

## **APPENDICES**

Appendix	1	Table of Defendants' resins
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## Appendix 1

<b>Old Name</b>	<b>New Name<sup>1</sup></b>	<b>Form</b>	<b>Colour</b>	<b>Metallocene /ZN</b>	<b>MFR</b>	<b>UV content</b>	<b>Date Released Commercially</b>	<b>Date Discontinued</b>
ME8130 <sup>2</sup>	n/a	Pellet	Black	ZN	3.6			
ME8131 <sup>3</sup>	n/a <sup>4</sup>	Powder (powder version of ME8130)	Black	ZN	3.6 <sup>5</sup>			
ME8132 <sup>6</sup>		Pellet	Black	ZN	3.4			
ME8133 <sup>7</sup>		Powder (powder version of ME8132)	Black	ZN	3.4			
ME8151 <sup>8</sup>	n/a	Pellet	Natural	ZN	3.6			
ME8152 <sup>9</sup>	n/a <sup>10</sup>	Powder (powder version of ME8151)	Natural	ZN	3.6			2000
<b>Old Name</b>	<b>New Name</b>	<b>Form</b>	<b>Colour</b>	<b>Metallocene /ZN</b>	<b>MFR</b>	<b>UV content</b>	<b>Date Released Commercially</b>	<b>Date Discontinued</b>

<sup>1</sup> See AMF1 para 175 & S5/125

<sup>2</sup> See S4/39

<sup>3</sup> See S4/39

<sup>4</sup> Discontinued in 2000, no new name (S5/126)

<sup>5</sup> See S4/39 (but c/f AMF1 para 123 which states it had an MFR of 3.4)

<sup>6</sup> See S4/39

<sup>7</sup> See S4/39

<sup>8</sup> See S4/39

<sup>9</sup> AMF1 para 59 (but para 123 states it had a MFR of 3.6)

<sup>10</sup> Discontinued in 2000, so no new name (S5/126)

ME8154 <sup>11</sup>	n/a <sup>12</sup>	Pellet	Natural	ZN	3.4			2000
ME8158 <sup>13</sup>	n/a <sup>14</sup>	Pellet	Natural	ZN	9			2000
ME8159 <sup>15</sup>	n/a	Powder (powder version of ME8158)	Natural	ZN	9			
<b>ME8160</b>	<b>RM8402</b>	<b>Pellet</b>	<b>Natural</b>	<b>M</b>	<b>6</b>	<i>Initially Tinuvin 622 at 1,500; then Tinuvin 783 at 1,300 from Autumn 1999<sup>16</sup></i>		
ME8161	RM8403	Powder (powder version of ME8160)	Natural	M	6	<i>Tinuvin 783 at 1,300</i>		
ME8166 <sup>17</sup>	n/a	Pellet	Natural	M	3.2	<i>Tinuvin 622 at 2,500</i>		1999
ME8167 <sup>18</sup>	n/a	Powder (powder version of ME8166)	Natural	M	3.2	<i>Tinuvin 622 at 2,500<sup>19</sup></i>		1999

<sup>11</sup> S4/39 & AMF1 para 73

<sup>12</sup> Discontinued in 2000, so no new name (S5/125) Re-introduced in 2003 as RG7402

<sup>13</sup> AMF1 para 73

<sup>14</sup> Discontinued in 2000, so no new name (S5/125)

<sup>15</sup> See S4/39

<sup>16</sup> AMF2 para 24, 28

<sup>17</sup> S4/39 & AMF1 para 99 (but her para 73 refers to MFR2). Discontinued Summer 1999, so no new name (AMF1 para 176)

<sup>18</sup> AMF1 para 123. Discontinued Summer 1999, so no new name (AMF1 para 176).

<sup>19</sup> AMF1 paras 181 & 186

Old Name	New Name	Form	Colour	Metallocene /ZN	MFR	UV content	Date Released Commercially	Date Discontinued
ME8168 <sup>20</sup>	RM8342	Pellet	Natural	M	6	<i>Initially Tinuvin 622 at 2,500; then Tinuvin 783 at 1,500 from September 1999<sup>21</sup></i>		
ME8169 <sup>22</sup>	RM8343	Powder (powder version of ME8168)	Natural	M	6	<i>Initially Tinuvin 622 at 2,500; then Tinuvin 783 at 1,500 from September 1999<sup>23</sup> Tinuvin 783 at 1,500<sup>24</sup></i>		
ME8170	RM8404	Pellet	Black	M	6			
ME8171	RM8405	Powder (powder version of ME8171)	Black	M	6			
ME8176		Pellet	Black	M	3			
ME8177		Powder (powder version of ME8177)	Black	M	3			

<sup>20</sup> AMF1 para 59.

<sup>21</sup> See S4/162

<sup>22</sup> AMF1 para 115

<sup>23</sup> See S4/162

<sup>24</sup> AMF1 para 181, 186

Old Name	New Name	Form	Colour	Metallocene /ZN	MFR	UV content	Date Released Commercially	Date Discontinued
ME8178	RM8344	Pellet	Black	M	6			
ME8179 <sup>25</sup>	RM8345	Powder (powder version of ME8171)	Black	M	6			
n/a	<b>RM7402<sup>26</sup></b>	<b>Pellet</b>	<b>Natural</b>	<b>M</b>	<b>4</b>	<i>Tinuvin 783 at 1,500</i>		
n/a	RM7403 <sup>27</sup>	Powder	Natural	M	4	<i>Tinuvin 783 at 1,500</i>		
LE8162 <sup>28</sup>	RG7242	Pellet	Natural	ZN	4.5			
LE8163	RG7243	Powder (powder version of LE8163)	Natural	ZN	4.5			
n/a <sup>29</sup>	RG7402	Pellet	Natural	ZN				
n/a	RG7403	Powder (powder version of RG7403)	Natural	ZN				

<sup>25</sup> S4/39 & AMF1 para 123

<sup>26</sup> Created in December 2000, so no ME name (AMF1 para 176)

<sup>27</sup> Created in December 2000, so no ME name (AMF1 para 176)

<sup>28</sup> See S4/39

<sup>29</sup> RG7402 was the same grade as ME8154, but with a different UV package.

