

## *Executive Summary*

### Meeting NO<sub>x</sub> emission limits at low temperature

*Written by Henrik Andersen, Umicore Catalyst USA*

Umicore's new TripleCat SCR catalyst allows for low temperature operation already from 300F with its 3 fold activity compared to standard SCR catalyst, cutting cost by eliminating the need for expensive duct burners and gas/gas heat exchangers and associated costs.

*Full Story....*

### Medical Campus Laboratory Plume Dispersion Modeling

*Written by Jeffrey Everett and Paul Harris, Ph.D., Airflow Sciences Corp.*

CFD modeling was utilized to evaluate exhaust plume dispersion of a medical laboratory ventilation system. The model domain included the entire medical campus, comprised of many buildings, parking garages, and pedestrian areas. The CFD flow simulations included a variety of wind scenarios and stack exhaust flow rates. The goal was to track the exhaust gas concentrations from the stacks over the surrounding medical campus to ensure that the plumes were adequately dispersed into the atmosphere and not harmful to the public.

*Full Story....*

### The Status of U.S. EPA OTM-036 and the Promise of Lowering Reported FPM<sub>2.5</sub> Emissions on Wet Stacks

*Written by Jim Guenthoer, Clean Air Engineering*

Since OTM-36's original release in 2016, and subsequent pulling by the EPA due to droplet size problems with the precutter, SRI has developed a program to process PSD sampling data. Based upon simulations and studies using this program, Clean Air Engineering believes that adjustable precutters can be developed which will accurately measure PM<sub>2.5</sub> in a variety of wet stacks across multiple industries, thereby eliminating the up to 30% bias on the high side from the current EPA Method 5. Work originally planned for 2020 had to be postponed due to the pandemic, however Clean Air hopes that their data set will provide impetus for the EPA to re-release OTM-36.

*Full Story....*

## Meeting NO<sub>x</sub> emission limits at low temperature

Written by Henrik Andersen, Umicore Catalyst USA

The increasingly stringent emission requirements put in place by authorities and communities around the country, requires boiler and turbine operators to reevaluate their emission strategy.

Small and medium sized boilers are often the foundation for production for smaller and middle-sized companies. Until recent they have been able to continue operation with only primary types of emission control (e.g. low NO<sub>x</sub> burners). These smaller compact boilers often feature a very low exhaust gas temperature < 400°F, a temperature too low for NO<sub>x</sub> removal using traditional Selective Catalytic Reduction (SCR).

If operation have not been possible using only primary types of emission control, installation of an downstream SCR catalyst combined with reheating of the exhaust

gas have been necessary in order to get the boiler into emission compliance, resulting in increased cost not only in the revamp phase but also during operation.

A standard vanadium based SCR catalyst has an operation temperature window from around 400°F to 1,100°F. Installations with operation temperatures down to 350°F has been seen even though at this temperature the catalyst activity potential is very low and a significant “penalty” in terms of catalyst volume is paid, which adds to a large system footprint and cost, as well as increased pressure drop.

Having a catalyst with an optimal temperature range of operation between 300°F and 500°F would enable these small and medium sized boiler operators to continue operation while still meeting more stringent emissions

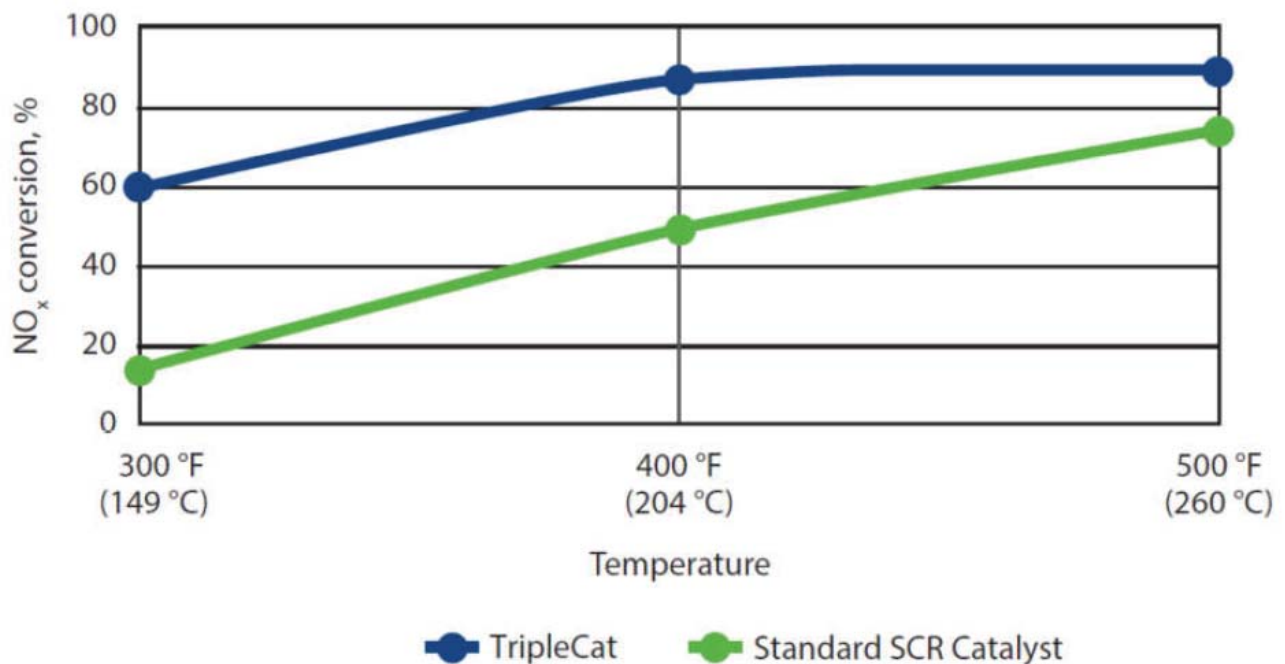


Figure 1: NO<sub>x</sub> Conversion versus temperature

requirements. Such a revamp would pose a lot smaller financial burden than using a traditional type SCR catalyst where reheating of gas would be needed in many cases.

