CHASE NEDROW
INDUSTRIES

VERSION 1.2

ENGINEERED SOLUTIONS

for Thermal Processing Units

CUTTING-EDGE SOLUTIONS FOR A SUSTAINABLE FUTURE. | CHASENEDROW.COM

RFA RENEWABLE FUELS ASSOCIATION

Emisshield® CONSERVE ENERGY. ENHANCE PRODUCTION.

SPACE FOUNDATION CERTIFIED SPACE TECHNOLOGY

Growth Energy™

CHASE NEDROW
INDUSTRIES

Chase Nedrow Industries specializes in supplying refractory products, refractory special shapes, refractory installation services, and Emisshield High Emissivity Coatings. Our offices, warehouse, and manufacturing facilities are located in Wixom, Michigan, and South Bend Indiana. Our team has extensive experience in the refractory industry in a myriad of applications such as ethanol, power generation, steel, foundry, process boilers, kilns, biofuels, and heat treating.

Starting in 2015, Chase Nedrow partnered with Emisshield, Inc. the industry's leader in High Emissivity Coatings. Emisshield is a NASA-licensed, high emissivity coating technology that increases heat transfer and saves energy while increasing production in nearly all heat-driven industrial applications. Emisshield® Systems are ceramic nanoparticle materials with high emissivity and heat re-radiation capabilities extending over a wide temperature range up to 3100°F. As the exclusive Emisshield Strategic Partner licensed to install in the Ethanol Industry, we believe our partnership could bring you and your organization value throughout your facility in various applications.

Main Table of Contents

Why Chase Nedrow?

Our Vision

We envision a future where our focus on quality refractory products, seamless installation services, special refractory shapes, and in-depth high emissivity coating expertise converge to propel plants around the world to the peak of their industries while upholding our commitment to environmental stewardship through longer material lifespans, reduced emissions, and greater overall efficiency.

THE EMISSHIELD DIFFERENCE

BENEFITS

Developed By Nasa

Reduce Carbon Emissions

Production Increases

Protect Refractory and Steelwork

Energy Savings

Reduce Maintenance and Downtime

CHARACTERISTICS

Thermal Stability	Thermal Shock Resistance	Adhesion Strength
3100°F (1700°C)	-392°F to 2732°F	> 5,000 PSI

Hemispherical Emissivity	Applied Thickness
0.85 - 0.95	50 - 100 µ (2 - 4 mils)

NASA TECHNOLOGY AVAILABLE TO YOU NOW

As both a Space Certification Partner and a Space Technology Hall of Fame member, Emisshield continues to challenge the status quo across heat-driven industrial applications.

The high temperature and abrasive environments found in the Biofuel & Ethanol Industries provide numerous applications for Emisshield. Emisshield Coating Systems allow these industrial processes to maximize the working life of their insulative linings by enhancing their thermal efficiency and reradiating capabilities. Chase Nedrow can apply Emisshield in the field on existing refractories or metals with proper surface preparation and inspection during scheduled operational shutdowns.

When Emisshield is applied to the hot face of an industrial unit's lining, radiant and convective energy from the burners and hot gases are absorbed at the surface of the coating and reradiated evenly throughout the unit, creating a uniform temperature distribution.

Serving all Industry Market Areas **Worldwide**

ASSET PROTECTION PLAN

Quality Controlled Application

Chase Nedrow and Emisshield certify that proper QA/QC is followed at each step of the application process. Chase Nedrow provides a QA/QC officer to ensure proper application and adherence to the substrate

Abrasion Resistance Properties

Chase Nedrow confirms the coating goes through proper mixing to achieve maximum particle distribution when it is applied to the ceramic fiber and burner tile. Abrasion-resistant properties provided by the coating protect the fiber from high-velocity gases.

Maximum Adhesion

The utilization of airless spray systems allows the coating to penetrate into the ceramic fiber, which maximizes adhesion and protects the fiber from overheating and devitrifying throughout its service life. Emisshield is applied at 4-6 mils thick by a certified installer.

As a valued partner, we provide yearly inspections to ensure the application and lifespan of our products.

Each APP inspection follows a thorough project evaluation and includes a full report of findings, any necessary touchups, and a certification from our operations manager.

ASSET PROTECTION PLAN

CERTIFIED

INSPECTION

Date of Certificate

CERTIFICATE OF INSPECTION

This is to certify that Dryers A & B and RTO at the below-named facility were inspected by Jeremy Hood, a Certified Emisshield Inspector, on the date below.

Producer Name

The ceramic fiber in Dryers A & B and RTO were found to be in serviceable condition. The Emisshield High Emissivity Coating did require retouching, primarily in the combustion chambers and upper transition. The RTO did not require any retouching.

This inspection is the first of four included with the Asset Protection Plan. The next inspection will be on the following date: DATE

CHASE NEDROW INDUSTRIES

JEREMY S. HOOD, OPERATIONS MANAGER

Testimonial

CARBONGREEN
BIOENERGY

CARBON GREEN BIOENERGY

To whom it may concern,

I am writing this letter to verify the results Carbon Green BioEnergy, LLC (CGBE) captured after implementing Emisshield High Emissivity Coatings (HEC's) into our Thermal Oxidizer and express the positive experience CGBE had working with Chase Nedrow Industries throughout the implementation process. In 2019, CGBE contracted Chase Nedrow to provide and properly install Emisshield HEC's to approximately 3,243sqft of Refractory Ceramic Fiber HP Modules, One Burner and approximately 100sqft of insulating Firebrick Walkway of our gas Thermal Oxidizer. Through the hard work off all who were involved, CGBE plant personnel, Chase Nedrow Certified Installers and Emisshield Technical Review Committee, CGBE was able to quantitatively capture the following results after the installation of Emisshield High Emissivity Coatings.

1. 1,209 BTU/GAL improvement in dryer and thermal oxidizer natural gas efficiency
2. The Delta Temperature (ΔT) between the average thermal oxidizer combustion chamber temperature and the stack temperature increased significantly. We averaged 1,149°F (ΔT) in the pre-period and 1,195°F (ΔT) in the post-period. This is a 46°F increase in our (ΔT).
3. 5.2% reduction in excess air
4. The decrease in combustion air flow doubled the retention time in the TO Combustion Chamber which improved thermal destruction of VOC's and natural gas. NO_x emissions were reduced by 20%
5. Upon Physical inspection of the HEC after being in service for one year, the HEC's have reduced the abrasion issues on the ceramic fiber.

After 3 months of pre-period and post-period data was collected, analyzed, and meticulously verified, CGBE is confident that the implementation of Emisshield HEC's and the involvement of Chase Nedrow will provide value to our operations throughout the life of the Coating.

Sincerely,

Edward Thomas, Plant Manager
Carbon Green BioEnergy, LLC
7795 Saddlebag Lake Road
Lake Odessa MI 48849

CASE HISTORY

Thermal Oxidizers

Overview

Chase Nedrow has found that coating thermal oxidizers with Emisshield High Emissivity Coatings significantly improves thermal performance. These findings include, but are not limited to:

- **Significant natural gas savings**
- **Lower stack temperatures**
- **Reduction in excess air**
- **Improved thermal destruction of VOCs**
- **Decreased hot spots**

Emisshield®

Application Information

An ethanol plant in the Midwest of the United States recently coated one of its thermal oxidizers—the entire interior surface, including the ceramic fiber and the upper and lower chambers. The burner tile was also coated in addition to the brick walkway.

