

Firestone

BUILDING PRODUCTS

**Firestone Building
Products Company, LLC**

250 West 96th Street
Indianapolis, IN 46260
Phone: 317-575-7000
Fax: 317-575-7100

July 6, 2011

California Energy Commission
1516 Ninth Street
Sacramento, California 95814-5512
docket@energy.state.ca.us

California Investor-Owned Utilities
c/o Architectural Energy Corporation
142 Minna Street
San Francisco, California 94105

DOCKET
10-BSTD-01

DATE	JUL 06 2011
RECD.	JUL 06 2011

Re: Docket No. 10-BSTD-01, 2013 Building Efficiency Standards – Firestone Building Products Company's Second Set of Comments

Dear Sir or Madam:

The comments set forth below are submitted by Firestone Building Products Company, LLC ("Firestone"), a major manufacturer of commercial roofing systems. These comments are a follow up to Firestone's previous comments dated June 9, 2011 to the California Energy Commission ("Commission" or "CEC"), a copy of which is enclosed for your convenience.

Firestone's original set of comments to the CEC addressed two (2) issues from the Stakeholders' Workshop held on June 1, 2011: the proposal by the Investor-Owned Utilities ("IOUs") to raise the prescriptive aged reflectance standard for low-sloped roofs to 0.70 across all climate zones; and the proposal by California Energy Commission ("Commission" or "CEC") staff to establish a mandatory minimum aged reflectance standard for low-sloped roofs of 0.55 for most climate zones. Firestone's original comments set forth Firestone's concerns that the revised Title 24 reflectivity standards would have a significant adverse effects on competition in the roofing market, negatively impacting both California consumers and businesses.

Firestone appreciates the importance of building design in conserving energy, and the significance, in particular, of roofing systems to promote energy conservation. To assist the CEC's understanding of the impact of the current draft proposals on the roofing industry, Firestone has been discussing the proposed standards with CEC staff and the IOU's representatives.¹ While Firestone

¹ In particular, Firestone representatives have met in person and had telephone discussions with Mazi Shirakh, Senior Mechanical Engineer for the CEC, and Dan Suyeyasu, Director of Energy Programs, Architectural Energy Corporation, as representative of the IOUs. These discussions were at the June 10, 2011 CEC Staff



NOBODY COVERS YOU BETTER™

<http://www.firestonebpc.com>



supports the objective of energy efficiency, Firestone believes the original proposed roof reflectivity numerical standards would not be cost effective. Based on conversations with CEC staff and the IOU's representative, Firestone urges the Commission to adopt a roof reflectance/insulation trade-off approach as set forth in these comments. The roof reflectance/insulation trade-off standard would allow owners, roof designers and architects to choose from a continuum of potential trade-off costs during the construction process. It would also have the advantage of allowing competition in the California building products' marketplace by permitting market access to various products (provided the required trade-off standards are met), while achieving the energy conservation goals of both the CEC and the IOUs.

The Key Factors the Commission Must Consider in Adopting Building Standards

The statutory authority of the Commission to promulgate and periodically update building standards to increase energy efficiency is set out in Cal. Pub. Res. Code §25402. The standards adopted or revised by the Commission must be "cost-effective when taken in their entirety and when amortized over the economic life of the structure compared with historic practice." Cal. Pub. Res. Code §25402(b)(3). When considering cost-effectiveness, this same subsection requires the Commission to consider the value of energy saved, the impact on product efficacy for the consumer, and the life cycle costs of complying with the standard. It also requires the Commission to consider a number of additional factors, including the economic impact of a proposed standard on California businesses, and alternative approaches and their associated costs.

Firestone's Proposed Tiered Trade-Off Approach

Consistent with Cal. Pub. Res. Code §25402, the inclusion of trade-off strategies in Title 24 would be especially beneficial for California consumers, building owners, architects and roof designers. Under this approach, an increase in insulation of the roofing and building structure would result in a reduced reflectivity requirement for the building structure's roof. Conversely, a reduction in insulation of the roofing and building structure would result in an increased reflectivity requirement for the roof.

