PPG Automotive Coatings
Supplier Contamination Prevention Training

Craters and Dirt

January 2019

Training Objectives:

- Describe defects in paint caused by contamination
- Help suppliers understand the impact of contamination for PPG and its customers
- Highlight areas of risk in raw material manufacturing and packaging industries
- Outline the care that must be taken to reduce the risk of contamination in our supply chain

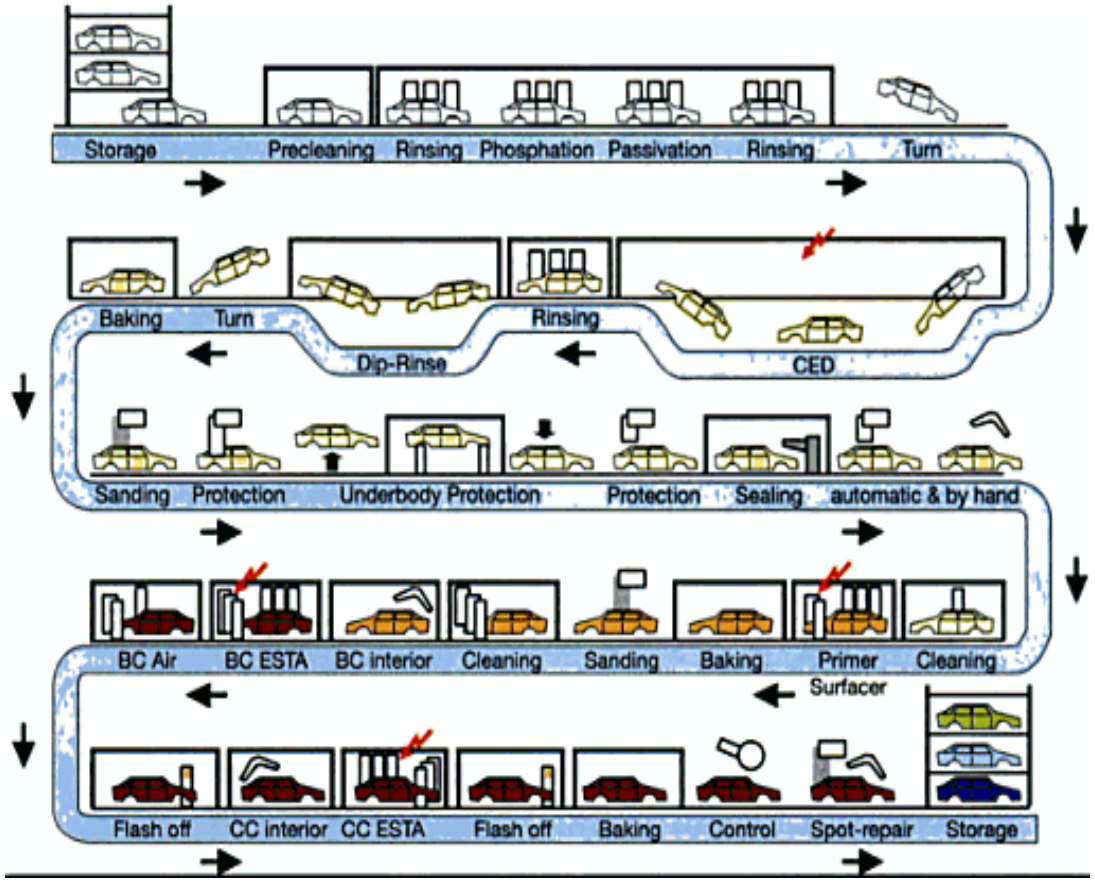
Contamination that causes defects in our paint

- Dirt, debris, rust, particulate
- Gels or Seeds
- Low surface tension contaminants that cause craters in our paint
  - Cross-contamination from a prior batch
  - Foreign contamination from maintenance materials, cleaning products, etc.

For several investigations related to contamination, the root cause was traced to the raw material, packaging or bulk transport

What happens if our paint is contaminated?

- Defects will appear on the paint when the vehicles are painted
- PPG's customer will need to repair the defects
- If the defect rate is too high, the entire line will be shut down and employees will be sent home
- The cost of running an automotive line is approximately $1,000,000 USD per hour



An automotive paint line

What risks can be present at a supplier facility?