With input from clients and sales team, Umicore’s R&D have developed the TripleCat DNX-LT (TripleCat) SCR catalyst with an over 3-fold activity increase in the 300F-350°F range compared to a traditional catalyst (see figure 1 on page 1).

One of the parameters that is customized for an SCR project is the amount of active sites of the catalyst. And by active site is meant where the reaction between  $\text{NH}_3$  and  $\text{NO}$  takes place to form harmless  $\text{N}_2$  and  $\text{H}_2\text{O}$ . For instance, at high temperatures, a lower amount of active sites is needed due to the limiting factor of the SCR activity is the transport of gas to and from the catalyst surface and thus the  $\text{NO}_x$  reduction is less controlled by the amount of active sites in the catalyst itself. On the other hand, when operating at lower temperatures the amount of active sites become important for the  $\text{NO}_x$  reduction activity. In the production of many types of SCR catalysts there is a certain limit for how many active sites you can load onto the surface of the catalyst and still maintain a good activity per site. Simply, the surface becomes too crowded which causes the  $\text{NO}_x$  removal efficiency of each active site to decrease and in addition, you risk the compromising the thermal stability of the catalyst as well as the risk of forming unwanted by-products.

With this in mind, Umicore has conducted extended research and development, utilizing a completely new way of making a catalyst with significantly increased  $\text{NO}_x$  reduction activity at low temperatures. The catalyst can “carry” a high amount of catalytic active materials while still maintaining not only a high efficiency of each active site, but also a good stability in the flue gas. This has been possible by developing a unique production method in combination with right choice of catalyst materials. Moreover, combining the catalyst with a corrugated glass fiber-based substrate gives the opportunity to have a high catalyst mass which is furthermore beneficial for low temperature performance as well as a low pressure drop. The final catalyst is still vanadium-titania based that is reinforced with glass-fibers which has been a well proven technology for flue gas after treatment for decades.

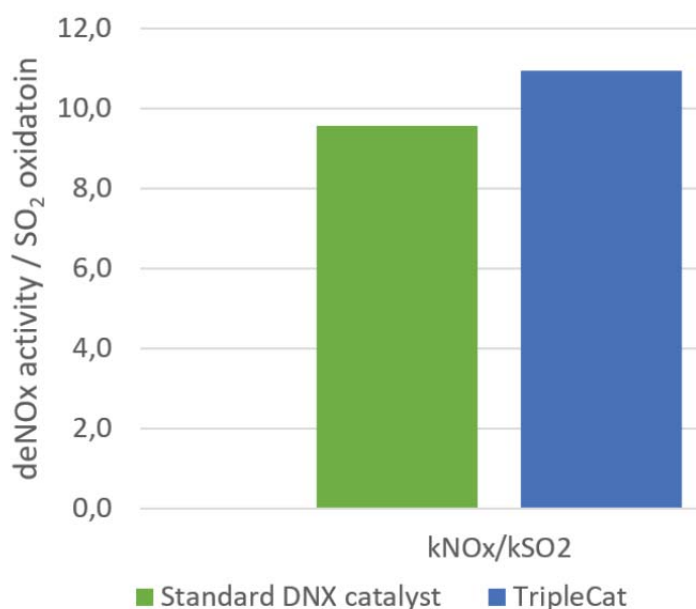
**AMMONIUM BISULPHATE (ABS)**

You can’t say low temperature operation without addressing the elephant in the room... ABS. In the presence of  $\text{SO}_3$  (not  $\text{SO}_2$ ) and  $\text{NH}_3$  at low temperature, ABS will form. For low temperature application it does not take much  $\text{SO}_3$  be-

fore we are below the ABS formation temperature or dew point. Hence it is prerequisite that  $\text{SO}_3$  gasses are removed from the flue gas prior to the catalyst or that sulphur free fuel or NG are used when operating a SCR catalyst at low temperatures.

An increased vanadium loading on the catalyst also comes with an increased  $\text{SO}_2$  to  $\text{SO}_3$  oxidation, but because  $\text{SO}_2$  oxidation normally increases exponentially with increasing temperature the oxidation rate becomes very low in the low temperature range. Moreover, the Umicore catalyst is a lightweight catalyst and is therefore born with low  $\text{SO}_2$  oxidation based on volume. Having said that, you still have a couple times more vanadium as that of a regular type DNX catalyst, hence higher  $\text{SO}_2$  oxidation as well. Because this catalyst still has high  $\text{NO}_x$  removal efficiency per vanadium atom, it has been possible to achieve high  $\text{NO}_x$  removal without compromising the ratio between de $\text{NO}_x$  performance and  $\text{SO}_2$  oxidation.

For example, if de $\text{NO}_x$  removal had decreased per active



*Figure 2: SCR activity to SO<sub>2</sub> oxidation ratio: The aim for the catalyst was to get a similar or if possible a higher number compared to the standard DNX catalyst. This show that the increased vanadium loading on the catalyst is contributing to the DeNOx reaction and not just SO<sub>2</sub> oxidation. The k number for the catalyst is higher than the standard DNX catalyst indicating an even better suppression of the SO<sub>2</sub> oxidation a crucial property especially at low temperature operation.*

site you would see that the ratio decreased compared with standard catalyst and as Figure 2 on page 2 illustrates, this is clearly not the case, in fact it performs a little better. Moreover, the unique corrugated based substrate ensures that macropores are present which allows for better resistance from pore blocking, for instance caused by ABS. They simply allow the flue gas to enter into the interior of the catalyst despite build-up of deposits on the catalyst surface.

