Assessment of DCC PY.34 & PR.104 End Uses & Alternates – Coatings Example

I. General Information:

Company Name:	Company A	Contact Name:	
Address:		Contact Phone #:	
Postal Code:		Contact e-mail:	
City, Country:		Date:	
Type of Business:	Industrial Coatings		
Annual volume of PY.34/ PR.104 used:			
Comments:			

II. End Use Definition:

Chrome Grade:	☒ PY.34 ☐ PR.104	
Sector:	☒ Coatings ☐ Plastics	
Authorised Use:	☒ Industrial ☐ Professional	
Sub Sector:	☐ Transportation ☐ Manufacturing ☐ Protective, Marine & Infrastructure ☒ Agricultural, Construction & Earth Moving ☐ Industrial Packing & Containers ☐ Architecture (i.e. coil) ☐ Signs ☐ Road Marking	☐ Agriculture ☐ Manufacturing ☐ Containers & Covers ☐ Flooring ☐ Infrastructure & Construction ☐ Thermoplastic Road Marking ☐ Other:
End Use Application:	Yellow Agricultural Equipment	
Applicable Alternates (List of CI #'s):	Inorganics: PY.184, PY.53, PY.42 Azo Diarylides: PY.12, PY.13, PY.17, PY.83 Benzimidazolones: PY.151, PY.154, PY.194 Monoazo: PY.65, PY.73, PY.74, PY.75, PY.95 Speciality Azo: PY.155 Speciality other: PY.110, PY.138, PY.139	
Criteria for Use (Select all that apply):	☒ Shade functionality ☒ Chroma ☒ Metamerism ☒ Opacity ☐ Dispersibility	☒ Durability ☒ Heat stability ☒ Migration ☒ Chemical resistance ☐ Other:

