NO_x emission rate of 9 ppm.

Implementation Schedule:

Nearly 1.5 million dollars in capital cost would be required to upgrade both 25 MMBTU/hr natural gas-fired boilers and the remaining 71 MMBTU/hr natural gas-fired boiler. The 71 MMBTU/hr boiler currently operates in a backup capacity.

Due to the requirements to operate at least one of the boilers in each building at a time, ATK can only replace one boiler at a time. ATK can replace one of the boilers by December 1, 2019.

Pollutant [$PM_{2.5}$, SO_2 and VOC]

Control Options:

Use of pipeline quality natural gas
Good combustion practices
Good design and proper operation

Good Combustion Practices
Several operations are listed in the U.S. EPA's RBLC database where good combustion practices (GCP) are the accepted technology for minimizing particulate emissions.

Particulate emissions are reduced by good combustion practices by keeping the burners maintained properly so that they continue to operate according to their design.

Use of Natural Gas Only as Fuel
Particulate emissions from combustion of natural gas are typically very low and generally lower than from combustion of other fuels such as diesel. ATK currently employs natural gas as fuel for control of particulate emissions from combustion sources at the facility.

Technological Feasibility:

All control technologies are technically feasible.

Economic Feasibility:

All control technologies are economically feasible.

BACT Selection:

Use of pipeline quality natural gas, good combustion practices, and good design and proper operation constitute BACT for the boilers.

Implementation Schedule:

Proper operations are already in place.

Startup/Shutdown Considerations

Flue Gas Recirculation (FGR), Low NO_x burners and good combustion practices will control emissions during startup/shutdown. Good combustion practices and proper operation of the boiler include good engineering design, adherence to operation and maintenance procedures, inspections, use of clean burning fuel, and burner optimization. Analysis.

2.1.5 Solvent Cleaning

Description:

Solvent degreasers are used to remove various contaminants from pieces of equipment. Solvent degreasing is the physical process of using an organic or inorganic solvent to remove tars, greases, fats, oils, waxes, or soil from metal, plastic, printed circuit boards, or other surfaces. This cleaning is typically done prior to such processes as painting, plating, heat treating, and machining, or as part of maintenance operations. The solvent containers can be horizontal or vertical. The solvent may be agitated. Agitation increases the cleaning efficiency of the solvent. Agitation can be used with pumping, compressed air, vertical motion, or ultrasonics.

Control Options:

- Carbon adsorption
- Refrigerated primary condensers
- Increased freeboard ratio
- Combination of covers
- Water covers
- Internal Draining Rack
- Spray hose/spray nozzle
- Reduced room drafts
- Selected operation and maintenance practices

BACT Selection:

Compliance with the requirements of R307-335 is considered BACT for solvent degreasers ("PM2.5 Serious SIP – BACT for Small Sources.," 2017).

2.1.6 Emergency Generators

Description:

ATK operates diesel-fueled, gasoline powered, and natural gas fired generators. As emergency generators, they are seldom used with periodic maintenance firing and occasional use with loss of power. Some larger generators are installed in stationary locations to handle critical operations. All stationary generators meet the applicable requirements for generators contained in EPA's NESHAP or NSPS, which is BACT for generators. These federal regulations address NO_x, organic emissions, and particulates.

Control Options:

Control Options for $PM_{2.5}$:
- Catalyzed Diesel Particulate Filter (CleanAIR Systems, 2009)
- Diesel Oxidation Catalyst (CS, 2009)
- Diesel Particulate Filter (CS, 2009)

Control Options for NO_x:
- Exhaust Gas Recirculation (CS, 2009)
- NO_x Adsorber Catalyst (CS, 2009)
- Selective Catalytic Reduction (CS, 2009)
- Turbocharging and aftercooling (US EPA, 1993)
- Engine Ignition Timing Retardation (US EPA, 1993)
- Modifying air-to-fuel ratio (US EPA, 1993)

Control Options for SO_2:
- Ultra-Low Sulfur Diesel Fuel (Bradley Nelson, 2010)

Control Options for VOC:

- Catalyzed Diesel Particulate Filter (CS, 2009)
- Diesel Oxidation Catalyst (CS, 2009)

BACT Selection:

Evaluation of Findings & Control Selection ("PM2.5 Serious SIP – BACT for Small Sources.," 2017):

Control Options for $PM_{2.5}$: The DAQ did not find any PM2.5 controls that were cost effective for controlling $PM_{2.5}$ emissions. Therefore, BACT for direct PM2.5 emissions is proper maintenance and operation of the emergency stationary diesel engine.

Control Options for NO_x: The installation of a new emergency stationary diesel engine subject to the newest requirements for stationary emergency engines as specified in 40 CFR 60 Subpart IIII could potentially be cost effective and feasible for this source category, depending on a site-by-site analysis. This is assuming an old engine that is not currently subject to 40 CFR 60 Subpart IIII. This control selection is not applicable to newer engines. In the absence of replacing an old engine with a new engine, the installation of exhaust gas recirculation technology on older engines could be cost effective and feasible, again depending on a site-by-site basis of actual cost to retrofit the stationary emergency diesel engine on site. This control selection is assuming an old engine that is not currently subject to 40 CFR 60 Subpart IIII.

Control Options for SO_2: The DAQ recommends the use of ultra-low sulfur diesel fuel as BACT for SO2 control.

Control Options for VOC: The DAQ did not find any VOC controls that were cost effective for controlling VOC emissions. Depending on the age of the engine and site-specific information, a diesel oxidation catalyst could be cost effective for controlling VOC emissions. However, the DAQ does not recommend a diesel oxidation catalyst as BACT for this source category due to the fact this control option is probably not cost effective. Therefore, the DAQ recommends proper maintenance and operation of the emergency stationary diesel engine as BACT for control of VOC emissions. A site-specific cost/ton removed could be derived for making a determination on the requirement of installing a diesel oxidation catalyst.

2.1.7 Small Boilers < 10 MMBTU/hr

Description:

Boilers (or process heaters) are used in a variety of industrial and commercial applications to produce steam or hot water. Examples of sources that operate boilers and process heaters include oil and gas sources, petroleum refineries, manufacturing plants, agricultural, and food processing plants, and commercial industries.

Boilers are designed in many different configurations and sizes depending on the fuel, required heat output, and emission controls. In general, boilers convert chemical energy in fuel into thermal energy. Boilers have combustion chambers, where the fuel is mixed with oxygen. Burners introduce fuel and air into the combustion chamber at the required velocity, turbulence, and concentration ("PM2.5 Serious SIP – BACT for Small Sources.," 2017).

Boilers can be fueled using a variety of fuel types, such natural gas, fuel oil, propane, biomass, or coal. Natural gas is the most common type of fuel for boilers. This BACT analysis was performed for boilers fueled by natural gas and dual fuel boilers (e.g. natural gas as primary fuel and diesel or fuel oil as backup fuel) with input ratings less than or equal to 10 MMBtu/hr.

<u>Control Options:</u>

The following control technologies were identified as available options for PM2.5 emissions from boilers with input ratings less than or equal to 10 MMBtu/hr.

- Good combustion practices
- Use of gaseous fuels
- Baghouses
- Cyclone
- Wet Scrubber
- Electrostatic Precipitators

The following control technologies were identified as available options for NO_x emissions from boilers with input ratings less than or equal to 10 MMBtu/hr.

- Good combustion practices
- Pre-combustion modifications (oven fire air, low excess air, air staging, etc.)
- Combustion controls
- FGR
- Low NOX burners
- Ultra-low NOX burners
- SCR
- SNCR

The following control technologies were identified as available options for SO_2 emissions from boilers with input ratings less than or equal to 10 MMBtu/hr.

- Good combustion practices
- Use of low sulfur fuels
- Wet Scrubbers

The following control technologies were identified as available options for VOC emissions from boilers with input ratings less than or equal to 10 MMBtu/hr.

- Good combustion practices
- Carbon Adsorption
- Thermal Oxidizers
- Catalytic Oxidizers

BACT Selection:

The economic feasibility analysis demonstrates that retrofit options and boiler replacements are generally not cost effective options for boilers under 5 MMBtu/hr. Retrofitting or replacing boilers between 5 and 10 MMBtu/hr could both be cost effective options depending on the boiler size, age, and hours of operation.