As part of a trade-off structure, and for the reasons set forth in Firestone's prior comments, any new prescriptive solar reflectance standard for nonresidential low-sloped roofs should be no more than 0.65 when insulation is not considered, rather than 0.70 as currently proposed. As demonstrated in Firestone's prior comments, the proposed 0.70 standard raises at least two (2) concerns. First, there is significant variation in the testing results for immediate and aged reflectivity.² Second, if the prescriptive aged reflectance standard were to be set at 0.70, most of the

(continued...)

Workshop and via conference call and email. The discussions between the parties have been positive and have primarily focused on a tiered trade-off system between roof reflectivity and insulation.

² As shown on Tables I and II to Firestone's original comments, many of the roofing product offerings listed with Cool Roof Rating Council ("CRRC") have an aged solar reflectance level of 0.69 or 0.68. The CRRC allows for a five percent (5%) variation when performing random testing for verification of initial values. In addition, there is

roofing product offerings currently on the market would be unavailable to California consumers. The severe reduction in available product could possibly result in product shortages, and significant increases in prices.

Based on the reasoning above, and on conversations with CEC staff and the IOU representative, Firestone believes that an insulation trade-off framework works best for roof reflectivity. In an email dated Friday, July 1, 2011, to Roofing Industry Stakeholders, Dan Suyeyasu, with Architectural Energy Corporation, as a representative of the IOUs sent a proposed trade-off system. This system would incorporate insulation trade-offs and is as follows:

1. A roof prescriptive reflectivity value of .67 or greater in all climate zones except high-rise residential 1 and 16, with no required insulation trade-off.
2. There will be no mandatory minimum for reflectance, meaning any product can still be installed on any roof if a trade-off procedure is used to add insulation (or other energy efficiency features are utilized).
3. There would be a simplified trade-off procedure with continuous insulation based on the following universal trade-off available in all climate zones:

<u>Reflectance</u>	<u>Insulation R-Value</u>
0.60	R-Value of 5
0.55	R-Value of 7
0.50	R-Value of 9
0.45	R-Value of 12
0.40	R-Value of 15

4. Below a reflectance of 0.40, the installer could use other trade-off techniques permitted by the California Code.

While Firestone agrees with the modified trade-off approach proposed in Mr. Suyeyasu's July 1 email, Firestone would propose a maximum prescriptive reflectivity standard of 0.65 instead of .67,

(continued...)

greater than two percent (2%) measurement uncertainty with aged values. This variability and margin for error is the result of several factors, including a procedure by which samples from the CRRC weathering farm are handled several times by different individuals; and demonstrated variations of several percentage points within testing laboratories. The testing procedures and the length of testing are based on the California Energy Code.

without required insulation trade-offs, to increase cost-effectiveness and competition. Given the need for a competitive market, and the margin for error in the three (3) year aged testing process, Firestone believes the 0.65 reflectivity value still meets the energy conservation goals of the CEC, while ensuring adequate market access and competition to the benefit of California consumers.

Advantages of the Proposed Tiered Trade-Off Approach

The proposed tiered trade-off system has a number of advantages over a mandatory prescriptive roof reflectivity standard, all while having the same mitigation effect on commercial building energy consumption. These advantages are as follows:

1. An insulation/roof reflectivity trade-off system emphasizes total energy conservation, instead of focusing on one particular means of obtaining a reduction in energy consumption for commercial structures. By utilizing a trade-off system between insulation and roof reflectivity, commercial construction and design industries may tailor energy conservation solutions to the individual needs of clients and building owners. Such a system would allow for multiple solutions to be employed to meet the Title 24 prescriptive standards, which would include a number of products that may be excluded if the Title 24 standards only considered roof reflectivity.
2. An insulation/roof reflectivity trade-off system allows for greater assurance that a competitive market will exist for roofing systems in the California market. Numerous materials may be employed by a building and roof designer to meet a tiered trade-off standard, which include an assortment of different building materials that would not be permitted if a strict numeric roof reflectivity standard were employed. The allowance for different building materials under a trade-off system will mean greater competition within the California construction industry.³
3. An insulation/roof reflectivity trade-off system will allow for greater design flexibility by building and roofing designers and for building owners throughout California. Not all California climate zones are the same. An insulation/roof reflectivity trade-off optimized for one climate zone, may not be optimal in another climate zone. A tiered trade-off system will allow individuals to tailor specific roofing and building insulation solutions to meet the particular climate zone and other individual circumstances affecting the building structure.
4. An insulation/roof reflectivity trade-off system will result in greater cost savings to California consumers. If the prescriptive standards are solely based on roof reflectivity, such a standard can be expensive given the limited number of products in the market that

