ARMA Spring Committee Meetings
April 8 - 11, 2019

Ambassador Hotel Chicago
1301 North State Parkway
Chicago, IL 60610

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ASPHALT ROOFING MANUFACTURERS ASSOCIATION

Thank You Sponsors!

ARMA 2019 Spring Joint Committee & Board Meetings
Schedule of Events
April 8 - 11, 2019

Ambassador Chicago
1301 N State Pkwy
Chicago, IL 60610

Monday, April 8

Time	Session or Event
12:30pm – 3:00pm	Codes Steering Group
1:00pm – 4:00pm	Communications, Marketing and Education Committee Working Session
3:30pm – 5:00pm	Technical Affairs Committee

Tuesday, April 9

Time	Session or Event
7:30am – 8:30am	ARMA Breakfast
8:30am – 12:15pm	Committee Meeting Business Session
12:15pm – 1:00pm	ARMA Lunch
1:00pm – 5:00pm	Committee Meeting Business Session
1:00pm – 5:00pm	Health, Safety and Environment Committee Session
6:00pm – 7:30pm	ARMA Reception

Wednesday, April 10

Time	Session or Event
7:30am – 8:00am	ARMA Breakfast
8:00am – 12:00pm	Health, Safety and Environment Committee Session

10:00am – 12:00pm	ARMA Counsel Forum ***(Closed Session)**
12:00pm – 1:00pm	ARMA Lunch
1:00pm – 5:00pm	ARMA Executive Committee Meeting ***(Closed Session)**
6:00pm – 7:30pm	ARMA President's Reception

Thursday April 11

Time	Session or Event
7:30am – 8:30am	ARMA Breakfast
8:30am – 12:00pm	ARMA Board of Directors Meeting
12:00pm – 1:00pm	ARMA Lunch
1:00pm – 4:00pm	ARMA Board of Directors Meeting

2019 Spring Committee Meetings
General Business Agenda
Tuesday, April 9, 2019
Salon 2/3/4

Time	Session
7:30am (1 hour)	Breakfast
8:30am (15 minutes)	**Introduction and Opening Remarks** Call to Order and Introductions Review of Antitrust Policy
8:45am (45 minutes)	Bill McHugh, CRCA
9:30am (45 minutes)	John Leatham, Chomarat North America
10:15am (30 minutes)	**Break**
10:45am (45 minutes)	Harry Dietz, NRCA Updates
11:30am (30 minutes)	Darrel Higgs, DPH Consulting
12:00pm (15 minutes)	Carol Perkins, IKO & Lynn Picone, GAF - ARMA CMEC Update
12:15pm (45 minutes)	Lunch - Riverview Room
1:00pm (60 minutes)	Dr. Craig Dixon, KL&A, Inc.
2:00pm (45minutes)	Jonathan Davis - Owen Corning
2:45pm (15 minutes)	**Break**
3:00pm (45 minutes)	Rich Walke & Alpesh Patel - UL
3:45pm (60 minutes)	Rich Kozial & Pat Shaughnessy – WJE Consultants
4:45pm	Adjourn
6:00pm (90 minutes)	ARMA Reception – Astor Terrace

ASPHALT ROOFING™
MANUFACTURERS ASSOCIATION

To: ARMA Members and Staff

From: Reed Hitchcock, Executive Vice President

Re: Antitrust Compliance - Quick Reference

The Asphalt Roofing Manufacturers Association ("**ARMA**" or "**Association**") has in effect an Antitrust Compliance Policy ("Policy"). The Policy is intended for the guidance of ARMA member company representatives, officers, directors and staff, when engaged in any activity conducted in the name of, or on behalf of, ARMA. All such persons are expected to be familiar with the Policy and to follow it both in letter and spirit.

The following cautionary statements are taken from the full Policy and are intended to be used as a quick reference tool. This document is not a substitute for the full Policy, which is available from the Association's office and with which all are expected to be conversant. At all Association meetings and events, including informal gatherings before, during or following such meetings and events, **ARMA** members, their representatives and guests will not discuss any of the following competitively sensitive topics:

1. Current or future prices, price levels, costs or profit margins.
2. What is a fair or rational profit level.
3. Actions which could lead to standardizing or stabilizing prices.
4. Pricing or bidding methodologies or procedures.
5. Pricing practices or strategies, including methods, timing or implementation of price changes.
6. Whether or how prices, warranties or other terms of sale are advertised.
7. Cash or any other discounts, rebates, service charges or other terms and conditions of sale.
8. Credit terms.
9. Product warranty terms.
10. Actual, planned or projected production, production capacity or capacity utilization.
11. Projected demand.
12. Confidential company plans for new products.
13. Dividing or allocating geographic or product markets or customers.
14. Whether or on what terms to do business with a supplier, competitor or customer.
15. Whether or on what terms to solicit other companies' employees for employment.
16. The business practices of individual firms.
17. The validity of any patent or the terms of any patent license.
18. Ongoing litigation, unless being reported upon by ARMA's General Counsel or discussed appropriately at ARMA's Counsel Forum.

We hope the above rules will be helpful as you participate in ARMA meetings and other activities. If you have any questions about antitrust compliance, do not hesitate to contact ARMA's General Counsel:

C. Michael Deese
ARMA General Counsel
Howe & Hutton, Ltd.
Tel: (202) 466-7252 x103
Email: cmd@howehutton.com

ARMA Communications, Marketing, and Education Committee

Asphalt Roofing Manufacturers Association
Communications, Marketing, and Education Committee
(CMEC) Agenda
Monday, April 8, 2019

Communications, Marketing, and Education Committee
Chair: Carol Perkins, IKO
Vice Chair: Lynn Picone, GAF

Time	Discussion	Back-up Materials
1:00pm (5 minutes)	Call to Order • Review of Antitrust Policy • Review of Meeting Agenda • Review and Approval of Previous Meeting Minutes	- February 26 Meeting Minutes -ARMA Antitrust Quick Reference
1:05pm (20 minutes)	Overview of 2019 Projects and Activities • Key Successes So Far This Year • Upcoming Opportunities	- March Activity Report
1:25pm (20 minutes)	ARMA Webinars • Topic Discussion • Committee Vote • Media Partner Overview • Next Steps	
1:45pm (30 minutes)	ARMA Tagline • Review of Proposed Taglines • Committee Vote • Next Steps	
2:15pm (15 minutes)	Networking Break	
2:30pm (30 minutes)	Possible Changes to the Awards Program • Review and Discussion of Changes Proposed by Staff or Members • Committee Vote • Next Steps	
3:00pm (30 minutes)	ARMA Digital Analysis • Review of Findings • Recommendations / Possible Actions • Next Steps	
3:30pm (20 minutes)	*Professional Roofing* Roundtable Questions • Review of Questions • Drafting Responses • Next Steps	

3:50pm (10 minutes)	New Business / Other Business	
	Review of Action Items	
4:00pm	Adjournment	

Asphalt Roofing Manufacturers Association
Communications, Marketing and Education Committee Monthly Report
February 2019

Monthly Summary

This month, the ARMA communications team focused on announcing the winners of the 2019 Excellence in Asphalt Roofing awards program and promoting the winning contractors and projects. As a result, editorial contributions are secured for *Roofing Contractor, Roofing Magazine* and *Roofers' Coffee Shop.* The team also met with seven different editors during the IRE show to cultivate opportunities for the rest of 2019; follow up is ongoing.

Media Development

Activity	Progress	Next Steps or Notes
Press Release: 2018 Q4 product shipment report	The release was circulated in late January but continues to generate media coverage.	*Roofing Magazine* and *Roofers' Coffee Shop* published the news this month.
Press Release: Announcing the Excellence in Asphalt Roofing Award Winners	The release was circulated to the media during the IRE.	The news was shared in *Building Enclosure*, *Roofing Contractor*, *Facility Executive*, *Roofers' Coffee Shop*, *Retrofit Magazine*, and *Retrofit's E-newsletter*.
Roofing Contractor's State of the Industry Report	ARMA contributed content to tailored questions submitted by the editor.	The news was shared online and in print.

Editorial Contributions or Opportunities

Activity	Progress	Next Steps or Notes
Cincinnati music hall case study	The article was reviewed by the CMEC and submitted to the editor in late February.	Monitor for placement in *Roofers' Coffee Shop.*
Press Release: Announcing the hiring of Chadwick Collins, ARMA's new technical director	The release was finalized internally and is ready for CMEC review.	Circulate the release to the CMEC in early March.

Column feature in *Roofing Contractor*	Staff secured a column opportunity to feature Reed Hitchcock in an upcoming issue.	Work with the editor and staff to determine a topic or a range of topics.
Case study on the Silver award winner (The Sonoma Dome) for *Roofing Contractor Magazine.*	Staff is currently working with the editor and the contractor to begin the case study article.	Finalize logistics with the editor and contractor, begin writing the feature.
Case study on Our Lady of the Lake Children's Hospital (an Honorable Mention) for *Roofing Magazine.*	This editorial contribution was secured for the publications May/June edition, which focuses on healthcare.	Begin writing the article and secure additional information from the contractor.
A blog series with *Roofers' Coffee Shop*	An ongoing blog series is secured and will cover a diversity of topics. The blog will be penned by Reed Hitchcock.	Work with staff and the editor to determine appropriate topics.
Additional technical writing/editorial contributions	Staff is currently working with the ARMA technical team to develop additional editorial contributions focused on highly technical, topic-intensive pieces.	Work with staff to determine topics and then begin considering which publication would be the best fit.

The IRE

Activity	**Progress**	**Next Steps or Special Notes**
The Excellence in Asphalt Roofing awards program	Staff coordinated three awards presentations at the IRE honoring the Gold*, Silver, Bronze and two Honorable Mentions. **Gold was presented directly to the member company since the contractor did not attend IRE.*	Use the photography from the event to help spread the awards program further across the roofing and construction media. Some media outlets (such as *Facility Executive)* have already included images of the presentations.

Media Cultivation for 2019	Staff met with the editors of *Roofers' Coffee Shop, Roofing Contractor, Roofing Magazine, Building Enclosure, Professional Roofing, Building Operation Management,* and *Buildings Magazine* during the IRE to discuss upcoming opportunities and ARMA topics.	Follow up with the editors and coordinate media contributions or coverage of upcoming ARMA news.
Women in Roofing	ARMA attended the Women in Roofing event at the IRE alongside several CMEC members. This was also promoted on ARMA's social media channels.	Continue to seek opportunities to support Women in Roofing's initiatives through the help of *Roofers' Coffee Shop.*

ARMA Social Media

Activity	Progress	Next Steps or Special Notes
Promoting ARMA topics on Facebook and LinkedIn	ARMA reached over 2,700 professionals on Facebook and 1,200 on LinkedIn while promoting Women in Roofing, recent media placements, and the Excellence in Asphalt Roofing awards program.	Continue promotion of ARMA's many topics and begin crafting a specialized post for each awards program winner and honorable mention.