The estimated costs for low NO_x burner retrofits start at $8,454 per ton of NO_x removed and boiler replacements start at $13,542. Retrofitting or replacing existing low-NO_x boilers with ultra-low NO_x boilers also proved to be cost prohibitive. Retrofits costs start at $24,735 per ton of NO_x removed and replacement costs start at $46,173 ("PM2.5 Serious SIP – BACT for Small Sources.," 2017).

DAQ recommends the use of natural gas as primary fuel and good combustion practices as BACT for the existing boilers operating at major sources within the nonattainment area. Diesel or fuel oil may only be used as backup fuel or in areas where natural gas is not available. The sulfur content of any diesel or fuel oil burned shall not exceed 15 ppm by weight.

An evaluation to determine whether retrofitting or replacing boilers between 5 and 10 MMBtu/hr with low-NO_x or ultra-low NOx burners is economically feasible should be conducted on a case-by-case basis.

2.1.8 Miscellaneous Painting

Description:

BACT Analysis for Miscellaneous Painting
VOC emissions are controlled at the facility through VOC content limits and work practice standards. Most VOC emissions are fugitive emissions evolved from hand wiping during tooling and hardware preparation. As such, point source control is limited.

Control Options:

Paint booth with particulate filters
Use of low VOC paint
Work practice standards

Low VOC Paints and Solvents

Products manufactured at the facility are subject to strict specifications from NASA and Department of Defense requirements. Therefore, VOC content in paints and solvents used to produce products for those agencies are exempt in federal standards. VOC in paints and solvents used in other operations are regulated by state rules at the manufacturer level. Therefore, most non-exempt paints and solvents used at the facility are delivered as low-VOC content.

Work Practice Standards

Work practice standards are the most effective to control fugitive VOC emissions. Standards require containers to be closed unless adding or removing a VOC containing material. This effectively limits the amount of evaporation that can occur.

Technological Feasibility:

Because painting is conducted plant wide a specific paint booth with add-on control is not possible for miscellaneous painting operations (Jason Wells, 2017).

Using low VOC paints and solvents is technically feasible for non-exempt processes that occur at the facility.

Economic Feasibility:

All remaining controls are economically feasible.

BACT Selection:

Low VOC Paints and Solvents
Already implemented at the facility, no additional cost expected.

Work Practice Standards
Already implemented at the facility, no additional cost expected.

Implementation Schedule:

Proper operations and controls are already in place.

Startup/Shutdown Considerations

There are no startup/shutdown operations to be considered for these sources.

2.2 Consideration of Ammonia

Ammonia emissions at the ATK site is are from the combustion of natural gas, and the waste water treatment plant operations, and propellant reclamation. The unreacted ammonia can be treated as a $PM_{2.5}$ precursor.

Control Options:

Good combustion practices are the only control technology for minimizing NH_3 emissions from heaters. Control options for wastewater emissions and propellant reclamation are still under investigation.

Technological Feasibility:

Control technologies to minimize NH_3 emissions from heaters are technically feasible.

Economic Feasibility:

Control technologies to minimize NH_3 emissions from heaters are economically feasible.

BACT Selection:

The technology identified for controlling NH_3 emissions from the ovens and heaters is the use of pipeline quality natural gas and good combustion practices.

Implementation Schedule:

Proper operations are already in place.

Startup/Shutdown Considerations

There are no startup/shutdown operations to be considered for these sources.

3.0 Conclusion- Emissions Reduction through BACT implementation

One boiler operating in Building M-14 can be replaced with a boiler that has ULNB with FGR. This boiler will become operational by December 1, 2019. The reduction in PTE for NO_x emissions will be 4.0 tpy.

$PM_{2.5}$, SO_2 and VOCs are estimated to remain the same.

Replacement of 24 filter bags in each of four dust collectors used to control carbon fiber dust (M005-DC-01, M005-DC-02, M113-DC-01, and M113-DC-02). These filter replacements will become operational by December 1, 2019. The reduction in PTE for $PM_{2.5}$ emissions will be 0.60 tpy.

4.0 Implementation Schedule and Testing Requirements

The controls at the ATK site have already been implemented and the testing requirements are outlined in Section 5.0 below.

5.0 $PM_{2.5}$ SIP – ATK Promontory Specific Requirements

The ATK Promontory specific conditions in Section IX.H.12.a address those limitations and requirements that apply only to the ATK Promontory site in particular.

a. ATK Launch Systems Inc. – Promontory

i. During the period November 1 to February 28/29 on days when the 24-hour average $PM_{2.5}$ levels exceed 35 ug/m3at the nearest real-time monitoring station, the open burning of reactive wastes with properties identified in 40 CFR 261.23 (a) (6) (7) (8) will be limited to 50 percent of the treatment facility's Department of Solid and Hazardous Waste permitted daily limit. During this period, on days when open burning occurs, records will be maintained identifying the quantity burned and the $PM_{2.5}$ level at the nearest real-time monitoring station.

ii. During the period November 1 to February 28/29, on days when the 24-hour average $PM_{2.5}$ levels exceed 35 ug/m^3 at the nearest real-time monitoring station, the following shall not be tested:

A. Propellant, energetics, pyrotechnics, flares and other reactive compounds greater than 2,400 lbs. per day; or

B. Rocket motors less than 1,000,000 lbs. of propellant per motor subject to the following exception:

I. A single test of rocket motors less than 1,000,000 lbs. of propellant per motor is allowed on a day when the 24-hour average $PM_{2.5}$ level exceeds 35 ug/m^3 at the nearest real-time monitoring station provided notice is given to the Director of the Utah Air Quality Division. No additional tests of rocket motors less than 1,000,000 lbs. of propellant may be conducted during the inversion period until the 24-hour average $PM_{2.5}$ level has returned to a concentration below 35 ug/m^3 at the nearest real-time monitoring station.

C. During this period, records will be maintained identifying the size of the rocket motors tested and the 24-hour average $PM_{2.5}$ level at the nearest real-time monitoring station on days when motor testing occur.

iv. Natural Gas-Fired Boilers

A. Building M-576

I. One 71 MMBTU/hr boiler shall be upgraded with low NOx burners and flue gas recirculation by January 2016. The boiler shall be rated at a maximum of 9 ppm. The remaining boiler shall not consume more than 100,000 MCF of natural gas per rolling 12- month period unless upgraded so the NOx emission rate is no greater than 30 ppm.

II. Records shall be kept on site which indicate the date, and time of startup and shutdown.

B. Building M-14

I. One 25 MMBTU/hr boiler shall be upgraded with low NO_x burners and flue gas recirculation by December 2019. The boiler shall be rated at a maximum of 15 ppm.

6.0 References

Jason Wells. (2017, May 3). ATK Launch Systems, Inc. BACT Analysis.

Kris H. Blauer. (2018, March 22). Response to SIP BACT Analysis Comments.

PM2.5 Serious SIP – BACT for Small Sources. (2017, August 11). Utah DAQ Minor Source NSR.

NSR

Site Name: ATK Launch Systems Inc.
Owner: Orbital ATK Inc.

Contact: Jason Wells
P.O. Box 707
Brigham City, UT 84302

Description of Facility:

The Promontory facility is located in a rural area of Box Elder County approximately 24 miles northwest of Brigham City, Utah. The facility is a manufacturer of propellants, explosives, flares and related specialty products. $PM_{2.5}$ and precursor emissions at the facility are generated from the following sources: (1) boilers, (2) emergency generators and similar internal combustion engines, (3) operations using VOC compounds, (4) testing and (5) open burning.

The site contains 21 natural gas and 19 fuel oil fired boilers. Table 1 and Table 2 identify the facility's natural gas and fuel oil boilers, respectively. Fuel oil boilers use ultra-low sulfur (< 15 PPM) fuel, and are located in areas where natural gas is not available.

All emergency generators, engines and other mobile sources are listed in Table 3. Equipment identified on this list uses ultra-low sulfur fuel exclusively, and is maintained and operated in accordance with 40 CFR Part 60, Subpart IIII and 40 CFR Part 63, Subpart ZZZZ requirements.

VOC sources include paint booth operations, chemical process solvents, and miscellaneous cleaning operations. Other VOC emissions are associated with fuel consumption from boilers, mobile sources and engines.

Energetic materials are tested during the manufacturing process to verify reactivity characteristics. Completed products are also tested to verify performance standards are met. Direct $PM_{2.5}$ emissions and NOx are the most likely emissions contributed from energetic material testing. Test quantities range from 75 grams up to 1.4 million pounds.