### FIELD CASE

The catalyst has been tested and exposed to real flue gas conditions up to several thousand hours of operation on a diverse type of plants such as cement-, biomass-, waste-plants and off-course boilers, and was currently in regular operation in about 5 plants around the globe by the end of 2020.

As we will describe below, a small sized boiler had struggled to reach emission regulations but with the new catalyst this installation is now under the emission limit.

The specific boiler is a boiler based in the US. As a background history, the SCR catalyst was originally designed to be operating with four times the current flue gas flow rate

and at higher temperatures too. So, with catalyst designed for four times higher flow rate it should for sure meet the emission requirement, right? Unfortunately, the combination of several design related issues and due to in particular operation below the 350°F temperature, it was a challenge for the plant to meet the required emissions. Even with overdosing of ammonia the required NOx out was not meet, the plant had operated with exceptions from their permit and was on their final and last exceptions.

The whole revamp project consisted of optimizing the ammonia injection for the lower flue gas flow rate including changes to the guide vanes, the existing catalyst was taken out and replaced with the new catalyst along with half of the cross section blocked off.

On the picture in Figure 3 you can see that the catalyst has a much darker tone than traditional DNX deNOx catalyst which is a clear indication of the increased amount of active sites. In the middle you see the test elements installed. The test elements allow the client to follow the performance of the catalyst over time.



*Figure 3: Umicore's TripleCat catalyst with test elements installed in a US based boiler, the darker color of the catalyst compared to standard DNX catalyst is due to the much higher vanadium loading.*

With the new catalyst installed and a final tuning of the boiler, and the plant started up and is now able to meet their requirements both for NO<sub>x</sub> and NH<sub>3</sub> slip. It has been operating for +4,000 hours and emission limits are still met, demonstrating the strong performance of the new catalyst.

#### FINAL THOUGHTS

To sum up, Umicore's new SCR catalyst was developed towards low temperature operation without necessary reheat of gases before entering the catalyst by increasing low temperature activity over three times to the conventional SCR catalyst. This project demonstrated the value of working with a customer, to develop a catalyst that meet a new need for them: in this case the increased demand for low temperature SCR operation. The catalyst has now been demonstrated in several plants meeting all projected performance targets.

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#### BIOGRAPHY



*Henrik Andersen was born and raised in Denmark. He received his masters in science and chemical engineering from the Technical University of Denmark, Copenhagen, Denmark 2005.*

*Since 2008, Henrik has worked in air pollution control and DeNO<sub>x</sub> catalyst when he joined the Umicore DeNO<sub>x</sub> catalyst team in Copenhagen (part of*

*Topsoe back then). In 2016 he jumped on an opportunity to relocate to their office in the U.S., initially for a limited time, though now he has made it a more permanent fixture.*



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# Medical Campus Laboratory Plume Dispersion Modeling

*Written by Jeffrey Everett and Paul Harris, Ph.D., Airflow Sciences Corporation*

## INTRODUCTION

A primary consideration in the design of building ventilation systems and exhaust stacks is to ensure that the stack exhaust plume is adequately dispersed into the atmosphere. Particularly with multi-story buildings and skyscrapers, the aerodynamic conditions in the vicinity of the building can vary widely under different wind speed and weather conditions. Proper exhaust stack design must ensure that the stack extends high enough above the top of the building, and expels gas at an appropriately high velocity, to minimize the risk of downdraft that could pull the exhaust plume back toward the building ventilation intakes, or toward the ground or other pedestrian walkways. While a number of industry standards and stack design parameters have been developed over time to aid in this process, Computational Fluid Dynamics (CFD) modeling has become a powerful tool in analyzing the plume behavior under a range of external conditions, taking into account the actual building geometry, the influence of surrounding buildings and other structures, and the local topography.

## BACKGROUND

At a medical campus research center, the small amounts of gases released from laboratory experiments are collected in fume hoods and exhausted through vent stacks on the roof of the building. Figure 4 shows a close-up view of the building and vent stack arrangement.



**Figure 4: Research building roof and exhaust stack geometry (Building intake louvers in orange)**

As part of a recent upgrade project, the facility planned to replace existing vortex dampers in the exhaust system with variable-speed drives to modulate the exhaust fan flow rates. As part of the re-design, a dispersion study was desired to evaluate the exhaust plume behavior over a range of potential system flow rates and aid in developing an optimized fan duty cycle. A survey of the nearby area highlighted several potential concerns, including building intake vents, pedestrian gathering places, and parking garages. There was concern that these gases might be blown down to ground level or be entrained into other nearby buildings before the gas concentration had been diluted to a harmless level. Given the variability of the wind, the variety of nearby locations the gases might travel to, and the low concentration of the gases involved, physical testing to determine the gas dispersion would have been time consuming and costly. Therefore, Computational Fluid Dynamics (CFD) modeling was chosen to analyze the plume behavior under a range of different ambient wind conditions and fume hood gas flow rates.

## CFD MODEL DEVELOPMENT

A three-dimensional CFD model was constructed of the exterior of the laboratory buildings, the nearby medical campus, and the surrounding community. A combination of 2D campus maps, 3D building CAD of campus buildings, and Google Earth 2D/3D measurement tools were utilized to develop the geometry of buildings, trees, and the overall layout of the terrain. Topological data of the ground elevation, which varied significantly across the model domain, was imported from USGS survey records, and integrated with the building geometry to ensure that each building's overall height was correctly positioned relative to the ground elevation. Figures 5 and 6 on page 6 provide details of the terrain and CFD model geometry.