## Appendix 2

### Kingspan v Borealis – Claimants’ Table of UV Measurements (Assuming annual irradiance of 80 Kly)

Years exposure in N. Europe	Kly	GJ/m2	Approx Hours in WOM of 0.35W/m2 (CIBA & Cytec, ASTM G26)	Approx Hours in WOM of 0.51W/m2 (Borealis, ISO 4892)	Approx equivalent UVX Rating	UVX Rating	Hours in WOM of 0.35W/m2 before reaching 50% ELaB
1	80	3.35	1,300-1,500	930-1,100	UV1 / UV2	UV1	1,000
2	160	6.7	2,700-3,100	1,860-2,100	UV2 / UV3	UV2	2,000
3	240	10.0	4,000-4,600	2,790-3,200	UV4 / UV5	UV3	3,000
4	320	13.4	5,300-6,100	3,720-4,300	UV5 / UV6	UV4	4,000
5	400	16.7	6,650-7,700	4,640-5,400	UV6/ UV7 / UV8	UV5	5,000
6	480	20.1	8,000-9,200	5,580-6,400	UV8 / UV9	UV6	6,000
7	560	23.4	9,300-10,700	6,510-7,500	UV9 / UV10 / UV11	UV7	7,000
8	640	26.8	10,600-12,200	7,440-8,600	UV10/UV11/UV12	UV8	8,000
9	720	30.1	12,000-13,800	8,370-9,600	UV12/UV13/UV14	UV9	9,000
10	800	33.5	13,300-15,300	9,300-10,700	UV13/UV14/UV15	UV10	10,000

Note: Columns 4 & 5 (re hours in WOM) show ranges to reflect the different approaches of Professor Malatesta and Dr Botkin to the calculation of global irradiance. The figures are not precise and may be affected by rounding.

Note 2: The Defendants do not accept that the conversion from WOM hours to years of outdoor exposure is reliable or accurate (see paragraphs 9-10 of the Defendants’ Note on UV units).

**Kingspan v Borealis – Claimants’ Table of UV Measurements (Assuming annual irradiance of 90 Kly)**

<b>Years exposure in N. Europe</b>	<b>Kly</b>	<b>GJ/m2</b>	<b>Approx Hours in WOM of 0.35W/m2 (CIBA &amp; Cytec, ASTM G26)</b>	<b>Approx Hours in WOM of 0.51W/m2 (Borealis, ISO 4892)</b>	<b>Approx equivalent UVX Rating</b>	<b>UVX Rating</b>	<b>Hours in WOM of 0.35W/m2 before reaching 50% ELaB</b>
1	90	3.77	1,500-1,700	1,050-1,200	UV1 / UV2	UV1	1,000
2	180	7.5	3,000-3,400	2,100-2,400	UV3	UV2	2,000
3	270	11.3	4,500-5,100	3,150-3,500	UV4 / UV5	UV3	3,000
4	360	15.1	6,000-6,800	4,200-4,800	UV6 / UV7	UV4	4,000
5	450	18.8	7,500-8,500	5,250-5,900	UV7 / UV8 / UV9	UV5	5,000
6	540	22.6	9,000-10,200	6,300-7,000	UV9 / UV10	UV6	6,000
7	630	26.4	10,500-11,900	7,350-8,200	UV10/UV11/UV12	UV7	7,000
8	720	30.1	12,000-13,600	8,400-9,400	UV12/UV13 / UV14	UV8	8,000
9	810	33.9	13,500-15,300	9,450-10,500	UV13/UV14/UV15	UV9	9,000
10	900	37.7	15,000-17,000	10,500-11,700	UV15/UV16/UV17	UV10	10,000

Note: Columns 4 & 5 (re hours in WOM) show ranges to reflect the different approaches of Professor Malatesta and Dr Botkin to the calculation of global irradiance. The figures are not precise and may be affected by rounding.

Note 2: The Defendants do not accept that the conversion from WOM hours to years of outdoor exposure is reliable or accurate (see paragraphs 9-10 of the Defendants’ Note on UV units).

## APPENDIX 3

### SERIES A – S2/133

AUGUST 1997 (1 OF 2)

<b>SERIES A</b>											
<b>AUGUST 1997 (1 OF 2)</b>											
<b>GRADES TESTED</b>			<b>TEST RESULTS</b>								
	<i>MFR</i>	<i>DESCRIPTION</i>	<i>(Borealis WOM – 0.51 W/m<sup>2</sup>)</i>								
			<b>Elongation at Break</b>			<b>E-modul (MPa)</b>					
			<i>0 hours</i>	<i>2,000 hours</i>	<i>3,000 hours</i>	<i>0 hours</i>	<i>2,000 hours</i>	<i>3,000 hours</i>			
ME8167	3.2	Natural Borecene	460 <i>(100%)</i>	<b>*220</b> <i>(48%)</i>	<b>*95</b> <i>(21%)</i>	770	890	900			
ME8169 (RM8343)	6	Natural Borecene	320 <i>(100%)</i>	<b>*150</b> <i>(47%)</i>	<b>*90</b> <i>(28%)</i>	650	680	700			
ME8177 (RM8345)	3	Black Borecene	460 <i>(100%)</i>	460 <i>(100%)</i>	460 <i>(100%)</i>	750	890	790			
ME8179 (RM8345)	3	Black Borecene	460 <i>(100%)</i>	460 <i>(100%)</i>	460 <i>(100%)</i>	690	710	700			
ME8131	3.4	Black Ziegler Natta	140 <i>(100%)</i>	130 <i>(93%)</i>	110 <i>(79%)</i>	560	680	650			
ME8152	3.6	Natural ZieglerNatta	260 <i>(100%)</i>		<b>*110</b> <i>(42%)</i>	580		680			

- An asterisk (\*) indicates that a specimen has failed the 50% EAB test.
- Figures in brackets and in red express the values as percentages of the initial, unexposed, values. Where no electronic versions of the results exist and precise data points are not identified in the documents, these figures have been estimated from examination of the graphs and must be treated as approximate