III. Justification of the Need for PY.34 and/or PR.104:

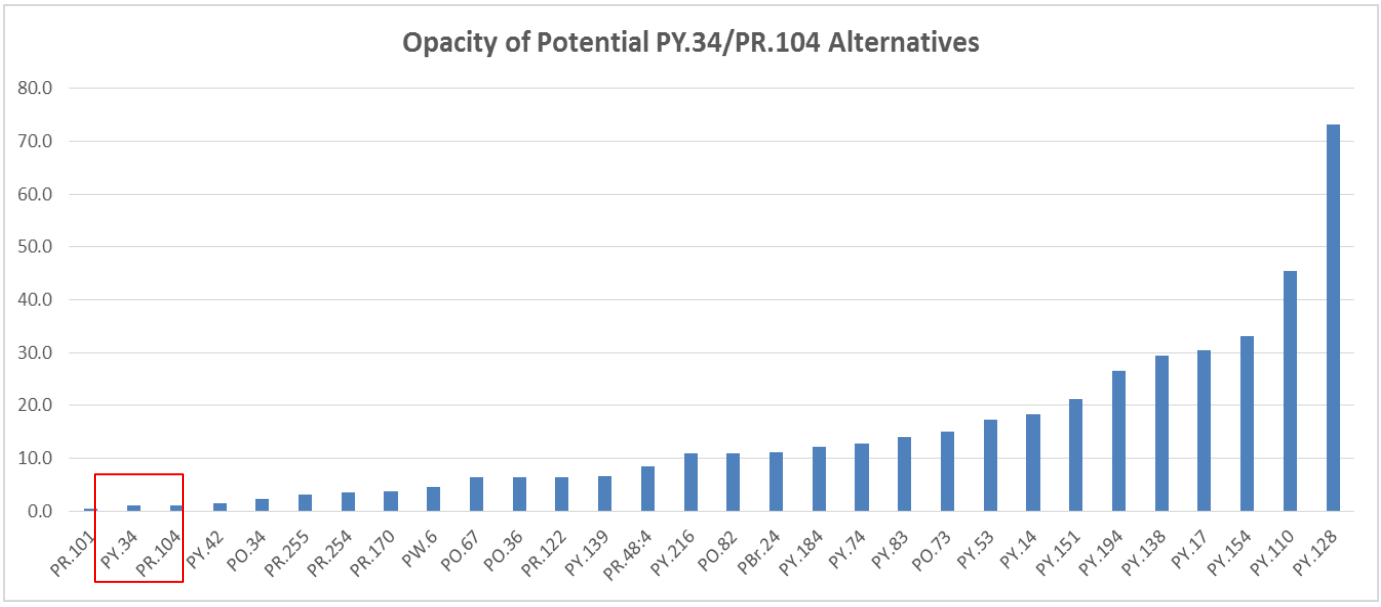
Details of Technical Criteria:
Opacity / hiding: The alternates have less opacity / hiding and therefore cannot adhere to specific customer demands of a maximum of 2 coats with a dry film thickness of 50-150 microns. Alternates generally require 4 coats and generate a dry film thickness of >300 microns. Due to less opacity of alternatives, a higher pigment loading is also needed, but % is limited (paint needs to be paintable) and hence an increase of layer thickness leads to insufficient drying / paint hardening resulting in the coating becoming less protective. Customers often require Dft 120-150 in one layer. With respect to agricultural equipment the end product is almost always (part of) a very high-value piece of equipment such as the mechanical arm of a farming machine that is difficult, if not impossible, to repaint after installation, with long life expectancy and high cost in case of failure of the coating or degradation. Durability: Lead free products have lower durability compared to PY.34, which is a concern when the offer of durability tends to encompass time (up to 30 years guaranteed protection and colour stability – usually at least 5+ years on top of the wear and tear). As agricultural equipment items are expensive, the coated end products would risk serious degradation or residual value loss if the paint faded or was otherwise denatured. Shade functionality and Chroma: As internationally accepted safety protocols recommend yellow for caution in heavy equipment use, PY.34 and PR.104 provide the right shade for these widely adopted conventions. PY.34 and PR.104 pigments can be mixed together to achieve the brightest shades, whereas mixing of lead free products cannot achieve the same shades or brightness (chroma). Additionally for this application the coatings produced from PY.34 and PR.104 not only have a decorative function but instead have an important signal and contrast function. The yellow is used as a contrast colour on the equipment to highlight dangerous moving parts and prevent operator injuries in situations of variable lighting and background. Agricultural environments are one of the most common environments where the background can vary from grey to light yellow with green and browns in between. There is no colour that gives as much contrast in all of those situations as a deep and powerful yellow. No metamerism: Due to the broad shade functionality, PY.34 can be mixed together with PR.104 and with other pigments to exhibit low metamerism. Lead free pigments when mixed together have higher metamerism which is contractually often not acceptable. Chemical and solvent resistance: PY.34 and PR.104 are chemical and solvent resistant, which is a key requirement for ACE applications. Lead free organic pigments suffer from poorer chemical and solvent resistance, which makes them unsuitable for this end use. Migration: PY.34 does not migrate in solvent based coatings. However, lead free organic pigments tend to migrate. This is a problem when a clear coat is added on top of a coloured base coat, as the colour will migrate through if the pigment suffers from migration. Heat stability: All of the coatings in this category are applied by spraying and then cured by stoving/heat. Lead free pigments have a heat stability of 120-140°C whereas PY.34 can be heated to greater than 200°C.

IV. Technical Evidence of Alternate Deficiencies versus PY.34 and/or PR.104: *(Insert scanned displays, graphs, photographs etc.)*

Opacity:

The below drawdown highlights the transparency of an organic alternate; Benzimidazolone PY.151 compared to the PY.34 range.