Emisshield Benefits

Since the date of the Emisshield application, the plant operators have reported the following:

1,209 BTU

Per Gallon Improvement in Natural Gas Efficiency

46° F

Increase in ΔT

1.9-4.1%

Destruction Removal Efficiency Retention

5.2%

Reduction in Excess Air

20%

NO_X Emissions Reduced

- Hot Spots Were Minimized
- Increased Abrasion Resistance of the Ceramic Fiber

Dryer Application 1

Overview

Chase Nedrow has found that coating Rotary Drum Dryers with Emisshield High Emissivity Coatings significantly improves thermal performance. These findings include, but are not limited to:

- **Significant natural gas savings**
- **Production Increase**
- **Uniformity in the dryer system**
- **Reduced maintenance costs and downtime**
- **Decreased ramp-up and cool-down time**

Application Information

An ethanol plant located in the United States Midwest coated two rotary drum dryers. All of the ceramic fiber surfaces were coated, including the combustion chamber and the transition. The burner tile was also coated in addition to the installed brick walkway.

Emisshield Benefits

Since the date of the Emisshield application, the plant operators have reported the following:

4%

Fuel Savings

Improved Uniformity

After one year inspection, the ceramic fiber still appears like new.

Less Cleaning Down-stream During Outages

Reduced Maintenance Costs and Downtime

Hot Spots Were Minimized

Increased Abrasion Resistance of the Ceramic Fiber

Dryer Application 2

Overview

Chase Nedrow has found that coating ethanol plant dryers with Emisshield High Emissivity Coatings can improve coproduct production and energy efficiency. These findings include, but are not limited to:

- **Increased dry coproduct yield**
- **Improved drying performance**
- **Lower gas use per ton dried**
- **Steady ethanol output, more efficient coproducts**
- **Favorable energy-output ratio year-round**

Application Information

Emisshield High Emissivity Coating Technology was applied to two rotary drum dryers at a Midwest ethanol facility. The coating was installed across key thermal surfaces to enhance energy efficiency and improve coproduct drying performance.

Emisshield Benefits

Emisshield improved coproduct production efficiency while maintaining consistent ethanol output.

3.8%

Increase in coproduct yield per gallon of ethanol

3.3%

increase in total dried coproduct production

Maintained Consistent Ethanol Output

Natural gas usage decreased

Per ton of dried coproduct

Stable Operation Across Seasonal and Moisture Variations

Dryer Application 3

Overview

This case study aligns with the performance summary detailed on page 14. It highlights energy efficiency and operational improvements.

Application Information

At a Midwest-based ethanol plant, Dryer A was coated with high emissivity coatings. The application included all ceramic fiber surfaces within the combustion chamber and transition section, as well as the burner tile.

Emisshield Benefits

7.36%

Reduction in MMBtu/hr consumption

2.28%

Decrease in inlet temperature to Dryer B

Increased Moisture Removal Efficiency

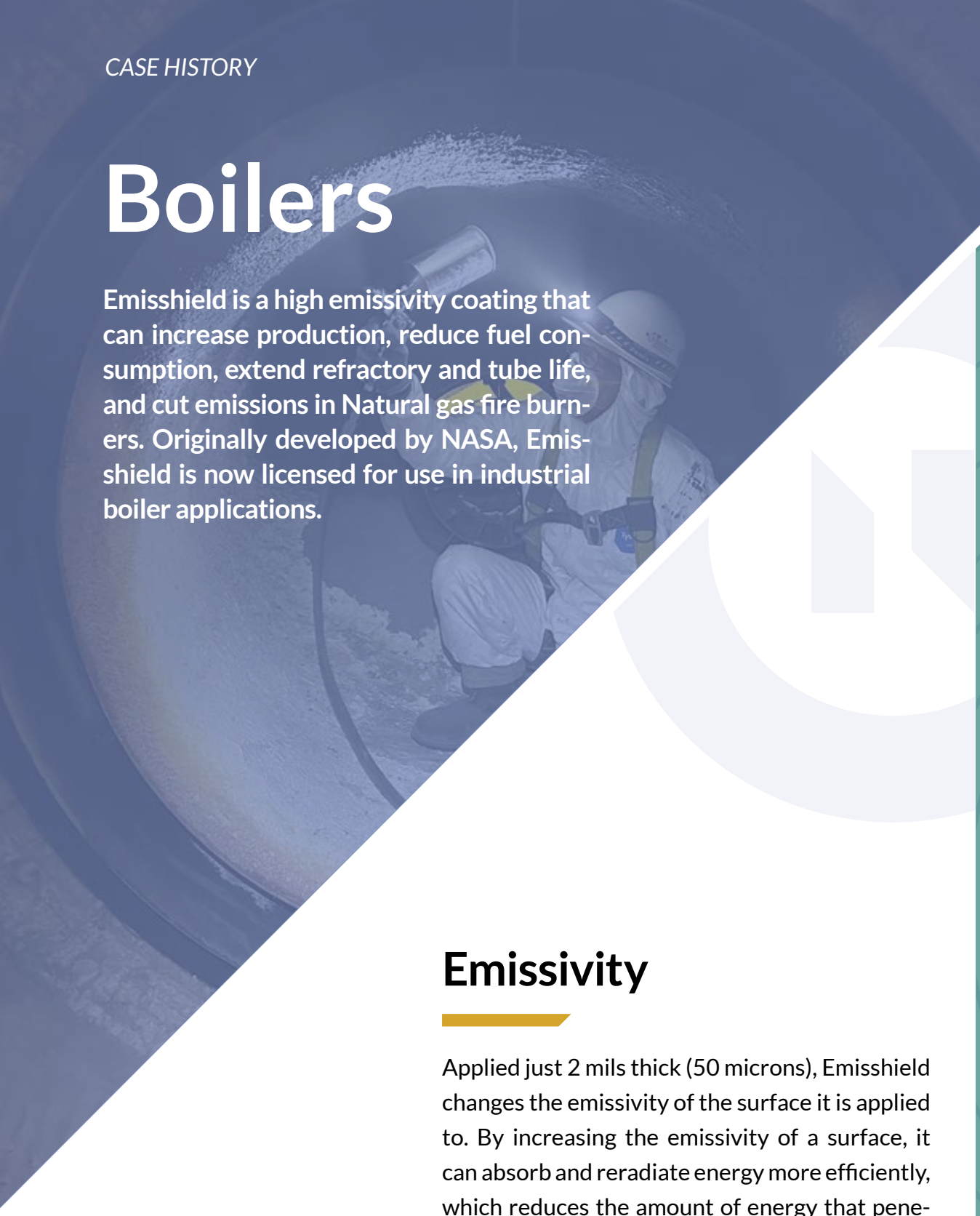
~617

Gallons/day increase in ethanol production

- Hot Spots Were Minimized
- Reduced Maintenance Requirements and Downtime

Boilers

Emisshield is a high emissivity coating that can increase production, reduce fuel consumption, extend refractory and tube life, and cut emissions in Natural gas fire burners. Originally developed by NASA, Emisshield is now licensed for use in industrial boiler applications.



Emissivity

Applied just 2 mils thick (50 microns), Emisshield changes the emissivity of the surface it is applied to. By increasing the emissivity of a surface, it can absorb and reradiate energy more efficiently, which reduces the amount of energy that penetrates into the substrate, keeping the shell cooler and the unit running at maximum efficiency. Additionally, these coatings provide incredible bonding strength, which allows them to withstand the intense environments of boilers.