**SERIES A – S2/260**

**DECEMBER 1997 (2 OF 2)**

<b>SERIES A</b>			<b>(S2/260)</b>			
<b>DECEMBER 1997 (2 OF 2)</b>						
<b>GRADES TESTED</b>			<b>TEST RESULTS</b>			
	<i>MFR</i>	<i>DESCRIPTION</i>	<b>Elongation at Break (Borealis WOM – 0.51 W/m<sup>2</sup>)</b>			
			<i>0 hours</i>	<i>2,000 hours</i>	<i>3,000 hours</i>	<i>5,000 hours</i>
ME8167	3.2	Natural Borecene	460	*220 <sup>30</sup>	*95	
			(100%)	(48%)	(21%)	
ME8169 (RM8343)	6	Natural Borecene	320	*150	*90	
			(100%)	(47%)	(28%)	
ME8177(RM8345)	3	Black Borecene	460	460	460	460
			(100%)	(100%)	(100%)	(100%)
ME8179(RM8345)	3	Black Borecene	460	460	460	460
			(100%)	(100%)	(100%)	(100%)
ME8131	3.4	Black Ziegler Natta	140	130	110	80
			(100%)	(93%)	(79%)	(57%)
ME8152	3.6	Natural ZieglerNatta	260		*110	
			(100%)		(42%)	

- An asterisk (\*) indicates that a specimen has failed the 50% EAB test.
- Figures in brackets and in red express the values as percentages of the initial, unexposed, values.

<sup>30</sup> Asterisk (\*) used to indicate that specimen has failed the 50% EAB test.

## SERIES B – S2/240

(“THE DYNO TESTS”)

NOVEMBER 1997 (1 OF 2)

SERIES B			(S2/240)			
(THE “DYNO TESTS”)						
NOVEMBER 1997 (1 OF 2)						
GRADES TESTED			TEST RESULTS			
MFR	DESCRIPTION	Elongation at Break %				
		<i>(Borealis WOM – 0.51 W/m<sup>2</sup>)</i>				
		0 hours	500 hours	1,000 hours	1,500 hours	
ME8152	3.6	Natural ZN	[630]	[395]	[*300]	[320]
			(100%)	(62%)	(48%)	(51%)
	3.6	Red Dyno ZN	[215]	[230]		[215]
			(100%)	(107%)		(100%)
	3.6	White Dyno ZN	[160]	[180]		[180]
			(100%)	(113%)		(113%)
	3.6	Yellow Dyno ZN	[175]	[175]		[200]
			(100%)	(100%)		(114%)
	3.6	Green Dyno ZN	[200]	[395]		[290]
			(100%)	(198%)		(145%)
ME8167	3.2	Natural Borecene	[1,050]	[970]	[900]	[750]
			(100%)	(92%)	(86%)	(71%)
ME8169	6	Natural Borecene	[1,010]	[1,025]	[800]	[*415]
			(100%)	(101%)	(79%)	(41%)
	6	Red Borecene mix	[600]	[580]		[620]
			(100%)	(97%)		(103%)
	6	White Borecene mix	[445]	[500]		[470]
			(100%)	(112%)		(106%)
	6	Yellow Borecene mix	[510]	[550]		[500]
			(100%)	(108%)		(98%)
	6	Green Borecene mix	[785]	[750]		[610]
			(100%)	(96%)		(78%)

- An asterisk (\*) indicates that a specimen has failed the 50% EAB test.
- Values set out above in square brackets and in blue are approximate values only. They have been approximated based on graph at S2/240.
- Figures in brackets and in red express the values as percentages of the initial, unexposed, values. Where no electronic versions of the results exist and precise data points are not identified in the documents, these figures have been estimated from examination of the graphs and must be treated as approximate

## SERIES B – S3/63

MAY 1998 (2 OF 2)

SERIES B ( THE “DYNO TESTS” ) MAY 1998 (2 OF 2)			(S2/260)						
GRADES TESTED			TEST RESULTS						
	MFR	DESCRIPTION	Elongation at Break %						
			<i>(Borealis WOM – 0.51 W/m<sup>2</sup>)</i>						
			0 hours	500 hours	1,000 hours	1,500 hours	2,000 hours	3,000 hours	5,000 hours
ME8152 (ZN)	3.6	Natural ZN	[630] (100%)	[395] (62%)	[*300] (48%)	[320] (51%)	[*240] (38%)		
	3.6	Red Dyno ZN	[215] (100%)	[230] (107%)		[215] (100%)	[200] (93%)		
	3.6	White Dyno ZN	[160] (100%)	[180] (113%)		[180] (113%)		[175] (109%)	[260] (163%)
	3.6	Yellow Dyno ZN	[175] (100%)	[175] (100%)		[200] (114%)		[110] (63%)	[150] (86%)
	3.6	Green Dyno ZN	[200] (100%)	[395] (198%)		[290] (145%)		[*40] (20%)	[*5] (3%)
ME8167	3.2	Natural Borecene	[1,050] (100%)	[970] (92%)	[900] (86%)	[750] (71%)	[*320] (30%)		
ME8169	6	Natural Borecene	[1,010] (100%)	[1025] (101%)	[800] (79%)	[*415] (41%)	[*190] (19%)		
	6	Red Borecene mix	[600] (100%)	[580] (97%)		[620] (103%)		[650] (108%)	[490] (82%)
	6	White Borecene mix	[445] (100%)	[500] (112%)		[470] (106%)		[475] (107%)	[485] (109%)
	6	Yellow Borecene mix	[510] (100%)	[550] (108%)		[500] (98%)		[560] (110%)	[510] (100%)
	6	Green Borecene mix	[785] (100%)	[750] (96%)		[610] (78%)		[510] (65%)	[*70] (9%)

- An asterisk (\*) indicates that a specimen has failed the 50% EAB test.
- Values set out above in square brackets and in blue are approximate values only. They have been approximated based on graph at S2/260.
- Figures in brackets and in red express the values as percentages of the initial, unexposed, values. Where no electronic versions of the results exist and precise data points are not identified in the documents, these figures have been estimated from examination of the graphs and must be treated as approximate

## SERIES C – S3/78

JULY 1998 (1 OF 4)

