The Impact of $PM_{2.5}$ Legislation on Filter Bag Performance Alternatives

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McIlvaine Company Hot Topic Hour
October 28, 2010

Summary of National Ambient Air Quality Standards (1997-2006)

	1997 Standards		2006 Standards	
	Annual	**24-hour**	**Annual**	**24-hour**
$PM_{2.5}$ (Fine)	**15 µg/m^3** Annual arithmetic mean, averaged over 3 years	**65 µg/m^3** 98th percentile, averaged over 3 years	**15 µg/m^3** Annual arithmetic mean, averaged over 3 years	**35 µg/m^3** 98th percentile, averaged over 3 years
PM_{10} (Coarse)	**50 µg/m^3** Annual arithmetic mean, averaged over 3 years	**150 µg/m^3** Not to be exceeded more than once per year on average over a 3-year period	**Revoked**	**150 µg/m^3** Not to be exceeded more than once per year on average over a 3-year period

State Rules

- SCAQMD Rule 1156 in 2005 reduced the frequency of compliance tests when verified fabrics are used in the cement industry. This was expanded in Rule 1155 to cover other applications.

- EPA OAQPS sent a memo in September 2007 to the Regional Offices encouraging actions similar to SCAQMD's rule.

Filter Media Options

- Pulse Jet
  - PPS Felt
  - P-84® Felt
  - Teflon® Felt
  - PPS Felt / membrane
  - PPS Felt / PTFE Resin
  - Woven Fiberglass
  - Woven Fiberglass / membrane
  - PPS Felt / P-84® Blends
  - Aramid (Nomex®) Felt
- Reverse Air
  - Woven Fiberglass
  - Woven Fiberglass/ membrane

Evolution of Standard Test Methods

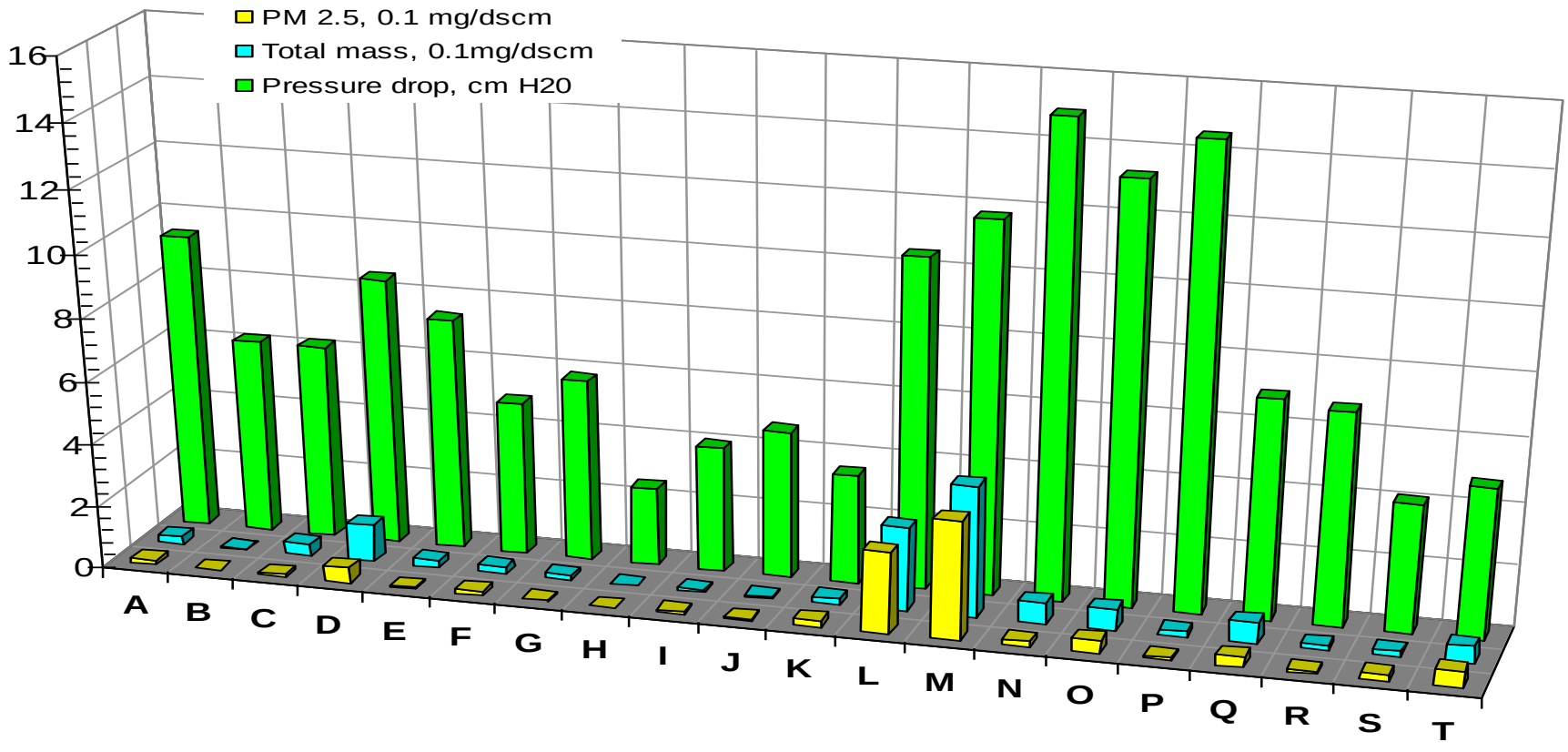
	EPA/ETV	ASTM	ISO
YEAR	2000	2002	2011
I.D.	BFP	D6830	"11057"
GOAL	Verification of BFP Vendor Claims 2.5 Efficiency ΔP	Product Development End User Suitability 2.5 Efficiency ΔP	Comparison of Operational Performance & Particle Emission
PROTOCOL	EPA	EPA/Modified	ISO
SAMPLE	Vertical Round Disc	Vertical Round Disc	Vertical Round Disc
FILTER FACE VELOCITY	120 m/h	120 m/h[1]	2 m/min. (120 m/h)
DUST (Concentration)	Pural NF 18.4 g/dscm	Pural NF[1] 18.4 g/dscm	Pural NF 5.0 g/m^3
CLEANING	Pulse Jet	Pulse Jet[1]	Pulse Jet