ARMA Webinars

Activity	Progress	Next Steps or Special Notes
Develop the ARMA webinar series	Staff discussed creating a webinar series with several editors during the IRE, and discussed the potential webinar topics during the February CMEC call.	Continue to build out partnership options with media members and await feedback from the CMEC regarding which webinar topics should have the highest priority.

ARMA Tagline

Activity	Progress	Next Steps or Special Notes
Develop an ARMA tagline that can house all of our steep and low-slope messaging.	Five ARMA taglines were shared with the CMEC during the February call, four of which received positive notes. These four tagline suggestions were recirculated to the entire CMEC for consideration.	Use the CMEC's feedback to develop tagline finalists and then present them to the committee for a final vote.

Excellence in Asphalt Roofing

Activity	Progress	Next Steps or Special Notes
Potential changes to the awards program	Staff assigned "homework" to the CMEC in late February to consider possible changes to the awards program. These included moving the submission deadline, requiring a steep and low-slope winner, creating submissions guidelines for contractors, updating the judging criteria and expanding the scoring range.	Collect feedback from the CMEC and submit refined changes to the committee for a vote.

ARMA Digital Analysis

Activity	Progress	Next Steps or Special Notes
Conduct a thorough, in-depth digital analysis of the professional community's opinion on asphalt roofing and other roofing options	The Kellen digital team is actively working on a digital analysis, and ARMA staff uploaded a brief, qualitative survey to over 25 pages on the website.	Collect valuable data from the website's survey and continue to work with the Kellen digital team.

Upcoming Activities

- Promote the Excellence in Asphalt Roofing awards program
- Cultivate new media opportunities
- Develop the ARMA webinar series
- Work to finalize the ARMA tagline
- Continue to work with Kellen Digital to complete the online analysis
- Monitor for upcoming placements
- Collect responses from the CMEC “homework”

ARMA Offers Subscription to Detailed Shipment Report

The Report Covers the North American Asphalt Roofing Industry

Washington, D.C. (April 01, 2019) – The Asphalt Roofing Manufacturers Association (ARMA) is now offering an annual subscription to its full detailed shipment report, which provides asphalt roofing product shipment data for the United States and Canada.

The quarterly report shares product shipments by geography and product type for asphalt shingles, modified bitumen, and built-up-roofing (BUR) materials. The report offers quarterly and year-to-date shipment data, as well as comparisons to the previous year's reports.

The report is available through a 1-year (4 quarterly reports) subscription for $7,500 USD. Subscription is only available to entities that **do not** qualify for ARMA membership. ARMA will continue to issue summary quarterly reports, which can be found on the ARMA News & Press page.

"The asphalt roofing shipment data is relevant and valuable to a number of industries, which is why we've decided to make this information available," said ARMA's Executive Vice President Reed Hitchcock. "We expect professionals from an array of industries will find the report useful."

For more information, visit https://asphaltroofing.org/quarterly-product-shipment-report/

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About ARMA:
The Asphalt Roofing Manufacturers Association (ARMA) is the North American trade association representing the manufacturers and suppliers of bituminous-based residential and commercial roofing products, including asphalt shingle roofing systems, modified bitumen roofing systems, roll roofing systems, and built-up (BUR) roofing systems. For more information visit www.asphaltroofing.org, or follow us on LinkedIn, YouTube and Facebook.

ARMA Technical Affairs Committee

Technical Affairs Committee
Co-Chair: Jean-Francois Cote, SOPREMA, Inc.
Co-Chair: Greg Keeler, Owens Corning

Time	Session	Back-up Materials
3:30PM (10 minutes)	**Introduction and Opening Remarks** -Call to Order and Introductions -Review of Antitrust Policy -Review of Meeting Agenda -Approval of Minutes (TBD)	Antitrust Quick Reference Minutes
3:40PM (5 minutes)	**Ventilation Task Force** Chair: Paul Scelsi	
3:45PM (5 minutes)	**ARMA Meeting Education Task Force** Chair: Michelle Benatti	
3:50 PM (15 Minutes)	**ARMA-Sustainability Task Force** Chair: Jean Francois Cote	
4:05PM (15 minutes)	**ARMA Asphalt Shingle Recycling Task Force** Chair: Vacant	
4:20PM (40 minutes)	**ARMA Technical Review Task Force (Publication Review)** Chair: Lynn Picone -Technical Bulletins	Residential Asphalt Roofing Manual (2014)
5:00PM	Adjournment	

NOTE: The CRTF will have a task force meeting at the end of the CSG meeting prior to the start of the TAC meeting.

Dispelling Myths of RAS vs. RAP

Summary

Reclaimed Asphalt Pavement (RAP) and Reclaimed Asphalt Shingles (RAS) dominate the recycled raw material market in the asphalt road paving industry. The use of recycled materials is a practice of good stewardship, extends the life of rock quarries, reduces the use of our limited natural resources, preserves landfill space and is less expensive than virgin materials.

Since 2009, the National Asphalt Paving Association (NAPA) has documented over 12.73M[1] tons of Reclaimed Asphalt Shingles (RAS) used as a recycled raw material in Hot Mix Asphalt (HMA), Warm Mix Asphalt (WMA) and cold mix, contributing both to asphalt content (AC) and replacing virgin aggregates. RAS is a proven component in mix designs of over 250M[2] tons of roads in the USA.

In 2017, 99% of the available RAP, or 76.9M tons, were integrated into new asphalt roads in 46 states, saving $2.127B. In the same period, 8.5% of the available RAS, or 944,000 tons, replaced virgin materials in 32 states[3], saving $74M. Per ton, RAP has a savings value of $27.91 per ton. RAS savings value is $78.39 per ton.

- RAP has availability of 77.7M tons, RAS has ~11M tons.
- RAS as a road paving raw material is 2.8 times more valuable, per ton, than RAP.
- RAS has an 91.5% landfill rate with an unrealized opportunity value of $789M.

Table 1 Most Used Recycled Materials in the Paving Industry

Material	Material Quantity, Million Tons		% Agg.	% AC	Aggregate Cost Savings, $ Billion		Asphalt Binder Cost Savings, $ Billion		Total Cost Savings, $ Billion	
	2016	2017			2016 ($9.87)	2017 ($10.04)	2016 (346.68)	2017 (365.62)	2016	2017
RAP - 99% Recycled	76.9	76.2	95%	5%	$ 0.721	0.734	1.333	1.393	2.055	2.127
RAS - 8.5% Recycled	1.39	0.944	50%	20%	$ 0.007	0.005	0.096	0.069	$ 0.103	0.074
*RAS - Est. Landfilled	9.61	10.056	50%	20%	$ 0.047	0.0532	0.666	0.735	$ 0.714	0.789

Notes:
NAPA reports RAS as 50% Agg. includes granules and limestone filler (30% is fines aggregate, miscible in liquid asphalt)
Processing Cost includes RAP fractionating or RAS Reduction
RAS - NAPA reports 8.5% recycling rate leaving 91.5% unrecycled or landfilled.

Source: Asphalt Pavement Industry Survey on Recycled Materials and Warm-Mix Asphalt Usage 2017, *RAS – Est. Landfilled value independently calculated*

[1] *Source:* Asphalt Pavement Industry Survey on Recycled Materials and Warm-Mix Asphalt Usage 2017, page 22, Figure 10
[2] Typical percentage of RAS is 5%. 12.73M tons of RAS @ 5% = 254.66M tons of asphalt pavement.
[3] *Source:* Asphalt Pavement Industry Survey on Recycled Materials and Warm-Mix Asphalt Usage 2017, page 24, paragraph 2, Approved in some or all mixtures by the Department of Transportation in 32 states

Valuable Raw Material Resources

Asphalt paving and asphalt shingles are both highly engineered materials, designed to perform under the harshest conditions. They are comparable in their raw material make-up of aggregates and asphalt, are exposed to extreme outdoor elements and must perform.

Asphalt paving requires a base mix and a surface mix. Reclaimed Asphalt Pavement, in general, takes material from the surface course. The example mix design, includes three aggregates of different properties and size distributions. The aggregates will vary based on the geography of the road, and raw material sources, but this is not a concern as the recyclate is used as a raw material in the same market in which it was originally installed. The asphalt binder is typically 6%, depending on the state, and has a Performance Grade (PG) which is designed to perform under the conditions in which they are to be used. The asphalt binder example used is PG64-22, which is defined as the maximum seven-day pavement temperature of 64˚C (147˚F) and the minimum pavement design temperature likely to be experienced of -22 ˚C (-7.6 ˚F). Recycled asphalt binder in RAP is closer to the performance grade specified in new roads but the aged value of the binder requires a compensating PG virgin asphalt binder[4].

Table 2 Mix Design Example, Asphalt Pavement Surface Layer

Mix Design	Material Description
48%	AASHTO No. 57 - Primary Raw Aggregate, 1 1/2" top size, with 95% smaller than 1" with very little powder or fines. Clean. V
10%	AASHTO No. 8 - Crushed Stone Dust, 3/8" top size, with sizes down to silt material. Will not compact.
36%	AASHTO No. 10 - 1/2" top size. Clean. Will not compact.
6%	PG 64-22 Asphalt Binder

Asphalt shingles are complex, with each manufacturer protecting their proprietary blend of materials and designs. The key raw materials are consistent and easily added to asphalt paving virgin materials to produce high performance roads. The example mix design of a roofing shingle contains aggregates that are smaller than the RAP mix design aggregates shown in *Table 2 – Asphalt Pavement Top layer.* The aggregates are very specific, without variance, based on the geography of collected roofing product; therefore, predictable in its contribution to new road mix design. The asphalt is designed to perform at high top temperatures, therefore the asphalt is oxidized at the roofing plant. The asphalt binder grade example was measured on post-consumer shingles in Wisconsin or in other words, aged asphalt shingles, as PG124 (255.4˚F)[5]. Post Industrial binder grade ranged from PG109-111 (228.4-232.1˚F). Recycled asphalt binder in RAS is a Performance Grade that is much higher than necessary in new road specifications and larger quantities will require compensation with softer virgin asphalt binder.