³ If the prescriptive aged reflectance standard increases to 0.70 per the original CEC proposal, most roofing products currently on the market will be unavailable to California consumers. This would have a material adverse affect on competition in the market, possibly resulting in product shortages, and significant increases in prices as supply decreases and demand increases, all to the detriment of California consumers.

comply with such standards. Often, insulation can be a cheaper alternative to a more expensive roofing system. The trade-off system gives consumers the ability to shop for the best priced system employing a combination of insulation and roof materials. The resulting increase in options will have the effect of mitigating the cost of reaching the CEC's energy conservation goals in commercial construction.

5. An insulation/roof reflectivity trade-off system will allow for new products to come to market to meet the higher roof reflectivity prescriptive standards to be included in the new Title 24 standards. Imposing a simple numeric roof reflectivity standard in a single step would have significant adverse effects on competition in the roofing market, negatively impacting both California consumers and businesses. A trade-off system minimizes this effect by providing manufacturers time to develop and test roofing systems with higher tested reflectivity rates.

For the reasons set forth above, Firestone would recommend a tiered insulation/roof reflectivity trade-off system similar to that in Mr. Suyeyasu's July 1 email, except Firestone would propose a maximum prescriptive reflectivity standard of 0.65 instead of .67, without required insulation trade-offs, to increase cost-effectiveness and competition.⁴

Thank you for this opportunity to comment on the proposed standards. I would be pleased to arrange a follow-up discussion or telephone call with you and the technical staff and representatives of Firestone to discuss our concerns in further detail. To arrange such a discussion, please telephone me at (317) 575-7134.

Very truly yours,



Brian C. Fritts
Senior Counsel and Secretary
Firestone Building Products Company, LLC

Enclosures: Firestone's June 9, 2011 Comments

⁴ In addition, Firestone notes that there is currently no requirement for follow-up testing on a regular basis to ensure that roofing product is meeting the applicable standard. Firestone would take this opportunity to suggest that such follow-up testing would ensure that reflectivity values remain consistent and ensure that manufacturers are not changing the formula of their product without subsequent retesting.

Firestone

BUILDING PRODUCTS

**Firestone Building
Products Company, LLC**
250 West 96th Street
Indianapolis, IN 46260
Phone: 317-575-7000
Fax: 317-575-7100

June 9, 2011

California Energy Commission
1516 Ninth Street
Sacramento, California 95814-5512
docket@energy.state.ca.us

California Investor-Owned Utilities
c/o Architectural Energy Corporation
142 Minna Street
San Francisco, California 94105

**Re: Docket No. 10-BSTD-01, June 10, 2011 Staff Workshop, 2013 Building
Efficiency Standards**

Dear Sir or Madam:

The comments set out below are submitted by Firestone Building Products Company, LLC ("Firestone"), a major manufacturer of commercial roofing systems. These comments address two issues from the Stakeholders' Workshop held on June 1, 2011: the proposal by the Investor-Owned Utilities ("IOUs") to raise the prescriptive aged reflectance standard for low-sloped roofs to 0.70 across all climate zones; and the proposal by California Energy Commission ("Commission" or "CEC") staff to establish a mandatory minimum aged reflectance standard for low-sloped roofs of 0.55 for most climate zones.