Contamination risk is increased in the following ways:

- Insufficient oversight for bulk transport – incorrect wagon selected and/or inadequate cleaning
- Cross contamination during material processing in non-dedicated equipment – inadequate cleaning between products and/or insufficient scheduling guidelines
- Releasing excessive dirt in close proximity to processing vessels – dirty raw material containers, poor housekeeping and vessels not closed
- Contaminating non-silicone batches with silicone containing additives
- Use of equipment that has not been cleaned properly – tank, pump, hoses, stingers, funnels, etc.

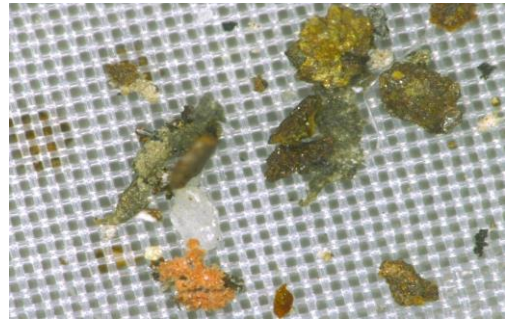
What risks can be present at a supplier facility?

Contamination risk is increased in the following ways:

- Improper storage of FG containers – pails, drums, totes
- Insufficient controls for temperature sensitive materials – e.g. allowing water based product to freeze
- Use of crater causing maintenance materials close to the production area
- Use of new or repaired equipment, gaskets, etc. without prior cleaning and testing
- Use of recycled drums in process or for packaging goods sent to PPG
- Employees wearing contaminated clothing, gloves, boots or skin while working close to the production area

Dirt, debris, rust, particulate

- If there are particles or seeds in the paint, the customer will have to sand the vehicles or reject them all together



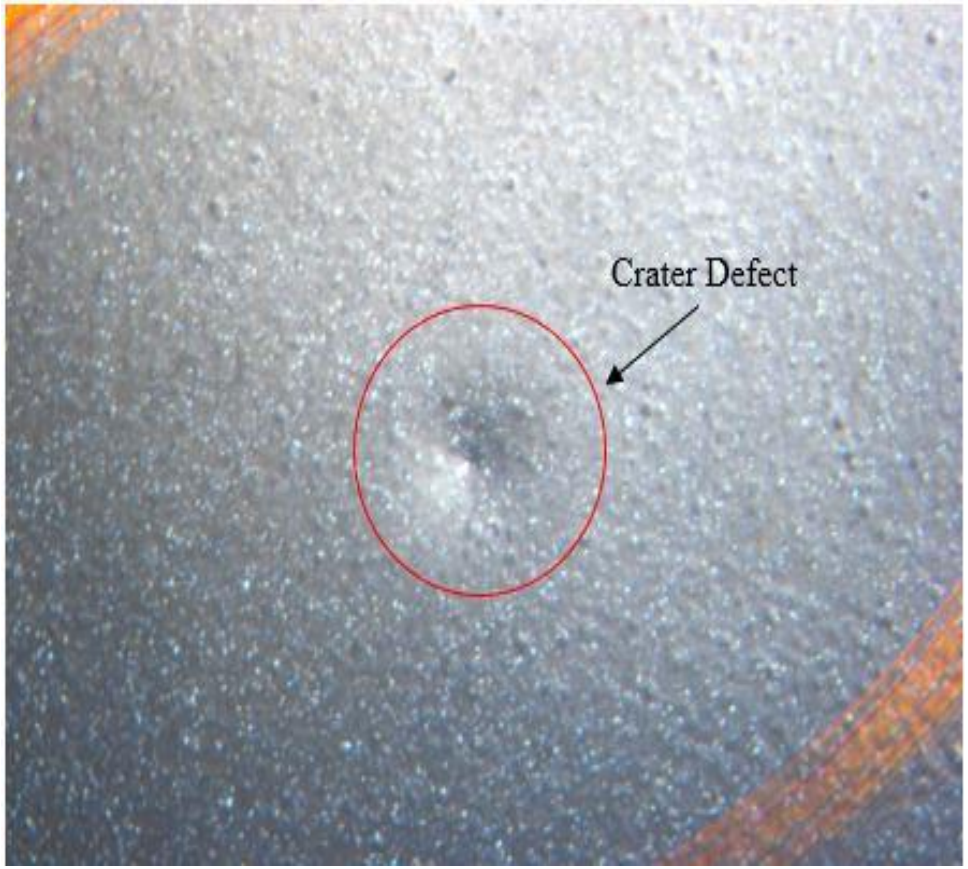
- Types of issues
  - Dirt/debris from environment and/or tops of containers
  - Rust from solvent pipes or storage tanks
  - Cellulosic fibers – from cotton mops, rags, cardboard, wood
  - Dried paint, tint paste or resin
  - Gels/seeds that formed – resin was filtered adequately and/or cross contamination has occurred
  - Metal – grinding operations where there are fine metallic particles in steel drum or pail manufacturing