[4] Performance of Recycled Asphalt Shingles in Hot Mix Asphalt, Federal Highway Administration Pooled Fund Study, IA State University, Pg. 47, Table 11 Mix Design Performance Grade

[5] Performance of Recycled Asphalt Shingles in Hot Mix Asphalt, Federal Highway Administration Pooled Fund Study, IA State University, Pg. 24, Table 8

Table 3 Mix Design Example, Asphalt Roofing Shingle

Mix Design	Material Description
36%	Granules - Trap Rock, 8 mesh (.093") top size, clean with tight size distribution to 35 mesh (.0165")
40%	Limestone - Powder, 42 mesh (.039) top size, size distribution to less than 325 mesh (.0017")
2%	Fiberglass Mat
20%	PG 124 Asphalt Coating
2%	Miscellaneous

- RAP aggregate varies based on region.
- RAS aggregate physical properties do not vary.
- Both RAP and RAS asphalt binder will require a compensation in Performance Grade virgin asphalt binder, based on quantities of recyclate blended with virgin materials.

Test Pavements

Recycled materials, in asphalt road paving, are tested around the world, in both academic settings and in roads we travel on daily. Full scale test tracks, with road sensors, as seen at MnRoad and NCAT, evaluate different technologies, including RAS, RAP, and RAS/RAP mix designs and record consistent data points measuring performance. The key failures, roughness, cracking (fatigue, transverse or miscellaneous), edge deterioration, bituminous patching and raveling/weathering are studied at different points in life and stress cycles.

The objective is to meet or exceed state agency quality assurance requirements and perform similarly to mixes without RAS or RAP[6].

MnRoad published results of six field projects, in March 2010, Research Project Final Report #2010-08[7], recommending "…binder grades should be limited to PG64-28, PG58-28 and PG 51-34 until further research can determine effects of shingles on modified binders."

IA State completed a comprehensive eight state mix design study, in September 2013, which tested variable designs. The report, sponsored by Federal Highway Administration and the Transportation Pooled Fund Partners, concluded that "…SMA pavements with RAS were successfully produced and constructed while meeting IDOT's quality assurance requirements. The SMA's did not have any binder drain-down when 5% RAS was utilized as a stabilizer."[8]

NCAT published Report NCAT14-06 in July 2014 concluding, in part, that "While some stakeholders fear that the use of recycled materials in asphalt may produce inferior mixtures to virgin asphalt mixtures, state agencies who have spent the time and resources into

[6] Performance of Recycled Asphalt Shingles in Hot Mix Asphalt, Federal Highway Administration Pooled Fund Study, IA State University, Pg. 3, Abstract

[7] Incorporation of Recycled Asphalt Shingles in Hot-Mixed Asphalt Pavement Mixtures, Office of Materials and Road Research, Minnesota Department of Transportation

[8] Performance of Recycled Asphalt Shingles in Hot Mix Asphalt, Federal Highway Administration Pooled Fund Study, IA State University, Pg. 206, G9. Conclusions

understanding material characterization, mix design and mixture production have seen significant economical and raw material savings."[9]

The University of IL and University of MA, Dartmouth, in October 2015, published a report on Stone Matrix Asphalt (SMA) containing RAS or RAP and found a better performing product[10] but the costs are 20-30% higher than typical dense graded mixtures. SMA is a gap graded hot mix asphalt (HMA) that is designed to maximize rutting resistance and durability by using a structural stone on stone contact. Because the aggregates are all in contact, rutting resistance relies on aggregate properties versus the asphalt binder properties. Aggregates do not deform as much as asphalt binder under load, therefore this stone on stone contact reduces rutting. RAS is a good solution as the smaller limestone gradation is like virgin limestone specification. and RAS can help offset a percentage of this greater expense[11]. In SMA, fibers are added as a stabilizer. RAS material does contain fiberglass and may reduce or negate the need for virgin fiber stabilizers.

King County, Washington published a Performance and Progress Report, January 2018[12] indicating Excellent (99 score) in performance on test pavements installed in 2009, reported in *Shingles in Paving*[13], August 5, 2014.

NCAT Report 18-03 evaluated performance and Life Cycle Cost benefits of stone matrix asphalt and found that in IL, MD and AL, the cost for SMA was lower when compared to polymer modified Super Pave mix designs. These three states use both or either RAS and RAP in their mix designs. "In general, SMA is used on state and interstate routes with high traffic volumes and projects where frequent maintenance is costly and disruptive to high traffic volumes."[14] Furthermore, "…reduced recycled materials contents, reduced plant versatility, and shortened paving windows could also contribute to the higher cost of SMA."[15]

- RAP and RAS has been thoroughly tested and is an accepted solution. A typical dense graded hot mix asphalt mixture may require a compensating softer PG asphalt as percentages of recyclate is increased.

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[9] Case Studies on Successful Utilization of Reclaimed Asphalt Pavement and Recycled Asphalt Shingles in Asphalt Pavements, pg. 28 Conclusion

[10] Performance space diagram for the evaluation of high- and low-temperature asphalt mixture performance, William G. Buttlar, Brian C. Hill, He Wang and Walaa Mogawer, page 10-11, Table 4 and 5

[11] 2018-08 NCAT Performance and Life Cycle Cost Benefits of Stone Matrix Asphalt Report 18-03, pg. 12, 2.4SMA Cost

[12] Use of Recycled Shingles in Hot Mix Asphalt on King County Unincorporated Roads, King County Road Services Division, Renton, WA, page 3, table 3 and 4

[13] King County, Department of Road Services Division*, Recycling and Paving with Recycled Asphalt Shingles,* August 5, 2014

[14] Performance and Life Cycle Cost Benefits of Stone Matrix Asphalt, pg 13, Figure 5 and 2.5 SUMMARY paragraph

[15] Performance and Life Cycle Cost Benefits of Stone Matrix Asphalt, pg 14, paragraph 1

- RAS is a practical solution for production of SMA hot mix asphalt as limestone is present in the required gradation and fiberglass adds stabilizers.
- RAS or RAP in a more expensive Stone Matrix Asphalt hot mix asphalt road can offset some of the higher costs of a higher performance road.

Asphalt Binder Replacement and Mix Design Specifications

If mixes are designed properly, RAP and RAS can improve performance, i.e. rutting resistance and increased stiffness but a more brittle mix may accelerate cracking and raveling[16]. Each state's Department of Transportation has an established approach to acceptance of RAS and RAP. The mix designs published by the state insures high performance roads with an acceptable amount of recyclate. The foundation of the state's spec is the asphalt binder replacement (ABR). For example, if a specification calls for 6% asphalt binder, the percentage that comes from a recycled material may be 20% or 1.2% of the total mix.

The state may require a bump downward on virgin binder, i.e. PG64-22 to PG 58-28.

A common state specification allows use of RAS to no more than 5%. If the RAS material contains 20% asphalt (asphalt content) than this will contribute 1% (16.6% of a 6% asphalt binder specification) asphalt binder replacement to the mix design.

Table 4 Mix Design Example, 5% RAS content hot mix asphalt (non-SMA)

Mix Design	Lbs.	Material Description, RAS Only
48%	960	AASHTO No. 57 - Primary Raw Aggregate, 1 1/2" top size, with 95% smaller than 1" with very little powder or fines. Clean. Will not compact.
6%	120	AASHTO No. 8 - Crushed Stone Dust, 3/8" top size, with sizes down to silt material. Will not compact.
36%	720	AASHTO No. 10 - 1/2" top size. Clean. Will not compact.
5.0%	100	PG 64-22 Asphalt Binder (or possibly PG 58-28 to compensate for higher PG of asphalt binder replacement)
5%	100	RAS measured as 20% asphalt content (1%)
0%	0	RAP, 6% asphalt content (1%)
100%	2000	

Asphalt Binder Analysis	Lbs.	Material Description
83%	100	PG 64-22 Asphalt Binder (or possibly PG 58-28 to compensate for higher PG of asphalt binder replacement)
17%	20	RAS, 20% asphalt content, 17% asphalt binder replacement
0%	0	RAP, 6% asphalt content, 0% asphalt binder replacement
100%	120	

A common state specification allows use of RAP to no more than 20%. If the RAP material contains 6% asphalt (asphalt content) than this will contribute 1.2% (20% of a 6% asphalt binder specification) asphalt binder replacement to the mix design.

[16] Testing Protocols to Ensure Performance of High Asphalt Binder Replacement Mixes Using RAP and RAS, IL Center for Transportation, pg. ii, Executive Summary

Table 5 Mix Design Example, 20% RAP content hot mix asphalt (non-SMA)

Mix Design	Lbs.	Material Description, RAP Only
48%	960	AASHTO No. 57 - Primary Raw Aggregate, 1 1/2" top size, with 95% smaller than 1" with very little powder or fines. Clean. Will not compact.
7%	144	AASHTO No. 8 - Crushed Stone Dust, 3/8" top size, with sizes down to silt material. Will not compact.
20%	400	AASHTO No. 10 - 1/2" top size. Clean. Will not compact.
4.8%	96	PG 64-22 Asphalt Binder (or possibly PG 58-28 to compensate for higher PG of asphalt binder replacement)
0%	0	RAS measured as 20% asphalt content (1%)
20%	400	RAP, 6% asphalt content (1%)
100%	2000	

Asphalt Binder Analysis	Lbs.	Material Description
80%	96	PG 64-22 Asphalt Binder (or possibly PG 58-28 to compensate for higher PG of asphalt binder replacement)
0%	0	RAS, 20% asphalt content, 17% asphalt binder replacement
20%	24	RAP, 6% asphalt content, 20% asphalt binder replacement
100%	120	

A third common state specification allows use of a combination of RAP and RAS, allowing no more than 20% asphalt binder replacement. Each recycled material contributes 10% asphalt binder replacement to the mix.

Table 6 Mix Design Example, 3% RAS/10% RAP content hot mix asphalt (non-SMA)

Mix Design	Lbs.	Material Description, RAS and RAP
48%	960	AASHTO No. 57 - Primary Raw Aggregate, 1 1/2" top size, with 95% smaller than 1" with very little powder or fines. Clean. Will not compact.
6%	120	AASHTO No. 8 - Crushed Stone Dust, 3/8" top size, with sizes down to silt material. Will not compact.
28%	564	AASHTO No. 10 - 1/2" top size. Clean. Will not compact.
4.8%	96	PG 64-22 Asphalt Binder (or possibly PG 58-28 to compensate for higher PG of asphalt binder replacement)
3%	60	RAS measured as 20% asphalt content (1%)
10%	200	RAP, 6% asphalt content (1%)
100%	2000	

Asphalt Binder Analysis	Lbs.	Material Description
80%	96	PG 64-22 Asphalt Binder (or possibly PG 58-28 to compensate for higher PG of asphalt binder replacement)
10%	12	RAS, 20% asphalt content, 17% asphalt binder replacement
10%	12	RAP, 6% asphalt content, 0% asphalt binder replacement
100%	120	

- The Federal Highway Administration and 32 individual states have written specifications to allow both RAP and RAS in their roads.
- Following these RAP and RAS mix designs will mitigate risks of using both RAP and RAS.

