



# Quality Control for Modified Asphalt Binders

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# Quality Control

Supplier  
QC

HMA  
Plant QC

Type of  
Modification

PMA  
Production

Loading and  
Transportation

Offloading/  
Storage

Production/  
Construction



# Types of Modification

Example of Modification Applications – Should Be Based on Crude Source, PMA Production Plant

	Where is the modification added?	Range of Polymer Composition	Parameters of Modification
SBS #1	Production	0-100%	Increase high end PGAB; no effect low temp properties; high molecular weight.
SBS #2	Production	0-10%	Increases high end PGAB, Lowers Elastic Response; low shear polymer.
Polyethylene	Production	0-XX%	
PPA	Truck	Typical 0.2-1.5%; 2% Max	Based on Manufacturer Recommendations; not compatible with amine based chemistry
Process Oil	Production	0-ZZ%	Improves low temperature properties.
WMA	Truck	0-AA%	Warm mix applications

# Types of Modification

Why do we use various modifiers?

- SBS/SBR
- Polyethylene
- Ter-polymers
- Rubber – Ground tire rubber
- Chemical Modification
  - PPA;
  - Process Oils (Ex. Aromatic or Paraffinic Oil)
- Warm Mix Technologies



# Types of Modification - PPA

- QC Guidelines for PPA
  - Dosage ratio varies from 0.2 to 1.5%
  - Ratios between 1.5 to 2% - less common
  - PPA modification should be indicated on the Bill of Lading
  - Supplier should provide training to end user to prevent the usage for emulsions and with some warm mix additives (unless a compatible anti-strip or WMA additive is used)
  - Manufacturer recommends PPA and compatible anti-strip/WMA products are added by the supplier to ensure compatibility and certification.
  - Some states recommend limitations on PPA content (Wyoming and Georgia)

# Types of Modification - WMA

- According to NAPA's "Warm Mix Asphalt: Best Practices – 3<sup>rd</sup> Edition" there are
  - 22 Processes and Products
  - 47 States have specifications for WMA
- [www.neaupg.uconn.edu](http://www.neaupg.uconn.edu)
  - NEAUPG Qualified WMA Technologies
    - 12 Approved Technologies
  - NEAUPG Qualification Process

# NEAUPG Qualified WMA Technology – March 2012

- Organic (Waxes) Additives
  - SONNEWARMix™
- Chemical Additives
  - CECABASE RT
  - Evotherm WMA
  - Low Emission Asphalt-Lite (LEA-Lite)
  - Rediset LQ
- Foaming
  - Advera
  - Double Barrel Green System Green Pac for Continuous and Batch Plants
  - Low Emission Asphalt (LEA)
  - MAXAM AQUABlack WMA System
  - Meeker Warm Mix System
  - Terex® Foamed Warm Mix Asphalt System
  - Stansteel Accu-Shear

# Northeast States WMA Qualification Process

- Part I – WMA Technology Qualifications/Experience
  - WMA Technology Specific Info; Results and Test Data
  - Experience with WMA
- Part II – Submit Binder and Additive Samples for Sponsor State DOT Testing
  - Binder and Additive Samples, Required Testing
- Part III – Required Mixture Testing on Sponsor State DOT Mix Designs
- Part IV – Submit Technology Specific Production Testing and Compaction Details
- Part V – Approval
  - No Negative Impact to Binder Performance Grade
  - Comparable Mix Properties



# WMA Compaction

- WMA Compaction will vary based on the paving conditions and technology
  - Warm weather paving
  - Pave in cool ambient conditions
  - Long haul
  - Higher percentages of RAP

Typically WMA can be produced at temperatures that are 35 to 100°F below traditional HMA temperatures.

# Supplier QC - PMA Production

- Laboratory Research and Development
  - Polymer Compatible/ Stability
  - Performance Properties
  - Are there limitations of use for a given polymer or chemical modification?



# Supplier QC - PMA Production

## Laboratory Research and Development

- Polymer Compatible/Stability
- Performance Properties
- Are there limitations of use for a given polymer or chemical modification?