Open burning is the method used to treat the majority of reactive waste produced at the site. The process is regulated by the Utah Division of Waste Management and Radiation Control through a Subpart X hazardous waste treatment permit. Permitted operations and treatment quantities are derived from the results of a human health risk assessment designed to evaluate potential impacts to nearby receptors. Air emissions related to open burning are direct $PM_{2.5}$, NOx, and VOC.

The site has 65 dust collection systems which control emissions from a variety of manufacturing operations. $PM_{2.5}$ emissions from these collection systems are generally low due to the effectiveness of newer filtration material to remove fine particulate.

Recent Permitting Actions:

Title V administrative amendment by source (Project #OPP0100090029)
4/05/2017

- Modification to incorporate changes resulting from the issuance of AO's DAQE-AN100090133-16 and DAQE-AN100090134-17.
- Added 93 hp generator to building M-340.
- Removed paint booth M-079-PB01 from Group 5 and replaced it with paint booth T-021B- PB01from Group 3.
- Reference to paint booth T-021B- PB01deleted from Group 3.
- Deleted M-079-DC01 Paint Sanding Dust Collector from Group 5.
- Deleted M-179-PB01 Paint Booth from Group 7.
- Deleted M-053-OV05 Bake Off Oven with Afterburner from Group 10.

Title V administrative amendment by source (Project #OPP0100090028)
11/08/2016

- Modification to incorporate changes resulting from the issuance of AO's DAQE-AN100090130-16 and DAQE-AN100090132-16.
- Added HCL Storage Tank Scrubber.
- Removed natural gas fired boiler (Bldg M-010, 8.37 MM Btu/hr).
- Added Cleaver Brooks boiler (12.55 MM Btu/hr, rating of 9 ppm for NOx).
- Added clarification that fuel sulfur requirements for some units are more stringent than R307-203-1(1).
- Added clarification that records for the M-705 Waste Water Treatment Facility shall be kept on a daily basis.
- Restructured monitoring and recordkeeping for the M-705 Waste Water Treatment Facility to agree with new AO.
- Added construction notification requirement for the HCL Scrubber approved for the M-705 Waste Water Treatment Facility.
- Added 0.0015 fuel sulfur weight percent requirement for All Natural Gas and Diesel Fired Boilers.
- Removed construction notification requirement for the Cleaver Brooks burner onto the Wickes boiler in Building M-576.

- Removed GHG requirement from Reviewer Comments.

Title V significant modification (Project #OPP0100090025)
04/14/2016

- Modification to incorporate changes resulting from the issuance of AO's DAQE-AN100090126-15 and DAQE-AN100090127-15.
- Add Propane-Fired Burn-Off Oven to Group 10.
- Replaced the burner on one of the M-576 Wickes Boilers. The new burner is a Cleaver Brooks rated for 9 ppm NOx.
- Updating boiler requirements for 40 CFR Part 63, Subpart DDDDD.

Title V renewal application (Project #OPP0100090024)
06/10/2015

- Renewal.
- Addition of 40 CFR Part 63, Subpart DDDDD requirements for boilers.
- Addition of R307-335-4 requirements for degreasers.

Title V administrative amendment - enhanced AO (Project #OPP0100090023)
07/3/2014

- Modification to incorporate changes resulting from the issuance of AO's DAQE-AN100090124-14 and DAQE-AN100090125-14.
- Remove KOSMO Test Site from the Title V permit per issuance of DAQE-AN100090124-14
- Replace dust collector M-174-DC02 with Wet Scrubber M-174 per issuance of DAQE-AN100090125-14.
- Update RICE requirements.
- Reorganization of permit requirements and edits requested by source to represent current operations.

Title V administrative amendment - enhanced AO (Project #OPP0100090022)
09/30/2013

- Modification to incorporate changes resulting from the issuance of AO's DAQE-AN100090123-13 and DAQE-AN100090122-13.
- Relocate 3.35 MMBTU boiler from Bldg M-338 to Bldg T-021A.
- Relocate 2.51 MMBTU boiler from Bldg T-021A to Bldg M-338.
- Remove two 13.6 MM BTU Boilers from M-113

Existing PTE / Allowable Emissions (tons/yr)

Table 1 shows the current potential to emit (PTE) values for the facility. The values are the sum of PTE issued in the approval orders listed in Table 2.

TABLE 1. Potential to Emit (tons/year)

PM_{10}	$PM_{2.5}$	SO_2	NOx	VOC	CO	NH_3	Chlorine	HCl	Other HAPs	CO2e
600.9	32.18	8.63	165.02	203.34	132.50	11.35	76.80	571.66	113.81	85,148.95

TABLE 2. Current Approval Orders

Approval Order	**Approval Order**	**AO Date**
Waste water treatment plant E-541 & M422	DAQE-802-94	22-Sep-94
M-705 Water Treatment Facility	DAQE-AN100090130-16	5-Oct-16
Safety Clean Degreasers	DAQE-389-96	12-Apr-96
Produce Various energetic materials in M-590 For Explosive manufacturing	DAQE-012-00	5-Jan-00
Natural gas & oil fired boilers	DAQE-AN100090132-16	5-Oct-16
Shuttle rocket motor testing	AN0009105-05	1-Aug-05
Emergency Generators	DAQE-AN100090133-16	19-Dec-16
T-75 and other testing operations except Large Motor	DAQE-AN100090124-14	14-Mar-14
Main Plant -- Groups 1-10 and S503 Burn-off oven	DAQE-AN100090126-15	14-Oct-15

Emissions Information / Discussion

2014 has been designated the baseline year for actual emissions from the facility. A summary of 2014 emissions, as reported in the Air Emission Inventory submission, is shown in Table 3.

TABLE 3. 2014 Emissions Summary (tons)

PM_{10}	$PM_{2.5}$	SOx	NOx	VOC	CO	NH_3	Chlorine	HCl	Other HAPs
45.88	19.13	1.86	51.02	31.18	117.18	0.44	0.26	4.7	6.9

The 2014 emissions inventory is a reasonable baseline for continuous emissions from the facility. PM and HCl values can be impacted by static testing depending on the number of tests conducted in a given year. PM and HCl evolved from static testing are unique emissions from a unique process.

Evaluation of Best Available Control Technology

ATK's BACT evaluation focuses on the following permitted sources with direct $PM_{2.5}$ and $PM_{2.5}$ precursor emissions (SOx, NOx, and VOC):

- Testing and open burning of energetic materials
- Boiler operations
- Emergency generators
- Coating and cleaning operations

Controls for emissions not related to direct $PM_{2.5}$ or precursors were not evaluated. The BACT evaluation is broken down into possible control technologies to remove $PM_{2.5}$ or precursor emissions from the aforementioned sources. In many cases, available controls are already required by existing permit requirements or federal standards.

BACT Evaluation for $PM_{2.5}$ Emissions

Option 1: Controls for Open Burning Energetic Waste

Description

As a manufacturer of propellants, explosives and pyrotechnics (PEP), ATK Launch Systems plays a vital role in supporting the nation's defense and space programs. Waste disposal processes create safety challenges unique to this industry; where employee safety is the prime concern. Minimizing employee exposure to PEP materials is a core safety philosophy. This philosophy is carried out by limiting the amount of PEP waste stored for extended periods of time. Open burning energetic waste limits quantities onsite and ensures reduced exposure to employees.

ATK Launch Systems completed an open burning risk assessment under the direction of the Division of Waste Management and Radiation Control (DWMRC) to satisfy requirements for a treatment permit under 40 CFR Part 264, Subpart X. Open burning limits are the direct result of the risk assessment process to protect human health and the environment.

Identify Control Technologies for Open Burning Energetic Waste

Table 4 lists possible control technologies compatible with open burning energetic waste.

TABLE 4 Control Technologies for Open Burning Energetic Waste

No.	Control Technology	Pollutant Controlled
1	Relocate the OBOD facility outside the Salt Lake City Non-attainment Area (SLCNAA)	PM_{10}, $PM_{2.5}$, NOx, NH_3 VOC
2	Transport waste to a commercial disposal facility outside the SLCNAA	PM_{10}, $PM_{2.5}$, NOx, NH_3 VOC
3	Develop a treatment process with add-on controls to reduce emissions	PM_{10}, $PM_{2.5}$, NOx, NH_3 VOC
4	Enhanced waste minimization efforts	PM_{10}, $PM_{2.5}$, NOx, NH_3 VOC

1. Relocate the OBOD facility outside the SLCNAA.

   Transporting waste to a facility developed by ATK outside the non-attainment area was evaluated. Costs for the hypothetical facility were based on purchasing 640 acres in a remote area of Box Elder County. The site requirements include access roads, security, electrical power service, water service and buildings. ATK would need to complete both the Division of Air Quality and the Division of Solid and Hazardous Waste permitting processes prior to construction of the facility.