<b>SERIES C</b> <b>(CIBA PROJECT TA 12106 - ARTIFICIAL WEATHERING)</b> <b>JULY 1998 (1 OF 4)</b>			(S3/78)
GRADES TESTED		TEST RESULTS	
	MFR	DESCRIPTION	Hours to 50% retained tensile impact strength (CIBA WOM, 0.35W/m <sup>2</sup> )
ME8168	6	Specimen B Tinuvin 622; 2,500ppm Irganox B215; 1,800ppm	[3,250]
		Specimen E Tinuvin 622; 2,500ppm Irganox HP2215; 1,500ppm	[4,600]
		Specimen H Tinuvin622; 2,500 ppm Irganox E201; 150ppm Irgafos168; 300ppm	[5,000]
		Specimen I Tinuvin 783; 2,500ppm Irganox B215; 1,800ppm	>7,000
		Specimen K Cyasorb UV3346; 2,500ppm Irganox B215; 1,800ppm	>7,000
ME8152	3.2	Specimen L Tinuvin 622; 2,500ppm Irganox B215; 1,800ppm	[4,800]

- An asterisk (\*) indicates that a specimen has failed the 50% EAB test.
- Values set out above in square brackets and in blue are approximate values only. They have been approximated based on graph at S3/78.

## SERIES C – S3/148

(CIBA PROJECT TA 12106 - FLORIDA WEATHERING)

OCTOBER 1998 (2 OF 4)

SERIES C (CIBA PROJECT TA 12106 - FLORIDA WEATHERING) OCTOBER 1998 (2 OF 4)			(S3/148)	
GRADES TESTED			Tensile Impact Strength (J/cm <sup>2</sup> )	
	MFR	DESCRIPTION	0 hours	1 Year (Florida exposure)
ME8168	6	Specimen B Tinuvin 622; 2,500ppm Irganox B215; 1,800ppm	[33.5]	[32]
			(100%)	(96%)
		Specimen E Tinuvin 622; 2,500ppm Irganox HP2215; 1,500ppm	[37.5]	[32]
			(100%)	(85%)
		Specimen H Tinuvin622; 2,500 ppm Irganox E201; 150ppm Irgafos168; 300ppm	[38]	[29]
			(100%)	(76%)
ME8152	3.2	Specimen I Tinuvin 783; 2,500ppm Irganox B215; 1,800ppm	[39]	[31]
			(100%)	(79%)
		Specimen K Cyasorb UV3346; 2,500ppm Irganox B215; 1,800ppm	[36]	[32.5]
		(100%)	(90%)	
ME8152	3.2	Specimen L Tinuvin 622; 2,500ppm Irganox B215; 1,800ppm	[29.5]	[29]
			(100%)	(98%)

- Values set out above in square brackets and in blue are approximate values only. They have been approximated based on graph at S3/148.
- Figures in brackets and in red express the values as percentages of the initial, unexposed, values. Where no electronic versions of the results exist and precise data points are not identified in the documents, these figures have been estimated from examination of the graphs and must be treated as approximate.

## SERIES D – S4/154

JULY 1999

<b>SERIES D</b>					
<b>(S4/154)</b>					
<b>JULY 1999</b>					
<b>GRADES TESTED</b>			<b>Elongation at Break</b>		
	<b>MFR</b>	<b>DESCRIPTION</b>	<i>(Borealis WOM – 0.51 W/m<sup>2</sup>)</i>		
			<i>0 hours</i>	<i>1,500 hours</i>	<i>2,500 hours</i>
ME8161	6	Tin 622; 1,500ppm	1,320	940	810
			(100%)	(71%)	(61%)
ME8160	6	(Ref.70354)	1,450	1,150	900
		Tin 783; 1,415 ppm	(100%)	(79%)	(62%)
ME8160	6	(Ref.70355)	1,120	1,300	810
		Tin 783; 2,760 ppm	(100%)	(116%)	(72%)
ME8167	3.2	Tin 783; 2,500ppm	[1,050]	[780]	[*300]
			(100%)	(74%)	(29%)
ME8169	6	Tin 783; 2,500ppm	[1,020]	[800]	[*300]
			(100%)	(78%)	(29%)

- An asterisk (\*) indicates that a specimen has failed the 50% EAB test.
- Values set out above in square brackets and in blue are approximate values only. They have been approximated based on graph at S4/154.
- Figures in brackets and in red express the values as percentages of the initial, unexposed, values. Where no electronic versions of the results exist and precise data points are not identified in the documents, these figures have been estimated from examination of the graphs and must be treated as approximate.

**SERIES E – S6/5**

**NOVEMBER 1999**

<b>SERIES E NOVEMBER 1999</b>							<b>(S6/5)</b>
<b>GRADES TESTED</b>		<b>TEST RESULTS (CIBA WOM, 0.35W/m<sup>2</sup>)</b>					
	<b>DESCRIPTION</b>	<b>% ETB retention</b>					<b>Hours to 50% elongation at break</b>
		<i>0 hours</i>	<i>4,000 hours</i>	<i>6,000 hours</i>	<i>8,000 hours</i>	<i>10,000 hours</i>	
Unidentified ZN grade <sup>31</sup>	Cyasorb UV 3346; 3,000ppm	[97]	[105]	[92]	[80]	[57]	10,480
		(100%)	(108%)	(95%)	(82%)	(59%)	
Unidentified ZN grade	Tin 783; 3,000ppm	[97]	[110]	[85]	[64]	[29]	8,970
		(100%)	(113%)	(88%)	(64%)	(30%)	
Unidentified ZN grade	Tin 622; 3,000ppm	[97]	[41]	[25]	[10]	[6]	3,760
		(100%)	(42%)	(42%)	(10%)	(6%)	
Unidentified ZN grade	Chimassorb 944	n/a	n/a	n/a	n/a	n/a	9,430

- An asterisk (\*) indicates that a specimen has failed the 50% EAB test.
- Values set out above in square brackets and in blue are approximate values only. They have been approximated based on graph at S6/5.
- Figures in brackets and in red express the values as percentages of the initial, unexposed, values. Where no electronic versions of the results exist and precise data points are not identified in the documents, these figures have been estimated from examination of the graphs and must be treated as approximate.