PY.34 Primrose	PY.34 Lemon	**PY.151**	PY.34 Medium



Most Opaque Transparent

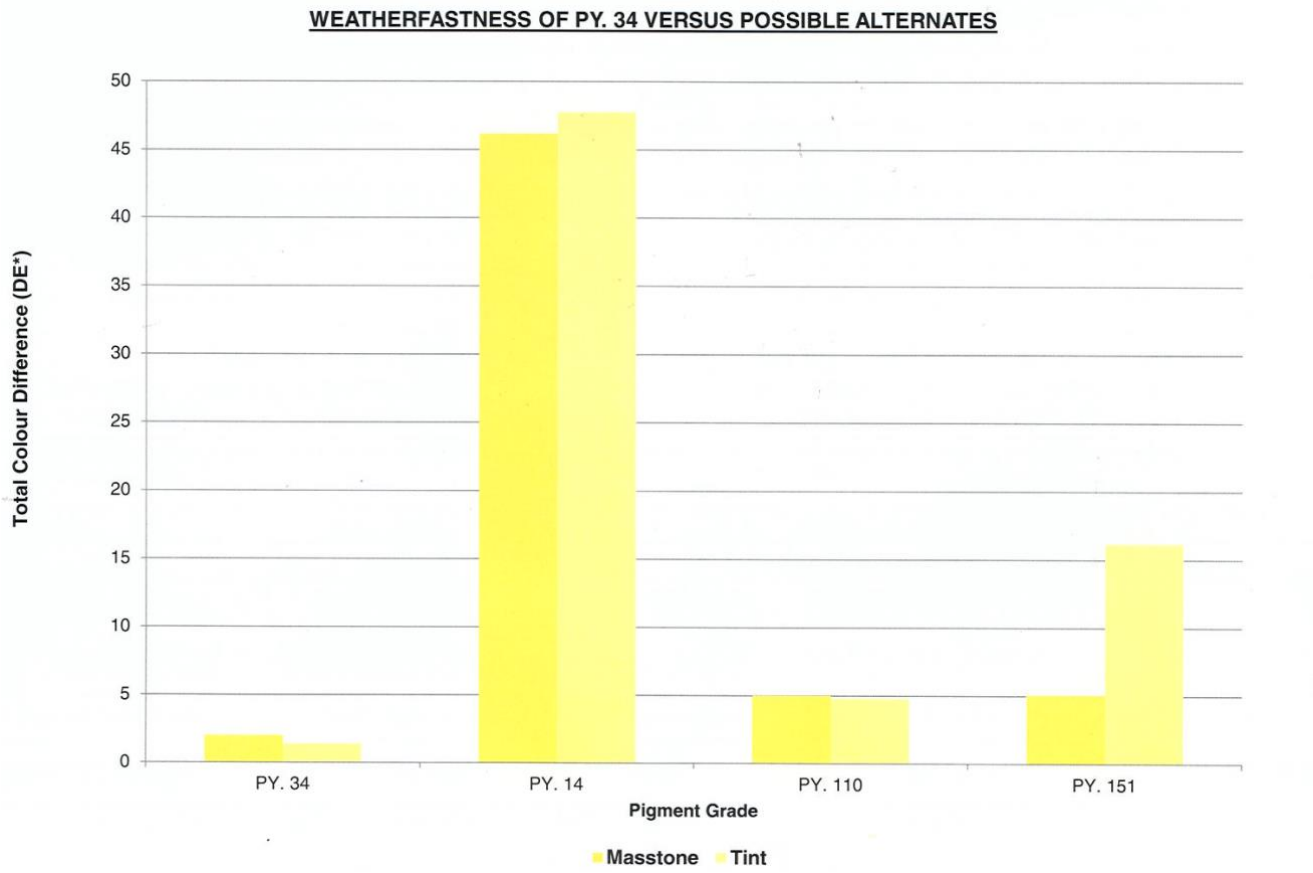
Weatherfastness:

The table below gives a summary of some typical results of the Florida[1] test involving two alternatives versus PY.34.

Product	ISO Grey Scale* - Florida - 1 year exposure	
	Masstone	1:10 Tint
Pigment Yellow 34	4-5 (Very Good - Excellent)	5 (Excellent)
Pigment Yellow 151	5 (Excellent)	4 (Very good)
Pigment Yellow 74	4-5 (Very Good - Excellent)	3-4 (Good - Very good)