Over 100 million computational cells were included in the CFD mesh. The mesh had a great variation in length scales; the domain was nearly a mile across, but also included the detail of the 48-inch exhaust stacks on the roof of the laboratories, with carefully selected cell sizing parameters to accurately track the plume dispersion. The model inlet boundary condition was applied around the outside perimeter of the domain – a circular domain with multiple inlets was constructed to allow the wind to enter the model from any direc-

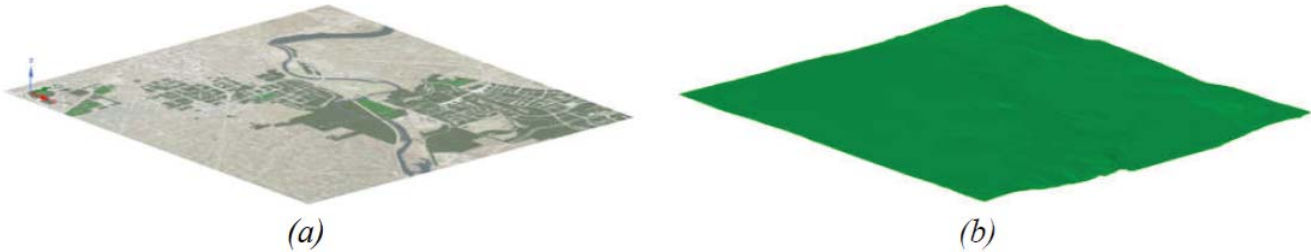


Figure 5: 2D aerial map (a) and topological surface generated from USGS data (b)

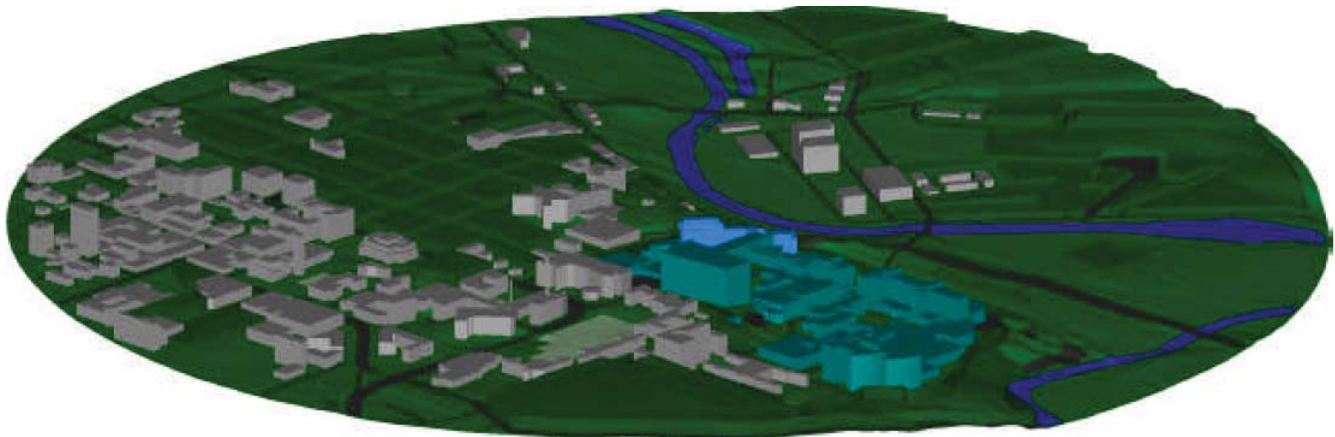
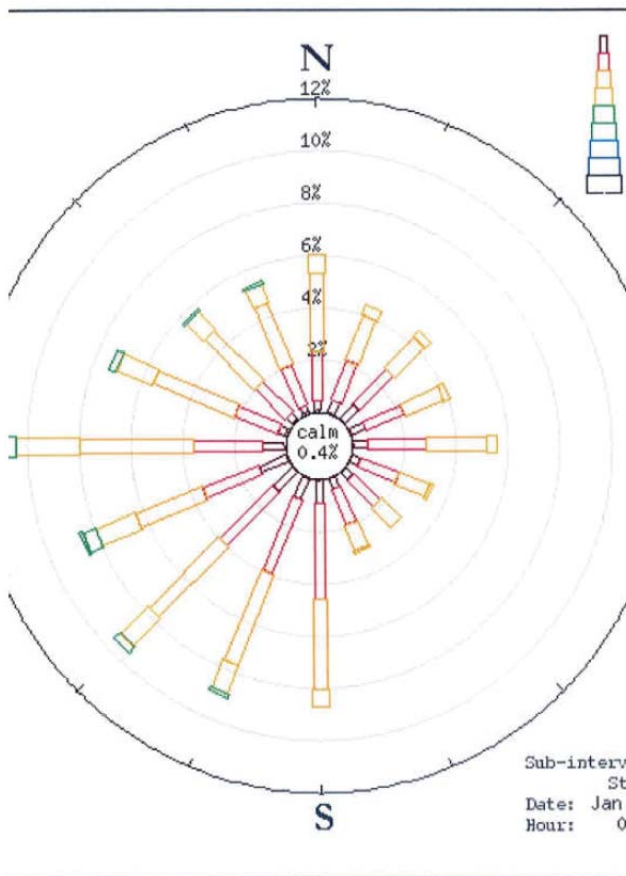


Figure 6: Completed CFD model geometry



tion. A wind rose map (Figure 7a) displays the most common wind conditions for a particular area and is used as a guide for selecting simulation scenarios. The wind velocity distribution is applied in the form of an atmospheric boundary layer (ABL) profile (Figure 7b). Numerous methods exist for calculating the shape of the ABL, but it is generally accepted that the profile curve is equal to the “prevailing wind speed” at a point located about 30 feet off the ground – this corresponds to the typical elevation of an anemometer or other measuring device at local weather stations.