Dirt, debris, rust, particulate

- Housekeeping is key to keeping environmental dirt to a minimum
- Ensure that dirt from raw material containers does not fall into product vessels or finished goods containers
- Keep vessels covered while mixing and filling
- Cover equipment adequately before maintenance work is performed in the area (especially overhead)
- Where possible – keep doors closed

Craters

Craters are dish shape deformations in a paint surface caused by the presence of a contaminant. It is also called a ‘fish eye’.

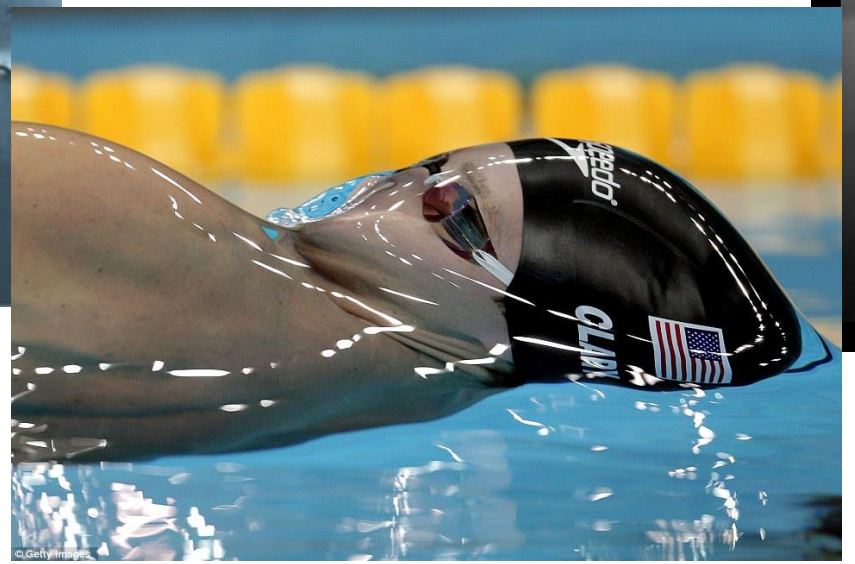


The difference in surface tension of the contaminant and the surface tension of the coating causes the paint to ‘crawl’ away from the contaminant.

The film thickness at the crater site is below specification and the appearance is unacceptable to PPG’s customers.

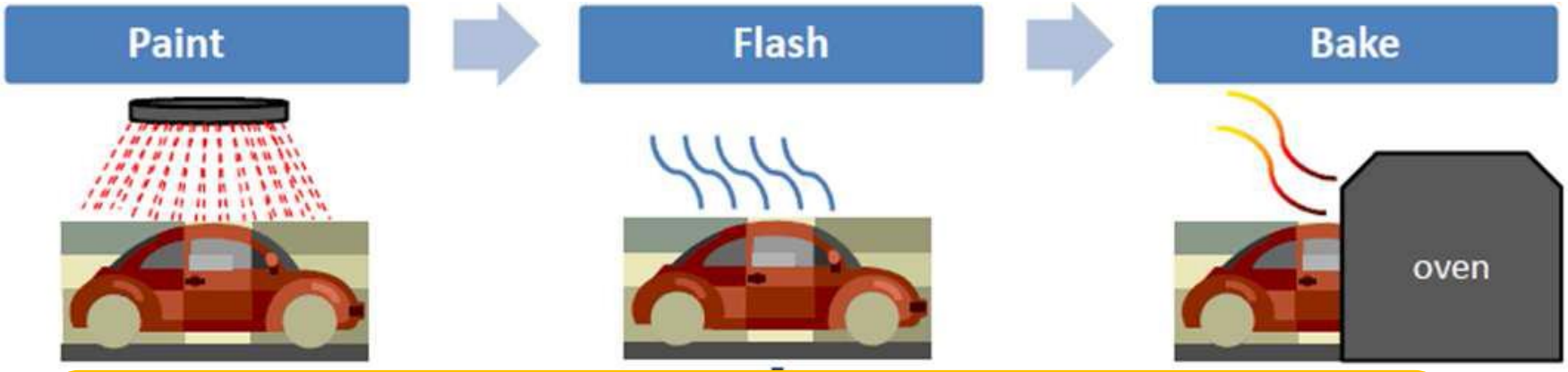
What do we mean by surface tension?

