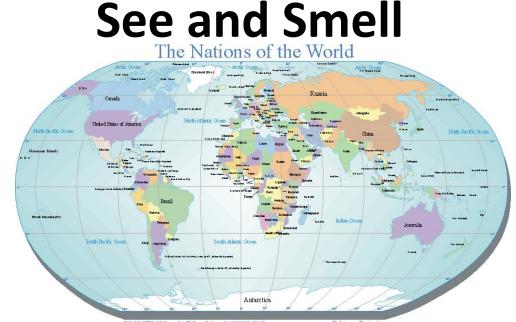
Visible Emission Management Forget the School, Use the Tool The Digital Opacity Compliance System Third Generation (DOCS III):

> USEPA Alternative Method 082 Visible Emission Management May 13, 2022

Shawn Dolan Virtual Technology LLC 801 309 3626 Air Sensor International Conference Shawn.Dolan@virtuallc.com

Opacity Globally Accepted Nuisance Emission Measurement People Complain About What they



World Bank Requires,<20% Opacity Guarantee for Payment ASTM D7520-16, used by World Bank: Opacity Measurement Thousands of Projects, located in nearly every country % Opacity is the Nuisance Emission Measurement Indicator. 1



Opacity Monitoring History



- 1800-1974 Opacity used to optimize combustion sources and determine the nuisance level of air emissions
 - 1968 Federal Government/Industry Panel Publish AP-40 Opacity legally established as measure.
 - 1970 EPA Published NAAQS, and national Opacity measure
 - 1971 EPA proposes 10% Opacity limit on Portland Cement
 - 1974 Reference Method 9 published in New Source Performance Standard, Opacity measurement.
- 1975 to 2000 Reference Method 9 is written into the vast majority of Clean Air Agency Regulations, City and County Ordnances throughout the US and developing countries and the measurement to the Maximum Visible Emission Allowed.
- 2007 ASTM Workgroup to meet Technology Transfer Act requirement for EPA to use consensus standards, Creates the Digital Camera Opacity Technique D7520
 - 2009 ASTM D7520-09 approved and published
- 2012 February EPA Office of Air Quality Planning and Standards published US EPA Alternate Method 082 (ALT 082), **Broadly Applicable Standard:**
 - Digital Camera Opacity Techniques (DCOTs) can be used "in lieu of Method 9", for all subparts of 40 CFR 60, 61 and 63

US EPA ALT 082 Broadly Applicable Standard Most Credible Evidence Today

Opacity can be used by All Enforcement Agencies in US to act, against a pollution source.²



Evolution of DOCS III Continued



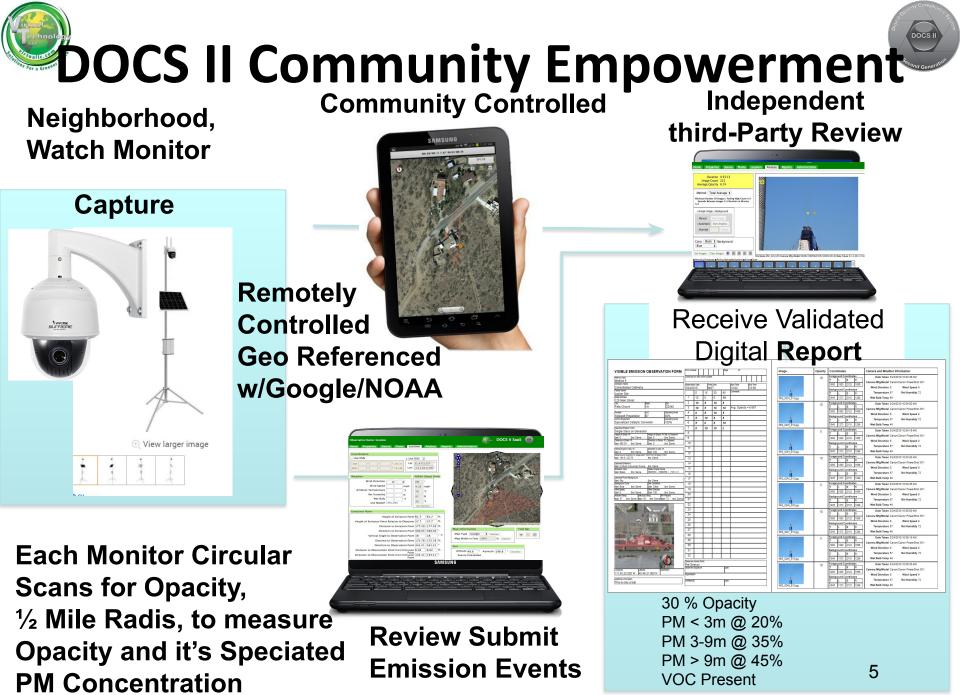
- 2012 to Present Fugitive Dust Applicability
 - Applicable to fugitives per 40 CFR 60 Subpart ooooa October 2012
- 2015- EPA opinion "Any Creditable Evidence" rule of Clean Air Act, DCOT Most Credible
 - Applicable to all Source types "a picture says a thousand words".
- 2015- FerroAlloy NESAP defines DCOT as BACT, and mandates for Process Fugitive Emis.
- 2016 ASTM D7520-16 Approved Applicable to all Opacity Sources
 - Digital Camera Opacity Technique (DCOT) Applicable
 - Stationary, Mobile, Fugitive
- 2017 FerroAlloy NESHAP final reconsideration ruling DCOT is BACT for Opacity.
- 2018 DOCS II Flare Watch Development begins expanded background, auto detect
- 2019 DOCS II Heavy Diesel Inspection and Maintenance Full Speed Opacity Monitoring
- 2020 Auto-Detect released to production clients for Flare Watch and HD Diesel ID
- 2020 Heavy Diesel Inspection and Maintenance Toll Integration
- 2021 Community Monitoring and Educational Tools
- 2021 Reflection/Refraction/Rayleigh/Mie, Scattering principles used to speciate Opacity into PM Concentration within the Plume.
- 2022 Neighborhood Wide Area Scanning Opacity Monitor
 Reporting % Opacity and concentrations of PM <3,3-9,>9
 DOCS III Monitors Opacity from Feet to Miles Away