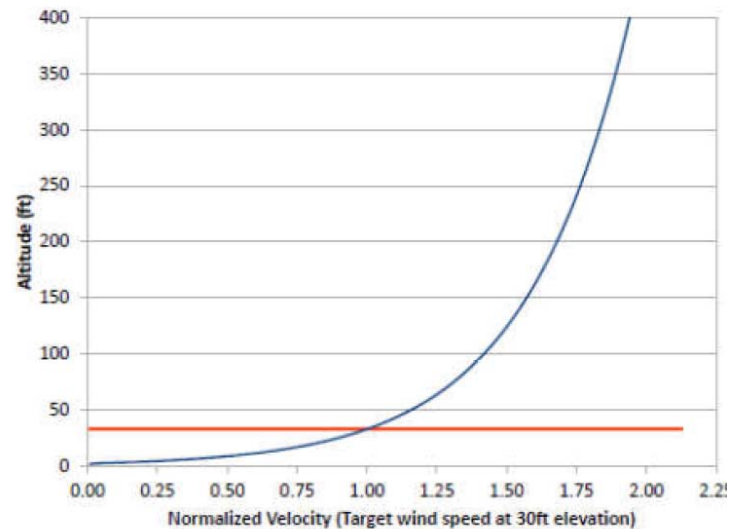


Figure 7: Meteorological wind rose (a) and calculated atmospheric boundary layer profile (b)

Although the model construction allows simulation of any wind direction and velocity, typical analyses focus on a combination of the prevailing wind directions as reported by the wind rose, as well as any other condition that could result in a sub-optimal dispersion pattern due to the position of the exhaust location relative to nearby buildings or other features that could influence the aerodynamics.

Using the Azore® CFD solver, air flow patterns were calculated across the domain based on several different wind speeds and directions. The exhaust gases emitted from the stacks on the roof of the laboratory were also tracked as a separate species. The HPC parallel processing of the Azore solver allows for the timely calculation of multiple solutions with varying inputs, even with such a large number of computational cells. For these simulations, two computers, each

with 18 CPUs, 36 cores and 384 GB of RAM, were utilized in parallel.

Once the CFD simulations had converged, Azore’s integrated post-processing tool was used to quantify the gas concentration at several critical locations and visualize the dispersion of the gas species spatially. The post-processing workflow includes generation of gas concentration statistics, color contour plots, and animations, all of which can be scripted within Azore for easy, accurate, and repeatable analysis of multiple cases. Visualization of the gas dispersion using color contours and path lines superimposed on the geometry of the medical campus buildings clearly communicates the flow patterns and gas concentration levels at key locations. Example plots from one of the CFD model simulations are displayed in Figure 8 below.

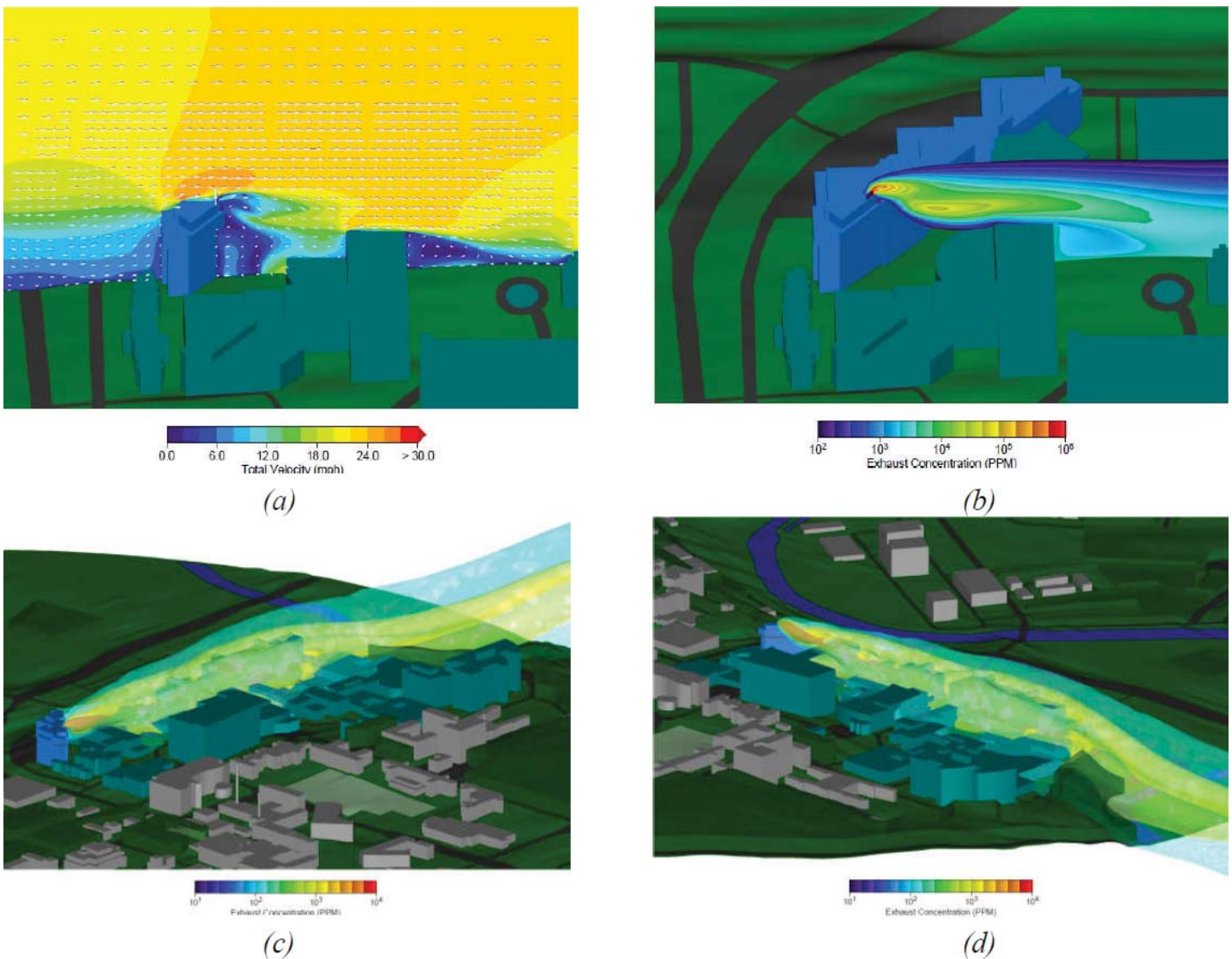
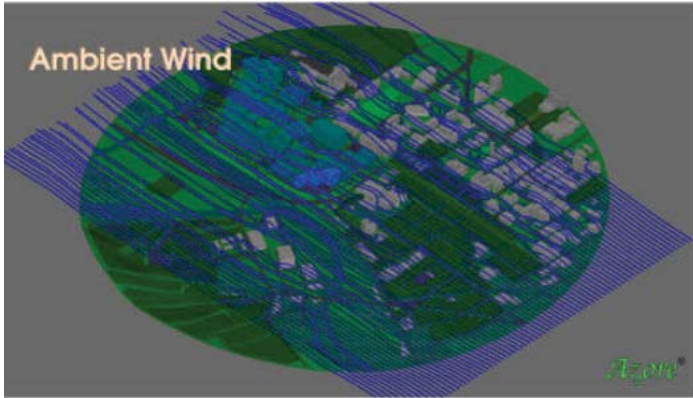