Emisshield®

Vastly Superior

Emisshield is effective up to over 3100° F and has been shown to last over 5 years in boiler applications. All Emisshield products are made to order and are manufactured in the United States of America. Emisshield formulations are tailor-made for specific refractory chemistries and metal alloys. No specific curing or drying instructions are needed, allowing operators to follow standard start up procedures.

Emisshield Benefits

10%

Increase in Production

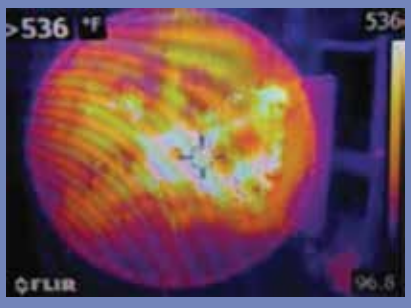
10%

Decrease in Fuel Consumption

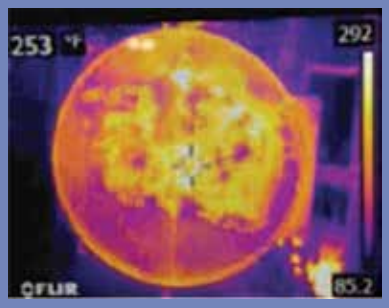
Reduce Build-up on Refractory and Tubes

Reduced Emissions Per Unit of Product Boilers

Improved Refractory and Tube Life

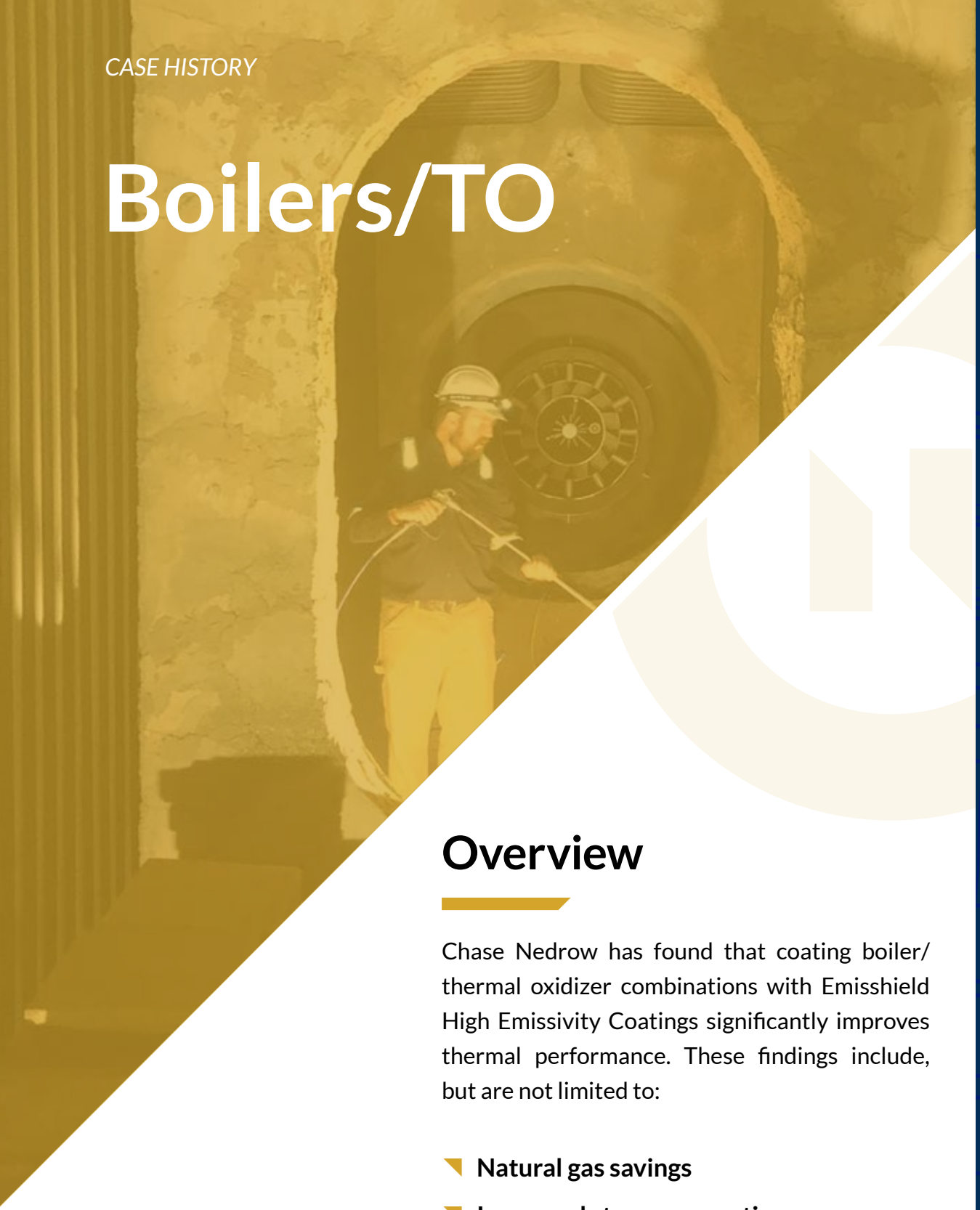


Package boiler before application



Package boiler door 3 months afterEmisshield application

Boilers/TO



Overview

Chase Nedrow has found that coating boiler/thermal oxidizer combinations with Emisshield High Emissivity Coatings significantly improves thermal performance. These findings include, but are not limited to:

- **Natural gas savings**
- **Increased steam generation**
- **Destruction removal efficiency increased**
- **Decreased CO2 emissions**

Emissivity

An Ethanol Plant located in the United States Midwest coated one Boiler/ Thermal Oxidizer combination unit. All of the steel water walls were coated, including the burner chamber, refractory choke ring, and brick walkway.

Emisshield Benefits

Since the date of the Emisshield application, the plant operators have reported the following:

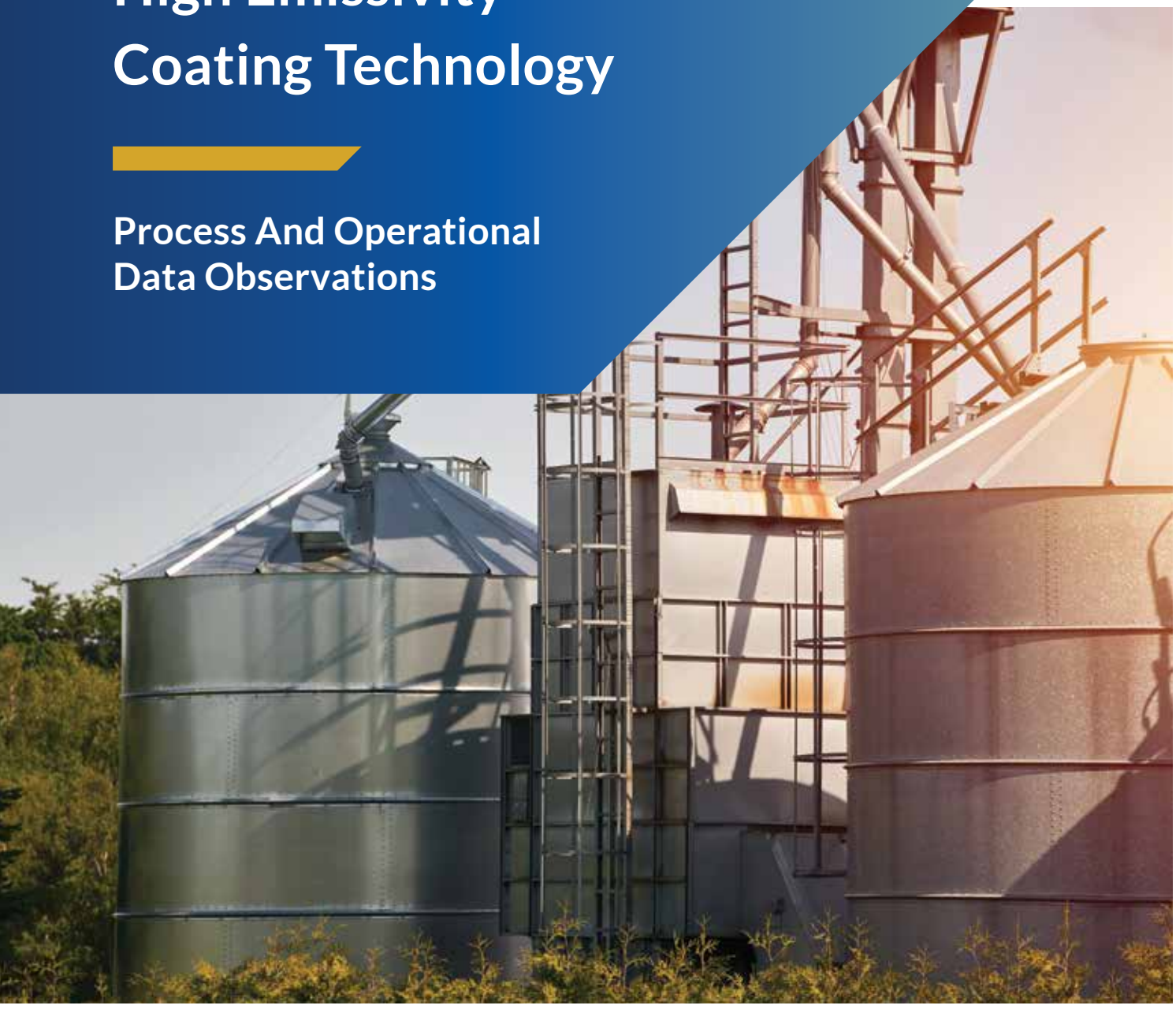
- **Significant Fuel Savings**
- **Improved Destruction Removal Efficiency**
- **Reduction of NOx**
- **Reduction in Maintenance and Downtime**

After a 3-year inspection, the Emisshield coating maintains adhesion and performance characteristics.

PROtect℠

Application Of Emisshield High Emissivity Coating Technology

Process And Operational Data Observations



Project Overview

Guardian Energy Lima (GEL), owns and operates an ethanol production facility in Lima, Ohio. GEL contracted Chase Nedrow Industries to install Emisshield High Emissivity Coating Technology on thermal process equipment operated at the facility.

Technology Summary

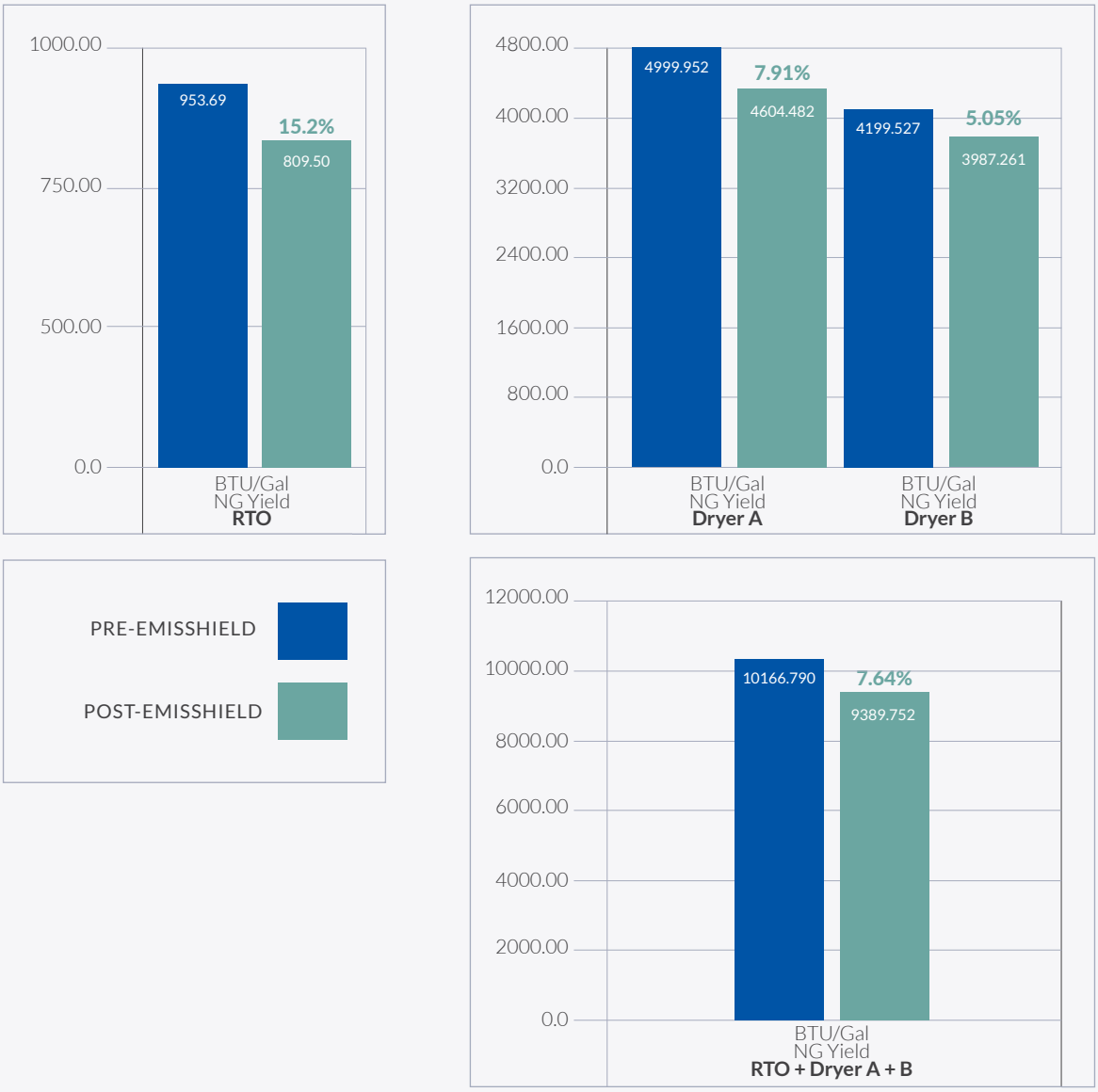
Emisshield® is a NASA licensed, high emissivity coating technology that has demonstrated the ability to increase heat transfer and improved energy usage, while increasing production in nearly all heat driven industrial applications. Emisshield® Systems are ceramic nanoparticle materials with high emissivity and heat re-radiation capabilities extending over a wide temperature range of up to 3100°F. Emissivity is the ability of a surface to emit heat as radiation, or thermal energy. Emisshield® increases the emissivity of a surface, which allows for the absorption and re-radiation of energy more efficiently, reducing the amount of energy that penetrates the substrate, keeping the shell cooler and the Unit running at maximum efficiency. Emisshield® can be applied to thermal oxidizers (TOs), regenerative thermal oxidizers (RTOs), boilers, and dryers.