2. Transport waste to a commercial disposal facility outside the SLCNAA.

   Transporting waste to a commercial disposal facility outside the SLCNAA was evaluated to reduce emissions. A limited number of facilities are available in the country to accept energetic wastes. However, the facilities that can receive the type of waste generated at ATK Launch Systems do not have enough capacity to treat all of the material.

3. Develop a treatment process with add-on controls to reduce emissions

   The option of developing a process to treat energetic compounds using a process with add-on controls to minimize emissions was evaluated. Types of energetic materials requiring disposal include bulk Class 1.1 and Class 1.3 propellants, flare illuminants, military-grade high-explosives and developmental energetic compounds. These energetic compounds may contain metal powders, oxidizers, and a variety of high explosive compounds.

   The Department of Defense (DOD) has developed the technology to deactivate military munitions which are appropriately sized to be treated in a controlled process using add-on controls. This process is also available commercially with limited capacity. The energetic compounds typical disposed using this option are manufactured articles containing limited quantities of energetic compounds which do not exceed the treatment process limits.

4. Enhanced waste minimization efforts

   ATK maintains a pollution prevention and waste minimization program to reduce open burning. Open burning has been reduced by implementing process changes, and by employee generated efforts to reduce the quantity of waste generated. Additional efforts to reduce open burning include process changes to reduce batch sizes to minimize scrap quantities, and to segregate waste by PEP contamination level.

Technical Feasibility

1. Relocate the OBOD facility outside the SLCNAA.

   Current manufacturing processes do not produce wastes meeting Department of Transportation (DOT) packaging weight and dimension requirements. Modifying manufacturing process to produce wastes meeting DOT packaging requirements potentially increases employee exposure and increases safety risks to employees. The DOT testing and approval process prevents obtaining approvals in a timely fashion which delays implementing the option. PEP wastes typically exit the manufacturing process prior to being finalized and are less stable than finalized product. Unstable and uncharacterized wastes can't be shipped and require disposal onsite. Shipping PEP wastes outside the SLNAA increases the quantity of waste PEP compounds transported on public roads, and potentially increases risks to the public. Obtaining environmental permits for this facility could delay and possibly prohibit implementation of this option. An implementation date of no earlier than 2023 is provided as an indicator that permitting could require a minimum of a decade from the start date. Due to the combination of permitting and technical challenges, this option is not technically feasible.

2. Transport waste to a commercial disposal facility outside the SLCNAA.

   The option to transport waste to commercial disposal facilities outside the non-attainment area was evaluated. Similar to transporting waste to an OBOD facility outside the SLCNAA, this option requires DOT approval to ship waste energetics on public roads. Bulk shipments may not be possible, resulting in manufacturing delays and employee safety concerns. In addition, commercial facilities in operation do not have capacity to treat all of ATK's energetic waste as it is generated. Therefore, it is likely that waste would be stored for longer periods of time while waiting for shipment. This markedly increases risk to facilities and personnel. Due to capacity limitations at commercial facilities and the limited ability to ship bulk energetic waste on public roads; this option is considered technically infeasible.

3. Develop a treatment process with add-on controls to reduce emissions

   Assuming the use of the current treatment technologies, treating energetic wastes using thermal treatment at the Promontory facility with add-on controls would require an overhaul in current manufacturing and handling procedures. Thermal treatment conducted in contained chambers requires the energetic material being treated to be of specific size and composition. In most processes at ATK, PEP is generated heterogeneously ranging from small amounts of PEP contamination to bulk propellant. Normalizing the waste stream would require employee handling to sort material. Furthermore, some materials would need to be reduced into quantities acceptable for treatment. Both would be labor intensive and significantly increase employee exposure compared to bulk open burning.

   Due to the composition of energetic compounds produced at ATK, the requirement for air pollution control (APC) devices would be much greater than a typical incinerator or combustion chamber. APC devices would require the capability to treat combustion products generated from combusting metals, oxidizers, polymers and plastics. The heterogenic nature of the material makes it difficult to design controls effective for all pollutants.

   Due to the nature of energetic compounds, there is a portion of wastes that could not be combusted in a closed chamber because of the explosive potential, and would require treatment by open burning or open detonation.

   There are no known technologies available capable of treating the diversity of waste generated at the facility with sufficient throughput. The technology would need to be developed from operations that most resemble those at ATK. This option may not be technically feasible to treat all wastes generated at the facility.

4. Enhanced waste minimization efforts

   A task force charged to minimize the amount of energetic waste generated and to find alternative paths to disposal could reduce the overall amount of waste that needs to be thermally treated. The task force would be required to develop appropriate, alternative technologies for particular waste streams that present low risk to employee safety and facilities. The effort could potential reduce energetic waste open burning by approximately 20%.

Economic Feasibility of Remaining Controls

Table 5 lists remaining control technologies feasible for open burning energetic waste.

TABLE 5. Remaining Control Technologies for Open Burning Energetic Waste

No	Name of Control Technology	Total Capital Cost	Annualized Cost of Control	Annual Pollutant Removal**	Cost/Ton
1	Develop a treatment process with add-on controls to reduce emissions	$40,000,000	3,000,000*	29.2 tons $PM_{2.5}$ 2.9 tons NOx	$93,458
2	Enhanced waste minimization efforts	-	200,000	5.9 tons $PM_{2.5}$ 0.58 tons NOx	$30,864

* 20 year lifecycle + 50% O&M per year
** Assumes 1,000,000 lbs PEP burned per year

1. Develop a treatment process with add-on controls to reduce emissions

   Uncertainty associated with developing these costs includes the potential for facility, manufacturing and process change requirements. These variables present a high level of uncertainty, and could prevent or delay full implementation.

   Costs for this option are based on combustion chambers built for other facilities in the country. In general, the facilities have steady, predictable waste streams. An additional 20% was added to the capital cost to account for uncertainty in developing an appropriate process.

   Due to uncertainty in developing an effective and reliable process, the overall capital cost and annual cost/ton for pollutant removal is unreasonable. In addition, due to development time and funding cycles, it would be at least five years before the project could be fully implemented.

2. Enhanced Waste minimization

   Initiating a waste minimization task force would require an expected annual investment of $200,000. The cost would cover development initiatives required to remove targeted waste streams from OBOD. However, only 20% of the energetic waste generated would be compatible with alternative processing without introducing increased risk to employee safety and facilities. The nearly $31,000/ton pollutant removal is unreasonable for the limited benefit.

Option 2: Controls for Testing Energetic Material

Description

There currently are no control technologies for $PM_{2.5}$ emissions or precursors generated during testing of propellants, energetic or pyrotechnics.

Identify Control Technologies for Testing Energetic Material

Table 6 lists possible control technologies compatible with energetic material testing.

TABLE 6. Control Technologies for Testing Energetic Material

No.	Control Technology	Pollutant Controlled
1	Develop a new rocket motor testing site outside the SLCNAA	PM_{10}, $PM_{2.5}$, NOx, NH_3 VOC
2	Test rocket motors at an existing facility located outside the SLCNAA	PM_{10}, $PM_{2.5}$, NOx, NH_3 VOC
3	Provide add-on controls at the present location for rocket motor testing	PM_{10}, $PM_{2.5}$, NOx, NH_3 VOC
4	Provide add-on controls for production testing	PM_{10}, $PM_{2.5}$, NOx, NH_3 VOC

1. Develop a new rocket motor testing site outside the SLCNAA.

   Moving rocket motor testing to a facility developed by ATK outside the non-attainment area was evaluated. Costs for the hypothetical facility were based on purchasing 1280 acres in a remote area of Box Elder County. Site requirements include access roads, security, electrical power, water service and buildings. Site development would also be subject to completing New Source Review, Approval Order and possibly Title V Operating Permit requirements.