Firestone appreciates the importance of building design in conserving energy, and the significance, in particular, of roofing systems to promote energy conservation. While Firestone supports the objective of energy efficiency, Firestone believes the proposed numerical standards would not be cost effective. If the Commission decides to adopt the new numerical standards, Firestone urges the Commission to phase-in the standards rather than making the proposed standards effective upon promulgation. As discussed below, imposing the new standards in a single step would have significant adverse effects on competition in the roofing market, negatively impacting both California consumers and businesses. This effect can be minimized by providing manufacturers time to develop and test roofing systems that meet the proposed numerical limits.



NOBODY COVERS YOU BETTER™

<http://www.firestonebpc.com>



The Key Factors the Commission Must Consider in Adopting Building Standards

The statutory authority of the Commission to promulgate and periodically update building standards to increase energy efficiency is set out in Cal. Pub. Res. Code § 25402. The standards adopted or revised by the Commission must be “cost-effective when taken in their entirety and when amortized over the economic life of the structure compared with historic practice.” Cal. Pub. Res. Code §25402(b)(3). When considering cost-effectiveness, this same subsection requires the Commission to consider the value of energy saved, the impact on product efficacy for the consumer, and the life cycle costs of complying with the standard. It also requires the Commission to consider a number of additional factors, including the economic impact of a proposed standard on California businesses, and alternative approaches and their associated costs.

The Proposed Numerical Standards Are Not Cost Effective

Slide number 5 presented at the June 1, 2011 workshop asserted that the cost of moving from the present prescriptive standard of 0.55 to the proposed prescriptive standard of 0.70 would not result in an increase in product cost. Slide number 8 maintained that field applied coatings and single-ply membranes meeting the 0.70 standard were less expensive than products meeting the 0.55 standard. Based in part on these conclusions, slide number 10 concluded that raising the prescriptive standard to 0.70 in climate zones 2 through 15 would be cost effective in terms of saving energy. Participants at the workshop requested copies of the data and analyses relied upon by the presenters to arrive at these conclusions. To date, this information has not been provided. Nevertheless, the conclusions are flawed.

For example, the conclusions concerning cost on slides 5 and 8 appear to be heavily influenced by the cost of field-applied liquid coatings. Yet liquid coatings are not comparable to single-ply membranes, because liquid coatings serve a different purpose (liquid coatings do not waterproof a building as do single-ply membranes), and must be re-applied much more frequently. As a consequence, field-applied coatings have very different cost factors than single-ply membranes. The material costs for liquid coatings are less, but the life cycle installation costs are higher. However, according to slide 5, the survey simply looked at material costs, incorrectly assuming that installations costs were the same. As a second example, it clearly would not be cost effective to expend substantial time and resources to develop a product that ultimately is tested as meeting a 0.70 standard, when there already are products available on the market that have been tested as meeting 0.69, which is well within the variability and margin of effort of the testing methods. We will discuss this further below.

Implementation of the Proposed Numerical Standards Will Have A Negative Effect on California Consumers

The presentation on June 1, 2011 asserted that both field-applied coatings and single-ply membranes are currently available that meet the proposed 0.70 prescriptive aged reflectance standard. In particular, slide number 8 indicates that 22 of the 57 single-ply membranes that can be purchased today meet the aged reflective standard of 0.70. This was used to support the

proposed standard's cost effectiveness and to justify standards that are effective upon final promulgation.

However, considering the listing of products by the Cool Roof Rating Council ("CRRC"), the 22 products listed on slide number 8 represent the number of single-ply membrane brand names, rather than products, that are currently on the market. Many of the brand names are manufactured by a single company. For example, Carlisle SynTec Incorporated ("Carlisle") manufactures Sure-Weld, which is also sold to three other companies that market the product under their own brand names. As shown on enclosed Table I, discussed below, if the number of actual products that are currently manufactured is considered, only four products sold today meet the aged reflectance standard of 0.70. The number of products, as opposed to the number of brand names, on the market is a much more significant indicator of product availability.