Opacity Based Monitoring

Regulatory Compliance, Community Conservation



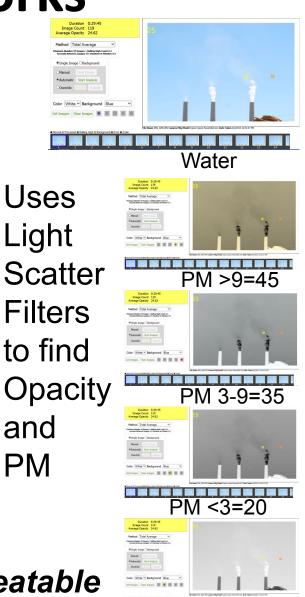




How DOCS III Works

- An image or images of the emission source are captured by a Certified Camera Operator, credential for the Neighborhood watch, 6th Grade Class
- The images are uploaded to the "Cloud" where they are acquired by a Certified Analyst who identifies the Regions of Interest Credential for High School Graduation
- DOCS II then applies algorithms to the Regions of Interest and calculates the opacity of each image and the average, based on the selected rule, e.g. 6 min. avg., 3 min. avg.
- Opacity calculated is then converted speciated PM
- DOCS II generates a VEE report with speciated PM
- Data Owner accepts/rejects the draft VEE report
- DOCS II generates final VEE report and archive record with Opacity and Speciated PM

Inexpensive, Simple, Fast, Reliable, Repeatable



and

PM



Community Air Protection Program

- Uses Promulgated Nuisance Emission Measure Opacity as base
 - Enables Regulators with Actionable Information
 - Defines the Source and the PM emission.
 - Wide Area Scanning Line of Sight for 1 mile.
 - Scans Fence lines for Nuisance Emissions
 - Measures Distance to plume LiDAR embedded
 - Measures Temperature Plume
 - Day and Night
- Stationary Sources
 - · Permitted with Opacity limits, require other compliance monitoring
 - Over 10,000 Stationary Sources monitored by DOCS
- Mobile Sources
 - Monitor for High Emitters at speed,
 - Vehicle Counts cars, trucks, trains, planes, ships
- Fugitive Area Sources
 - Larger sources farms and agriculture
 - Largest category of undocumented air pollution
 - Includes Wood Smoke and other unpermitted sources
- Natural Area Sources (spikes during event)
 - Great Dust Storm and Forest Fire Pictures
- Security and Surveillance Enabled
 - People/Animal detection
 - Automated perimeter search