<sup>31</sup> See Ms Fatnes’ evidence, (17/30): “Q. And it's likely, of course, that these were done with Ziegler Nattas? A. Yeah, that might well be. Q. Well, it's probable, isn't it, because you were at the forefront with Ziegler Natta, with metallocenes and I think one of your rivals was trying to follow you; yes? A. Yeah, I guess so.”

## SERIES C – S6/112

DECEMBER 1999 (3 OF 4)

<b>SERIES C</b>			<b>(S6/112)</b>		
<b>(CIBA PROJECT TA 12106 - FLORIDA WEATHERING)</b>					
<b>DECEMBER 1999 (3 OF 4)</b>					
<b>GRADES TESTED</b>			<b>Tensile Impact Strength (J/cm<sup>2</sup>)</b>		
	<b>MFR</b>	<b>DESCRIPTION<sup>32</sup></b>	<i>Florida weathering</i>		
			<i>0 hours</i>	<i>1 Year (Florida exposure)</i>	<i>2 Years (Florida exposure)</i>
ME8168	6	Specimen B Tinuvin 622; 2,500ppm Irganox B215, 1800ppm	[34]	[31]	[26.5]
			(100%)	(91%)	(78%)
		Specimen E Tinuvin 622; 2,500ppm Irganox HP2215; 1,500ppm	[37]	[32.5]	[33.5]
			(100%)	(88%)	(91%)
		Specimen H Tinuvin622; 2,500 ppm Irganox E201; 150ppm Irgafos168; 300ppm	[37.5]	[29]	[27.5]
			(100%)	(77%)	(73%)
		Specimen I Tinuvin 783; 2,500ppm Irganox B215; 1,800ppm	[38.5]	[31]	[30.5]
	(100%)	(81%)	(79%)		
ME8152	3.2	Specimen K Cyasorb UV3346, 2,500ppm Irganox B215; 1,800ppm	[36]	[32.5]	[32]
			(100%)	(90%)	(89%)
ME8152	3.2	Specimen L Tinuvin 622; 2,500ppm Irganox B215; 1,800ppm	[29.5]	[29]	[27.5]
			(100%)	(98%)	(93%)

- Values set out above in square brackets and in blue are approximate values only. They have been approximated based on graph at S6/112.
- Figures in brackets and in red express the values as percentages of the initial, unexposed, values. Where no electronic versions of the results exist and precise data points are not identified in the documents, these figures have been estimated from examination of the graphs and must be treated as approximate.

<sup>32</sup> Whilst the specimens tested are not referred to at S6/112 as “Specimen B”, “Specimen E” etc, the specimen types tested appear to be identical to those tested in the course of CIBA’s artificial weathering tests.



## SERIES F – S6/119

(CIBA PROJECT TA12492)

DECEMBER 1999

<b>SERIES F</b> <b>(CIBA PROJECT TA12492)</b> <b>DECEMBER 1999</b>						<b>(S6/119)</b>		
GRADES TESTED			% retained tensile Impact strength [J/cm <sup>2</sup> ]					
	MFR	DESCRIPTION	(CIBA WOM, 0.35W/m <sup>2</sup> )					
			6,000 hours (CIBA WOM)	8,000 hours (CIBA WOM)	10,000 hours (CIBA WOM)			
ME8168	6	(Specimen 1) Tin 622; 2,500ppm 360 Irganox Irgafos 168; 1,440ppm	[11%]	[10%]				
ME8168	6	(Specimen 4) Tin 622; 2,500ppm 360 Irganox Irgafos 168; 1,040ppm	[45%]	[11%]	[10%]			
ME8168	6	(Specimen 5) Tin 622; 2,500ppm 360 Irganox Irgafos 38; 1,040ppm	[74%]	[69%]	[62%]			
ME8168	6	(Specimen 7) Chimassorb 2020; 2,500ppm Irgafos 168; 1,100ppm	[73%]	[67.5%]	[70%]			
ME6168	6	(Specimen 8) Tinuvin 622; 1,250 ppm Chimassorb 2020; 1,250ppm Irgafos168; 1,100ppm	[80%]	[58%]	[77%]			
ME6168	6	(Specimen 9) Tinuvin 622; 2,500 ppm Irgafos 168; 1,100ppm	[90%]	[80%]	[30%]			
ME8152		(Specimen 12) Tinuvin 622; 2,500 ppm 360 Irganox Irgafos 168; 1,440 ppm	[73%]	[17%]	[12%]			

- Values set out above in square brackets and in blue are approximate values only. They have been approximated based on graph at S6/119.

## SERIES G – S7/195

OCTOBER 2000

<b>SERIES G</b>										
<b>OCTOBER 2000</b>										
<b>(S6/119)</b>										
<b>GRADES TESTED</b>			<b>Type of Testing</b> <i>(Borealis WOM – 0.51 W/m<sup>2</sup>)</i>							
	<b>MFR</b>	<b>DESCRIPTION</b>	<b>Tensile Impact Strength</b> <i>(ISO8256)</i>				<b>Elongation to break</b> <i>(ISO 257)</i>			
			<b>0</b> <b>hours</b>	<b>1,000</b> <b>hours</b>	<b>2,000</b> <b>hours</b>	<b>3,000</b> <b>hours</b>	<b>0</b> <b>hours</b>	<b>1,000</b> <b>hours</b>	<b>2,000</b> <b>hours</b>	<b>3,000</b> <b>hours</b>
ME8152	3.6	With Tin 622; 2,500ppm <sup>33</sup>	189	242	225	215	[690]	[75]		
			(100%)	(128%)	(119%)	(114%)	(100%)	(11%)		
ME8161 (RM8403)	6	With Tin 783; 1,300 ppm	272	254	215	140	[1280]	[980]	[680]	[580]
			(100%)	(93%)	(79%)	(51%)	(100%)	(77%)	(53%)	(45%*)
ME8169 (RM8343)	6	With Tin 783; 1,500ppm	340	330	290	280	1290	970	677	619
			(100%)	(97%)	(85%)	(82%)	(100%)	(75%)	(52%)	(48%)

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- Figures in brackets and in red express the values as percentages of the initial, unexposed, values. Where no electronic versions of the results exist and precise data points are not identified in the documents, these figures have been estimated from examination of the graphs and must be treated as approximate.