Table I enclosed with this letter identifies the manufacturers of single-ply membrane products listed by CRRC as of June 1, 2011. For each of the manufacturers, the table gives the solar reflectance rating for each of the products and brands. If PVC products; Carlisle, Cooley, and Sarnafil products sold under other brand names; and products that are no longer manufactured, are omitted, there are only four products that meet the proposed 0.70 standard: (1) Firestone's ReflexEON; (2) Cooley's TPO; (3) Sika Sarnafil's G410; and (4) Carlisle's TPO. As also shown on Table I, the vast majority of the single-ply products listed with CRRC do not meet an aged reflective standard of 0.70.

If the prescriptive aged reflectance standard increases from the current limit of 0.55 to the proposed limit of 0.70, most of the single-ply products currently on the market will be unavailable to California consumers. The availability of only four compliant products would have a material adverse affect on competition in the market, possibly resulting in product shortages, and significant increases in prices as supply decreases and demand increases, all to the detriment of California consumers.

Slide number 8 also indicated that there are 134 of 248 field-applied coatings available that currently meet the proposed prescriptive standard of 0.70. We suspect that as with single-ply membranes discussed above, the number of field-applied coatings represents brand names on the market, and that the number of products currently on the market is considerably smaller. In addition, many companies prefer single-ply membranes over field-applied coatings because of increased durability (most coatings must be re-applied in 5 to 10 years), and improved weather proofing. Thus, the availability of field-applied coatings does not alleviate the shortage of single-ply membranes currently meeting the proposed 0.70 standard.

The expected price increase for compliant products if the proposal is adopted is compounded by the existing high price of current products that meet an aged reflectance standard of 0.70. The only Firestone product currently listed with CRRC as meeting the 0.70 standard is ReflexEON TPO, White. That product has a relatively high cost as compared to Firestone's other products, and has been difficult to market in California, and elsewhere, because of its higher price.

Implementation of the Proposed Numerical Standards Will Have a Negative Effect on Businesses

It will take Firestone, and other manufacturers of roofing systems, a significant amount of resources and time to develop and test products that comply with the proposed standards. As shown on enclosed Table II, discussed below, Firestone will be unable to sell up to ten different roofing products in California if the proposed standard becomes effective upon final promulgation. This result is unduly harsh to both producers and consumers in the market, as many existing products in the market are within the expected variability and margin for error of the 0.70 standard. This adverse market effect will come at a time when revenue will be needed to fund research and development programs.

Enclosed Table II lists all of Firestone's CRRC roofing products available today, including field-applied coatings, single-ply membranes, metal, and modified bitumen. As shown on the table, five Firestone products are listed with CRRC as having a reflectance level of 0.70 or higher, and ten products are listed as having a reflectance level below 0.70, or are undergoing the three year aging process required to test such products. Firestone intends to undertake an ambitious research and development program to design products that meet the proposed prescriptive standard of 0.70. However, it will take time to develop and test these products, and in the interim, Firestone will be unable to sell in California the ten products listed with CRRC as not meeting the standard or where the aging process is pending. In addition to the impact on consumers discussed above, this inability to sell many of Firestone's roofing products will have a serious negative impact on the company's sales and revenues. This negative effect is expected to last for five years, well beyond the expected effectiveness date of the proposed standards of early 2014. Even with an accelerated research and development program, Firestone estimates that it will take two years to develop products that can meet the proposed standards, and that an additional three years will be required to assess whether the new products satisfy the aged standard.

An Alternative Approach

Based on the recognized variability of test results, any new prescriptive solar reflectance standard for nonresidential low-sloped roofs should be no more than 0.65. As shown on enclosed Tables I and II, many single-ply products listed with CRRC have an aged solar reflectance level of 0.69 or 0.68, including four Firestone roofing products. Per the ASTM C1549 test standard typically used in testing for both initial and aged reflectivity values, the difference between a measured reflectance level of 0.70, and 0.69 or 0.68, is well within expected variability and margin for error. The CRRC allows for a five percent (5%) variation when performing random testing for verification of initial values. In addition, there is greater than two percent (2%) measurement uncertainty with aged values. This variability and margin for error is the result of several factors, including a procedure by which samples from the CRRC weathering farm are handled several times by different individuals; and demonstrated variations of several percentage points within testing laboratories. Moreover, weathering farms used by CRRC to determine average aged value are not representative of the California climate zones. It is important to emphasize that the testing procedures and the length of testing is not within Firestone's control but is based on the California Energy Code.