Emisshield Hect Application

GEL contracted with Chase Nedrow Industries to install Emisshield HECT in two natural gas fired dryers, and one natural gas fired RTO. Over the course of November 17-18, 2022, Emisshield HECT was applied to the RTO burner cone, ceramic fiber modules on the side walls and ceiling, and door. Emisshield HECT was also applied to each of the dryers' burner tiles, combustion chamber, including the upper and lower transition, and to the hot face of the dryer doors.

Emisshield Hect Application

Upon startup post-coating GEL operators noticed significant process improvements. Facility personnel believe that due to the application of Emisshield HECT, GEL was able to improve operational productivity. Operational data was analyzed for a comprehensive period of operation pre-Emisshield HECT application occurring from February 25, 2022, through November 11, 2022. This data was compared against operational data obtained post-Emisshield HECT application occurring from November 27, 2022, through January 12, 2023. Postapplication data occurring beyond January 13 was not included within this analysis, as cellulase was introduced into the fermentation process. Data from November through January more accurately demonstrates the direct impact of Emisshied HECT.



Data tables detailing the production and operational observations are attached. The following operational and process improvements were observed:

- The natural gas combustion rate (measured in MMBtu/hr) decreased in all coated units. Overall natural gas combustion of all units combined (RTO, Dryer A, and Dryer B) decreased 0.33% post-Emisshield application (with observed higher DDGS throughput rates), when compared to pre-Emisshield operation.
- Natural gas yield (measured in Btu/gal) has improved, meaning less natural gas is being combusted to produce one gallon of ethanol. Overall, the natural gas yield decreased 7.64% post-Emisshield application, when compared to pre-Emisshield operation.

- Other operational improvements allowed for an increase in ethanol production which can be further capitalized with the improved capacity gained in the dryers recognized with the application of Emisshield HECT. GEL observed an increase in approximately 45 tons per day of DDGS, when compared to pre-Emisshield operation.
- Post-Emisshield testing conducted on March 1, 2023, preliminary (pending OEPA approval) shows Volatile Organic Compound (VOC) destruction efficiency increased to 97.88%. This is compared to engineering testing conducted on November 8, 2022, pre-Emisshield application, using the same EPA approved methodologies, which demonstrated a VOC destruction efficiency of 95.45%
- Temperature improvements were observed in all equipment. Dryer A and B inlet temperatures decreased post-Emisshield application, and RTO outlet temperature decreased. RTO combustion chamber temperature increased with the use of less natural gas combustion, which could be a contributor to the increase in destruction efficiency. Furthermore, pre- and post-thermographic inspection data of the RTO indicates lower shell temperature after Emisshield HECT application.

Conclusion

Preliminary process data observed post installation of Emisshield HECT shows favorable operational benefits. Energy efficiency improvements and ethanol production gains are evident in data presented post coating. Benefits will vary based on the thermal processes coated.

Data Tables

	RTO		Dryer A	Dryer B
	RTO TEMP °F	RTO OUT TEMP °F	Dryer A Inlet Temp °F	Dryer B Inlet Temp °F
Pre-Emisshield	1629.74	374.32	993.39	889.23
Post-Emisshield	**1637.85**	**372.41**	**900.55**	**870.57**
% Reduction		**0.51%**	**9.35%**	**2.10%**

Tables Continued on Page 25

	RTO		Dryer A	
	NG Consumption MMBtu/day	NG Yield Btu/Gal	NG Consumption MMBTU/day	NG Yield BTU/gal
Pre-Emisshield	198.06	953.69	1059.484	4999.952
Post-Emisshield	**184.25**	**809.50**	**1049.472**	**4604.482**
% Reduction	**6.97%**	15.12%	**0.94%**	7.91%

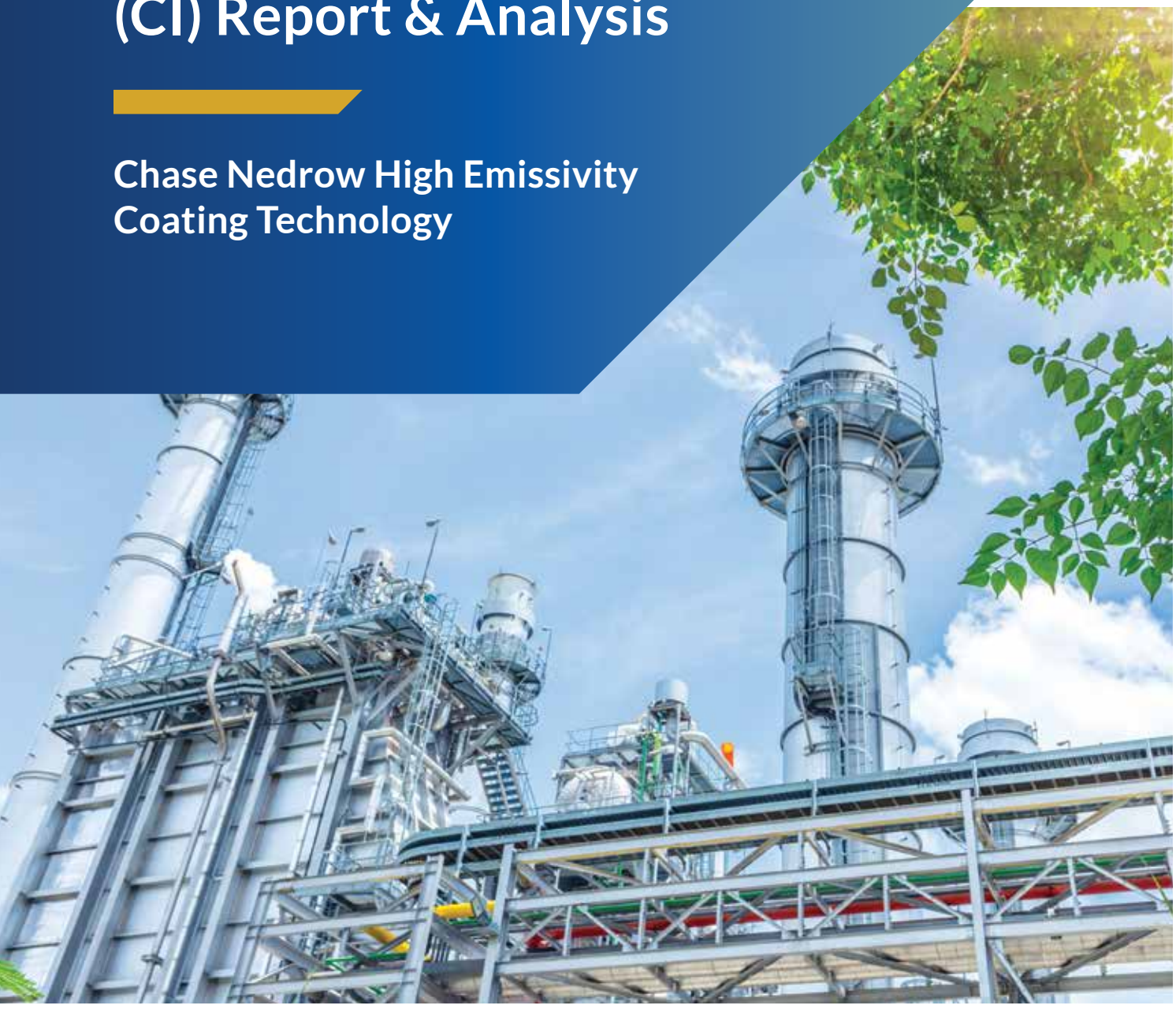
	Dryer B		RTO + Dryer A + B	
	NG Consumption MMBtu/day	NG Yield Btu/Gal	NG Consumption MMBTU/day	NG Yield BTU/gal
Pre-Emisshield	890.415	4199.527	2147.96	10166.790
Post-Emisshield	**907.043**	**3987.261**	**2140.77**	**9389.752**
% Reduction	**-1.87%**	5.05%	**0.33%**	7.64%

OCTOBER 2022

PROtect℠

Carbon Intensity (CI) Report & Analysis

Chase Nedrow High Emissivity Coating Technology



1 Background

As more low carbon fuel programs are developed to incentivize the production of renewable fuels, more producers are implementing carbon reduction strategies to capitalize on these programs and associated incentives. Competition drives producers to obtain the lowest carbon score possible. Understanding the impact and potential reduction of certain technologies on a producer's carbon score is integral in project planning.