   The ATK Promontory facility has a long history of static testing large rocket motors for both the National Aeronautics and Space Administration (NASA) and the DOD. The existing location has unique large motor testing capabilities that are not available at other locations in the United States. The site is a national asset, and plays a vital role in developing and testing launch vehicles for both space exploration and national defense

2. Test rocket motors at an existing facility located outside the SLCNAA.

   There are no existing facilities with the required capabilities to test large motors (100,000 to 1,400,000 lbs propellant) outside the SLCNAA. Therefore, a facility would need to be designed and constructed to meet testing requirements for large motors. In addition, there are limited facilities in the nation that can test medium size motors (10,000 to 100,000 lbs propellant). In most cases, those facilities are government owned and at capacity to fulfill the operating agency's needs. Other existing facilities are privately owned by competing manufacturers. The ATK test facility is an asset to provide testing for government customers as well as protect intellectual property.

3. Prove add-on controls at the present location for rocket motor testing.

   No add-on controls exist for rocket motor sizes tested at the ATK facility.

4. Production testing with add-on controls

   There are no readily available, proven add-on controls for capturing emissions from small-scale production testing

Technical Feasibility

1. Develop a new rocket motor testing site outside the SLCNAA.

   To offer the same capacity as the current test facility, a new facility would need to have three rocket motor test stands and four production test facilities constructed. The implementation schedule to build the new test facility would be impractical. In addition, obtaining environmental permits for this facility could delay and possibly prohibit implementation altogether. An estimated implementation date of no earlier than 2027 is likely. Due to the combination of permitting and technical challenges, this option is technically infeasible.

2. Test rocket motors at an existing facility located outside the SLCNAA.

   The existing location has been developed by NASA and the DOD, and has unique test capabilities for large motors that are not available at other locations in the United States. The site is a national asset, and plays a vital role developing heavy lift vehicles for both space exploration and national defense. There are no existing facilities with the required capabilities to test large motors outside the SLCNAA. The lack of existing facilities that can provide the same functionality as the current facility makes this option technically infeasible.

3. Prove add-on controls at the present location for rocket motor testing.

   There are no existing add-on controls for rocket motor testing. An EPA study used to develop the *National Emission Standards for Hazardous Air Pollutants: Test Cells/Stands* concluded there is no viable emission control device for rocket motor tests. Refer to the Federal Register/Vol.67, No. 93/Tuesday, May 14, 2002/ Proposed Rules; page 34557.

   "A number of characteristics of the exhaust from rocket engine testing (extremely high temperatures, extremely high volumetric flow rates, and very short test durations) and the infrequent timing of testing raise a number of unique problems that must be resolved for an emission control device to be considered a viable option for reducing HAP emissions from test cells/stands used for testing rocket engines. Consequently, we could identify no candidate MACT technologies for analysis. Without a viable emission control device, we are unable to estimate the potential costs associated with it use. Similarly, we are unable to estimate the potential reduction in HAP emissions which might result from the use of such a device.

   Thus, we concluded that MACT for existing sources is the MACT floor. Consequently, MACT for existing test cells/stands used for testing rocket engines is no reduction in HAP emissions."

   Since the NESHAP evaluation in 2002, the status of add-on controls for test facilities for rocket motor testing has not changed. Therefore, this option is technically infeasible.

4. Production testing with add-on controls

   Although production testing is typically done with small PEP quantities compared to full-scale tests, the testing is conducted in specific facilities with unimpeded ventilation.

Introducing add-on controls to the ventilation system introduces risks to the facility and personnel due to the exhaust rate needed to prevent back-pressure. This risk makes the option technically infeasible.

Economic Feasibility of Remaining Controls

No controls have been found that are technically feasible.

Option 3: Controls for Process Dust Collection

Description

Currently, most process dust emissions are collected by fabric filter. In some cases, wet scrubbers are used to alleviate the risk of fire when strong oxidizing materials are involved. Two infrequently used cutting processes are controlled by single or tandem cyclones.

Identify Control Technologies for Process Dust Collection

Table 7 lists possible control technologies compatible with process dust collection.

TABLE 7. Control Technologies for Process Dust Collection

No.	Control Technology	Pollutant Controlled
1	Enhanced Fabric Filter	PM_{10}, $PM_{2.5}$
2	Wet Scrubber	PM_{10}, $PM_{2.5}$
3	Cyclone	PM_{10}, $PM_{2.5}$

1. Enhanced Fabric Filter

   Most process dust collection is performed with standard 80/20 cellulose, polyester blend filters. This type of filter has an approximately 70% efficiency on particulate in the 1-3 micron range. Enhanced fabric filters typically include an additional membrane layer to increase filtration efficiency for fine particulate. Nanofiber membranes or PTFE membranes can increase efficiency to 90-95%.

2. Wet Scrubber

   Wet scrubbers are used where strong oxidizing chemicals are processed. Wet scrubbers reduce the flammability risk compared to fabric filtration. Wet scrubbers used in these processes are approximately 90% efficient in removing fine particulate.

3. Cyclones

Stand-alone cyclones (not combined with fabric filter) are used in two operations. In both cases the process generates shavings that are effectively removed by the cyclone.

Technical Feasibility

1. Enhanced Fabric Filter

A fabric filter with an enhanced membrane layer should be feasible in operations where dust loading is not a concern. The enhanced fabric filter will be evaluated for dust collectors with the highest estimated $PM_{2.5}$ emissions.

2. Wet Scrubber

Wet scrubbers are only implemented in areas where fabric filtration is not suitable. Otherwise, wet scrubbers are not considered a best available control for normal process dust.

3. Cyclones

Cyclones are not a best available control for most dust collection processes at the facility

Economic Feasibility of Remaining Controls

1. Enhanced Fabric Filter

Enhanced fabric filtration is a technically feasible control that could potentially remove more $PM_{2.5}$ in processes where loading is not a limitation. An economic analysis was conducted to evaluate cost for using the control on dust collection systems that are responsible for most of the facility's direct $PM_{2.5}$ emissions. Results are shown in Table 7a. Calculations are shown in the Appendix.

TABLE 7a.	**Emission Reduction Cost per Ton**				
Pollutant	$PM_{2.5}$	SO_x	NO_x	NH_3	VOC
Quantity (tons)	0.6	N/A	N/A	N/A	N/A
Cost per ton	$4,800	N/A	N/A	N/A	N/A

The analysis is based on replacing 24 filter bags in each of four dust collectors used to control carbon fiber dust (M005-DC-01, M005-DC-02, M113-DC-01, and M113-DC-02). Annual emissions were estimated from PM_{10} values recorded in the 2014 air emission inventory. The replacement filter bags include a nanofiber membrane that would increase $PM_{2.5}$ filtration efficiency by approximately 25% (based on minimum efficiency rating value). The increased filtration efficiency would reduce direct $PM_{2.5}$ emissions by a total of 0.6 tons/year from the four dust collectors. The cost to install upgraded filters would be an estimated $3,120/dust collector. Fabric filters with a nanofiber membrane typically cost 30% more than standard filters. The total increase in cost to replace the filters annually is $2,880. The control is economically feasible as long as dust loading does not require more frequent filter changes.

Option 4: Natural Gas and Fuel Oil Combustion

Description

$PM_{2.5}$ is produced during incomplete combustion of natural gas and fuel oil. Emissions are greatly reduced when equipment is properly maintained to maximize combustion efficiency.

Identify Control Technologies for Natural Gas and Fuel Oil Combustion

Table 8 lists possible control technologies available for natural gas and fuel oil combustion.

TABLE 8. Control Technologies for Natural Gas and Fuel Oil Combustion

No.	Control Technology	Pollutant Controlled
1	Work Practice Standards	$PM_{2.5}$
2	Run-time limitations on RIC engines	$PM_{2.5}$, NOx, SOx

1. Work Practice Standards for boilers and generators

   40 CFR, Part 63, Subpart DDDDD, or Boiler MACT, requires a tune-up and inspection schedule for natural gas and fuel oil boilers to minimize poor combustion. The scheduled frequency is based on boiler heat input rating, with larger boilers checked more frequently.

   The Reciprocating and Internal Combustion Engine (RICE) rule requires maintenance and fuel checks on emergency backup generators and limits the number of hours generators can be used for non-emergency purposes. The combined effect of the rule is to reduce emissions through limits on fuel combustion and minimizing poor combustion.

2. Run-time limitations on RIC Engines

   Reciprocal and internal combustion engines are limited by Subpart ZZZZ and Subpart IIII to 100 hours/year for maintenance. In addition, all emergency backup generators at the facility are limited to a yearly fuel limit.