The attractive force exerted upon the *surface* molecules of a liquid by the molecules beneath that tends to draw the *surface* molecules into the bulk of the liquid and makes the liquid assume the shape having the least *surface* area.



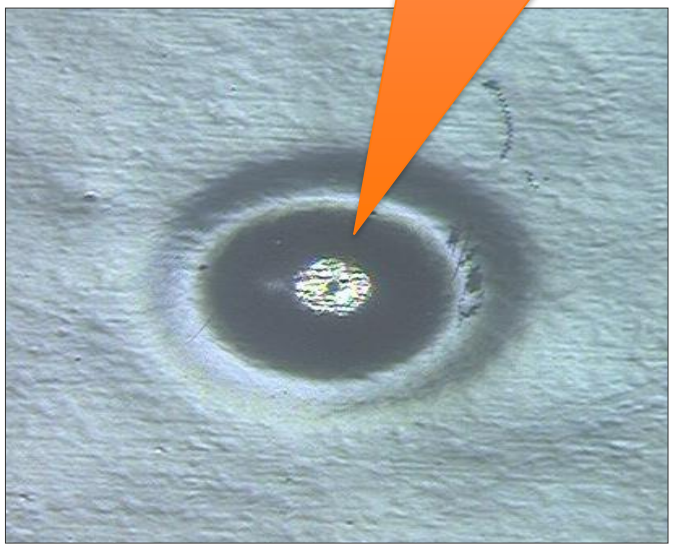
Crater contamination at a customer's site

- The **presence of low surface tension contaminants** in the paint causes craters
- Even very small quantities of the contaminant (**less than 0.001%**) can cause craters



The crater defect can show up on PPG's customer's line in the flash or the bake stages of the process

The paint has crawled away from the tiny droplet of contaminant to form a crater



Magnification of a crater defect on a vehicle

Bulk Shipments to PPG Automotive Coatings & Resin Sites

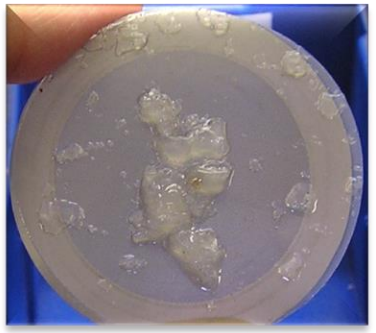
- Numerous contamination events were traced to the road tanker or tank wagon used to transport the material
- Numerous road tankers carrying raw materials to a PPG automotive resin or coatings site have been rejected because the sample did not pass the contamination tests
- For suppliers arranging bulk transport for delivery to PPG, strong oversight is needed to ensure compliance to requirements

Road Tankers/Tanks Wagons delivering solvents to PPG

- Sampling devices for checking solvent cleanliness
- Solvent dedicated wagons are recommended where possible
- If the wagon is NOT dedicated, then wagon selection based on prior content is critical
- A solvent wagon prior load MUST be another solvent

These are examples of devices that PPG has fabricated to allow sampling from the bottom valve of the wagon.

Approximately 20 liters of solvent are drawn through a filter device to check for dirt, debris and gels.



The wagon will be rejected if there are gels or excessive dirt

Approved Solvent Classifications

Solvent prior loads for solvents

Acetates	Glycol Ether
Alcohols	Glycol Ether Esters
Aliphatics	Ketones
Aromatics	Mineral Spirits
Esters	Naptha
Ethylene Glycol	

Any questions/concerns – contact the PPG Quality Manager at the receiving site

Tank Wagons/Road Tankers Delivering Non-Solvents

- Dedicated wagons are recommended where possible
- If the wagon is NOT dedicated, then wagon selection based on prior content is critical
- Use of a reliable cleaning station is also key
- PPG's Prohibited Prior Contents list must be adhered to when selecting the wagon
  - Oils & Greases
  - Materials with Low Surface Tension Additives
  - Strong Acids & Bases
  - Powders & Colorants