Notes:
1 – ETS, Inc. can modify test conditions such as filter face velocity, user-supplied dust, dust feed rate, reverse air cleaning, etc. to suit the end user's requirements.

Environmental Technology Verification (ETV) Results

A-K membrane

L-T non-membrane



Filtration Performance Results

Vendor	$PM_{2.5}$ Outlet (gr/dscf)	Total PM (gr/dscf)	Average Residual ΔP (in w.g.)	# Cleaning Cycles
Donaldson Company	<0.0000073	<0.0000073	1.41	177
GE Energy	<0.0000073	<0.0000073	1.19	115
W.L. Gore & Associates	<0.0000073	<0.0000073	1.07	120
TDC Filter Mfg.	0.0000638	0.0000675	6.24	3600
BWF America	0.0000523	0.0000523	1.64	263

Bag Quality Control Program

- **Fabric**
  - Construction
  - Tensile
  - Permeability
  - Mullen Burst
  - MIT Flex Endurance
  - Finish
  - Filtration Performance
  - Fabric Thermal Stability (% Shrinkage)
  - Organic Matter (LOI)
- **Thread**
  - Material
  - Strength
- **Hardware**
  - Caps
  - Rings
  - Bands
- **Bags**
  - Inspect for general quality of workmanship
  - Length as fabricated
  - Length under tension
  - Cuff to thimble & cap mate
  - Cage Fit

Review and Conclusions

- Both PM 2.5 and total emission test results have consistently shown that the fundamental filtration capability of the vast majority of fabrics tested far exceeds any existing emission control requirement.

- ETV/BFP has proven to be a very valuable tool for:
  - verifying vendor filtration performance & pressure drop claims

Review and Conclusions

- ASTM 6830 with more than 300 tests conducted has proven to be:
  - an essential component of QA/QC programs when purchasing new bag sets
- There is an industry wide high level of fabric development activity which has shown greatly improved filter performance both regarding efficiency & pressure drop.

Review and Conclusions

- Future enforcement will most likely be focused on plant baghouse O&M.
- It will be important to demonstrate what aspects of O&M plans are practical and valuable so as not to make these plans an operational nightmare.
- Tighter emission enforcement will increase the value of bag & fabric QA/QC and Bag Monitoring Programs and make performance warranties all the more important.