# Polymer Compatibility/Stability

- Temperature of milling
- Tank Storage Temperature
- Polymer loading
- Polymer composition
- Mill Gap
- Base Asphalt Crude Composition Base Asphalt  
Chemical composition
- Curing time at various polymer percentage levels
- Days of stability
- Tank heel age and composition prior to production  
runs



# Polymer Compatibility/Stability

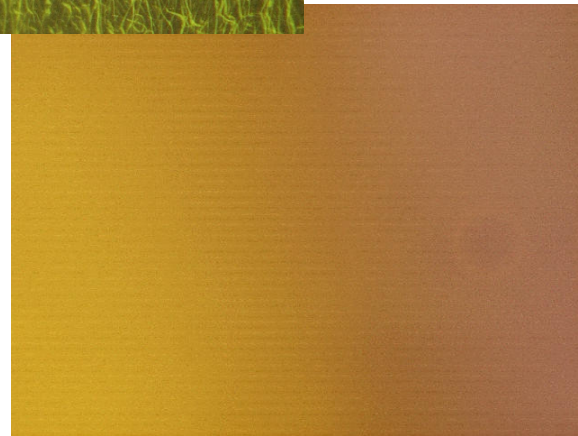
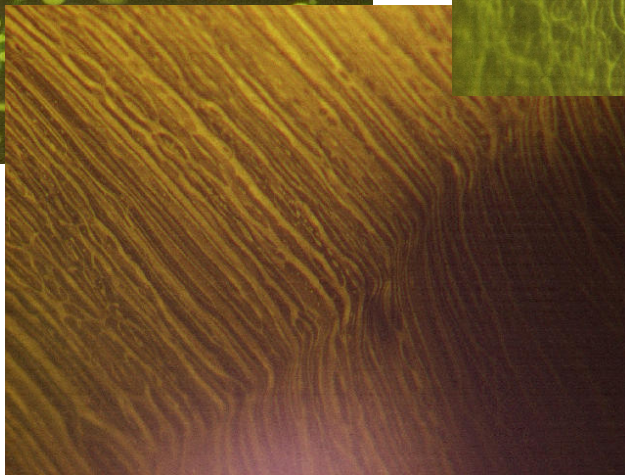
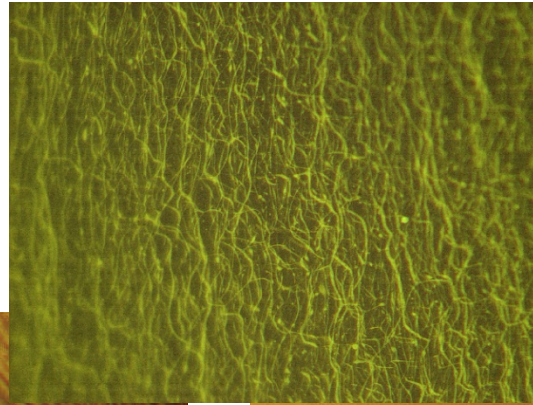
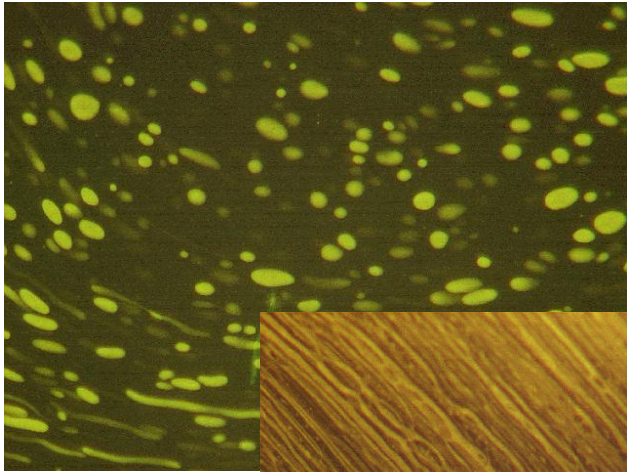
	SBS10-10	SBS10-20	SBS10-30	SBS10-40	SBS10-50
PG 70-22	X	X	X	X	X
Polymer	A	B	C	D	E
Sep Test, R + B Diff	0	3.9	2.8	0	-2.2
% Difference – DSR	-2.2	3.8	4.8	0	-1.5
ODSR Fail Temp	99	94.9	94.3	97.4	95.9
RDSR Fail Temp	98	93.0	94.6	95.8	95.1
PG Classification	PG 94-XX	PG 88-XX	PG 94-XX	PG 94-XX	PG 94-XX
True Grade	98-XX	93-XX	94.3-XX	95.8-XX	95.1-XX

# Supplier QC - PMA Production

- PMA Plant  
Production  
Parameters

- Can the PMA  
plant process  
the SBS?
- Does this SBS  
help cure times,  
PGAB  
properties?