To aid in the decision-making process for capital project implementation, Chase Nedrow Industries, Inc. has retained PROtect, LLC to determine the potential reduction of a High Emissivity Coating Technology (HECT). For this case study a sample facility has been modeled using currently available carbon calculators. Additional operating scenarios were then calculated based on the integration of the high emissivity coating (HEC) on various units. This report identifies the reduction impacts through the use of the HECT.

For this analysis, PROtect, LLC has used the State of California's Low Carbon Fuel Standard (LCFS) Tier 1 Simplified Carbon Intensity (CI) Calculator for Starch and Fiber Ethanol (LCFS Tier 1) to which it used by fuel producers to calculate the carbon intensity of a producer's fuel.

2 Chase Nedrow Coating Technology Description

In 2015, Chase Nedrow Industries, Inc. partnered with Emisshield®, Inc., the industry's leader in High Emissivity Coatings. Emisshield® is a NASA licensed, high emissivity coating technology that increases heat transfer and saves energy while increasing production in nearly all heat driven industrial applications. Emisshield® Systems are ceramic nanoparticle materials with high emissivity and heat re-radiation capabilities extending over a wide temperature range of up to 3100°F. Emisshield® increases the emissivity of a surface, which can absorb and re-radiate more energy efficiently which reduces the amount of energy that penetrates the substrate, keeping the shell cooler and the Unit running at maximum efficiency. Additionally, these coatings provide incredible bonding strength which allows it to withstand the intense environment of boilers, thermal oxidizers, dryers, and most thermal processes.

Emisshield® coatings are applied directly to the existing ceramic fiber. Not only does this coating demonstrate thermal stability at high temperatures, but it is also resistant to thermal shock at temperatures between -392°F to 2732°F. Emisshield® increases the abrasion resistance of the ceramic

fiber refractory decreasing maintenance costs and downtime. It has been shown to last over 5 years in boiler applications.

Beyond decreasing maintenance costs, Emisshield® also provides energy savings and decreased emissions. Emisshield® can be applied to thermal oxidizers (TOs), regenerative thermal oxidizers (RTOs), boilers, and dryers. Application in any of this equipment will result in a decrease of natural gas consumption, decrease NOx emissions, decreased ramp up and cool down time, minimization of hot spots, and a significant decrease in inlet temperature. In dryer applications, uniformity in the dryer system has also been observed.

2 Chase Nedrow Industries, Inc. Carbon Intensity Standard Factors and Description

For each operational scenario the CARB Tier I calculator was used. In an effort to create uniformity and consistency in baseline analysis, some standard factors were used. These factors are considered representative of a typical plant. The following standard factors that were applied to each scenario are as follows:

Factor Description:	Standard Selection
Electricity Mix Region for Feedstock	1-U.S. Ave Mix
Electricity Region Used for Fuel	14-RFCM Mix
Distance Final Product is shipped by rail*	2,300 miles
Standard corn transport distance:	40 miles

**It is assumed for the sake of the calculator that no rail shipment is greater than 2,300 miles.*

In all cases, it is assumed that the final product of the plant (fuel-grade ethanol) is shipped by rail from the facility for further distribution. Other baseline factors are determined as follows:

- The sample facility's yield is calculated based on grain usage and 200 proof ethanol production (prior to the denaturant addition).
- The electricity usage is calculated based on electricity invoices from the sample facility.
- The natural gas usage is based on natural gas bills from the sample facility.

A summary of the site-specific factors is found below. It should be noted that the sample facility data is considered representative, however, variability in the site-specific data could vary from plant to plant based on numerous considerations.

4 CI Calculator Scenario Description and Inputs

In addition to the CI reduction benefits, there has been energy improvements after the application of Emisshield®. As detailed below, the electricity usage is compared across four scenarios. Electricity yield comparison shows a usage reduction from 0.61 to 0.60 kilowatt hours (kWh) across the different scenarios. Likewise, the natural gas yield decreases from 26,736 British Thermal Units (BTUs)) per gallon (BTU/gal) to 25,244 BTU/gal.

BASELINE

Baseline data was collected for the 24-month period before Emisshield® was applied to the sample facility's Thermal Oxidizer (TO) and DDGS Dryers. The baseline data represents normal operations before the changes and serves as a comparison point for determining efficiency gains from the Emisshield® coating. The baseline carbon intensity was 72.70 gCO2e/MJ.

SCENARIO 1

Emisshield® was applied to the TO in September 2019. While corn-grind and ethanol production were lower due to a shortened reporting period, the ethanol yield (gal/bushel) and natural gas yield (btu/gal) reflect the improvement to efficiency per gallon of ethanol produced. The ethanol yield improved by 0.05 gallons per bushel and the natural gas yield decreased by 961.14 btu. While the gains in ethanol yield were marginal, the decrease in natural gas usage is reflective of the increased heat retention and lower gas demands to maintain the process. This improved the carbon intensity by 0.52 grams to 72.18 gCO2e/MJ.

It should be noted that the reporting period for Scenario One was shortened to 18 months to focus on timeframe Emisshield® was applied to just the TO, prior to the installation on Dryer A.

SCENARIO 2 AND 2A

Emisshield® was applied to Dryer A in April 2021. Two (2) scenarios were modeled to capture the carbon impacts of the addition of Emisshield® to multiple units. Scenario 2 is a 23-month reporting period that reflects the cumulative impact of Emisshield® being applied to both the TO and Dryer A. This scenario accounts for the TO being the only unit with Emisshield® from October 2019 through March 2021 and both the TO and Dryer A having Emisshield® from April 2021 to August 2021. Scenario 2 shows a 0.05 gal/bushel improvement to ethanol yield as well as demonstrating that the natural gas yield continued to improve with the additional coating. Scenario 2 showed a 1288.72 btu/gal decrease in natural gas usage from the baseline figures and an additional 327.58 btu/gal reduction from Scenario 1. As with Scenario 1, the efficiency gains are the direct result of increased heat retention and therefore lower heat/gas demand. Scenario 2 resulted in a decrease of 0.75 gCO2e/MJ from the baseline and a reduction of 0.23 gCO2e/MJ from Scenario 1.

Because Scenario 2 includes a longer reporting period with the cumulative impacts of a staged installation (TO only and then TO and Dryer A), Scenario 2a is being provided to focus on the period of operation where Emisshield® was applied to both the TO and Dryer A (April 2021 to August 2021), prior to application in Dryer B. Scenario 2a yielded a 0.01 gal/bushel increase to ethanol yield over Scenario 2 and a 1,079.55 btu/gal improvement to natural gas yield. Scenario 2a resulted in a decrease of 1.54 gCO2e/MJ from the baseline and a reduction of 1.02 gCO2e/MJ from Scenario 1. Due to the short dataset for Scenario 2a, Scenario 2 is considered more representative of carbon impacts.