Figure 8: CFD color contour plots of (a) wind velocity, (b) exhaust concentration, (c)-(d) exhaust concentration iso-surfaces



(a) (b)  
**Figure 9: Streamline plots of (a) ambient wind and (b) exhaust gas**

In the simulation shown in Figures 8 and 9, the wind accelerates over the west side of the building and then separates, creating a re-circulation zone immediately downstream of the exhaust stacks. The exhaust spreads vertically in this wake, allowing a region of non-zero concentrations to remain close to the ground as it flows to the east. A typical design modification to address this would involve a re-design of the stack to either increase the height of the exit plane above the roof, or increase the exit velocity of the exhaust, such that the exhaust enters the ambient air in the orange region of the wind profile and avoids the re-circulation zone. Overall for this analysis, six different CFD simulations were conducted with different combinations of wind speed, wind direction, and exhaust stack flow rate. The results were utilized to help the facility operations department determine an appropriate VFD duty cycle to ensure that the exhaust emissions did not exceed dangerous concentrations of contaminants in the vicinity of the research building or other nearby locations. The results also illustrated the sensitivity of the exhaust dispersion to ambient conditions, and the potential need to correlate the exhaust system control strategy with the wind speed and/or direction.

A video animation of the flow patterns in this simulation was also created using the Azore CFD software. The animation can be viewed at the following link:

[https://www.youtube.com/watch?v=KmlNka\\_3aNE](https://www.youtube.com/watch?v=KmlNka_3aNE)

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**BIOGRAPHY**

*Mr. Jeffrey D. Everett is a Senior Engineer with Airflow Sciences Corporation. He has been with ASC since December 2008, performing a wide range of physical flow model studies dealing with pollution control equipment including SCRs, ESPs, scrubbers, and baghouses. Mr. Everett also has worked on an HVAC duct flow balancing project for the Boeing Helicopters Osprey and has been involved in R&D efforts analyzing pressure loss across structural trusswork.*



*He has performed over 100 CFD model studies for ESPs, SCRs, and sorbent injection systems, as well as other industrial applications such as HVAC design, food processing, gas dispersion tracking, and blast furnaces. He has experience in several types of power plant testing, including 3D velocity testing, coal pipe balancing, gas sampling, and online video inspections.*

*Prior to joining ASC, Mr. Everett worked as an Aerothermal Engineer at Chrysler, LLC from 2005 through 2008. His responsibilities included the testing and validation of vehicle aerodynamics, cooling/HVAC systems, and underbody thermal protection. Mr. Everett received a B.S.E. in Aerospace Engineering from the University of Michigan in 2003, graduating Magna cum Laude. He received his M.S.E. in Mechanical Engineering from Michigan in 2004. While at UofM he was active in research projects involving plasmadynamics, ion propulsion, and automotive fuel cell systems.*

*Dr. Paul J. Harris is a Senior Engineer with Airflow Sciences Corporation. He started at ASC in January 1999 after completing his doctorate degree. Dr. Harris has conducted field testing, applied CFD, and developed software*



*for the electric power and food processing industries. He has been involved in roughly 250 CFD modeling projects for industrial customers. Many of Dr. Harris' projects have involved CFD studies for thermal processing equipment such as food dryers and roasters, fiberglass mat production, and gas turbine exhaust systems.*

*He has significant experience in CFD modeling of pollution control equipment such as SCRs, ESPs, and FGD systems. Dr. Harris has also performed numerical simulations to improve cooling systems for lasers, design aircraft interior venting, and optimize thermal mixing in industrial equipment. Dr. Harris has been granted two US Patents for novel flow mixing devices developed through CFD modeling. Dr. Harris has also contributed to the development of the Azore® software suite, a commercial CFD package that is distributed and supported by Azore Software, LLC.*

*Dr. Harris received his B.S., M.S., and Ph.D. degrees in aerospace engineering from the University of Arizona where he specialized in computational fluid dynamics, heat transfer, and applied mathematics.*



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## The Status of U.S. EPA OTM-036 and the Promise of Lowering Reported FPM<sub>2.5</sub> Emissions on Wet Stacks