Technically Feasibility

1. Work Practice Standards for boilers and generators

   Technically feasible and supports preventative maintenance and energy conservation plans

2. Run-time limitations on RIC Engines

   Program is in place and is technically feasible

Economic Feasibility of Remaining Controls

1. Work Practice Standards for boilers and generators

   Adherence to work practice standards is an effective and technically feasible control for fine particulate emissions. An economic analysis was conducted to determine the cost of the control for each ton of fine particulate removed. Results are shown in Table 8a. Calculations are shown in the Appendix.

TABLE 8a.	Emission Reduction Cost per Ton				
Pollutant	$PM_{2.5}$	SO_x	NO_x	NH_3	VOC
Quantity (tons)	0.30	0.03	3.92	N/A	0.21
Cost per ton	ND	ND	$7,143	N/A	ND

Reduction estimated from difference between 80% and 70% combustion efficiency
ND, not determined because economically feasible for other pollutants

   The estimated emission reduction is based on the removal of pollutants by increasing boiler combustion efficiency by 10%. Greater combustion efficiency is achieved when boilers are properly tuned. Annual tuning for all boilers cost an average of $3,000 per year. Pollutant reduction for generators is generally less due to reduce run time, but proper maintenance and fuel quality contributes an average 15% additional pollutant removal. The annual cost to sample and analyze generator fuel is estimated at $3,600. Routine generator maintenance is estimated at $21,000/year to perform quarterly preventative maintenance checks. The work practice standards provide a modest reduction in $PM_{2.5}$ and precursor emissions.

2. Run-time limitations on RIC Engines

   No additional cost

BACT Evaluation SO_2 Emissions

Option 1: Ultra Low Sulfur Fuel in Boilers

Description

There are 17 fuel oil boilers at the site. All 17 boilers are smaller than 10 MMBTU/HR capacity, and were installed between 1960 and 2000. The boilers are located in remote areas where natural gas is not available. Ultra-low sulfur fuel is the only fuel oil used in the boilers.

Identify Control Technologies for SO_x Emissions from Boilers

Table 9 lists possible control technologies available for SO_x Emissions from Boilers.

TABLE 9. Control Technologies for Natural Gas and Fuel Oil Combustion

No.	Control Technology	Pollutant Controlled
1	Ultra-low Sulfur Fuel	SO_x

1. Ultra-low Sulfur Fuel in Boilers

   Ultra-low sulfur fuels are limited to 15 ppm sulfur content by weight. NSPS boilers are limited to a sulfur content of 0.5% by weight. As a result of using ultra-low sulfur fuel, SOx emissions are reduced by over 97%.

Technical Feasibility

1. Ultra-low Sulfur Fuel in Boilers

   The only fuel oil being delivered to the facility is ultra-low sulfur fuel. The option is technically feasible.

Economic Feasibility of Remaining Controls

1. Ultra-low Sulfur Fuel in Boilers

   The only fuel oil being delivered to the facility is ultra-low sulfur fuel. The option is economically feasible.

Option 2: Ultra-Low Sulfur Fuel in Engines, Mobile Sources and Fugitive Sources.

Description

The site contains a variety of engines, mobile sources and fugitive sources. The largest category of stationary engines is emergency generators which are operated for routine maintenance or during power outages only. Each emergency generator is typically operated less than 100 hours per year. Refer to Table 3 for a complete list. The last category on Table 3 is miscellaneous use of fuel oil for testing such as when it is used as part of a DOT classification test. All uses combined accounted for 1.06 tons of sulfur dioxide emissions in 2008.

Identify Control Technologies for SO_x Emissions from Engines, Mobile and Fugitive Sources

Table 10 lists possible control technologies available for natural gas and fuel oil combustion.

TABLE 10. Control Technologies for Natural Gas and Fuel Oil Combustion

No.	Control Technology	Pollutant Controlled
1	Ultra-low Sulfur Fuel	SO_x

1. Ultra-low Sulfur Fuel in Engines, Mobile and Fugitive Sources

   Ultra-low sulfur fuel has 97% lower sulfur content than low sulfur diesel used in non-road engines. Ultra-low sulfur fuels are required to be used by the RICE standard. In addition, ultra-low sulfur fuel is required to be used in tractors, construction equipment, etc. operated on the plant. Finally ultra-low sulfur diesel is the only approved diesel that can be used during test operations.

Technical Feasibility

1. Ultra-low Sulfur Fuel in Engines, Mobile and Fugitive Sources

   The only fuel oil being delivered to the facility is ultra-low sulfur fuel. The option is technically feasible.

Economic Feasibility of Remaining Controls

1. Ultra-low Sulfur Fuel in Engines, Mobile and Fugitive Sources

   The only fuel oil being delivered to the facility is ultra-low sulfur fuel. The option is economically feasible.

BACT Evaluation NO_x Emissions

Option 1: Upgrade Largest Boilers with NOx Controls

Description

The facility currently operates thirty eight (38) boilers at various locations on the 20,000 acre facility. Twenty one (21) boilers are located in the South Area and operate on natural gas. Seventeen (17) boilers, located in remote locations where natural gas is not available, burn fuel oil. The four largest natural gas boilers were evaluated. One of the boilers is 71 MMBTU/hr input heat rating and is already controlled to a 9 ppm NOx emission rate that meets BACT. A second 71 MMBTU/hr boiler is used in a backup capacity and is restricted to a 100,000 MCF rolling 12 month natural gas limit. Two other boilers are 25 MMBTU/hr and are uncontrolled for NOx. The cost estimates reported in this submission are preliminary, and are based on previous boiler upgrades. An engineering evaluation will be required for an accurate estimate.

Identify Control Technologies for NO_x Emissions from Largest Boilers

Table 11 lists possible control technologies available for natural gas and fuel oil combustion.

TABLE 11. Control Technologies for NOx Emissions from Largest Boilers

No.	Control Technology-Combustion Control	Pollutant Controlled
1	Replace burner with low NOx burner and Flue Gas Recirculation to achieve 9 ppm emission rate	NOx
2	Selective non-catalytic reduction	NOx
3	Selective catalytic reduction	NOx

1. Low NOx burner and Flue Gas Recirculation

   This control technology is the most commonly used for boiler less than 100 MMBTU/hr heat input rating. It utilizes a specially designed burner that lowers combustion temperature to minimize NOx formation during combustion. In addition, a portion of flue gas is comingled with combustion air to reduce temperature and oxygen content.

2. Selective non-catalytic reduction (SNCR)

   This control technology involves the injection of a NO_x reducing agent, such as ammonia or urea, in the boiler exhaust gases at a temperature of approximately 1400-1600 °F. The ammonia or urea breaks down the NO_x in the exhaust gases into water and atmospheric nitrogen. Selective non-catalytic reduction technology is extremely difficult to apply to industrial boilers that modulate frequently. This is because the ammonia (or urea) must be injected in the flue gases at a specific flue gas temperature. In industrial boilers that modulate frequently, the location of the exhaust gases at the specified temperature is constantly changing. Thus, it is not technically feasible to apply selective non-catalytic reduction to industrial boilers that have high turndown capabilities and modulate frequently.

3. Selective catalytic reduction (SCR)

This control technology involves the injection of ammonia into the boiler exhaust gases with the presence of a catalyst. The catalyst allows the ammonia to reduce NO_x levels at lower exhaust temperatures than selective non-catalytic reduction. For this technology the exhaust gases can be between 500°-1200 °F. Based on literature from the boiler manufacturer, this technology is typically not used for boilers with inputs less than 100 MMBTU/hr (Cleaver Brooks Boiler Emission Guide, November 2010, page 12). All boilers are below the 100 MMBTU/hr input rating.

Technical Feasibility

1. Low NOx burner and Flue Gas Recirculation

   Upgrading the boiler with a low NOx burner and flue gas recirculation are technically feasible. The achievable NOx emission rate is expected to be 9 ppm.

2. Selective non-catalytic reduction (SNCR)

   This control technology involves the injection of a NO_x reducing agent, such as ammonia or urea, in the boiler exhaust gases at a temperature of approximately 1400-1600 °F. The ammonia or urea breaks down the NO_x in the exhaust gases into water and atmospheric nitrogen. Selective non-catalytic reduction technology is extremely difficult to apply to industrial boilers that modulate frequently. This is because the ammonia (or urea) must be injected in the flue gases at a specific flue gas temperature. In industrial boilers that modulate frequently, the location of the exhaust gases at the specified temperature is constantly changing. Thus, it is not technically feasible to apply selective non-catalytic reduction to industrial boilers that have high turndown capabilities and modulate frequently.