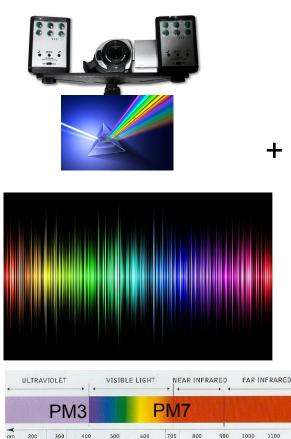




Opacity/PM/VOC



Cameras Document Light Scatter humans can not see



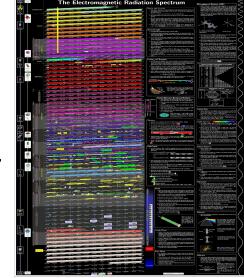
PANCHROMATIC FILM

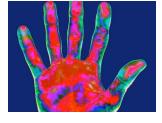
NFRARED FILMS

EXTENDED RED-SENSITIVE PANCHROMATIC FILMS

EXTREME INFRARED SENSITIVE MATERIALS

Energy/Intensity Level, humans can not feel





Temperature delta's humans can not feel

120

LIMIT OF TRANSMISSION BY GLASS



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Between Selected ROI's 30 % Opacity PM < 3m @ 20% PM 3-9m @ 35% PM > 9m @ 45% VOC Present ⁸



Spot the Smoke Air Quality Complaint System People Complain About What They See and Smell, Nuisance Emissions



Load App



Take or Attach an Exiting



Log In or Create an Account



Touch the Screen to Indicate Where you are looking



Submit to create a Draft Report Submit Draft for Opacity Analysis Receive Final Report





2013-01-24 14-43-41



Ambient Temp (in F degrees): 45 Dew Point (in F degrees): 31 Relative Hum (in %s): 60 Wind Speed (in mph): 0 Wind Direction (in degrees): N Observer Lat Lox: 41.19667,4112.10275 Source Lat Lox: 41.19687,4112.10211 Opacity (in %s): TBD



CLICK HERE for review and opacity determination





Building Community Air Monitoring Infrastructure



Flare Monitoring System with Opacity Event

Flare Convert to JPEG every 15 seconds Side Mounted During marked event times Intrinsic all weather and display for observation cut down Internet Protocol Cam Time Marked Files to Local copy of MP4 "video files" mirrored Cloud high-capacity drives, Archived monthly Time marked by "Control Operators log" Observation Reportin for events or detections against known Analysis Site backgrounds https://virtuallc.com/Docs_Saas/Analysis.aspx?osid=1811 P - ■ C Ø Virtual Technology LLC - Leade... ● Docs Web - Analysis 👻 🖃 🖷 👻 Page 👻 Safety 👻 Tools 👻 🔞 🖉 🏂 🏨 Company Virtual Technology DOCS II SaaS ation Name: FlareWatch Demo Source Plume Location Analyze Reports MPEG to JPFG Method Total Average 🗸 JPFG Review Fondle between the single and multi-image view using the Remote copy of MP4 "video files" button in the upper right corner of the image when you hover Click on image to select/deselect the Start Image and then Control Operators log, Mark Event times. click on a subsequent End Image, to create the Observation set, when the Method selected is Total Average. If Method selected is Method 9, select/deselect the start image and the following 23 will be auto selected, to create the Observation Cuts MP4 into (1) JPG/15 seconds set. As the Observation sets are listed based on the selection to reselect the images in the Observation set, delete the listed Observation set using the red circle, and then reselect Once all Observation sets have been selected, the Extracts JPG sets (Observations) Observations will be created with a save function from this master Observation. All data from all tabs, will be copied from his master Observation to the child Observations selected Clear Image

Observation

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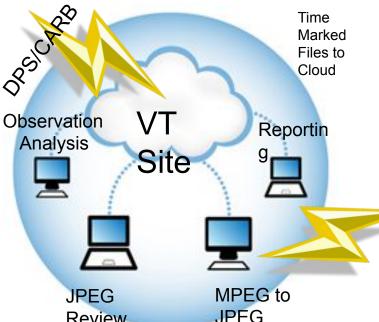
Runs screening on Observations Marks observations JPG w opacity. Generates Monthly and Semi Annual report.



Heavy Duty Vehicle Emissions Enforcement

DOCS II

Convert to JPEG every 15 seconds During marked event times and display for observation cut down



Enforcement Site Under the Came of the Comment of the Came of the



Local copy of MP4 "video files" mirrored high capacity drives, Archived monthly Time marked by "Control Operators log" for events.

Review JPEG Remote copy of MPEG "video files" Plate/Transponder number tag to images. MP4 into JPG at set interval (reduce storage) Opacity Analysis on high image (smoke > 5%) Creates Violation Record (Image, Opacity, Plate/Trans) Transmits Violation record to ??? For enforcement Automated Enforcement Close out Generates monthly follow up report