Prohibited Wagon Prior Contents

Any questions/concerns – contact the PPG Quality Manager at the receiving site

Oils & Greases

Lubricating Oils	Machine Oils	Silicone Greases	Perfluoropolyethers
Silicones	Waxes	Vegetable Oils	

Materials with Low Surface Tension Additives

Silicone bases additives	Fluorocarbons	Defoamers	Acrylic emulsion
Adhesion Promoter	Fluorine based additives	Cleaning Compounds	Detergents
Dispersants	Refrigerants	Release Agents	Surfactants

Strong Acids & Bases

Hydrochloric	Sulfuric	Potassium Hydroxide	Sodium Hydroxide
Perchloric			

Powders & Colorants

Pigments	Dye	Dispersions	Dry Powders

Sources of Foreign Contamination from Bulk Transport

- Inadequate cleaning
  - Prior contents residue remaining
  - Residual caustic or detergent from inadequate rinsing
  - Contaminants from maintenance performed on the interior ‘barrel’
  - New valve or other parts installed without pre-cleaning
- Prohibited maintenance materials used
  - Silicone greases
  - Perfluoropolyethers (PFPE) type lubricants
  - Lubricants with low surface tension additives
- Contaminated hoses and/or couplings used for off-loading material
  - Cross contamination from previous material in transfer hose/couplings

Example Causes of Poor Road Tanker Cleaning

- Spray system for interior inadequate – design and/or pressure used
- Caustic tank contaminated or low strength
- Ineffective rinsing – caustic or detergent residue
- Temperatures not well controlled for steam and water flushes
- Drying process allows environmental dirt
- Valves not cleaned correctly, residue from prior loads on gaskets
- Cleaning after interior maintenance ineffective at removing contaminants
- **Inspection criteria is not well defined and does not align with PPG's requirements**

Containers

- All container types must be approved before use
- Tote cleaners, drum & pail manufacturers are audited on a regular basis
- All packaging (drums, pails, plastic IBC's, totes) must be delivered to PPG free of contamination
- Use of recycled drums anywhere in the supplier's process related to PPG automotive products is strictly prohibited

Silicone Handling

- If silicone containing materials are used on site, ensure that appropriate procedures are in place to prevent inadvertent cross contamination
- Separate tools and storage are recommended

Pink labeling is used as a visual aid at PPG Automotive plants

Dedicated tools and storage areas are also used at PPG

PPG's Global Materials Registration List (MRL)