3. Selective catalytic reduction (SCR)

   This control technology involves the injection of ammonia into the boiler exhaust gases with the presence of a catalyst. The catalyst allows the ammonia to reduce NO_x levels at lower exhaust temperatures than selective non-catalytic reduction. For this technology the exhaust gases can be between 500°-1200 °F. Based on literature from the boiler manufacturer, this technology is typically not used for boilers with inputs less than 100 MMBTU/hr (Cleaver Brooks Boiler Emission Guide, November 2010, page 12). All boilers are below the 100 MMBTU/hr input rating.

Economic Feasibility of Remaining Controls

1. Replace burner with low NOx burner and Flue Gas Recirculation

   All costs are based on a preliminary data, and additional time will be required to accurately evaluate costs and implementation dates. Estimate includes annual costs for equipment depreciation and maintenance. Depreciation is based on a 20-year period. Annual Maintenance costs are based on 1% of the initial purchase price. Operating and energy costs are not included.

TABLE 11a. Cost for Natural Gas Burner Upgrades

No	Name of Control Technology	Total Capital Cost	Annualized Cost (20 years)	Amount & Type of Pollutant controlled	Cost/Ton
1	Replace 71 MMBTU/hr boiler burner with low NOx burner and Flue Gas Recirculation to achieve 9 ppm emission rate	$900,000	$45,000	3 tons NO_x	$15,151
2	Replace both 25 MMBTU/hr boiler burners with low NOx burner and Flue Gas Recirculation to achieve 9 ppm emission rate	$800,000	$20,000	4.3 tons NOx	$9,346

1. Replace 71 MMBTU/hr boiler burner with low NOx burner and Flue Gas Recirculation

   Upgrading the second 71 MMBTU/hr boiler would cost an estimated $900,000 capital cost to implement and only result in a NOx reduction of 3 tons per year based on actual fuel use. A 20 year depreciation rate was used to calculate the cost per ton reduction. The $15,151 cost per ton is unreasonable for the limited NOx reduction and the required capital cost.

2. Replace both 25 MMBTU/hr boiler burners with low NOx burner and Flue Gas Recirculation

   Upgrading both 25 MMBTU/hr boilers would cost an estimated $400,000 capital cost per boiler. A 20-year depreciation rate was used to calculate the cost per ton reduction. The $9,300 cost per ton is unreasonable for the limited NOx reduction and the required initial capital cost.

BACT Evaluation VOC Emissions

Option 1: Control VOC from Paints and Solvents

Description

VOC emissions are controlled at the facility through VOC content limits and work practice standards. Most VOC emissions are fugitive emissions evolved from hand wiping during tooling and hardware preparation. As such, point source control is limited.

Identify Control Technologies for VOC Emissions from Paint and Solvent Sources

Table 12 lists possible control technologies available for natural gas and fuel oil combustion.

TABLE 12. Control Technologies for VOC Emissions from Paint and Solvents

No.	Control Technology	Pollutant Controlled
1	Low VOC Paints and Solvents	VOC
2	Work Practice Standards	VOC

1. Low VOC Paints and Solvents

   Products manufactured at the facility are subject to strict specifications from NASA and Department of Defense requirements. Therefore, VOC content in paints and solvents used to produce products for those agencies are exempt in federal standards. VOC in paints and solvents used in other operations are regulated by state rules at the manufacturer level. Therefore, most non-exempt paints and solvents used at the facility are delivered as low-VOC content.

2. Work Practice Standards

   Work practice standards are the most effective to control fugitive VOC emissions. Standards require containers to be closed unless adding or removing a VOC containing material. This effectively limits the amount of evaporation that can occur.

Technical Feasibility

1. Low VOC Paints and Solvents

   Using low VOC paints and solvents is technically feasible for non-exempt processes that occur at the facility.

2. Work Practice Standards

   Work practice standards for controlling fugitive VOC emissions are already implemented at the facility and are an effective control

Economic Feasibility of Remaining Controls

1. Low VOC Paints and Solvents

   Already implemented at the facility, no additional cost expected.

2. Work Practice Standards

   Already implemented at the facility, no additional cost expected.

Results of Analysis

The following was determined to represent BACT for this source.

BACT Results for $PM_{2.5}$ Emissions

Option 1: Controls for Open Burning Energetic Waste

There are no available, feasible controls for open burning energetic waste at the Promontory site. Therefore, the current operation meets BACT for $PM_{2.5}$ emissions from open burning.

Option 2: Controls for Testing Energetic Material

There are no available, feasible controls for testing energetic material at the Promontory site. Therefore, the current operation meets BACT for $PM_{2.5}$ emissions from energetic material testing.

Option 3: Controls for Process Dust Collection

Four dust collectors (two in building M5 and two in M113) with the highest 2014 PM2.5 emissions were evaluated to determine if enhanced fabric filters would reduce fine particulate emissions. Upgrading all four collectors to fabric filters with a nanofiber membrane could capture an additional 25% of fine particulate. The result is a 0.6 ton reduction based on 2014 air emission inventory values. The estimated cost is $6,240 per ton to achieve the additional removal. However, cost could increase markedly if particulate loading results in more frequent filter changes to keep the process operating. The uncertainty and relatively small additional removal over current controls fail to distinguish this option as BACT. Therefore, the current operation meets BACT for $PM_{2.5}$ emissions from process dust collection.

Option 4: Natural Gas and Fuel Oil Combustion

Work practice standards for boilers and run-time limitations for reciprocal and internal combustion engines are existing controls implemented to minimize fine particulate from the respective equipment. The controls come from federal standards designed to minimize hazardous air pollutants. Each is effective in maintaining good combustion practices when burning natural gas and fuel oil. Therefore, the existing controls meet BACT for $PM_{2.5}$ emissions from natural gas and fuel oil combustion.

BACT Evaluation SO_2 Emissions

Option 1: Ultra-Low Sulfur Fuel in Boilers

Ultra-low sulfur is the only fuel delivered to the facility. This option already meets BACT to control SOx emissions from boiler combustion.

Option 2: Ultra Low Sulfur Fuel in Engines, Mobile Sources and Fugitive Sources

Ultra-low sulfur is the only fuel delivered to the facility. This option already meets BACT to control SOx emissions from generator engines, mobile sources and other combustion sources.

BACT Evaluation NO_x Emissions

Option 1: Upgrade Largest Boilers with NOx Controls

Nearly two million dollars in capital cost would be required to remove approximately six tons of NOx from natural gas boilers between 25 MMBTU/hr and 71 MMBTU/hr input. The cost is unreasonable for minimum gain and since the 71 MMBTU/hr boiler operates in a backup capacity. The existing equipment meets BACT for NOx emissions from the largest natural gas boilers.

BACT Evaluation VOC Emissions

Option 1: Control VOC from Paints and Solvents

Most VOC emissions at the facility are fugitive emissions generated from a variety of manufacturing operations. The most effective control for these fugitive emissions are keeping chemical containers closed and properly managing waste. In addition, VOC content limits in products used at the facility limit emissions directly from the source. The combination of low-VOC content and work practice standards effectively minimize VOC emissions from manufacturing operations where point source control is limited. Therefore, this option is BACT to control VOC emissions.

Appendix I: Calculations

Table 5. Remaining Control Technologies for Open Burning Energetic Waste

Option 1: Develop a treatment process with add-on controls

Assumes add-on controls are 99% efficient in removing pollutants

$$29.5\,\frac{\text{tons PM2.5}}{\text{year}} - 0.3\,\frac{\text{tons PM2.5}}{\text{year}} = 29.2\,\frac{\text{tons PM2.5}}{\text{year}} \text{ reduced}$$

$$2.9\,\frac{\text{tons NOx}}{\text{year}} - 0.03\,\frac{\text{tons NOx}}{\text{year}} = 2.87\,\frac{\text{tons NOx}}{\text{year}} \text{ reduced}$$

Total PM2.5 and precursor reduced = 32.1 tons

Estimated capital cost of equipment based on Camp Minden burn unit designed for M6 propellant with ten percent uncertainty cost added.