# Verifying that the PMA Production is Cured



# PMA Storage

What is the storage stability of the modified binder?

What temperature should the binder be stored at?

Does the storage temperature of the PMA affect the PGAB binder properties?



# Transportation of PMA to HMA Plant

- Modifier Classification should be provided on the Bill of Lading
- Examples:
  - SBS/Warm Mix Surfactant
  - SBS/PPA Modified
- The trailer should be inspected to be free and clear of contamination
- An example of typical verbiage from a supplier QC plan is below:
  - A statement of this certification, signed by the driver, will be on each shipment/delivery ticket. This statement reads “I certify that this tanker is free of contaminating material upon loading. The product on prior load was \_\_\_\_\_.”

# Effects of Trailer Bottoms

Sample ID	ROB	Flash, C	ODSR @ 52C, kPa	Mass Loss, %	Penetration
ROB11-70	0%	254	1.48	-0.360	201
ROB11-01	0.5% ROB-A	265	1.45	-0.428	207
ROB11-08	0.5% ROB-B	265	1.38	-0.389	207
ROB11-15	0.5% ROB-C	257	1.44	-0.368	206
ROB11-22	0.5% ROB-D	262	1.45	-0.406	207
ROB11-29	0.5% ROB-E	265	1.38	-0.456	216
<b>Average @ 0.5% ROB</b>		<b>263</b>	<b>1.42</b>	<b>-0.409</b>	<b>209</b>
<b>AVG % Change at 0.5% ROB</b>		3.5	-4	13.7	3.8
ROB11-50	1% ROB-A	257	1.34	-0.564	216
<b>% Change at 1.0% ROB</b>		1.2	-9.4	56.7	7.5
ROB11-60	2% ROB-A	251	1.21	-0.770	230
<b>% Change at 2.0% ROB</b>		-1.2	-18.2	114	14.4