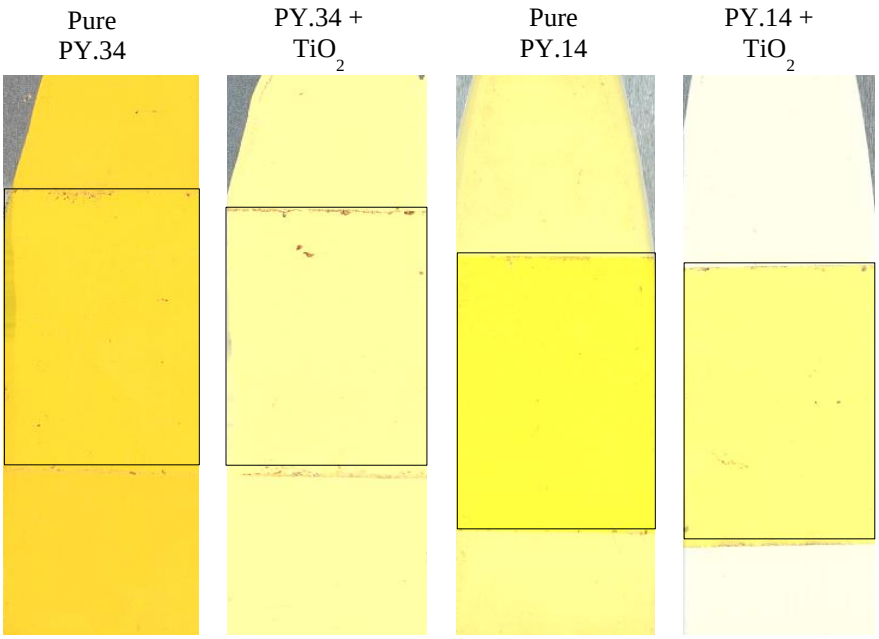
The exposure above is based on 1 year exposure – when one considers that the applications for which we are asking authorization tend to have exposure of the pigment to weather for 5+ years going right up to 30 – one will understand that even the rather modest degradation shown by some of the pigments after one year is unacceptable.

The chart below gives a sample of the difference in weathering of potential alternatives and PY.34:



[1] The Florida test is the standard weathering test for pigments – the unique combination of climate conditions of warmth, humidity and salinity providing the most challenging environments for any pigment. See here for an example of a company offering these services which are globally accepted standards.

Furthermore the following scanned panels show the effects of weathering in a more direct manner:

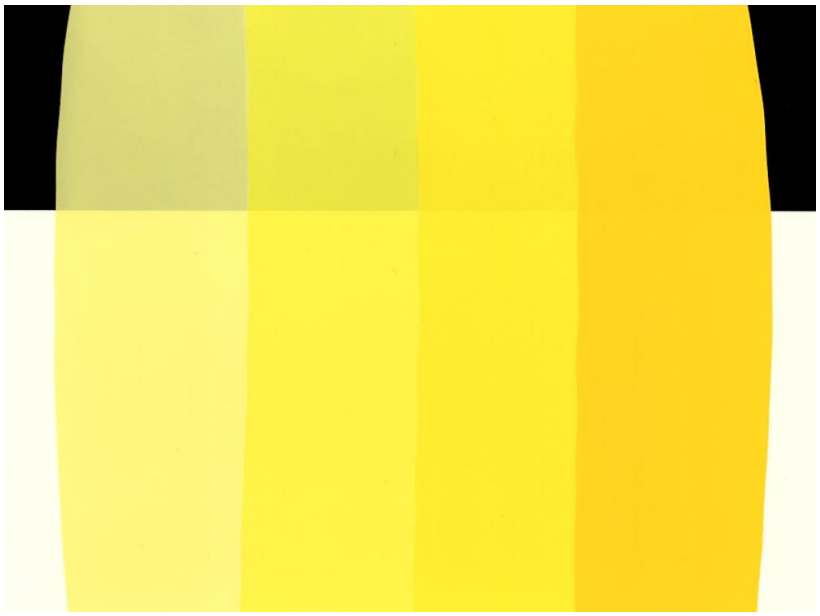


PY.34:
No significant colour change after 1 year

PY.14:
Significant colour change after 1 year

Chroma:

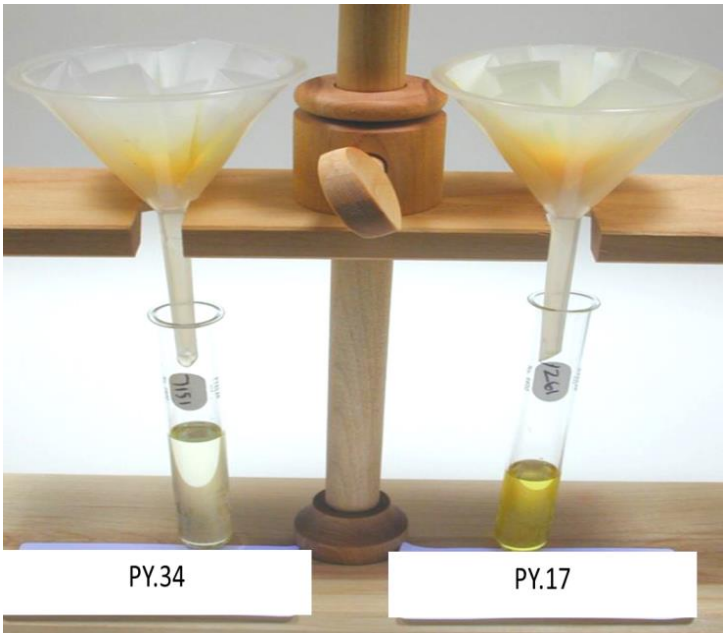
In the below display the low chroma of the PY.53 is evident when compared versus the PY.34 grades. The alternate is much lighter and dirtier than that of PY.34. The colour power or chroma is so much lower that this limits the depth and strength that can be achieved – to circumvent this weakness so much additional pigment is required that other technical issues (such as thickness of coatings, flexibility of plastics) is compromised.



PY.53 PY.34 PY.34 PY.34

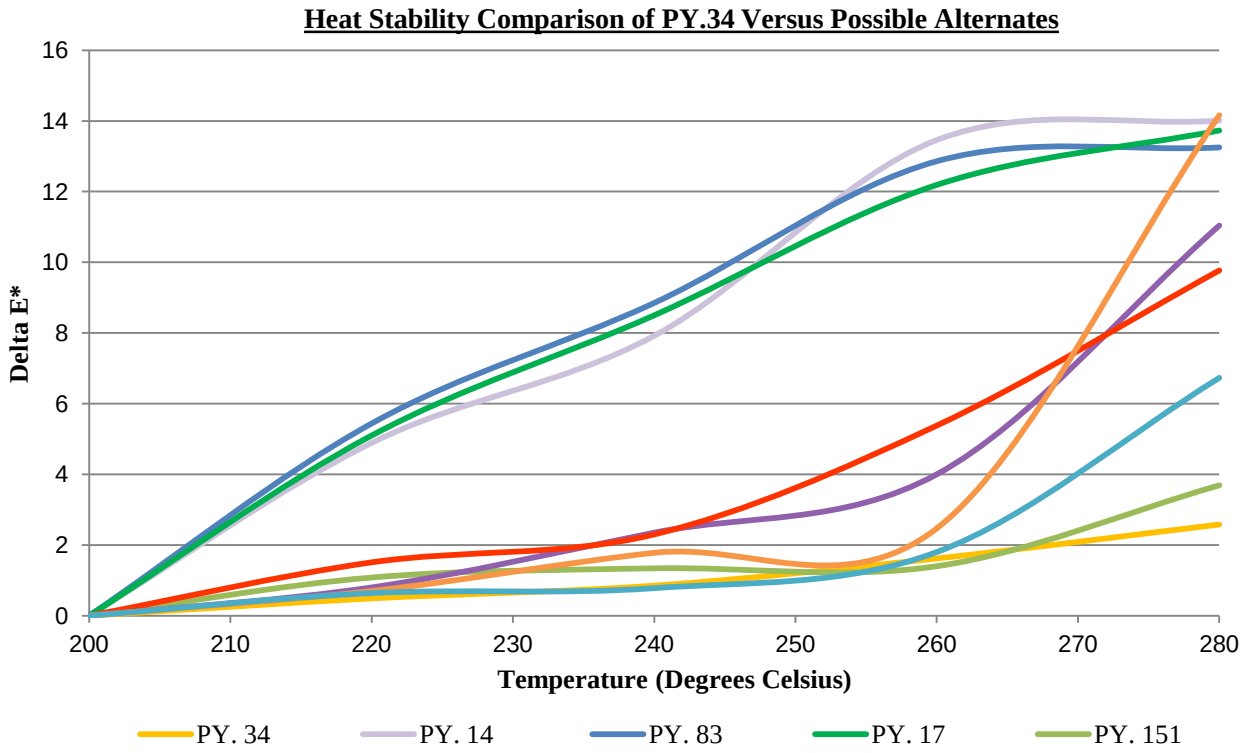
Chemical Resistance:

Organic pigments typically have worse solvent resistance compared to PY.34, as per the photograph featured below. As the PY.34 is being used in demanding solvent based paints it must remain insoluble in order to maintain high gloss and to withstand substrate cleaning.