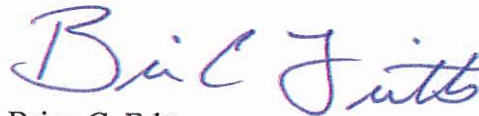
To prohibit the sale of products that are only slightly under the proposed standards, and are within the range of expected testing variability, would be unreasonable (and potentially arbitrary), and would create the very real potential for shortages and increased prices. There would be little, if any, gain in energy efficiency by banning these products from the market, especially during the time companies are developing new products to meet the ultimate standards.

In addition, based upon the importance of modified bitumen to consumers and the housing industry, any mandatory minimum solar reflectance standard should be set at a level that would allow continued use of modified bitumen. Energy efficiency would not be compromised because the trade-off approach under the prescriptive standard would provide for overall building energy efficiency.

If the Commission adopts the proposed prescriptive standard of 0.70, and establishes a mandatory minimum standard of 0.55, the new standards should not be effective upon promulgation, but instead should be phased in. The Commission could retain the .55 standard as a mandatory minimum, with a higher imposed standard three (3) years later, which would allow existing products to be marketed while companies develop and test products that can satisfy the proposed standards at such later date. Adopting a phase-in approach also would provide companies time to adequately test the new products for effectiveness and durability. This phase-in approach would be similar to the approach routinely used by the CEC for its periodic review and update of Title 24 standards.

Thank you for this opportunity to comment on the proposed standards. I would be pleased to arrange a meeting with you and the technical staff and representatives of Firestone to discuss our concerns in further detail. To arrange such a discussion, please telephone me at (317) 575-7134.

Very truly yours,



Brian C. Fritts

Secretary and Senior Counsel
Firestone Building Products Company, LLC

Enclosures: Table I and Table II

Table I: Single-Ply Thermoplastic and Thermoset Products Listed with CRRC on June 1, 2011

Manufacturer Information	Brand	Model	Solar Reflect.		Therm Emit.		SRI		Comments
			init	3 yr	init	3 yr	init	3 yr	
Dew Roofing Systems, LLC	Dew-Viente (PVC)	SRW-1202-White	0.87	0.82	0.86	0.79	109	104	Discontinued. Dew exited the single-ply business in January 2011.
Firestone Building Products LLC	Firestone	ReflexEON TPO White	0.84	0.78	0.83	0.86	105	96	Firestone's ReflexEON TPO
Ecology Roof Systems	White Elvaloy Roof System	ERS-9000 FB							
SR Products	SR Products	Sion							
Viridian Systems	HK 5000/5001	White	0.87	0.76	0.87	0.84	110	93	Flex's PVC
Flex Membrane International, Inc.	Flex Roof Membrane	White							
IB Roof Systems	IB Roof Systems	50, 60, 80 mil White PVC, Sandblast	0.87	0.74	0.88	0.89	110	91	IB's PVC (made by CGT)
SR Products	SR Products	SuperoPly TPO White							
Coolay Incorporated	CSP (with or without fleeceback)	TPO - White	0.79	0.72	0.87	0.87	98	88	Coolay's TPO
Tremco, Inc.	Tremco TPO/TPO FB	White							
Gonklm Company Inc.	Gonklm	HygroW	0.83	0.74	0.88	0.87	104	87	Probably discontinued due to Duroport discontinuing Hypalon
Burkeline Roofing	M-368 Hypalon	NA							
Dew Roofing Systems, LLC	Dew-Viente (PVC)	White	0.86	0.70	0.86	0.82	108	84	Discontinued. Dew exited the single-ply business in January 2011.
Coolay Incorporated	C3 (with or without fleeceback)	PVC White							
Mule-Hide Products Co., Inc.	Mule-Hide	F-PEM	0.86	0.70	0.86	0.82	108	84	Coolay's PVC
Johns Manville	JM PVC	White							
Carlisle SynTec Incorporated	Sure-Flex PVC Kac	White							
Tremco, Inc.	Tremco	TPA/TPA FB White							
Skyline Building Systems, Inc.	Dectec	R12000							
Sika Sarnafil Inc.	Sarnafil	G410 Energy Smart White	0.83	0.70	0.90	0.86	104	85	Sarnafil's G410
WeatherBond	WeatherBond Pro	White TPO							
Versico Incorporated	Versiweid	White TPO							
Mule-Hide Products Co., Inc.	Mule-Hide	TPO-C White	0.79	0.70	0.90	0.86	99	85	Carlisle's TPO
Carlisle SynTec Incorporated	Sure-Weid	TPO White							
Firestone Building Products LLC	Firestone	UltraPly TPO XR White							
GenFlex Roofing System, LLC	GenFlex	Fleece Backed TPO White	0.79	0.69	0.78	0.81	96	82	Firestone's Fleece-backed TPO
Duro-Last Roofing Inc.	Duro-Last	White	0.88	0.68	0.87	0.84	111	82	Duro-Last's PVC
Firestone Building Products LLC	UltraPly TPO White	TPO White	0.79	0.68	0.85	0.83	98	81	Firestone's TPO (this is not currently sold by GenFlex)
GenFlex Roofing System, LLC	GenFlex	TPO Std. White							