SCENARIO 2 AND 2A

Emisshield® was applied to Dryer B in September 2021. Similar to Scenario 2 and 2a, two (2) scenarios were modeled to capture the carbon impacts of the addition of Emisshield® to multiple units. Scenario 3 includes a full 24-month reporting period that reflects the cumulative impacts of Emisshield® being applied to the TO and both Dryers. This scenario accounts for Emisshield® only being applied to the TO from October 2020 to March 2021, Emisshield® being applied to the TO and Dryer A from April 2021 to August 2021, and Emisshield® being applied to the TO, Dryer A, and Dryer B from September 2021 to June 2022. The results in similar efficiency gains as Scenario 2. Scenario 3 resulted in an increase in ethanol yield in gal/bushel, from the baseline 2.82 to 2.90 gal/bushel of ethanol produced. Furthermore, Scenario 3 displayed a natural gas yield similar to Scenario 2; a reduction of 1491.82 btu/gal from baseline. The carbon intensity decreased by 1.13 grams from the baseline and showed a decrease of 0.38 gCO2e/MJ from Scenario 2.

Scenario 3a is being provided, similar to Scenario 2a, due to the various stages of implementation of Emisshield® being accounted for in Scenario 3. Where the reporting period for Scenario 3 includes a period of time when Emisshield® was applied to the TO, a time where it was applied to the TO and Dryer A and a time period where it was applied to the TO, Dryer A and Dryer B, Scenario 3a accounts for the period after installation had occurred on all three units (September 2021 – June 2022). This scenario yielded an improvement of 0.04 gal/bushel as well as a 648.92 btu/gal improvement to natural gas yield over Scenario 2. Scenario 3a resulted in a decrease of 6.40 gCO2e/MJ from the baseline and a reduction of 5.88 gCO2e/MJ from Scenario 1. Due to the short dataset for Scenario 3a, it does not account for variation in temperature caused by summer heat nor operational variability. Because of these shortcomings in

Scenario 3a, Scenario 3 is considered more representative of carbon impacts.

	Baseline	Scenario 1 - Applied to TO	Scenario 2 -Applied to Dryer A	
Reporting Period[1]:	10/2017 – 9/2019	10/2019 – 3/2021	10/2019 – 8/2021	
Months in Dataset:	24	18	23	
Corn use, bushels:	39,038,371.00	27,878,342.00	36,306,692.00	
Undenatured ethanol produced, gal:	110,269,320.00	79,922,597.00	104,174,314.00	
Ethanol Yield, gal/bushels:	2.82	2.87	2.87	
DDGS Produced, tons:	294,885.00	200,426.00	259,339.00	
Wet DGS Produced, tons:	1,908.00	1,096.00	1,359.00	
Corn Oil Produced, tons:	13,653.40	10,665.20	14,267.64	
Natural Gas, MMBtu:	2,948,147.25	2,059,984.08	2,650,940.48	
Natural Gas Yield, btu/gal:	26,735.88	25,774.74	25,447.16	
Electricity Usage, kWh:	67,152,102.44	48,441,678.82	63,028,540.82	
Electricity Yield, kWh/gal:	0.61	0.61	0.61	
CARBON INTENSITY SCORES (gCO2e/MJ)				
Land Use Change	19.80	19.80	19.80	
Facility Product Carbon Footprint	52.90	52.38	52.15	
Total Product Carbon Footprint	**72.70**	**72.18**	**71.95**	

[1] *For information on the timeline for Emisshield® installation, refer to the above scenario narratives.*

Scenario 2a - Applied to Dryer A	Scenario 3 - Applied to Dryer B	Scenario 3a -Applied to Dryer B
4/2021 – 8/2021	7/2020 – 6/2022	9/2021 – 6/2022
5	24	10
8,428,350.00	39,520,212.00	16,137,893.00
24,251,717.00	114,683,836.00	47,431,021.00
2.88	2.90	2.94
58,913.00	280,356.00	113,661.00
263.00	1,597.00	647.00
3,602.44	16,439.38	6,718.17
590,956.40	2,895,085.86	1,228,130.39
24,367.61	25,244.06	25,892.98
14,586,862.00	68,330,861.94	28,107,516.32
0.60	0.60	0.59
19.80	19.80	19.80
51.36	51.77	46.50
71.16	**71.57**	**66.30**

5 Monetary Assessment

To calculate the monetary benefit of the carbon reductions for each scenario, a comparison has been made from the ethanol settlement of the Baseline against the three scenarios, as captured in the table below. The ethanol settlement for each scenario is compared to a yield of 110,000,000 gallons, with a baseline of $793,100 to $896,203 from Baseline through Scenario 3.

The ethanol yield across the scenarios started at 2.82 gallons per bushel at Baseline and increased to 2.90 gallons per bushel by Scenario 3.

The Carbon Intensity (CI) for each Scenario from Baseline decreases from 72.70 gCO2e/MJ to 71.57 gCO2e/M in Scenario 3, a reduction of 0.63 gCO2e/MJ, as detailed in the table below. Scenario 2a and 3a are not included as Scenarios 2 and 3 were considered more representative.

	Baseline	Scenario 1 - Applied to TO	Scenario 2 - Applied to Dryer A	Scenario 3 - Applied to Dryer B
CI, gCO2e/MJ	72.70	72.18	71.95	71.57
Difference from baseline (CI):	–	-0.52	-0.75	-1.13
Ethanol Settlement:	$0.00721	$0.004	$0.005	$0.008
110,000,000 gallons	–	$412,412.00	$594,825.00	$896,203.00

Chase Nedrow's CARB Tier 1 Calculator output summary sheets is attached in Appendix B.

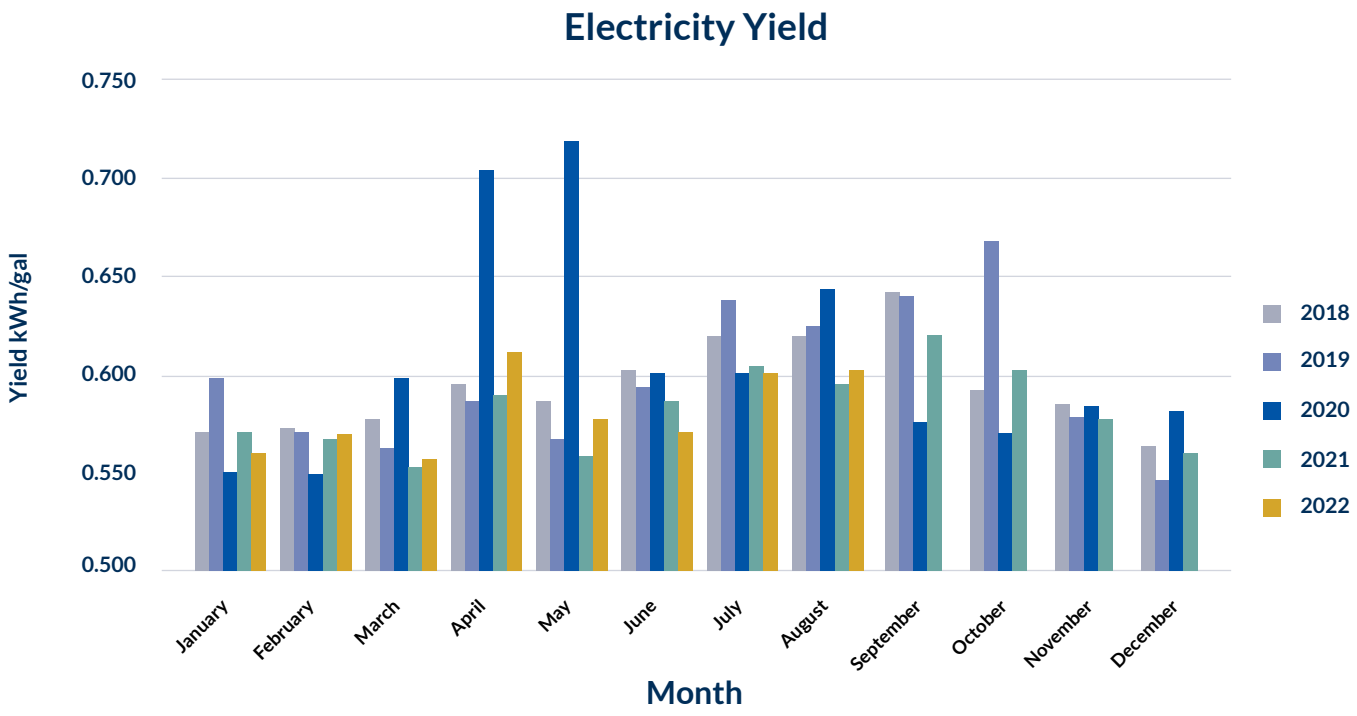
It should be noted that the Ethanol Settlement values represent a value for the CARB market in dollars per Carbon Intensity point. These values represent the value as of August 22, 2022.