<sup>33</sup> As accepted by Ms Fatnes in oral evidence (17/52/5–21).

**SERIES H – S8/70**

**DECEMBER 2000 (1 OF 2)**

<b>SERIES H</b>					
<b>(POLIMOON TESTS)</b>				<b>(S8/70)</b>	
<b>DECEMBER 2000 (1 OF 2)</b>					
<b>GRADES TESTED</b>		<b>TEST RESULTS</b>			
	<b>MFR</b>	<i>Elongation at break</i>			
		0 hours	1,250 hours	5,000 hours	7,500 hours
ME8169	6	1,250	1,250	1,150	1,200
		(100%)	(100%)	(92%)	(96%)
ME8161	6	1,260	1,250	1,200	1,250
		(100%)	(99%)	(96%)	(99%)
ME8167	3.2	1,580	1,250	1,150	1,200
		(100%)	(79%)	(73%)	(76%)

- Figures in brackets and in red express the values as percentages of the initial, unexposed, values.

**SERIES H – S8/173**

**DECEMBER 2000 (2 OF 2)**

<b>SERIES H</b>		<b>(S8/173)</b>				
<b>(POLIMOON TESTS)</b>						
<b>MAY 2001 (2 OF 2)</b>						
<b>GRADES TESTED</b>		<b>TEST RESULTS</b>				
	<b>MFR</b>	<i>Elongation at break</i>				
		0 hours	1,250 hours	5,000 hours	7,500 hours	10,000 hours
ME8169	6	1,250	1,250	1,150	1,200	870
		(100%)	(100%)	(92%)	(96%)	(70%)
ME8161	6	1,260	1,250	1,200	1,250	1,040
		(100%)	(99%)	(96%)	(99%)	(83%)
ME8167	3.2	1,580	1,250	1,150	1,200	1,180
		(100%)	(79%)	(73%)	(76%)	(75%)

- Figures in brackets and in red express the values as percentages of the initial, unexposed, values.

# SERIES I – S9/14-28

APRIL / JUNE 2001

SERIES I (CYTEC TSR#00-EU-02) April / June 2001 <sup>34</sup>			(S9/ 24) (S9/26)									
GRADES TESTED			TEST RESULTS (CIBA WOM, 0.35W/m <sup>2</sup> )									
	MFR	DESCRIPTION OF SPECIMEN <sup>35</sup>	% retained original elongation 14 minute processing cycle					% retained original tensile strength 14 minute processing cycle				
			0	2,000	4,000	6,000	10,000	0	2,000	4,000	6,000	10,000
ME8168	6	Formulation 2 Tin 783; 1,750ppm Zn. St. 2,000ppm	[100]	[80]	[*32]	[*25]	[*9]	[100]	[90]	[59]	[50]	[52]
ME8168	6	Formulation 3 Cyasorb UV-3346; 1,750ppm Zn. St. 2,000ppm	[100]	[85]	[71]	[*53]	[*28]	[100]	[100]	[81]	[60]	[59]
ME8168	6	Formulation 4 Cyasorb UV-3346; 1,750ppm Zn. St. 500ppm	[100]	[86]	[66]	[*45]	[*26]	[100]	[92]	[73]	[59]	[59]
ME8168	6	Formulation 5 Cyasorb UV-4611; 1,750ppm Zn. St. 2,000ppm	[100]	[93]	[91]	[84]	[*50]	[100]	[108]	[101]	[86]	[69]

<sup>34</sup> 10,000 hour results obtained in June 2001

<sup>35</sup> All had a base resin of Irganox B215

**SERIES I****(CYTEC TSR#00-EU-02)**April / June 2001<sup>36</sup>**(S9/ 25)****(S9/27)**

GRADES TESTED			TEST RESULTS (CIBA WOM, 0.35W/m <sup>2</sup> )									
	MFR	Description of Specimen	% retained original elongation 18 minute processing cycle					% retained original tensile strength 18 minute processing cycle				
			0	2,000	4,000	6,000	10,000	0	2,000	4,000	6,000	10,000
ME8168	6	Formulation 2 Tin 783; 1,750ppm Zn. St. 2,000ppm	[100]	[*10]	[*9]	[*11]	[*5.5]	[100]	[65]	[59]	[58]	[64]
ME8168	6	Formulation 3 Cyasorb UV- 3346; 1,750ppm Zn. St. 2,000ppm	[100]	[*22]	[*10.5]	[*12]	[*5]	[100]	[52]	[55]	[54]	[64]
ME8168	6	Formulation 4 Cyasorb UV- 3346; 1,750ppm Zn. St. 500ppm	[100]	[*26]	[*10.5]	[*10.5]	[*7.5]	[100]	[66]	[61]	[56]	[65]
ME8168	6	Formulation 5 Cyasorb UV- 4611; 1,750ppm Zn. St. 2,000ppm	[100]	[56]	[57]	[61]	[*31.5]	[100]	[83]	[77]	[76]	[66]

- An asterisk (\*) indicates that a specimen has failed the 50% EAB test.
- Values set out above in square brackets and in blue are approximate values only. They have been approximated based on graph at S9/24-27.

<sup>36</sup> 10,000 hour results obtained in June 2001

## SERIES J – S13/57

(KIWA TESTS)

APRIL / JUNE 2001

<b>SERIES J</b> <b>(THE KIWA TESTS)</b> <b>SEPTEMBER 2002</b>							<b>(S13/57)</b>			
GRADES TESTED			TEST RESULTS							
	MFR	DESCRIPTION OF SPECIMEN	Elongation at break %							
			0 hours	1,000 hours	1,500 hours	4,000 hours				
RM8402	6	Roto PDC 3,5mm <sup>37</sup> (100mm/min)	100%	110%		<b>*34%</b>				
RM8402	6	PDC 1mm <sup>38</sup> (100mm/min)	100%	103%		69%				
RM8402	6	Roto Rø 3.5 mm <sup>39</sup> (100 mm/min)	100%	95%		52%				
RM8402	6	Powder 1mm <sup>40</sup> (100 mm/min)	100%	103%		62%				
RM8402	6	Roto PDC 3,5mm <sup>41</sup> (50mm/min)	100%		50%	<b>*42%</b>				
RM8402	6	PDC 1mm <sup>42</sup> (50mm/min)	100%		104%					
RM8402	6	Roto Rø 3.5 mm <sup>43</sup> (50mm/min)	100%		90%	66%				

See parties' agreed note dated 1 June 2011 (Core Bundle, Volume 2, Tab 5)

<sup>37</sup> Flat sections cut from a cube shaped product rotomoulded from green dry blended powder in a trial by PDC. The test specimens were machined by Borealis directly from these sections. Sections and specimens were 3.5mm in thickness

<sup>38</sup> Flat sections were cut from a product which had been rotomoulded in a trial by PDC. The section was then compression moulded by Borealis to a 1mm thickness in order to comply with the UV test methodology in prEN13341 and KIWA. The test specimens were machined by Borealis from these 1mm sections.