7 Products ≥ 0.70

16 Products ≥ 0.65

24 Products ≥ 0.60

Table I: Single-Ply Thermoplastic and Thermoset Products Listed with CRRC on June 1, 2011

Manufacturer Information	Brand	Model	Solar Reflect.		Therm Emit.		SRI		Comments
			init	3 yr	init	3 yr	init	3 yr	
GAF Materials Corp	EverGuard®	Freedom(tm) TPO White							
GAF Materials Corp	EverGuard®	TPO FB Ultra White	0.76	0.68	0.90	0.83	94	81	GAF's TPO product line
GAF Materials Corp	EverGuard®	Slope Slope TPO White							
GAF Materials Corp	EverGuard®	TPO White							
GenFlex Roofing System, LLC	GenFlex TPO	GenFlex TPO Plus	0.79	0.68	0.85	0.87	98	82	This is a thicker version of the standard GenFlex TPO.
GenFlex Roofing System, LLC	GenFlex	White TPO	0.77	0.68	0.87	0.87	95	82	
Johns Manville	JM TPO .045, .060	N/A	0.77	0.68	0.87	0.87	95	82	
Seaman Corporation	FiberFite Roofing Systems	DC196 Off White	0.63	0.66	0.85	0.74	104	76	
Sika Sarnafil Inc.	Sarnafil	Tan 7101 G410 & S327	0.73	0.65	0.85	0.86	89	78	
Carlisle Syntec Incorporated	Sure-White	EPDM White							
Commercial Innovations, Inc.	RubberTite	White EPDM	0.76	0.64	0.90	0.87	94	77	Carlisle's White EPDM
Mule-Hide Products Co., Inc.	Mule-Hide	EPDM White-on-							
Conklin Company Inc.	Conklin	Flexion 50, 60	0.84	0.64	0.87	0.78	105	74	
Republic Powdered Metals, Inc.	GeoFlex	100	0.84	0.64	0.79	0.80	104	75	
Carlisle Syntec Incorporated	Sure-Weld	Tan TPO							
Flex Membrane International, Inc.	Flex Roofing Membrane	TPO Tan							
Mule-Hide Products Co., Inc.	Mule-Hide	TPO-C Tan	0.71	0.64	0.86	0.87	86	77	Carlisle's Tan TPO
Versico Incorporated	Versiweid	Tan TPO							
WeatherBond	WeatherBond Pro	Tan TPO							
Sika Sarnafil Inc.	Sarnafil	S327 Energy Smart White	0.83	0.63	0.90	0.86	104	75	
GAF Materials Corp	EverGuard®	EGFB White	0.85	0.62	0.86	0.84	107	73	
Sika Sarnafil Inc.	Sikaplan White	45, 50, 60, 72, 80	0.81	0.62	0.85	0.85	101	73	
Carlisle Syntec Incorporated	Sure-Flex	White PVC							
Crestwood Membranes Inc. t/a I2M	HSR	White 61050 50, 60, 80							
GAF Materials Corp	EverGuard®	PVC White	0.87	0.61	0.95	0.86	111	72	I2M's PVC
Mule-Hide Products Co., Inc.	Mule-Hide	PVC							
Versico Incorporated	Versiflex	White PVC							