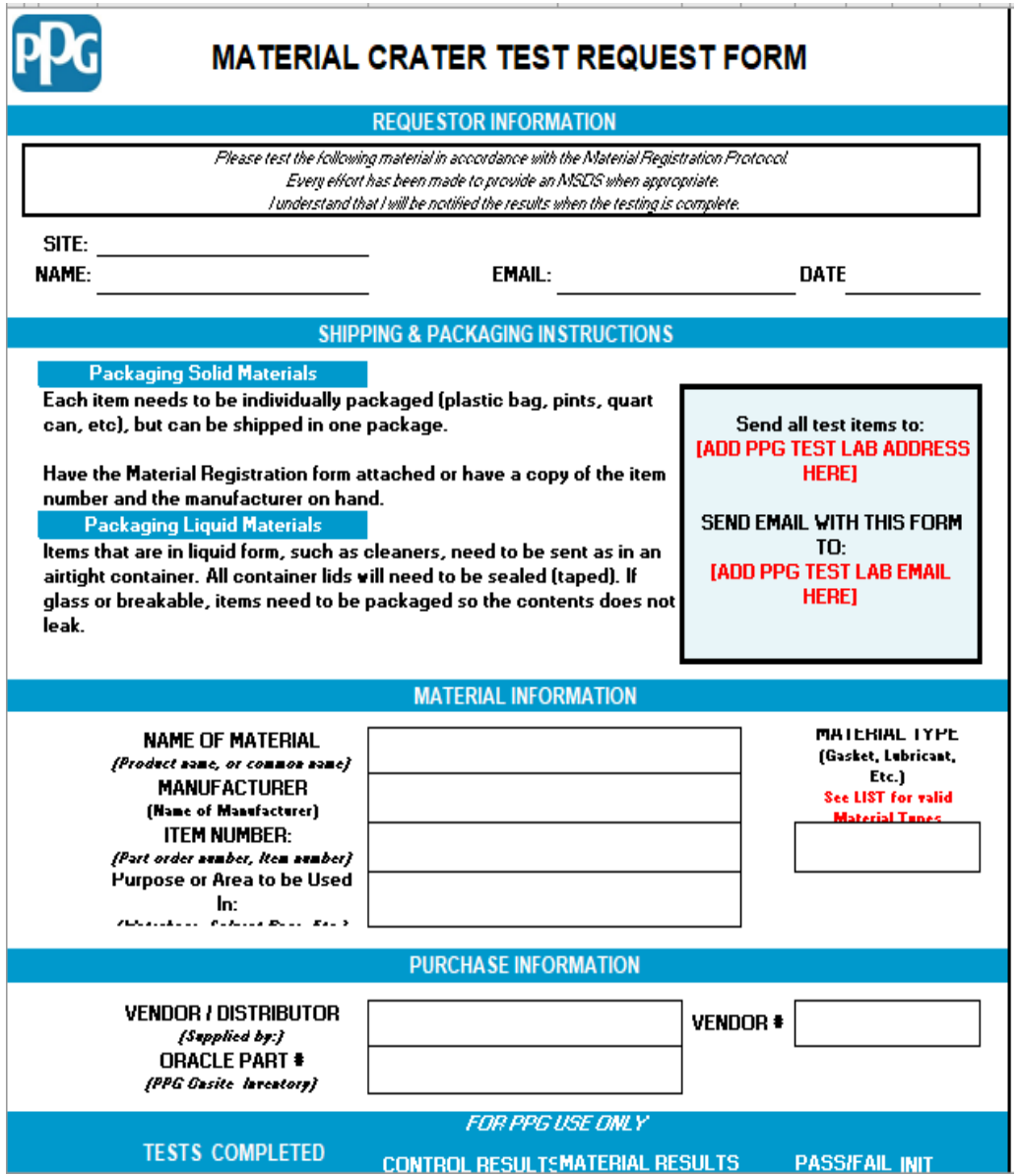
- Over 4000 maintenance materials and consumables (filters, etc.) have been tested in PPG labs – results are tracked on PPG's Global Materials Registration List (MRL)

PPG Industries Global Materials Registration List (MRL)

Global MRL Standard Information for Posting Externally

Date	Result	Type	Material Name/Common Name	Manufacturer	Product Code / Reference No.	Site Tested
6/20/2018	PASS	Lubricant	AMERALUBE A867	AMERALUBE		US - Cleveland
12/14/2010	PASS	Adhesive/Sealant	Loctite 222	Loctite, Henkel		ES - Valladolid
4/7/2008	PASS	Safety Equipment	Mask 3M 6900S	3M		ES - Valladolid
2/6/2009	PASS	Safety Equipment	Protection /Category III 3M 4530	3M		ES - Valladolid
4/15/2010	PASS	Adhesive/Sealant	Sealer Fiber Glass polyester 2K	Productos Quimicos FM 2005 S.L.		ES - Valladolid
4/24/2013	PASS	Adhesive/Sealant	Loctite 2400	Loctite, Henkel		DE - Weingarten
1/6/2011	PASS	Lubricant - oils, greases	"Joudol" Universal-Hochleistungs-Schmiermittel "SM"	EagleBurgmann Germany GmbH & Co. I		DE - Wuppertal
9/24/2010	PASS	Adhesive/Sealant	Silicex (Cracking Seal)	Fischer		ES - Valladolid
11/16/2010	PASS	Chemical	ALIETTE	BAYER		ES - Valladolid
11/16/2010	FAIL	Chemical	TOUCH DOWN PREMIUM	SYNGENTA AGRO S.A		ES - Valladolid
7/10/2017	PASS	Adhesive/Sealant	Loctite 262	Loctite, Henkel		RU - Lipetsk
11/8/2010	PASS	Chemical	Loctite 3090	Loctite, Henkel		IT - Quattordio
3/9/2011	PASS	Adhesive/Sealant	Loctite 326	Loctite, Henkel		ES - Valladolid
12/21/2010	PASS	Chemical	SILEX VEGA	ECOLAB		ES - Valladolid

Maintenance Material Controls - Crater Testing



MATERIAL CRATER TEST REQUEST FORM

REQUESTOR INFORMATION

Please test the following material in accordance with the Material Registration Protocol
Every effort has been made to provide an MSDS when appropriate.
I understand that I will be notified the results when the testing is complete.