Economics

From August 1997 to August 2018, the price of virgin asphalt, used to manufacture both roads and roofing shingles, has increased over 500%[17]. In the same period, a barrel of oil has increased over 300% from $19.95 to $68.06[18].

Recognizing this trend, in the 2009-2010 paving season, the National Asphalt Paving Association (NAPA) began surveying the use of recycled asphalt, harvested from both reclaimed asphalt pavement (RAP) and reclaimed asphalt shingles (RAS), in new paved roads. "Asphalt mixture producers remain the country's most diligent recyclers, with more than 99 percent of asphalt

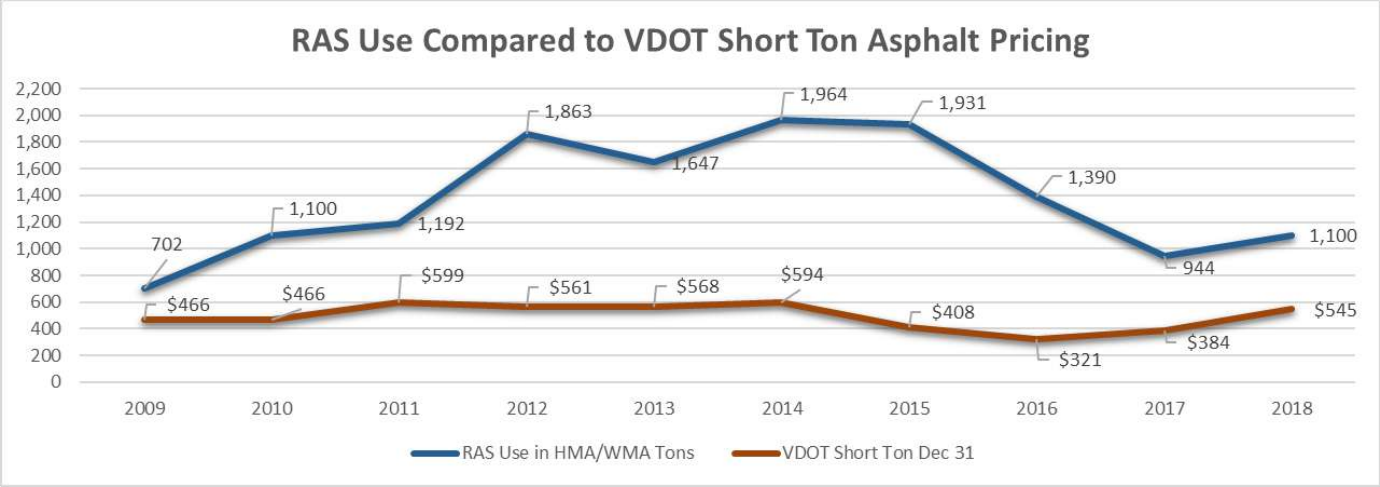
[17] *Source: U.S. Energy Information Administration & VDOT Adjustment for Asphalt & Fuel Indices PG64-S-22 Short Ton*

[18] *Source:* Cushing OK WTI Spot Price FOB Dollars per Barrel

mixture reclaimed from old asphalt pavements being put back to use in new pavements."[19] RAP is a waste stream that is easy for the paving contractor to recycle as he is removing and replacing the material, and the properties allow for immediate processing.

In general, post-consumer RAS is a waste stream that is collected one roof job at a time, or in 3-ton increments. Post-industrial RAS is collected in 22 tons increments. The reclaimed material is not always ready to process, meaning deleterious material must be removed. Reducing the shingle to the most common State Department of Transportation specification of <3/8" can be a one-step process. RAS contains over 3 times the asphalt per ton than RAP but is more intensive to reclaim; therefore, the lower the virgin material costs, the least attractive the paving manufacturer sees the process of reclaiming asphalt shingles.

The prevalence of RAS in asphalt mix designs follows virgin asphalt pricing. From December 31, 2014 to December 31, 2015, the Virginia Dept of Transportation virgin asphalt pricing dropped 31% and further dropped 15% in 2016, leveling off in 2017. In 2018, pricing has increased to near levels of the 2010-2014. In the subsequent years, RAS use dropped from 2.0M tons to less than 1.0M in 2017, with a projected use of 1.1M tons in 2018.



- RAP is a waste stream that is easy for the paving contractor to access, therefore a 99% recycle rate.
- RAS waste stream and processing is more complex, lowering recycle rate when the value of virgin asphalt decreases.

[19] 2017 Survey Exec Summary Asphalt Pavement Industry Survey Recycled Materials and Warm Mix Asphalt usage, Reclaimed Asphalt Pavement, pg. 1

Summary

Both RAP and RAS have been well studied, over many years, and successfully placed in asphalt roads throughout the USA.

The motivation for using recycled materials is one of good stewardship and low raw material pricing.

RAS is a raw material that is well accepted in governmental and academic communities, as a valuable resource, with superior aggregate material and over 3X asphalt content as compared to RAP.

RAP/RAS combination is a common mix design solution.

RAS in Stone Matrix Asphalt (SMA) is a less expensive solution to better roads as RAS is ~40% fine limestone and contains fiberglass stabilizers.

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The Effects of ~~Greases, Oils and Chemicals~~Contaminants on Modified Bitumen Sheet Materials

Introduction

Roofing systems are intended to provide protection from natural elements such as rain, snow, hail, and sleet~~, etc~~. Systems that are properly designed, installed and maintained should provide the user with long-term satisfactory protection from these elements. Some roofing systems, especially those on factories, restaurants, and fast food chains, require special care in design due to the presence of greases, oils, bacteria, and/or other agents on the roof surface that may~~tend to~~ adversely affect the integrity of the roof membrane. ~~Depending upon the number and type of contaminants present, t~~The specifier should~~must~~ select the type of roofing system that will best satisfy all performance requirements, based upon the number and type of contaminants present. This document is intended to aid the specifier by highlighting the effects the various contaminants may have on polymer modified bitumen membranes.

Effects of Oils and Greases

Modified bitumen roofing membranes are~~can be~~ adversely affected by exposure to cooking oils (animal or vegetable) and greases. Membrane degradation typically occurs around exhaust vents, where the roofing membrane has repeated contact with these contaminants. The organic substances contained within oils and greases~~the above contaminants~~ typically weaken and eventually break down the polymer-bitumen network, causing premature failure~~degradation~~ of the roof.

Petroleum-derived products, such as greases that leak from roof-top equipment or gasoline, paint thinners and kerosene spilled during servicing of roof-top equipment can likewise cause degradation of the roof.

Effects of Bacteria and Fungi

Factories producing foods such as potato pulp and dry milk have reported cases of modified bitumen membrane decay due to bacteria. Such deterioration, which usually starts as “mud cracking,” may ultimately lead to the total decay of the modified bitumen membrane and any surface coating.~~In~~ Excessive bird droppings may also cause degradation of the roof membrane, due to a combination of bacteria and the acidity of the droppings. The degree of degradation is dependent upon the type of microorganism, temperature and other ~~climatic~~ conditions, as well as ~~and~~ the composition of the bitumen.

Fungus growth, which typically occurs in hot, humid regions, does not cause the same detrimental effects as bacterial attack and usually poses only aesthetic concerns.

Effects of Other Chemicals

Other chemicals, such as solvents, acids, bases and oxidizing agents, can cause varying degrees of harm to polymer modified bitumen roofing membranes such as swelling, softening, and slumping of the membrane as well as poor traffic resistance. ~~Non-polar solvents can temporarily swell and soften polymer-modified bitumens, causing slumping and poor traffic resistance. They can also cause the polymers to “separate” from the asphalt. While polymer modified bitumens have excellent resistance to various inorganic acids and bases. Organic acids, such as acetic acid, are also known to have detrimental effects. Strong oxidizing agents can attack both the polymer and the bitumen in a membrane. Additionally, when ponding water is present, inert, solid dusts can contribute to “mud cracking.” All of these effects may lead to premature failure of the roofing membrane. More detailed discussions on the effects of specific chemicals may be found in the reference documents.~~ Contact the individual roofing material manufacturer to obtain specific information regarding the effects of chemicals and contaminants on modified bitumen sheet materials.

Recommendations

- Wherever possible, reduce or eliminate exposure of roofing components to contaminants.

- Determine the types and concentrations of contaminants that may be present on the roof. When re-roofing, investigate what effects, if any, contaminants have~~present~~ had on the existing roof before specifying and applying a new roofing system.
- Use commercially available traps and/or filters to prevent contaminants from being exhausted onto the roof.
- Establish a roof maintenance program to monitor affected roof sections and to properly maintain traps or filters.
- Provide positive drainage (~~i.e.,~~ at least 1/4" per foot roof slope) to prevent ponding in the affected area.
- If contaminant effects are minor, increase the number of plies and/or adding resistant coatings to provide adequate protection.
- Investigate alternate venting designs that minimize or eliminate contamination of the roofing membrane.

~~Applicable Reference Documents~~

~~Canadian Roofing Contractor, July 1991, pp. 10-13.~~
~~C. S. Barry and J. L. Jodoin, Roofer Magazine, February 1991, pp. 20-22.~~
~~H. M. Kalkanoglu, Roofer Magazine, February 1992, pp. 28-31.~~
~~R. W. Traxler in A. J. Hoiberg, Bituminous Materials: Asphalts, Tars, and Pitches, Vol. 1, 1979, pp. 323-346.~~
~~Shell Chemical Company, Kraton Thermoplastic Rubber, S.C.: 198-83, July 1983, pp. 4-5.~~
~~D. Fricklas, RSI Magazine, November 1990, p. 8.~~
~~R. B. Seymour and R. H. Steiner, Chemical Engineering, May 1954, pp. 232-242.~~
~~I. Rahimian and G. Zenke, Zum Verhalten Organischer Losemittel Gegenuber Bitumen, Bitumen, January 1986, pp. 2-8.~~
~~16th Biennial Materials of Construction Report, Chemical Engineering, No. 1954, pp. 172-234.~~

~~ARMA Form No. 305-MBS-93~~
~~Published May 1994 Published May 1994~~

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~~The~~ Effects of Ponding Water on Low Slope Roof Systems

~~Ponding water can have major negative consequences, regardless of the type of roofing system. Proper design, installation and maintenance of roofing structures can prevent this condition and its associated problems.~~

Ponding water is defined as ~~the~~ water which remains on a roof 48 hours or longer. It can result from rain, melting snow/ice or runoff from rooftop equipment. The Asphalt Roofing Manufacturers Association is~~has been~~ joined by many reputable organizations, such as the National Roofing Contractors Association, the Midwest Roofing Contractors Association, ~~and~~ the American Institute of Architects, and the International Institute of Building Enclosure Consultants in recommending that roof designs provide adequate slope (usually min. ¼" per foot) to ensure that the roof drains freely throughout the life of the building, ~~and to~~ thereby ~~avoid~~lessening the potential adverse effects of ponding water.