Table II: CRRC Listed Products from Firestone Building Products

CRRC Prod. ID	Brand	Model	Color Category	Product Type	Solar Reflect.		Therm Emit.		SRI		Slope Application
					init	3 yr	init	3 yr	init	3 yr	
0608-0003	AcryliTop	PC-100 White	Bright White	Field-Applied Coating	0.82	0.73	0.87	0.84	102	89	Low/Steep
0608-0033	Firestone	UltraPly TPO SA White	Bright White	Single-Ply-Thermoplastic	0.74	0.58	0.84	0.84	90	68	Low/Steep
0608-0009	Firestone	SBS Metal Flash-AL	Metallic	Modified Bitumen	0.81	0.75	0.44	0.43	92	82	Low/Steep
0608-0028	Firestone	APP 180 UltraWhite	Bright White	Modified Bitumen	0.72	pending	0.89	pending	88	pending	Low/Steep
0608-0014	Firestone	ReflexEON TPO White	Bright White	Single-Ply-Thermoplastic	0.84	0.78	0.83	0.86	105	96	Low/Steep
0608-0016	Firestone	UltraPly TPO XR White	Bright White	Single-Ply-Thermoplastic	0.79	0.69	0.78	0.81	96	82	Low/Steep
0608-0030	Firestone	SBS FR UltraWhite, SBS FR Torch UltraWhite, SBS Glass FR UltraWhite, SBS Premium FR UltraWhite, SBS Premium FR Torch UltraWhite	Bright White	Modified Bitumen	0.72	pending	0.92	pending	89	pending	Low/Steep
0608-0029	Firestone	APP 180 FR UltraWhite, APP Premium FR UltraWhite, APP 180 FR Cool UltraWhite	Bright White	Modified Bitumen	0.72	pending	0.9	pending	89	pending	Low/Steep
0608-0031	Firestone	SBS Cap UltraWhite, SBS Torch UltraWhite, SBS Premium Torch UltraWhite, SBS Glass UltraWhite, SBS Premium UltraWhite	Bright White	Modified Bitumen	0.72	pending	0.84	pending	87	pending	Low/Steep
0608-0027	Firestone	RubberGard(TM) EcoWhite(TM) EPDM	Bright White	Single-Ply-Thermoset	0.8	pending	0.84	pending	99	pending	Low/Steep
0608-0008	UltraPly TPO White	TPO White	Bright White	Single-Ply-Thermoplastic	0.79	0.68	0.85	0.83	98	81	Low/Steep
0806-0002	Unaclad Roof Panel	Weather X Solar White	Bright White	Metal	0.7	0.7	0.85	0.85	85	85	Low/Steep
0806-0003	Unaclad Roof Panel	Fluropon L/S Solar White	Bright White	Metal	0.7	0.68	0.85	0.81	85	81	Low/Steep
0806-0006	Unaclad Roof Panel	Fluropon Bone White	Off-White	Metal	0.7	0.69	0.84	0.84	85	83	Low/Steep
0806-0008	Unaclad Roof Panel	Fluropon L/S Regal White	Bright White	Metal	0.7	0.7	0.85	0.85	85	85	Low/Steep