Heat Stability:

The subsequent graph indicates that PY.34 is the most heat stable of all the grades tested, which can typically be said when comparing PY.34 to all organic alternatives. Heat stability is critical for coating baking systems as non-stable pigments will degrade causing the shade to change colour, which is highly undesirable to customer's.



V. Availability & Suitability of Alternatives:

Economic Considerations of Technical Criteria:
Cost and Opacity: All alternatives for this category have a higher cost per/kg that is at least 3 times higher than PY.34 and PR.104. In addition to this all lead free alternative systems to match the same shades with the same level of hiding must be coated with >2 coats and have a dry film thickness twice as thick compared to PY.34 and PR.104. As more coats are required this leads to higher (at least two times) labour/equipment costs and also has the environmental impact of more solvents being used. The consequence relevant for REACH is that the increase in cost will cause a decrease in the total market in effect the total economy will shrink. The effect for coatings is less marked than for plastics but still equivalent to a shrinking of 1% of the market size for every 1% in cost increase on the final product. Durability: The impact on durability is due to the fact that the equipment will either need to be repainted more regularly, to maintain its appearance as the lead free coating will fade after 3 years. In addition the resale value of the equipment will decline faster. Solvent and chemical resistance: Solvent and chemical resistance is a secondary impact relating to the life-span of a coating. Once exposed to chemicals or solvents, lead free organic pigments are less resistant than PY.34 and PR.104 causing the colour to degrade. The impact of chemical and solvent resistance is due to the fact that the equipment will either need to be repainted more regularly, to maintain its appearance or replaced. Shade functionality, Chroma and Metamerism: These criteria are customer driven. A customer will not accept a coating unless it meets their stringent colour/shade targets. This includes shade, chroma and metamerism targets.

VI. Standards / Directives / Customer Contractual Demands:

Economic Considerations of Technical Criteria:
There are no EU or member state driven directives relating to the agricultural, construction and earth moving sector. However it is convention for equipment in this sector to be safety yellow, orange or red shades for reasons of visibility and safety warning. The International Accident Prevention Association (IAPA) provides a guidance document on Safety Signs and Colours at Work, and indicates safety red for stop/prohibition or mandatory signs or equipment, yellow for caution / hazard, and orange for warning. Hence the convention for red stop / off / danger buttons, yellow for equipment that requires caution in use, and orange for safety guards etc. ISO 3864-4 Graphical Symbols and Safety Signs. Part 4: Colorimetric and photometric properties of safety sign materials - Specifies colours and measurement test methods for signs to be used in work places and public areas. Colour boxes for ISO safety red and ISO safety yellow are provided. ISO safety yellow is a small colour box for which PY.34 falls in the middle, while common alternates such as PY.184 and PY.83 fall outside. The standard makes reference to one of the reasons for safety colour choice; being the colour regions selected are to minimise confusion for those with colour vision deficiencies. Quality criteria are driven by customer contractual demand requirements that coatings manufacturers must adhere to: 1. Durability requirements, e.g. >1, 3, 5, 10, 15 years etc. PY.34 and PR.104 are required for coatings demanding >3 year durability. 2. Coating thickness required to achieve full hiding. This is assessed by amount of paint consumed per units coated, actual physical dry film measurements (to ensure adequate protection is achieved). The impact on end customers is the labour and equipment time to achieve the required painted object. 3. Achieving an acceptable shade/colour match – e.g. RAL standards such as 1021, 1023, 2004. Colour and metamerism deviations are considered unacceptable. These colour shade targets are most often specified and controlled by manufacturer brands. 4. In addition the coatings must be resistant to chemicals and solvents. Alternatives to PY.34 and PR.104 are more susceptible to chemicals and solvents.