If not addressed, ~~The known adverse effects of~~ ponding water ~~on roofs include~~can result in significant consequences including but not limited to:

- **Deflection/Deformation ~~of the deck structure~~:** As ~~Ponding~~ water accumulates in ponding areas, ~~can substantially increase~~ the load on roof can increase, resulting in deck~~s~~ deflection. The potential for ~~As water accumulates,~~ deck deflection~~s can~~ increase~~s~~ with the capacity of the area to hold water; this can ~~, thereby~~ result~~ing~~ in an increased risk of ~~additional ponding water which could~~ compromis~~ing~~e the structural integrity of the deck.
- **Ice Damage ~~to the roof surface~~:** Ice formations develop and move constantly with changes in temperature. This movement can "scrub" the roof membrane to ~~such~~ an extent that ~~considerable~~ physical damage to the membrane can occur.
- **Biological ~~The g~~Growth ~~of algae and vegetation~~:** When water stands for long periods of time, it promotes biological~~algae and vegetation~~ growth~~, will likely occur, and may cause d~~ Damage to the roof membrane can occur from chemical and physical attack from the bio-growth as well as the expansion and contraction of the bio-growth during wet and dry cycles. Additionally, vegetation and other debris can clog drains and cause additional ponding.
- ~~Accumulation of d~~Dirt~~/, d~~Debris Accumulation ~~and other contaminants in the ponding area~~: Accumulation of dirt and debris can support biological growth. If a ponding area dries, the accumulated dirt and debris can contract during dehydration (resulting possibly in "alligator cracking") and pull at the surface of the membrane.~~These elements can affect and damage the membrane surface.~~
- **Water Infiltration:** If roof membrane integrity is compromised, the risk of water infiltration into the building and subsequent interior damage is amplified.

~~Ponding water may lead to accelerated erosion and deterioration of the membrane surface that can result in failure of the roof system. Allowing even relatively small amounts of moisture beneath the roof membrane may reduce the thermal efficiency of the insulation. More importantly, moisture intrusion can cause serious damage to the deck, insulation, and membrane as well as the building's interior.~~

Best practices to manage ponding water are as follows:

- A roof's structural frame or deck should be sloped, and drainage components such as roof drains and scuppers should

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be included.

- Secondary drains may be required to help reduce the risk of a structural failure due to clogged drainage systems. Talk to your roof membrane manufacturer and/or roof system designer to determine the proper location of these components.
- If a deck does not provide the necessary slope to drain, a tapered insulation system can be used to create positive roof drainage.
- Crickets installed upslope of rooftop equipment and saddles positioned along a low-point between drains, can help minimize localized ponding in conjunction with a tapered insulation system.

If ponding water does occur, efforts should be taken to eliminate or reduce the accumulation and persistence of water on the roof surface. Failing to address ponding water can shorten the effective line of the roof membrane system.

To obtain specific information regarding the effects of ponding water on particular products and systems, contact the individual roofing material manufacturer.

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Ventilation and Moisture Control for Residential Roofing

The proper ventilation of attic areas is a ~~very important~~critical design and performance consideration. If implemented correctly, proper ventilation methods can help ensure the maximum service life of roof assembly materials, and can improve ~~heating and cooling~~energy efficiency of the building. The ~~M~~minimum amount of ventilation provided is defined by the ~~requirements are specified by insulation manufacturers for energy efficiency and by~~ building codes for residential construction~~officials for code compliance~~. In addition, ventilation is recommended~~quired~~ by shingle manufacturers to help ensure the performance of the roof materials. Overlooking this consideration may result in these ~~moisture related~~ problems:

- Premature failure of the roofing system~~including blistering~~
- Buckling of the roofing shingles due to deck movement
- Rotting of wood members
- Moisture accumulation in the deck and/or building insulation
- Ice dam formation in cold weather

In cold climates, internal building moisture is often a ~~primary~~ cause of roofing system problems. ~~Tighter construction techniques and heavier insulation applications help seal the side walls and create a more effective retarder against cold air penetration.~~ Occupancy generated water vapor may~~will eventually~~ reach an unconditioned space~~the cold underside of the roof deck~~ and condense. This may cause wood to rot in the walls and ceilings~~, plaster to crack and paint to peel~~. ~~Proper attic ventilation allows water vapor to escape before it condenses at the roof deck.~~ Proper ventilation also helps to reduce the occurrence of many problems such as expansion/contraction of decking and ice damming in cold, snowy climates. Ice dams are formed by the cyclical thawing of snow over the warmer portions of the roof and re-freezing at the cold eave. Refer to ARMA's Technical Bulletin "Protecting Against Damage from Ice Dams."

During the summer months, ~~very high~~ roof deck temperatures can significantly increase due to~~are caused by~~ the sun's energy~~radiant heat~~. ~~Eventually, t~~The heat from the deck radiates into~~permeates~~ the attic space, and will~~finally~~ reach~~es~~ the living space if the attic floor/ceiling is not well insulated. This will increase the demand on the home's cooling system and energy use.~~, of course, decreases cooling efficiency~~. Additionally, it will ~~recent research has reinforced the theory that prolonged exposure to extreme heat~~ accelerate~~s~~ the aging of asphalt roofing products. By properly ventilating the underside of the roof deck, heat buildup and its related problems will~~can~~ be reduced.

Refer to ARMA's Technical Bulletin "Attic Ventilation Best Practices for Steep Slope Asphalt Shingle Roof Systems." For any given home, the amount~~The calculation~~ of ventilation required~~ments~~ is dependent on three primary factors: the size of the attic, the placement of the vents and the airflow "~~r~~rating" of the vents. When considering air movement, ~~T~~there are two categories~~types~~ of vents ~~-~~, intake vents and exhaust vents. The optimal attic ventilation installation~~It~~ is a balanced combination of properly located, properly sized intake and exhaust vents (and there are many types within each category).~~these types that provides free-flow ventilation, the most efficient way to handle problems of unwanted heat and moisture in enclosed areas.~~

In some~~most~~ cases, a minimum net free~~-flow~~ ventilation area equal to one square foot per 150 square feet of attic floor area must be designed and properly installed to provide proper ventilation.

In other cases, ~~Where a properly designed and installed eave and ridge ventilation system is employed, a free-flow~~ ventilation can be ~~area equal to~~ at a ratio of ~~least~~ 1 square foot ventilation per 300 square feet of attic floor area. Ventilation manufacturers recommend that the free-flow ventilation be equally balanced between intake and exhaust vents regardless of which ratio is used. Because eave and ridge venting provides continuous air flor along the entire roof peak and eave, instead of localized as is the case with individual vents, it ~~is often sufficient. Combination eave and ridge venting~~ is generally viewed~~recognized~~ as the~~a~~ superior venting technique.

~~Vapor retarder effectiveness is dependent on thorough coverage, either of the attic floor, or the bottom of the rafters.~~

~~Penetrations, such as wiring chases, lights, flues and any holes or tears in the material can dramatically reduce the performance of a vapor retarder. The use of a vapor retarder, if well installed, can help to alleviate moisture concerns. Vapor retarders do not, however, help to remove heat or prevent the formation of ice dams. Ice dams are formed by the cyclical thawing of snow over the warmer portions of the roof and re-freezing at the cold eave. Proper ventilation can reduce the overall temperature of the roof deck, thereby minimizing the thawing of snow and ice on the surface of the roof.~~

~~Many modern homes are built with cathedral-style ceilings, with the insulation placed between the roof rafters. Free-flow ventilation must be provided to these assemblies under the roof deck through the use of vent baffles or chutes, which create a space between the roof deck and the insulation, or by constructing or using a ventilated deck sub-assembly, which is applied over or in place of the existing deck. (See Figure A.) In no instance should insulation be in contact with the underside of a roof deck or blocking the eave intake vents. Many homes also are built without overhanging eaves, and have no soffit in which to install a vent. Special facia vents, or venting "drip edge" vents are available for this application. When choosing any eave to ridge ventilation system, be certain that the lower vents meet the fresh air intake requirements of the local codes and provide at least as much capacity as the upper exhaust vent.~~

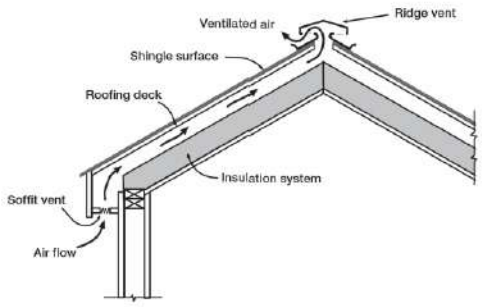

Figure A: Ridge and soffit ventilation system for cathedral ceilings using insulation vent baffles

The manufacturers of ventilation systems and vapor retarders should be consulted for proper use of their products. It should be noted that ~~ventilation specifications were created well before~~ the trend~~s~~ continue toward higher energy conservation, air barriers, and generally tighter housing construction methods~~, and cathedral ceilings. This standard may not be sufficient for every structure. Unusual situations require a designer with technical expertise.~~ The code requirements are minimums, and as such, make proper ventilation an important consideration for minimizing energy usage and optimizing roofing system performance. Standard 'one size fits all' solutions are not sufficient.

Additional guidelines may be found in the ~~free publication Give Your Attic a Breath of Fresh Air. Simply send a self-addressed stamped envelope to: American Society of Home Inspectors, 85 West Algonquin Road, Suite 360, Arlington Heights, IL 60005-4423. Further information may be found in the~~ Residential Asphalt Roofing Manual, published by the Asphalt Roofing Manufacturers Association, 529 14th Street, NW Suite 750~~1156 15th St., NW, Ste. 900~~, Washington, DC 200~~4505~~, www.asphaltroofing.org.