SITE: _____
NAME: _____ EMAIL: _____ DATE _____

SHIPPING & PACKAGING INSTRUCTIONS

Packaging Solid Materials
Each item needs to be individually packaged (plastic bag, pints, quart can, etc), but can be shipped in one package.

Have the Material Registration form attached or have a copy of the item number and the manufacturer on hand.

Packaging Liquid Materials
Items that are in liquid form, such as cleaners, need to be sent as in an airtight container. All container lids will need to be sealed (taped). If glass or breakable, items need to be packaged so the contents does not leak.

Send all test items to:
[ADD PPG TEST LAB ADDRESS HERE]

SEND EMAIL WITH THIS FORM TO:
[ADD PPG TEST LAB EMAIL HERE]

MATERIAL INFORMATION

NAME OF MATERIAL
(Product name, or common name)
MANUFACTURER
(Name of Manufacturer)
ITEM NUMBER:
(Part order number, Item number)
Purpose or Area to be Used In:

MATERIAL TYPE (Gasket, Lubricant, Etc.)
See LIST for valid Material Types

PURCHASE INFORMATION

VENDOR / DISTRIBUTOR
(Supplied by:)
ORACLE PART #
(PPG Onsite Inventory)

VENDOR #

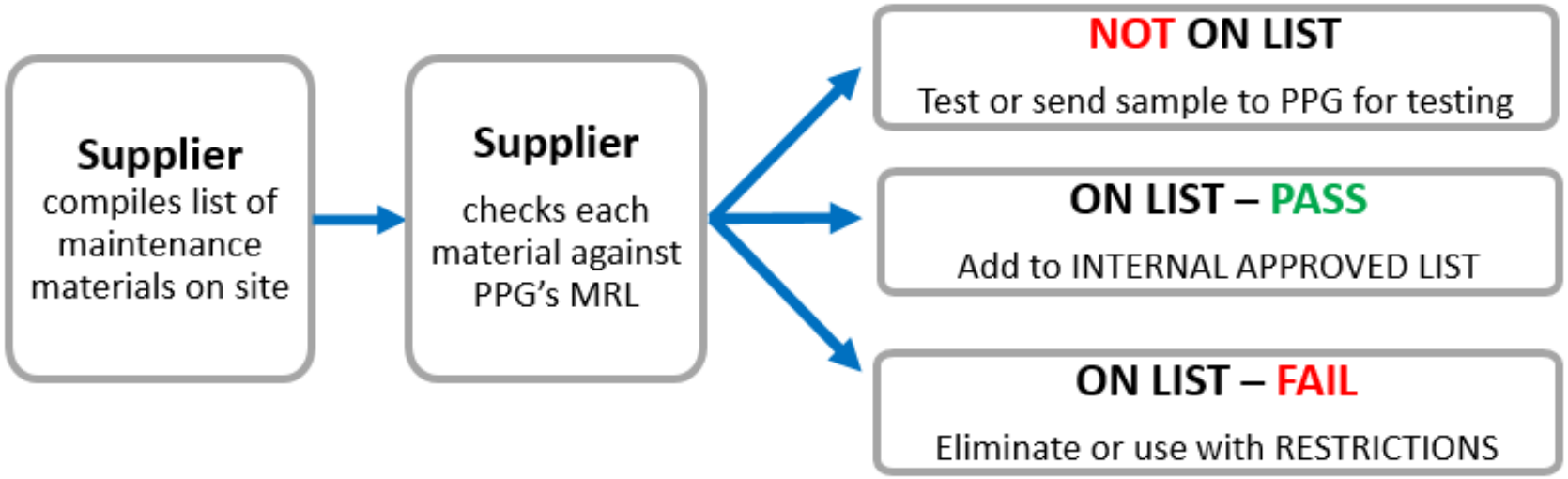
FOR PPG USE ONLY

TESTS COMPLETED | CONTROL RESULTS | MATERIAL RESULTS | PASS/FAIL | INIT

- Some of PPG's suppliers have the capability of testing materials for craters – contact PPG if interested in acquiring this capability
- For some critical processes at a supplier site, PPG will crater test materials
  - Contact the PPG receiving plant to check if testing can be done
  - Open the Global MRL and find the tab with the Request Form
  - Open the Global MRL and find the tab with the Request Form
  - Ensure that material samples sent are in pristine condition to prevent a false result

Maintenance Material Controls - Supplier Site List

- Each supplier sites should develop its own internal list of materials that can be used in PPG related processes
- Some maintenance materials fail crater testing, but are needed. These can have restricted use, away from product processes
- Use of visual aids are recommended – e.g. approved stickers



Maintenance Material Controls

IT'S NOT JUST SILICONES that can cause craters!