<sup>39</sup> Flat sections were cut from a cube shaped product that had been rotomoulded by Borealis from green dry blended powder supplied by PDC. The test specimens were machined by Borealis from these sections. The specimen thickness was 3.5mm.

<sup>40</sup> Samples compression moulded to 1mm thickness by Borealis directly from green powder supplied by PDC (and not at any stage rotomoulded in the course of the samples' preparation). The test specimens were machined by Borealis from these 1mm sections.

<sup>41</sup> Flat sections cut from a cube shaped product rotomoulded from green dry blended powder in a trial by PDC. The test specimens were machined by Borealis directly from these sections. Sections and specimens were 3.5mm in thickness

<sup>42</sup> Flat sections were cut from a product which had been rotomoulded in a trial by PDC. The section was then compression moulded by Borealis to a 1mm thickness in order to comply with the UV test methodology in prEN13341 and KIWA. The test specimens were machined by Borealis from these 1mm sections.

RM8402	6	Powder 1mm <sup>44</sup> (50mm/min)	100%		105%	
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- An asterisk (\*) indicates that a specimen has failed the 50% EAB test.

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<sup>43</sup> Flat sections were cut from a cube shaped product that had been rotomoulded by Borealis from green dry blended powder supplied by PDC. The test specimens were machined by Borealis from these sections. The specimen thickness was 3.5mm.

<sup>44</sup> Samples compression moulded to 1mm thickness by Borealis directly from green powder supplied by PDC (and not at any stage rotomoulded in the course of the samples' preparation). The test specimens were machined by Borealis from these 1mm sections.



## SERIES C – S16/109

(CIBA PROJECT TA12406 – Florida Weathering)

AUGUST 2003 (4 OF 4)

SERIES C (CIBA PROJECT TA12406 – Florida Weathering) AUGUST 2003 (4 OF 4)			(S16/109)					
GRADES TESTED			Tensile Impact strength [J/cm <sup>2</sup> ] (Florida Exposure of mPE-LLD)					
	MFR	DESCRIPTION	0kLy	144kLy	297kLy	452kLy	597kLy	734kLy
ME8168	6	[Specimen B] Tin 622; 2,500ppm	[34]	[31]	[26.5]	[23.5]	[5.5]	[12]
		Irganox B215; 1,800ppm	(100%)	(91%)	(78%)	(69%)	(16%)	(35%)
ME8168	6	[Specimen E] Tin 622; 2,500ppm	[37]	[32.5]	[33.5]	[31]	[29]	[27.5]
		Irganox HP 2215; 1,500ppm	(100%)	(88%)	(91%)	(84%)	(78%)	(74%)
ME8168	6	[Specimen H] Tin 622; 2,500ppm	[37.5]	[29]	[27.5]	[26.5]	[25]	[22]
		Irganox E201; 150ppm Irgafos 168; 300ppm	(100%)	(77%)	(73%)	(71%)	(67%)	(59%)
ME8168	6	[Specimen I] Tin 783; 2,500ppm	[38.5]	[31]	[30.5]	[26.5]	[27.5]	[21]
		Irganox B215; 1,800ppm	(100%)	(81%)	(79%)	(69%)	(71%)	(55%)
ME8168	6	[Specimen K] Cyasorb UV3346; 2,500ppm	[36]	[32.5]	[32]	[29.8]	[26]	[25.5]
		Irganox B215; 1,800ppm	(100%)	(90%)	(89%)	(83%)	(72%)	(71%)
ME 8152 <sup>45</sup> (Ziegler Natta)	6	[Specimen L] Tin 622; 2,500ppm	[29.5]	[29]	[27.5]	[27]	[24]	[23.5]
		Irganox B215; 1,800ppm	(100%)	(98%)	(93%)	(92%)	(81%)	(80%)

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- Figures in brackets and in red express the values as percentages of the initial, unexposed, values. Where no electronic versions of the results exist and precise data points are not identified in the documents, these figures have been estimated from examination of the graphs and must be treated as approximate.

<sup>45</sup> As confirmed by Jamtvedt: see Day 20, Page 29, Line 14

# SERIES K – S17/67

(CYTEC TSR#02-EU-99)