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ARMA Codes Steering Group

ARMA 2019 Spring Committee Meetings
Codes Steering Group - Working Meeting Agenda
Monday, April 8, 2019
Room: Bayshore West

Codes Steering Group
Chair: Aaron Phillips, TAMKO Building Products, Inc.
TRG Chair: Greg Keeler, Owens Corning

Time	Discussion Topic	Back-up Materials
12:30 PM (10 minutes)	**Call to Order** • Self-Introductions • Antitrust Reminder • Agenda Review • Approval of Past Meeting Minutes	-Antitrust Quick Reference
12:40 AM (30 minutes)	**Stakeholder Discussion** • IBHS • FRSA • RICOWI • FM Approvals	
1:10 AM (30 minutes)	**State and Local Code Activity** • Florida Building Commission • Monroe County • LA County • Denver Green Roof Ordinance • State and Local Adoption Process	
1:40 AM (30 minutes)	**Codes and Standards Update** • ICC Code Development • ASHRAE • California Energy Commission • UL 2218	
2:10 AM (20 minutes)	**Task Force & Technical Resource Group (TRG) Activities** ASTM D 7158 Texas Department of Insurance Miami Dade	
2:30PM (30 minutes)	**TRG: Cool Roof Task Force**	
3:00PM	**Adjournment**	

AMENDED IN ASSEMBLY MARCH 21, 2019

CALIFORNIA LEGISLATURE—2019–20 REGULAR SESSION

ASSEMBLY BILL No. 660

Introduced by Assembly Member Levine

February 15, 2019

~~An act relating to energy.~~ *An act to add Section 25402.13 to the Public Resources Code, relating to energy.*

LEGISLATIVE COUNSEL'S DIGEST

AB 660, as amended, Levine. Building energy efficiency ~~standards.~~ *standards: solar reflectance of roofs.*

Existing law authorizes the State Energy Resources Conservation and Development Commission to prescribe, by regulation, energy efficiency standards, including appliance efficiency standards. *Under this authorization, the commission has adopted requirements for thermal emittance, 3-year aged reflectance, and solar reflectance index of roofing materials used in new construction and reroofing projects.*

~~This bill would state the intent of the Legislature to enact legislation that would require the commission, commencing in 2020, to remove obstacles to selecting light-colored, cool roof materials for steep-sloped roofs and that would require the commission to consider increasing the minimum aged solar reflectance requirement for steep-sloped roofs on both new and existing nonresidential and residential buildings across California and for low-slope roofs on high-rise residential buildings by 2030.~~

This bill would require the commission to increase the minimum aged solar reflectance requirements for steep roofs and for low-slope roofs on high-rise residential buildings, to take effect on January 1, 2030, to unspecified amounts. The bill would authorize the commission to exempt

buildings in certain climate zones from these requirements if it determines that the increase in the minimum aged solar reflectance requirements would not be cost effective in those particular climate zones.

Vote: majority. Appropriation: no. Fiscal committee: ~~no~~ *yes*. State-mandated local program: no.

The people of the State of California do enact as follows:

SECTION 1. Section 25402.13 is added to the Public Resources Code, to read:

25402.13. (a) To mitigate the urban heat island effect consistent with the strategies for cool roofs developed pursuant to Section 71400, the commission shall do both of the following in regulations adopted pursuant to Section 25402:

(1) Increase the minimum aged solar reflectance requirement for steep roofs to ____.

(2) Increase the minimum aged solar reflectance requirement for low-slope roofs on high-rise residential buildings to ____.

(b) The commission may exempt buildings in certain climate zones from the requirements adopted pursuant to subdivision (a) if the commission determines that the increase in the minimum aged solar reflectance requirements would not be cost effective in those particular climate zones.

(c) Regulations adopted pursuant to this section shall take effect on January 1, 2030.

~~SECTION 1. It is the intent of the Legislature to enact legislation that would require the State Energy Resources Conservation and Development Commission, commencing in 2020, to remove obstacles to selecting light-colored, cool roof materials for steep-sloped roofs and that would require the commission to consider increasing the minimum aged (long term) solar reflectance requirement for steep-sloped roofs on both new and existing nonresidential and residential buildings across California (building climate zones 1 to 16, inclusive) and for low-slope roofs on high-rise residential buildings by 2030.~~

O

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Mod No.	TAS No.	Code Section	Concerns	Description
8282	103		SA Underlayments	Edits to TAS 103, including changing from "discontinuous roof systems" to "tile roof systems"; removing water absorption and crack cycling resistance references; adding Accelerated Weathering and Tensile Adhesion references; edited list of referenced standards; cleaned up existing language in document
8283	104		Nailed Underlayments	Edits to TAS 104, including changing from "discontinuous roof systems" to "tile roof systems"; removing water absorption references; adding Accelerated Weathering and Tensile Adhesion references; edited list of referenced standards; cleaned up existing language in document
8284	107		Wind Testing	Edits to TAS 107, including removal of "blow off" term; cleaned up language referencing D226; added clarity to installation and judgement of failure
8285	131		Unreinforced TPO	Edits to TAS 131, including specifically referencing unreinforced sheets; adding language for manufacturing location to be verified and listed in report; updated table for physical requirements and listed test methods
8286	131		Appendix A	Deleted in its entirety
8295		1516.2.1	Class A	Updated exceptions for Class A roof assemblies
		1507.2.5	Asphalt Shingles	Removed D225 reference
8293		1507.2.7.1	Labeling	Added that wrappers shall "be labeled to" indicate compliance
8294		1507.2.9.3	Drip Edge	Added language that drip edge at gables shall be installed over the underlayment
8288		R905.2.6.1	Labeling	Added that wrappers shall "be labeled to" indicate compliance
8291		1504.7	Impact Resistance	Removed references to CGSB and updated section reference to FM 4470
8300	114		Appendix D	Added Section 1.2 - This procedure is not applicable to roofing assemblies applied onto a steel deck substrate
8299	110			Added Section 1.2 - Manufacturing location of tested products shall be verified by testing laboratory and be included in the report; modified Table 4 to reflect reinforced and unreinforced TPO and applicable standards to reinforced TPO; Section 8 - modified table 8 to list Type IX as minimum for C578
8290		R905.2.8.5	Drip Edge	Added language that drip edge at gables shall be installed over the underlayment
8298	117		Insulation thickness	Added to section 3.10 that fastening requirments shall remain the same "and have a minimum thickness as specifiifed in the Roof System Assembly Product Approval.

RB272-19

IRC: R904 (New), R905.2.4.1, TABLE R905.2.4.1, R905.1, R905.16.6, R905.17.7, ASTM, FM, ICC, UL Chapter 44 (New)

Proponent: T. Eric Stafford, representing Insurance Institute for Business and Home Safety (testafford@charter.net)

2018 International Residential Code

Add new text as follows:

SECTION R904
WIND REQUIREMENTS FOR ROOF COVERINGS

R904.1 Wind resistance for roof coverings. Roof coverings shall comply with the wind provisions and limitations of this section.

Revise as follows:

~~**R905.2.4.1**~~ **R904.1.1 Wind resistance of asphalt shingles.** Asphalt shingles shall be tested in accordance with ASTM D7158. Asphalt shingles shall meet the classification requirements of Table ~~R905.2.4.1~~ R904.1.1 for the appropriate ultimate design wind speed. Asphalt shingle packaging shall bear a label to indicate compliance with ASTM D7158 and the required classification in Table ~~R905.2.4.1.~~ R904.1.1.

Exception: Asphalt shingles not included in the scope of ASTM D7158 shall be tested and labeled in accordance with ASTM D3161. Asphalt shingle packaging shall bear a label to indicate compliance with ASTM D3161 and the required classification in Table ~~R905.2.4.1.~~ R904.1.1.

TABLE ~~R905.2.4.1~~ R904.1.1
CLASSIFICATION OF ASPHALT ROOF SHINGLES

MAXIMUM ULTIMATE DESIGN WIND SPEED, V_{ult} FROM FIGURE R301.2(5)A (mph)	MAXIMUM BASIC WIND SPEED, V_{ASD} FROM TABLE R301.2.1.3(mph)	ASTM D7158[a] SHINGLE CLASSIFICATION	ASTM D3161 SHINGLE CLASSIFICATION
110	85	D, G or H	A, D or F
116	90	D, G or H	A, D or F
129	100	G or H	A, D or F
142	110	G or H	F
155	120	G or H	F
168	130	H	F
181	140	H	F
194	150	H	F

For SI: 1 foot = 304.8 mm; 1 mile per hour = 0.447 m/s.

a. The standard calculations contained in ASTM D7158 assume Exposure Category B or C and a building height of 60 feet or less. Additional calculations are required for conditions outside of these assumptions.

Add new text as follows:

R904.1.2 Concrete and clay tile. In regions where wind design is required in accordance with Figure R301.2(5)B, wind loads on concrete and clay tile shall be determined in accordance with Section 1609.5 of the *International Building Code.* Concrete and clay tile shall be tested to determine their resistance to overturning due to wind loads in accordance with SBCCI SSTD 11 or ASTM C1568. Where concrete and clay roof tiles do not satisfy the limitations in Chapter 16 of the *International Building Code* for rigid tile, a wind tunnel test shall be used to determine the wind characteristics of the concrete or clay tile roof covering in accordance with SBCCI SSTD 11.
In regions where wind design is not required in accordance with Figure R301.2(5)B, concrete and clay tiles shall be attached in accordance with this section or Section R905.3

R904.1.3 Metal roof shingles. Metal roof shingles shall be installed to resist the component and cladding loads specified in Table R301.2(2), adjusted for height and exposure in accordance with Table R301.2(3). Metal roof shingles shall be tested in accordance with FM 4474, UL 580 or UL 1897.

R904.1.4 Mineral-surfaced roll roofing. Mineral-surfaced roll roofing shall be installed to resist the component and cladding loads specified in Table R301.2(2), adjusted for height and exposure in accordance with Table R301.2(3).

R904.1.5 Slate shingles. Slate shingles shall be installed to resist the component and cladding loads specified in Table R301.2(2), adjusted for height and exposure in accordance with Table R301.2(3).

R904.1.6 Wood shingles. In regions where wind design is required in accordance with Figure R301.2(5)B, Wood shingles shall be installed to resist the component and cladding loads specified in Table R301.2(2), adjusted for height and exposure in accordance with Table R301.2(3). In regions where wind design is not required in accordance with Figure R301.2(5)B, wood shingles are permitted to be attached in accordance with Section R905.7.

R904.1.7 Wood shakes. In regions where wind design is required in accordance with Figure R301.2(5)B, Wood shakes shall be installed to resist the component and cladding loads specified in Table R301.2(2), adjusted for height and exposure in accordance with Table R301.2(3). In regions where wind design is not required in accordance with Figure R301.2(5)B, wood shakes are permitted to be attached in accordance with Section R905.8.

R904.1.8 Metal roof panels. Metal roof panels shall be installed to resist the component and cladding loads specified in Table R301.2(2), adjusted for height and exposure in accordance with Table R301.2(3). Metal roof panels shall be tested for wind resistance in accordance with FM 4474, UL 580, or UL 1897.