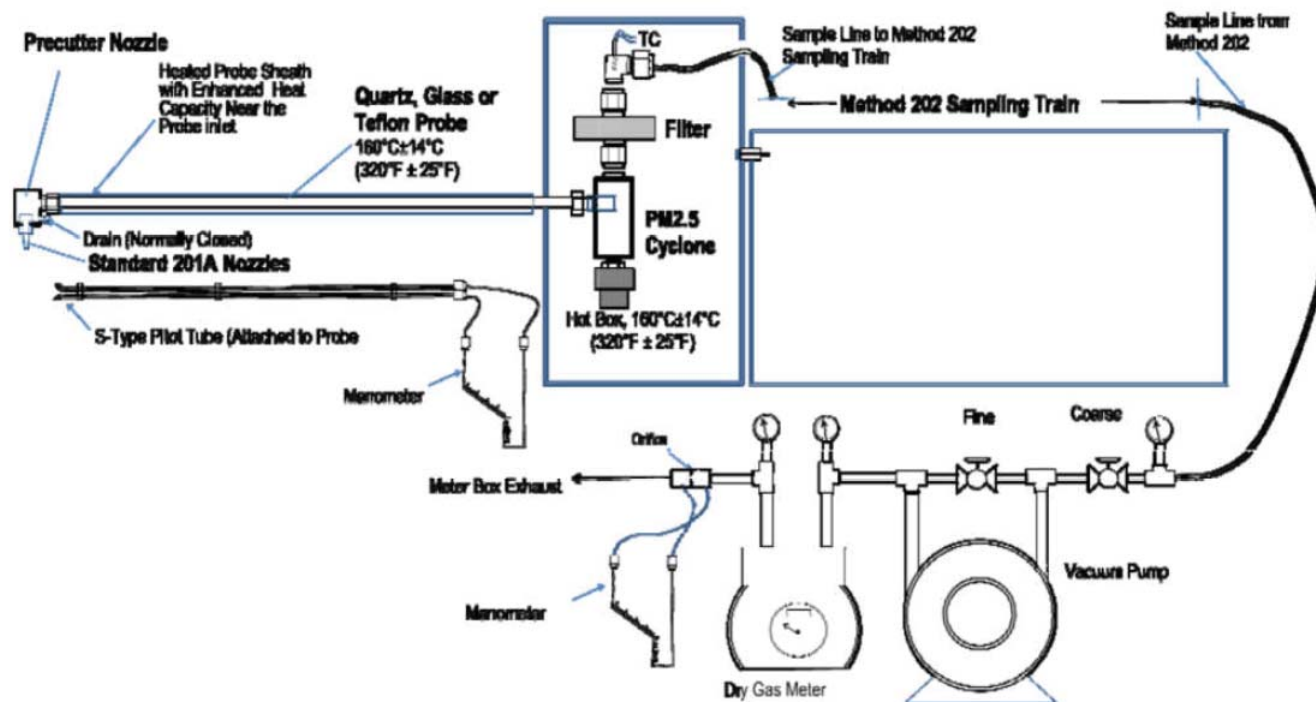
*Written by Jim Guenthoer, Clean Air Engineering*

The PM<sub>2.5</sub> National Ambient Air Quality Standard (NAAQS) was first promulgated in 1997 and the U.S. EPA has not yet developed an approved PM<sub>2.5</sub> stack testing method for wet stacks. The current U.S. EPA guidance for measuring PM<sub>2.5</sub> emissions in stacks with entrained water droplets is to use EPA Method 5 and report the total filterable particulate matter (FPM) as PM<sub>2.5</sub>.

This guidance presents obvious issues for industry as we showed in the Winter 2016 WPCA News article “U.S. EPA OTM-036: “Wet” Particle Sizing Test Method Promises Lower PM<sub>2.5</sub> Reportable Emissions.” This total FPM approach can bias the filterable PM<sub>2.5</sub> results high, in some cases as much as 30%. This overreporting was problematic back then and will be even more so now with the renewed regulatory focus on Environmental Justice, Citizen Monitoring empowerment and expected pressure to lower the PM<sub>2.5</sub> NAAQS in the future.

The good news was that several industry stakeholders, most notable the American Petroleum Institute (API) and the National Council for Air and Stream Improvement (NCASI) recognized the overreporting issue and funded research for the development of a PM<sub>2.5</sub> test method for wet stacks. This research led to the development of Other Test Method (OTM) -36: “Method for the Determination of Filterable PM<sub>2.5</sub> Emissions from Moisture Saturated and/or Droplet-laden Stationary Source Gas Streams (Constant Sampling Rate Procedure)” that was made final on April 7, 2016. Figure 10 is a schematic of that proposed method:

Clean Air Engineering (CleanAir) viewed this method development as positive step in the right direction. We fully supported the fundamental approach of the proposed method based on our prior work performing particle sizing studies using cascade impactors requiring precollectors on wet stacks.



*Figure 10: Original Proposed OTM-36 Sampling Train*



*Figure 11: CleanAir's CARB 501a/OTM-36 PCSC Precutter with APN Set (Patent Pending)*

There was however a critical flaw in the original sampling train. The most important element in the OTM-36 train is the precutter, or otherwise known as a precollector. The design of the original OTM-36 precutter, as endorsed by EPA, was sized for a droplet cut size of approximately 12 microns. This would take out the large drops that would rain from the plume when it exited the stack but allow the sampling of drops that EPA felt had the potential to generate  $PM_{2.5}$  emissions upon drying in the atmosphere.

Upon detailed inspection and preliminary calculations, Mr. Jim Guenthoer of CleanAir realized the physical design of the proposed OTM-36 precutter could not provide a droplet cut size of approximately 12 microns at the prescribed sampling rate but was instead considerable smaller. He estimated it was approximately 5 microns.