$40,000,000

Assuming equipment is in operation for 20 years and operation and maintenance cost are 50% of the yearly depreciation, the annualize cost is:

$$\$40{,}000{,}000 \div 20 \text{ years } = \frac{\$2{,}000{,}000}{\text{year}} \times 1.50 = \$3{,}000{,}000$$

Therefore...

$$\frac{\$3{,}000{,}000}{32.1 \text{ tons PM2.5 and precursor reduced}} = \textbf{\$93,458/ton PM}_{\textbf{2.5}}\textbf{ and precursor reduced}$$

Option 2: Enhanced waste minimization efforts

$$29.5\,\frac{\text{tons PM2.5}}{\text{year}} \times 0.20 = 5.9\,\frac{\text{tons PM2.5}}{\text{year}} \text{ reduced}$$

$$2.9\,\frac{\text{tons NOx}}{\text{year}} \times 0.20 = \times\, 0.58\,\frac{\text{tons NOx}}{\text{year}} \text{ reduced}$$

Estimated annual cost to run the waste reduction effort is $200,000/year

Therefore...

$$\frac{\$200{,}000}{6.48 \text{ tons PM2.5 and precursors reduced}} = \textbf{\$30,864/ ton NOx reduced}$$

Table 7a. Enhanced Fabric Filter for Process Dust Collection

PM2.5 Emissions from carbon fiber machining at M5 and M113 are controlled by four dust collectors, two in each building. The total PM2.5 emissions estimated from the 2014 AEI are 2.4 tons. Upgrading to a fabric fiber filter with a nanofiber membrane could potentially increase filtration efficiency by 25% for PM2.5 particles.

$$\mathbf{2.4 \frac{\text{tons PM2.5}}{\text{year}} \times 0.25 = 0.6 \frac{\text{tons PM2.5}}{\text{year}}} \textbf{ reduced}$$

Assuming filters are changed once per year for each collector

$$24 \frac{filters}{collector}\ x\ 4\ collectors = 96\ filters$$

Cost for upgraded filter is estimated at $130.00/filter

$$96\ filters\ x \frac{\$130.00}{filter} = \$12{,}480$$

Cost for the standard filter is estimated at $100.00/filter

$$96\ filters\ x \frac{\$100.00}{filter} = \$9{,}600$$

Cost to upgrade to the enhanced filter is:

$$\$12{,}480 - \$9{,}600 = \$2{,}880$$

Therefore...

$$\frac{\$2{,}880}{0.6\ tons\ PM2.5\ \text{reduced}} = \textbf{\$4,800/ ton } \mathbf{PM_{2.5}} \textbf{ reduced}$$

Table 8a. Work Practice Standards for boilers and generators

Pollutant reduction values are based on a 10% reduction in emissions due to increased combustion efficiency. Emissions data comes from boiler and generator emissions provided in 2014 AEI. Cost per ton was based on the pollutant with the most reduction.

$$3.92 \; \frac{\text{tons NOx}}{\text{year}} \; \textbf{reduced}$$

Estimated cost to tune boilers annually is $3,000

Estimated annual fuel testing cost for generators is $4,000

Estimated annual routine maintenance for generators is $21,000

Therefore...

$$\frac{\$28{,}000}{3.92\ tons\ \text{NOx reduced}} = \textbf{\$7,143/ ton NOx reduced}$$

Table 11a. Replace burner with low NOx burner and Flue Gas Recirculation

M576 Backup Boiler (71 MMBTU/hr, 100,000 MCF natural gas limit, 70,000 MCF actual use):

<u>NOx Emissions from Uncontrolled Burner (based on NG limit)</u>

NOx: $\frac{\text{85 ppm NOx}}{850\dagger} = 0.1 \; \frac{\text{lbs NOx}}{\text{MMBTU}}$

† Factor from Clever Brooks *Boiler Emission Guide*, Appendix E, pg 34.

$$0.1 \; \frac{\text{lbs NOx}}{\text{MMBTU}} * 0.001 \; \frac{\text{MMBTU}}{\text{scf}} = \; 0.0001 \; \frac{\text{lbs NOx}}{\text{scf}}$$

$$0.0001 \; \frac{\text{lbs NOx}}{\text{scf}} * \; 70{,}000{,}000 \frac{\text{scf}}{\text{year}} = 7{,}000 \; \frac{\text{lbs NOx}}{\text{year}} * \frac{1 \text{ ton}}{2000 \text{ lbs}} = 3.5 \frac{\textbf{tons NOx}}{\textbf{year}}$$

<u>NOx Emissions from 9 ppm Rated Burner</u>

NOx: $\frac{\text{9 ppm NOx}}{850\dagger} = 0.0106 \; \frac{\text{lbs NOx}}{\text{MMBTU}}$

† Factor from Clever Brooks *Boiler Emission Guide*, Appendix E, pg 34.

$$0.0106\ \frac{\text{lbs NOx}}{\text{MMBTU}} * 0.001\ \frac{\text{MMBTU}}{\text{scf}} = 0.0000106\ \frac{\text{lbs NOx}}{\text{scf}}$$

$$0.0000106\ \frac{\text{lbs NOx}}{\text{scf}} * 100{,}000{,}000\ \frac{\text{scf}}{\text{year}} = 1{,}060\frac{\text{lbs NOx}}{\text{year}} * \frac{1\ \text{ton}}{2000\ \text{lbs}} = \mathbf{0.53}\frac{\textbf{tons NOx}}{\textbf{year}}$$

$$3.5\frac{\text{tons NOx}}{\text{year}} - 0.53\frac{\text{tons NOx}}{\text{year}} = \mathbf{2.97\ tons\ NOx\ \ reduced}$$

Annualized capital cost over 20 years:

$$\frac{\$900{,}000}{20\ years} = \mathbf{\$45{,}000/year}$$

Therefore...

$$\frac{\$45{,}000}{2.97\ \text{tons NOx reduced}} = \mathbf{\$15{,}151/\ ton\ NOx\ reduced}$$

M14 Boilers (fuel use from 2014 Air Emission Inventory). Calculation is result for one boiler:

<u>NOx Emissions from Uncontrolled Burner</u>

NOx: $\frac{85\ \text{ppm NOx}}{850\dagger} = 0.1\ \frac{\text{lbs NOx}}{\text{MMBTU}}$

† Factor from Clever Brooks *Boiler Emission Guide*, Appendix E, pg 34.

$$0.1\ \frac{\text{lbs NOx}}{\text{MMBTU}} * 0.001\ \frac{\text{MMBTU}}{\text{scf}} = 0.0001\ \frac{\text{lbs NOx}}{\text{scf}}$$

$$0.0001\ \frac{\text{lbs NOx}}{\text{scf}} * 48{,}250{,}000\frac{\text{scf}}{\text{year}} = 4{,}825\ \frac{\text{lbs NOx}}{\text{year}} * \frac{1\ \text{ton}}{2000\ \text{lbs}} = \mathbf{2.4}\frac{\textbf{tons NOx}}{\textbf{year}}$$

<u>NOx Emissions from 9 ppm Rated Burner</u>

NOx: $\frac{9\ \text{ppm NOx}}{850\dagger} = 0.0106\ \frac{\text{lbs NOx}}{\text{MMBTU}}$

† Factor from Clever Brooks *Boiler Emission Guide*, Appendix E, pg 34.

$$0.0106\ \frac{\text{lbs NOx}}{\text{MMBTU}} * 0.001\ \frac{\text{MMBTU}}{\text{scf}} = 0.0000106\ \frac{\text{lbs NOx}}{\text{scf}}$$

$$0.0000106\ \frac{\text{lbs NOx}}{\text{scf}} * 48{,}250{,}000\ \frac{\text{scf}}{\text{year}} = 511.45\frac{\text{lbs NOx}}{\text{year}} * \frac{1\ \text{ton}}{2000\ \text{lbs}} = \mathbf{0.26}\frac{\textbf{tons NOx}}{\textbf{year}}$$

$$2.4\frac{\text{tons NOx}}{\text{year}} - 0.26\frac{\text{tons NOx}}{\text{year}} = \mathbf{2.14\ tons\ NOx\ \ reduced}$$

Annualized capital cost over 20 years for one boiler:

$$\frac{\$400{,}000}{20\ years} = \mathbf{\$20{,}000/year}$$

Therefore...

$$\frac{\$20{,}000}{2.14\ \text{tons NOx reduced}} = \mathbf{\$9{,}346/\ ton\ NOx\ reduced}$$