R904.1.9 Photovoltaic shingles. Photovoltaic shingles shall be tested in accordance with procedures and acceptance criteria in ASTM D 3161. Photovoltaic shingles shall comply with the classification requirements of Table R904.1.1 for the appropriate maximum basic wind speed. Photovoltaic shingle packaging shall bear a label to indicate compliance with the procedures in ASTM D 3161 and the required classification from Table R904.1.1.

R904.1.10 Building-integrated Photovoltaic roof panels. *BIPV roof panels* shall be tested in accordance with UL 1897. *BIPV roof panel* packaging shall bear a *label* to indicate compliance with UL 1897.

R904.1.11 Other roof systems. Built-up, modified bitumen, fully adhered or mechanically attached single ply systems, sprayed polyurethane foam, and liquid applied roof coverings shall be tested in accordance with FM 4474, UL1897 or UL 580 and installed to resist the component and cladding loads specified in Table R301.2(2), adjusted for height and exposure in accordance with Table R301.2(3).

Revise as follows:

R905.1 Roof covering application. Roof coverings shall be applied in accordance with the applicable provisions of this section and the manufacturer's installation instructions. ~~Unless otherwise specified in this section, roof~~ Roof coverings shall ~~be installed to resist the component and cladding loads specified in Table R301.2(2), adjusted for height and exposure in accordance with Table R301.2(3).~~ comply with the wind requirements specified in Section R904.

R905.16.6 Wind resistance. ~~Photovoltaic~~ *Wind resistance of photovoltaic shingles* shall be ~~tested~~ in accordance with ~~procedures and acceptance criteria in ASTM D3161. *Photovoltaic shingles* shall comply with the classification requirements of Table R905.2.4.1 for the appropriate maximum basic wind speed. *Photovoltaic shingle* packaging shall bear a label to indicate compliance with the procedures in ASTM D3161 and the required classification from Table R905.2.4.1.~~ Section R904.

R905.17.7 Wind resistance. Wind resistance of *BIPV roof panels* shall be ~~tested~~ in accordance with ~~UL 1897. *BIPV roof panel* packaging shall bear a *label* to indicate compliance with UL 1897.~~ Section R904.

Add new standard(s) as follows:

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428

C1568-08(2013): Standard Test Method for Wind Resistance of Concrete and Clay Roof Tiles (Mechanical Uplift Resistance Method) R904.1.2

FM

FM Approvals
Headquarters Office
Norwood MA 02062

4474-2011: American National Standard for Evaluating the Simulated Wind Uplift Resistance of Roof Assemblies Using Static Positive and/or Negative Differential Pressures R904.1.3, R904.1.8

ICC

International Code Council, Inc.
500 New Jersey Avenue NW
Washington DC 20001

SBCCI SSTD 11-97: Test Standard for Determining Wind Resistance of Concrete or Clay Roof Tiles R904.1.2

UL

UL LLC
333 Pfingsten Road
Northbrook IL 60062

580-2006: Test for Uplift Resistance of Roof Assemblies-with Revisions through October 2013 R904.1.3, R904.1.8

Reason: This proposal is one of two proposals intended to clarify the wind limitations in the IRC. Section R301.2.1.1 intends to limit the applicability of the IRC to areas where wind design is not required in accordance with Figure R301.2(5)B. However, Chapter 9 contains high wind requirements for asphalt shingles and for underlayment in wind design required regions, but for no other roof coverings. While Section R905.1 states that unless otherwise specified, roof coverings have to resist the component and cladding loads specified in Table

R302(2), that requirement is not necessarily correct for all roof coverings. Prescriptive attachment methods are provided for concrete and clay tile but the code does not specify any wind limitations on the use of this prescriptive method.
Therefore, a new section is proposed for Chapter 9 on roof coverings that specifically addresses the wind limitations in the IRC for roof covering attachment and specifies the performance requirements for roof coverings in wind design required regions. It is similar to and was patterned after Section 1504 in the IBC.

This proposal is not intended to change any technical requirements in the IRC related to wind design. It is intended to simply clarify the wind requirements for roof coverings in the IRC.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This code change proposal will not increase the cost of construction as it is primarily a clarification.

Staff Analysis: The referenced standard, ASTM C1568-08(2013), FM 4474-2011, ICC SBCCI SSTD 11-97 and UL 580-2006 are currently referenced in other 2018 I-codes.

Proposal # 4660

RB272-19

RB273-19

IRC®: R905.1.1, ASTM Chapter 44 (New)

Proponent: Gregory Keeler, Owens Corning, representing Owens Corning (greg.keeler@owenscorning.com)

2018 International Residential Code

Revise as follows:

R905.1.1 Underlayment. *Underlayment* for asphalt shingles, clay and concrete tile, metal roof shingles, mineral-surfaced roll roofing, slate and slate-type shingles, wood shingles, wood shakes, metal roof panels and *photovoltaic shingles* shall conform to the applicable standards listed in this chapter. *Underlayment* materials required to comply with ASTM D226, D1970, D4869, ~~and~~ D6757 and ASTM WK51913 shall bear a label indicating compliance to the standard designation and, if applicable, type classification indicated in Table R905.1.1(1). *Underlayment* shall be applied in accordance with Table R905.1.1(2). *Underlayment* shall be attached in accordance with Table R905.1.1(3).

Exceptions:

1. As an alternative, self-adhering polymer-modified bitumen *underlayment* complying with ASTM D1970 installed in accordance with both the *underlayment* manufacturer's and roof covering manufacturer's instructions for the deck material, roof ventilation configuration and climate exposure for the roof covering to be installed, shall be permitted.
2. As an alternative, a minimum 4-inch-wide (102 mm) strip of self-adhering polymer-modified bitumen membrane complying with ASTM D1970, installed in accordance with the *manufacturer's installation instructions* for the deck material, shall be applied over all joints in the roof decking. An *approved underlayment* for the applicable roof covering for maximum ultimate design wind speeds, V_{ult}, less than 140 miles per hour shall be applied over the entire roof over the 4-inch-wide (102 mm) membrane strips.
3. As an alternative, two layers of *underlayment* complying with ASTM D226 Type II; ~~or~~ ASTM D4869 Type III or Type IV; or ASTM WK51913 shall be permitted to be installed as follows in 3.1 through 3.4:
   - 3.1. Apply a 19-inch-wide (483 mm) strip of *underlayment* parallel with the eave. Starting at the eave, apply 36-inch-wide (914 mm) strips of *underlayment* felt, overlapping successive sheets 19 inches (483 mm). End laps shall be 4 inches (102 mm) and shall be offset by 6 feet (1829 mm).
   - 3.2. The *underlayment* shall be attached with corrosion-resistant fasteners in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at side and end laps.
   - 3.3. *Underlayment* shall be attached using metal or plastic cap nails with a nominal cap diameter of not less than 1 inch (25 mm). Metal caps shall have a thickness of not less than 32-gage sheet metal. Power-driven metal caps shall have a thickness of not less than 0.010 inch (0.25 mm). Minimum thickness of the outside edge of plastic caps shall be 0.035 inch (0.89 mm).
   - 3.4. The cap nail shank shall be not less than 0.083 inch (2.11 mm) for ring shank cap nails and 0.091 inch (2.31 mm) for smooth shank cap nails. Cap nail shank shall have a length sufficient to penetrate through the roof sheathing or not less than $^3/_4$ inch (19 mm) into the roof sheathing.

Add new text as follows:

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box
C700
West Conshohocken PA 19428

ASTM WK51913 - ????:: New Specification for Mechanically Attached Polymeric Roof Underlayment Used in Steep Slope Roofing

Reason: This is a placeholder for the ASTM Work Item to develop a standard related to synthetic underlayments. This will be the first ASTM Standard that applies specifically to synthetic underlayments and includes requirements that are related directly to synthetic underlayments. These requirements are much more appropriate for synthetic underlayment products than testing in accordance with the current standards which are specifically for asphalt impregnated products.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal simply adds requirements for products that are already in widespread use.

Staff Analysis: A review of the standard proposed for inclusion in the code, ASTM WK51913, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 2, 2019.

Proposal # 5310

RB273-19

RB274-19

IRC®: R905.1.1, TABLE R905.1.1(1)

Proponent: Mike Fischer, Kellen Company, representing The Asphalt Roofing Manufacturers Association (mfischer@kellencompany.com)

2018 International Residential Code

Revise as follows:

R905.1.1 Underlayment. *Underlayment* for asphalt shingles, clay and concrete tile, metal roof shingles, mineral-surfaced roll roofing, slate and slate-type shingles, wood shingles, wood shakes, metal roof panels and *photovoltaic shingles* shall conform to the applicable standards listed in this chapter. *Underlayment* materials required to comply with ASTM D226, D1970, D4869 and D6757 shall bear a label indicating compliance to the standard designation and, if applicable, type classification indicated in Table R905.1.1(1). *Underlayment* shall be applied in accordance with Table R905.1.1(2). *Underlayment* shall be attached in accordance with Table R905.1.1(3).

Exceptions:

1. ~~As an alternative, self-adhering polymer-modified bitumen *underlayment* complying with ASTM D1970 installed in accordance with both the *underlayment* manufacturer's and roof covering manufacturer's instructions for the deck material, roof ventilation configuration and climate exposure for the roof covering to be installed, shall be permitted.~~
2. As an alternative, a minimum 4-inch-wide (102 mm) strip of self-adhering polymer-modified bitumen membrane complying with ASTM D1970, installed in accordance with the *manufacturer's installation instructions* for the deck material, shall be applied over all joints in the roof decking. An *approved underlayment* for the applicable roof covering for maximum ultimate design wind speeds, V_{ult}, less than 140 miles per hour shall be applied over the entire roof over the 4-inch-wide (102 mm) membrane strips.
3. As an alternative, two layers of *underlayment* complying with ASTM D226 Type II or ASTM D4869 Type III or Type IV shall be permitted to be installed as follows in 3.1–3.4:
   - 3.1. Apply a 19-inch-wide (483 mm) strip of *underlayment* parallel with the eave. Starting at the eave, apply 36-inch-wide (914 mm) strips of *underlayment* felt, overlapping successive sheets 19 inches (483 mm). End laps shall be 4 inches (102 mm) and shall be offset by 6 feet (1829 mm).
   - 3.2. The *underlayment* shall be attached with corrosion-resistant fasteners in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at side and end laps.
   - 3.3. *Underlayment* shall be attached using metal or plastic cap nails with a nominal cap diameter of not less than 1 inch (25 mm). Metal caps shall have a thickness of not less than 32-gage sheet metal. Power-driven metal caps shall have a thickness of not less than 0.010 inch (0.25 mm). Minimum thickness of the outside edge of plastic caps shall be 0.035 inch (0.89 mm).
   - 3.4. The cap nail shank shall be not less than 0.083 inch (2.11 mm) for ring shank cap nails and 0.091 inch (2.31 mm) for smooth shank cap nails. Cap nail shank shall have a length sufficient to penetrate through the roof sheathing or not less than $^3/_4$ inch (19 mm) into the roof sheathing.