- Any material that has a low surface tension can pose a risk to our paints
- High temperature greases with 'fluorine' content
- Other common lubricants and products

High temperature lubricants frequently contain PTFE, a fluorine based chemical that causes SEVERE craters at very low levels!

Many popular products cause craters!

Maintenance and Production Process Controls

All gaskets must be rinsed before use in production

All new valves that will be in direct contact with PPG related materials must be pre-cleaned

Any new or repaired process equipment can be contaminated Pre-cleaning must be done prior to use

Equipment Cleaning

- Cross-contamination – when small amounts of material from a previous batch cause craters
- Dedicated equipment is ideal, but not always possible
- Ensure that equipment is cleaned thoroughly between batches – tanks, pumps, hoses, stingers, etc.

People Stuff

Work Wear

- Heavily soiled clothing, gloves, boots should be changed

Personal Care Products

- Many personal care/grooming products cause craters - avoid use of excessive amounts of hair gels, sprays, lotions, etc.
- Use SILICONE FREE SBS-40 provided

People Stuff

Food

- Many foods contain oils, greases, additives that can cause craters
- Washing hands before meals is required for safety reasons
- Washing hands after meals as well to prevent contamination in PPG related products is recommended

Summary

Contamination prevention measures needed by supplier:

- Housekeeping is key to minimizing dirt levels
- Strong oversight is needed for bulk transport
- Packaging must be free of contamination
- If using silicones, measures must be in place to prevent cross-contamination
- Each site should have an internal list of approve maintenance materials and consumables (refer to PPG's MRL for test results)

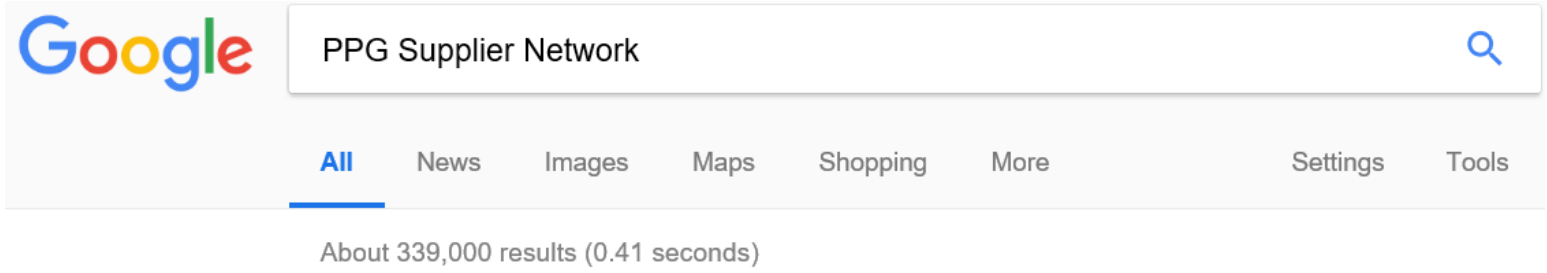
Summary

Contamination prevention measures needed by supplier:

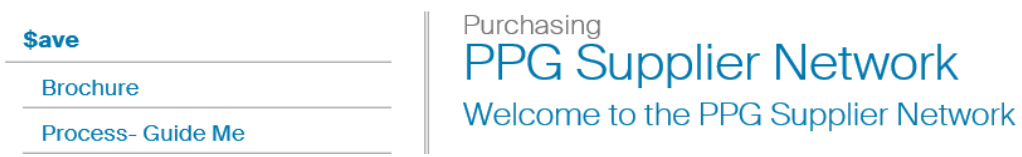
- All new or repaired equipment and parts in direct contact with PPG related materials must be pre-cleaned before putting in service
- For non-dedicated processing vessels, mills, piping, pumps, etc., thorough cleaning is required between batches of different products to prevent cross-contamination
- Minimize contamination risk with personnel awareness and policies – work wear, personal care products, food in the workplace

How to access the PPG Automotive Coatings documents

Search
"PPG Supplier Network"



Once on the PPG Supplier Network, scroll down to Information Links



Documents 6, 7 & 8 are posted by PPG Automotive Coatings for suppliers