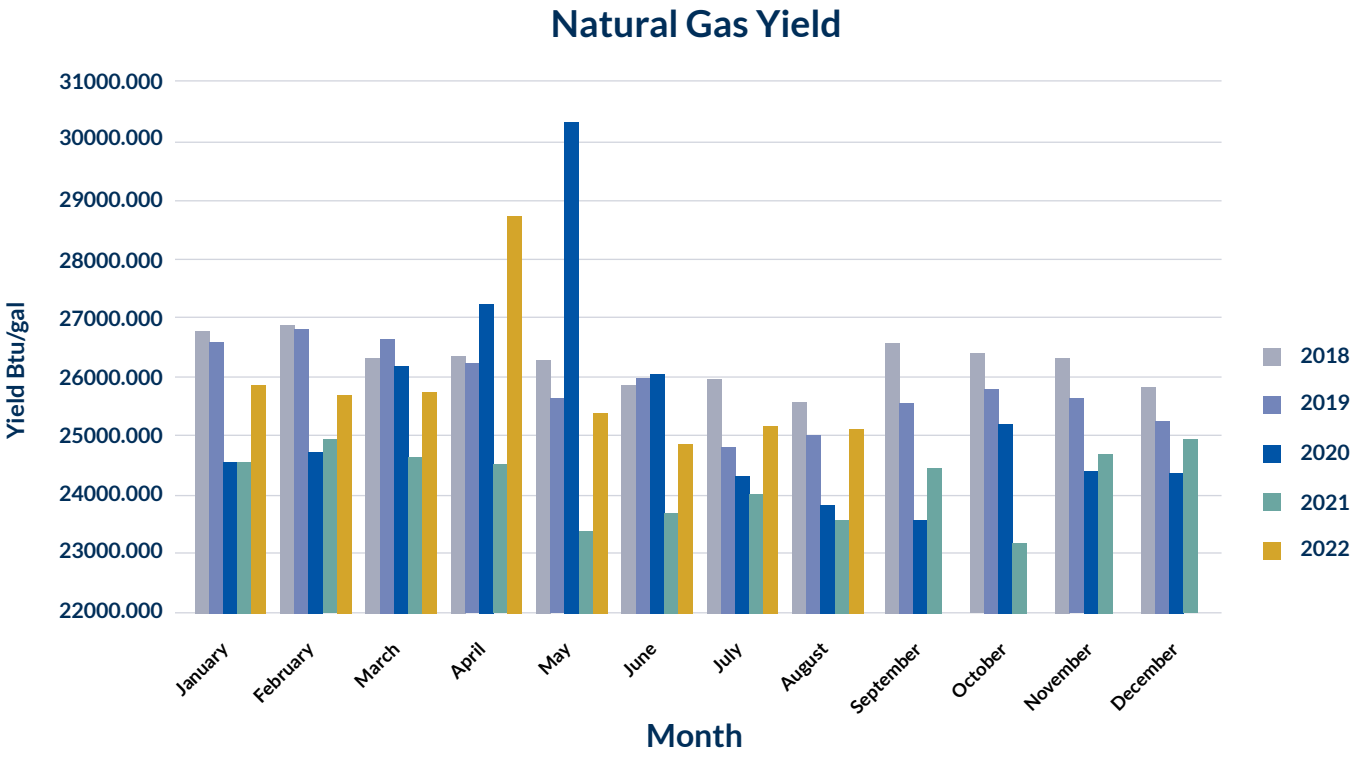
6 Conclusion and Recommendation

Based on the data compiled and assessment of the results of the CARB LCFS calculator, it is reasonable to anticipate a carbon intensity reduction ranging between 0.5 through 1.15 gCO2e/MJ due to the application of Chase Nedrow's installation of the Emisshield® coating. Carbon reduction will depend on technology to which the coating is applied, and the units coated. Again, each facility has varying operational factors and as such, different carbon impacts. Therefore, each site should be analyzed individually for a more definitive site-specific determination.

Appendix A

Chase Nedrow Industries, Inc. Electricity and Natural Gas Table





Appendix B

CARB Tier 1 Calculator Output Tables

BASELINE

Parameters	gCO2e/MJ
Corn Farming, Fertilizers and Ag Chemicals, N2O in Soil	28.32
Corn Transport	1.48
Co-product Credit	-10.96
Natural Gas Usage	22.01
Electricity Usage	5.94
Chemicals Usage (Standard)	2.02
Ethanol Transport Rail	2.57
Ethanol Distribution	0.46
Denaturant CI	0.95
Non-Combustion CI	0.09
Indirect Land Use	19.80

SCENARIO 1

Parameters	gCO2e/MJ
Corn Farming, Fertilizers and Ag Chemicals, N2O in Soil	27.90
Corn Transport	1.43
Co-product Credit	-10.33
Natural Gas Usage	21.22
Electricity Usage	5.92
Chemicals Usage (Standard)	2.02
Ethanol Transport Rail	2.57
Ethanol Distribution	0.46
Denaturant CI	1.09
Non-Combustion CI	0.09
Indirect Land Use	19.80

Appendix B CONTINUED

CARB Tier 1 Calculator Output Tables

SCENARIO 2

Parameters	gCO2e/MJ
Corn Farming, Fertilizers and Ag Chemicals, N2O in Soil	27.88
Corn Transport	1.42
Co-product Credit	-10.27
Natural Gas Usage	20.95
Electricity Usage	5.90
Chemicals Usage (Standard)	2.02
Ethanol Transport Rail	2.57
Ethanol Distribution	0.46
Denaturant CI	1.10
Non-Combustion CI	0.09
Indirect Land Use	19.80

SCENARIO 3

Parameters	gCO2e/MJ
Corn Farming, Fertilizers and Ag Chemicals, N2O in Soil	27.57
Corn Transport	1.49
Co-product Credit	-10.15
Natural Gas Usage	20.78
Electricity Usage	5.81
Chemicals Usage (Standard)	2.02
Ethanol Transport Rail	2.57
Ethanol Distribution	0.46
Denaturant CI	1.10
Non-Combustion CI	0.09
Indirect Land Use	19.80

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