After discussions with the industry stakeholders and EPA and with more evaluations and computational fluid dynamic (CFD) simulations it was proved that the droplet cut size of the OTM-36 precutter as proposed was about 4.8 microns. This smaller cut size would remove many of the drops that

EPA indicated contributed to  $PM_{2.5}$  emissions, thus biasing the results low. As a result, EPA pulled the method from their website and has discouraged its use until a more satisfactorily performing precutter can be developed.

To address this method set back, CleanAir began an internal project to address the precutter issue using the approach, mathematics, and experimental work that Southern Research Institute (SoRI) used in the development of the original EPA/SoRI precollector for the CARB 501 cascade impactor method and its related wet stack addendum CARB 501a. It was soon realized that to be able to achieve the operating range necessary to provide a 12-micron droplet cut size over the normal envelope of wet stack velocities and moistures it would be necessary to have a wide range of nozzle lengths and inlet diameters. This led to the development of an adjustable precutter nozzle (APN) kit (See Figure 11) that makes it possible to conform to CARB 501a protocol and meet the OTM-36 requirement of an approximate 12-micron precollector cut size.

Using the program called WinCDRS, developed by Dr. Joe

ts (F)	dp (inH2O)	vs (ft/sec)	%H2O	Q2.5	Dn	Nozzle length	Qnozzle	D50(PC)	%Isos
100	0.5	41.4	6.39	0.61	0.18	7.5	0.438	11.8	100
100	0.5	41.4	6.39	0.61	0.195	7.5	0.438	12.2	85.9
100	0.5	41.4	6.39	0.61	0.18	8	0.438	12.2	100
110	0.5	42.04	8.6	0.609	0.18	8	0.445	12.2	101
120	0.5	42.65	11.48	0.607	0.18	8	0.451	12.2	99.2
130	0.5	43.32	15.16	0.604	0.18	8	0.45	12	100.8
140	0.5	44	19.8	0.6	0.18	8.5	0.462	11.8	100.5
140	0.5	44	19.8	0.6	0.18	8	0.462	11.8	100.5
150	0.5	45	25.39	0.596	0.18	8	0.466	11.8	97.9
160	0.5	45.98	32.18	0.59	0.18	8	0.469	11.6	96.4
170	0.5	46.8	40	0.585	0.164	8	0.472	11.4	96.2
180	0.5	48.2	49.7	0.576	0.18	9	0.473	11.2	93.7

*Figure 12: Adjustable Precutter Nozzle Wet Source Trial Runs*

McCain of SoRI to process PSD sampling data, CleanAir ran a series of simulation runs for the APN using a range of velocity heads, temperatures and associated saturated moisture values. Figure 12 shows the results of the sampling simulations for a stack velocity head of 0.5 inches. It can be seen the target precutter cut size of about 12 microns (D50) was achievable for essentially all stack conditions.

In addition to the computer simulations, CleanAir worked with NCASI to have some limited CFD runs performed on a single configuration of the precutter at a single stack condition. The preliminary results of the trial showed that the CFD results fell within the range predicted by the calculated results.

As said back in 2016, we believe this method approach has the promise to provide more representative filterable PM<sub>2.5</sub> measurements in wet stacks. The next necessary step is to run a series of comparative field trials on wet sources using Method 5 and the revised version of OTM-36 using the PCSC precutter with the APN to see if a repeatable reduction in PM<sub>2.5</sub> emissions reporting can be realized.

This work was originally planned for 2020 but for obvious reasons, due to the pandemic, had to be postponed. Working

with other industry stakeholders along with NCASI the goal for 2021 is to generate a body of data to substantiate this advance in PM<sub>2.5</sub> source emissions sampling.

Our hope is that this data set will provide the impetus for EPA to re-release OTM-36 with a prescriptive approach to the precutter that will produce the desired results. Once that happens OTM-36 can be used across a broader swath of industries to address the current overreporting issue on wet stacks, allowing the more accurate characterization of actual PM<sub>2.5</sub> emissions from a host of sources.

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**BIOGRAPHY**

*Jim Guenthoer has over 40 years of experience in the field of air emissions testing and consulting. Prior to joining Clean Air Engineering, he worked at several other engineering consulting firms as well as air pollution control and source testing equipment manufacturers. While at those firms his roles included project management and field testing, as well as design, manufacture, technical service, and sales of in-situ cascade impactor particle sizing devices. While at one firm he was involved with research and de-*

velopment studies of novel particulate control technologies using enhanced electrostatics. He is a Qualified Source Testing Individual (QSTI), Groups I-IV and holds a master's degree in Environmental Engineering from the University of Washington, where he developed the foundation for his expertise in the field of particle size distribution using in-situ cascade impactors.



## Who We Are



The Worldwide Pollution Control Association (WPCA) has assembled a group of people and companies who are experts at some aspect of pollution control. In addition, the WPCA has organized a user advisory board who can give this group direction and assistance in performing service to pollution control business throughout the world.

## Our Mission

The mission of the WPCA is to enhance technical communication through seminars, technical journals and a website. The WPCA is a non-profit organization and our members and advisors need to be motivated by a desire to see the pollution control community make world wide technical progress through improved technical communication.

## Who Directs the WPCA?

The WPCA is a partnership which includes system/equipment/services suppliers, consultants and users. The WPCA President, Vice President and Advisory Committee are equipment users. The Corporate Sponsors and Board of Directors are suppliers. Together they develop annual seminars and events to achieve their goal of better technical communication for users of air pollution control systems.

## How do I become a Member of the WPCA?

In order to be a WPCA member, you must be an end user of pollution control equipment. When you register on-line for any WPCA sponsored seminar, you automatically become a member. If you would like to join, but cannot attend a seminar at this time, please download and send in the Registration Form at the top of the members list at [www.wpca.info](http://www.wpca.info). You will then be emailed regarding upcoming events and sent future copies of the WPCA News.

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