NOVEMBER 2003

SERIES K (CYTEC TSR#02-EU-99) 17 November 2003			(S17/67)									
GRADES TESTED			TEST RESULTS									
	MFR	DESCRIPTION	Elongation at Break					Tensile Impact Strength [Psi]				
			0 hours	1,689 hours	3,000 hours	4,773 hours	7,250 hours	0 hours	1,689 hours	3,000 hours	4,773 hours	7,250 hours
ME8168	6	Formulation 1 Tinuvin 783; 1,500ppm Zn St, 2,000ppm B215 1,800ppm	[1,850]	[1,550]	[1,400]	[1,250]	[1,120]	[4,800]	[3,800]	[3,500]	[3,400]	[2,350]
			(100%)	(84%)	(76%)	(68%)	(61%)	(100%)	(79%)	(73%)	(71%)	(49%)
ME8168	6	Formulation 2 THT 4611; 1,000ppm Zn St, 2,000ppm B215 1,800ppm	[1,900]	[1,750]	[1,650]	[1,280]	[1,200]	[5,020]	[4,600]	[3,700]	[3,200]	[2,500]
			(100%)	(92%)	(87%)	(67%)	(63%)	(100%)	(92%)	(74%)	(64%)	(50%)
ME8168	6	Formulation 3 THT 4611; 1,000ppm Zn St, 2,000ppm B215 1,500ppm	[1,800]	[1,650]	[1,550]	[1,350]	[1,250]	[4,600]	[4,300]	[3,400]	[3,600]	[2,700]
			(100%)	(92%)	(86%)	(75%)	(69%)	(100%)	(93%)	(74%)	(78%)	(59%)
ME8168	6	Formulation 4 THT 4611; 750ppm Zn St, 2,000ppm B215 1,500ppm	[1,800]	[1,600]	[1,480]	[1,300]	[1,250]	[4,500]	[4,200]	[3,500]	[3,600]	[2,700]
			(100%)	(89%)	(82%)	(72%)	(69%)	(100%)	(93%)	(78%)	(80%)	(60%)
ME8168	6	Formulation 5 THT 4611; 750ppm Zn St, 2,000ppm B215 1,200ppm	[1,820]	[1,700]	[1,380]	[1,360]	[1,150]	[4,800]	[4,300]	[3,450]	[3,700]	[2,750]
			(100%)	(93%)	(76%)	(75%)	(63%)	(100%)	(90%)	(72%)	(77%)	(57%)
ME8168	6	Formulation 6 THT 4611; 750ppm Zn St, 2,000ppm CX2888 900ppm	[1,875]	[1,575]	[1,350]	[1,200]	[1,100]	[4,550]	[4,200]	[3,200]	[3,300]	[2,600]
			(100%)	(84%)	(72%)	(64%)	(59%)	(100%)	(92%)	(70%)	(73%)	(57%)

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## APPENDIX 4

### *Embedded data*

- 1 The data slides in the PowerPoint file from which the slides emanate contained embedded data, of which Ms Fatnes was unaware, but which Kingspan was able to access by double clicking on the top slides. Kingspan's analysis of that data, which appears to me to be accurate, is as follows. The spread sheet at S10/127.008 shows the underlying data to the graphs shown in slides 6 and 7,<sup>46</sup> with the data in Row 4 of the spread sheet being the test results for ME8169/RM8343 that was used to form the two bar charts. There are no entries for Rows 3 and 5. However, Rows 8-10 contain entries relating to all three specimens tested in the course of Series G (i.e. ME8152, RM8343/ME8169 and RM8403/ME8161). These Rows contain formulae for the purposes of deriving the percentage retained properties of each specimen: see S10/127.010, which shows the formulae used for the purposes of deriving the entries to the cells.<sup>47</sup> These formulae reveal that the percentage retained properties were calculated for all three specimens, and that at some stage there were entries for Rows 3 and 5 relating to the test results for ME8152 and ME8161/RM8403 respectively, since the formulae in Rows 8 and 10 contain references to cells in Rows 3 and 5.<sup>48</sup> It seems, therefore, that at some stage after the percentage retained tensile impact and impact strength values of the 3 specimens were calculated, someone removed the ME8152 and ME8161/RM8403 test results and then produced bar graphs showing the results only for ME8169/RM8343, i.e. as per slides 6 and 7.<sup>49</sup>
- 2 Why the omission occurred in the embedded data is a mystery. It was nothing to do with Ms Fatnes, who suggested in evidence that it may have resulted from a malfunction of Excel, although this seems to me rather unlikely. However it happened. I am not convinced that there was any intention to mislead.
- 3 Someone certainly decided that the top slides would present RM 8343 data. I do not infer that that was with a view to cherry-picking data favourable to Borealis in presenting RM 8402. In respect of the Polimoon results RM 8403 [ME 8161] had marginally better results than RM 8343. In respect of the EaB results in Series G RM 8403 performed markedly better than ME 8152 and very similarly to RM 8343. ME 8152 failed by 1000 hours and RM 8343 performed comparably to RM 8403 with failure by 3000 hours. In the Tensile Impact tests ME 8152 performed much better than both the others and RM 8343 better than RM 8403 (82% of original at 3000

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<sup>46</sup> The graph shown being the line chart version of the bar chart on slide 7.

<sup>47</sup> For example, Cell C9 contains the formula "(C4/B4)\*100", which performs the calculation  $(970 \div 1290) \times 100$ .

<sup>48</sup> See, for example, the entry for Cell C8 ("=(C3/B3)\*100"). It is for this reason that the cells show an error code ("#DIV/0!") when the spreadsheet performs the calculation (as shown at S10/127.009); since Rows 3 and 5 are empty, any calculation requiring an entry from those rows (as per the formulae in Rows 8 and 10) produces an error.

<sup>49</sup> It is also possible that the original versions of these graphs did contain bars for ME8152 and ME8169/RM8403. At S10/127/006, the coloured rectangles shown along Rows 2-5 show the entries used to form the chart. Note that the rectangle surrounds not just the entries at Row 4, but also the entries at Rows 3-5 (i.e. the "old" ME8152 and ME8169/RM8403 cells). Since these cells now lie empty, no values show up on the graph.

hours compared with 51%). These results were omitted from the top slides but are in fact present in the embedded data (S 10/127.11).

## APPENDIX 5

- 1 Assume that 2,500ppm of Tinuvin 783 lasts for 7,000 hours (as in the Ciba tests).
- 2 Assume that 2,500ppm of Tinuvin 622 lasts for 4,600 hours (as in the Ciba tests).
- 3 If the concentration of Tinuvin 783 is decreased from 2,500ppm to 1,300ppm, the expected time to failure, applying the square root rule, would be determined by comparing the square roots of the different proportions as follows:  $(\sqrt{1,300} \div \sqrt{2,500}) \times 7,000 = 5,048$  hours.
- 4 If the concentration of Tinuvin 622 is increased from 2,500ppm to 3,000ppm, the expected time to failure, applying the square root rule, would be determined by comparing the square roots of the different proportions as follows:  $(\sqrt{3,000} \div \sqrt{2,500}) \times 4,600 = 5,039$  hours.
- 5 This therefore indicates that, based on the Ciba tests, 1,300ppm of Tinuvin 783 would be expected to give equivalent performance to 3,000ppm of Tinuvin 622.