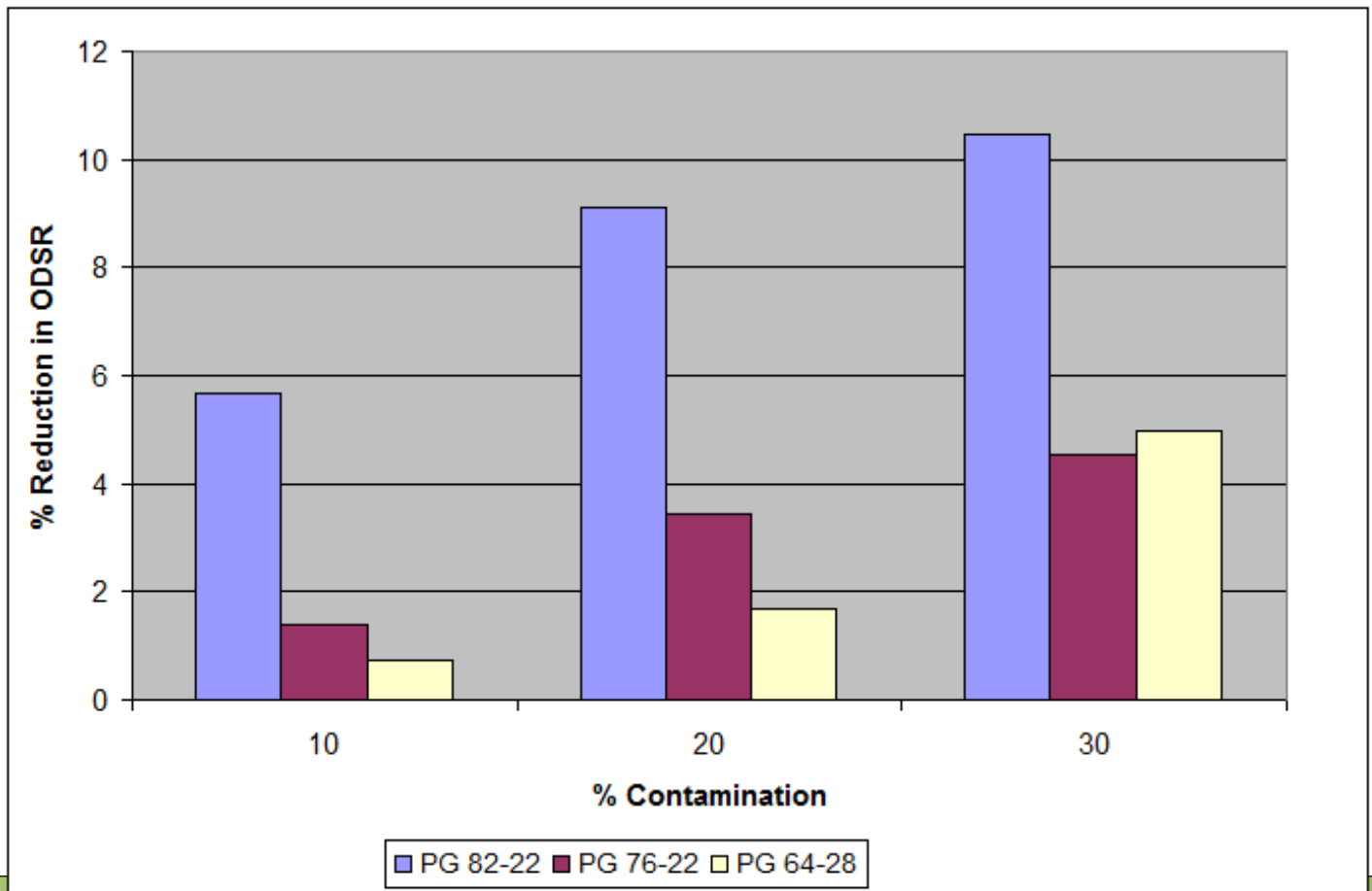
# QC at HMA Plant

- Establishing and checking the receiving tank
- Tank Storage Specifications
- Product Loading Guidelines

# QC at HMA Plant

- Tank Storage Specifications
  - Tank Model Number
  - Orientation
  - Height
  - Heating Type
  - Nominal Volume
  - Gross Volume, gal
  - Gross Volume, gal/inch
  - Coil Displacement Volume
  - Reserved Space Volume
  - Net Volume, gal
  - Net Volume, gal/inch

# Percent Reduction in ODSR Values at Various Levels of Co-mingling



# Results of Co-mingling

- PG 82-22: approximately for every 10% contamination with PG 64-22 the ODSR values will be reduced by 3-6%, and the RDSR values would be reduced 2 to 3%.
- PG 76-22: approximately for every 10% contamination with PG 64-22 the ODSR and RDSR values will be reduced by 1 to 2%.
- PG 64-28: approximately for each 10% contamination with PG 58-28 the ODSR values will be reduced by 1 to 3%, and the RDSR values will be reduced by 1 to 4%.

# Results of Co-mingling

Base PG Grade	Base PG Grade (PG Grade w/ % Let Down)	High Temp. True Grade	ODSR @ 82°C, kPa
<b>PG 82-22</b>	PG 82-22	90.09	1.89
	PG 82-22 (10% PG64-22)	84.99	1.28
	PG 82-22 (20% PG64-22)	82.69	1.06
	PG 82-22 (30% PG64-22)	80.67	0.891

# QC at HMA Plant

## Example Loading Guidelines

Last Product in Tank	Product to be Loaded			
	PG 58-28	PG 64-22	PG 70-22	PG 76-22
PG 58-28	OK to Load	Drain to Min. Level	Drain to Min. Level	Drain to Min. Level
PG 64-22	Drain to Min. Level	OK to Load	Drain to Min. Level	Drain to Min. Level
PG 70-22	Drain to Min. Level	Drain to Min. Level	OK to Load	Drain to Min. Level
PG 76-22	Empty to no measurable quantity	Empty to no measurable quantity	Drain to Min. Level	OK to Load





Questions?