TABLE R905.1.1(1)
UNDERLAYMENT TYPES

Portions of table not shown remain unchanged.

ROOF COVERING	SECTION	MAXIMUM ULTIMATE DESIGN WIND SPEED, V_{ult} < 140 MPH	MAXIMUM ULTIMATE DESIGN WIND SPEED, V_{ult} ≥ 140 MPH
Asphalt shingles	R905.2	ASTM D226 Type I or Type II ASTM D4869 Type I, II, III or IVASTM D6757	ASTM D226 Type II ASTM D4869 Type III or Type IVASTM D6757

For SI: 1 mile per hour = 0.447 m/s.

Reason: The proposal makes two editorial changes. The alternate for ASTM D 1970 is redundant as that standard is listed in Section R905.1.1. Table R905.1.1 (1) includes ASTM D226 Type II for high wind areas; that material is also appropriate for lower wind zone areas.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The proposal is editorial.

Proposal # 5672

RB274-19

RB275-19

IRC®: R905.1.1, TABLE R905.1.1(1), TABLE R905.1.1(2), TABLE R905.1.1(3)

Proponent: T. Eric Stafford, representing Insurance Institute for Business and Home Safety (testafford@charter.net)

2018 International Residential Code

Revise as follows:

R905.1.1 Underlayment. *Underlayment* for asphalt shingles, clay and concrete tile, metal roof shingles, mineral-surfaced roll roofing, slate and slate-type shingles, wood shingles, wood shakes, metal roof panels and *photovoltaic shingles* shall conform to the applicable standards listed in this chapter. *Underlayment* materials required to comply with ASTM D226, D1970, D4869 and D6757 shall bear a label indicating compliance to the standard designation and, if applicable, type classification indicated in Table R905.1.1(1). *Underlayment* shall be applied in accordance with Table R905.1.1(2). *Underlayment* shall be attached in accordance with Table R905.1.1(3).

Exceptions:

1. As an alternative, self-adhering polymer-modified bitumen *underlayment* complying with ASTM D1970 installed in accordance with both the *underlayment* manufacturer's and roof covering manufacturer's instructions for the deck material, roof ventilation configuration and climate exposure for the roof covering to be installed, shall be permitted.
2. As an alternative, a minimum 4-inch-wide (102 mm) strip of self-adhering polymer-modified bitumen membrane complying with ASTM D1970, installed in accordance with the *manufacturer's installation instructions* for the deck material, shall be applied over all joints in the roof decking. An *approved underlayment* for the applicable roof covering for ~~maximum ultimate design wind speeds, V_{ult}, less than 140 miles per hour~~ areas where wind design is not required in accordance with Figure R301.2(4)B shall be applied over the entire roof over the 4-inch-wide (102 mm) membrane strips.
3. ~~As an alternative, two layers of *underlayment* complying with ASTM D226 Type II or ASTM D4869 Type III or Type IV shall be permitted to be installed as follows in 3.1–3.4:~~

    3.1. ~~Apply a 19-inch-wide (483 mm) strip of *underlayment* parallel with the eave. Starting at the eave, apply 36-inch-wide (914 mm) strips of *underlayment* felt, overlapping successive sheets 19 inches (483 mm). End laps shall be 4 inches (102 mm) and shall be offset by 6 feet (1829 mm).~~

    3.2. ~~The *underlayment* shall be attached with corrosion-resistant fasteners in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at side and end laps.~~

    3.3. ~~*Underlayment* shall be attached using metal or plastic cap nails with a nominal cap diameter of not less than 1 inch (25 mm). Metal caps shall have a thickness of not less than 32-gage sheet metal. Power-driven metal caps shall have a thickness of not less than 0.010 inch (0.25 mm). Minimum thickness of the outside edge of plastic caps shall be 0.035 inch (0.89 mm).~~

    3.4. ~~The cap nail shank shall be not less than 0.083 inch (2.11 mm) for ring shank cap nails and 0.091 inch (2.31 mm) for smooth shank cap nails. Cap nail shank shall have a length sufficient to penetrate through the roof sheathing or not less than 3/4 inch (19 mm) into the roof sheathing.~~

TABLE R905.1.1(1)
UNDERLAYMENT TYPES

ROOF COVERING	SECTION	AREAS WHERE WIND DESIGN IS NOT REQUIRED IN ACCORDANCE WITH FIGURE R301.2(4)B ~~MAXIMUM ULTIMATE DESIGN WIND SPEED, V_{ult} < 140 MPH~~	AREAS WHERE WIND DESIGN IS REQUIRED IN ACCORDANCE WITH FIGURE R301.2(4)B ~~MAXIMUM ULTIMATE DESIGN WIND SPEED, V_{ult} ≥ 140 MPH~~
Asphalt shingles	R905.2	ASTM D226 Type I ASTM D4869 Type I, II, III or IVASTM D6757	ASTM D226 Type II ASTM D4869 Type III or Type IV~~ASTM D6757~~
Clay and concrete tile	R905.3	ASTM D226 Type II ASTM D2626 Type IASTM D6380 Class M mineral- surfaced roll roofing	ASTM D226 Type II ~~ASTM D2626 Type IASTM D6380 Class M mineral- surfaced roll roofing~~
Metal roof shingles	R905.4	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV	ASTM D226 Type II ASTM D4869 Type III or Type IV
Mineral-surfaced roll roofing	R905.5	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV	ASTM D226 Type II ASTM D4869 Type III or Type IV
Slate and slate-type shingles	R905.6	ASTM D226 Type I ASTM D4869 Type I, II, III or IV	ASTM D226 Type II ASTM D4869 Type III or Type IV
Wood shingles	R905.7	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV	ASTM D226 Type II ASTM D4869 Type III or Type IV
Wood shakes	R905.8	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV	ASTM D226 Type II ASTM D4869 Type III or Type IV
Metal panels	R905.10	Manufacturer's instructions	ASTM D226 Type II ASTM D4869 Type III or Type IV
Photovoltaic shingles	R905.16	ASTM D4869 Type I, II, III or IV ASTM D6757	ASTM D4869 Type III or Type IV ~~ASTM D6757~~

For SI: 1 mile per hour = 0.447 m/s.

TABLE R905.1.1(2)
UNDERLAYMENT APPLICATION

ROOF COVERING	SECTION	AREAS WHERE WIND DESIGN IS NOT REQUIRED IN ACCORDANCE WITH FIGURE R301.2(4)B ~~MAXIMUM ULTIMATE DESIGN WIND SPEED, V_{ult} < 140 MPH~~	AREAS WHERE WIND DESIGN IS REQUIRED IN ACCORDANCE WITH FIGURE R301.2(4)B ~~MAXIMUM ULTIMATE DESIGN WIND SPEED, V_{ult} ≥ 140 MPH~~

Asphalt shingles	R905.2	For roof slopes from two units vertical in 12 units horizontal (2:12), up to four units vertical in 12 units horizontal (4:12),underlayment shall be two layers applied in the followingmanner: apply a 19-inch strip of underlayment felt parallel toand starting at the eaves. Starting at the eave, apply 36-inch- widesheets of underlayment, overlapping successive sheets19 inches. Distortions in the underlayment shall not interferewith the ability of the shingles to seal. End laps shall be 4 inchesand shall be offset by 6 feet.For roof slopes of four units vertical in 12 units horizontal (4:12) or greater, underlayment shall be one layer applied inthe following manner: underlayment shall be applied shinglefashion, parallel to and starting from the eave and lapped 2 inches,Distortions in the underlayment shall not interfere withthe ability of the shingles to seal. End laps shall be 4 inchesand shall be offset by 6 feet.	~~Same as Maximum Ultimate Design Wind Speed, V_{ult} < 140 mph except all laps shall be not less than 4 inches.~~ Underlayment shall be two layers applied in the followingmanner: apply a 19-inch strip of underlayment felt parallel to and starting at the eaves. Starting at the eave, apply 36-inch-wide sheets of underlayment, overlapping successive sheets 19 inches. Distortions in the underlayment shall not interfere with the ability of the shingles to seal. End laps shall be 4 inches and shall be offset by 6 feet.
Clay and concrete tile	R905.3	For roof slopes from two and one-half units vertical in 12 units horizontal ($2^1/_2$:12), up to four unitsvertical in 12 units horizontal (4:12), underlaymentshall be not fewer than two layers applied asfollows: starting at the eave, apply a 19-inch stripof underlayment parallel with the eave. Starting atthe eave, apply 36-inch-wide strips of underlaymentfelt, overlapping successive sheets 19 inches.End laps shall be 4 inches and shall be offset by 6 feet.For roof slopes of four units vertical in 12 unitshorizontal (4:12) or greater, underlayment shall benot fewer than one layer of underlayment feltapplied shingle fashion, parallel to and startingfrom the eaves and lapped 2 inches. End laps shallbe 4 inches and shall be offset by 6 feet.	~~Same as Maximum Ultimate Design Wind Speed, V_{ult} < 140 mph, except all laps shall be not less than 4 inches.~~ Underlayment shall be two layers applied in the followingmanner: apply a 19-inch strip of underlayment felt parallel to and starting at the eaves. Starting at the eave, apply 36-inch- wide sheets of underlayment, overlapping successive sheets 19 inches. Distortions in the underlayment shall not interfere with the ability of the shingles to seal. End laps shall be 4 inches and shall be offset by 6 feet.

Metal roof shingles	R905.4	Apply in accordance with the manufacturer's installation instructions.	~~For roof slopes from two units vertical in 12 units horizontal (2:12), up to four units vertical in 12 unitshorizontal (4:12), u~~ Underlayment shall be twolayers applied in the following manner: apply a19-inch strip of underlayment felt parallel to andstarting at the eaves. Starting at the eave, apply36-inch-wide sheets of underlayment, overlapping successive sheets 19 inches. End laps shall be 4inches and shall be offset by 6 feet.~~For roof slopes of four units vertical in 12 units horizontal (4:12) or greater, underlayment shall beone layer applied in the following manner: underlaymentshall be applied shingle fashion, parallelto and starting from the eave and lapped 4 inches.End laps shall be 4 inches and shall be offset by 6 feet.~~
Mineral-surfaced roll roofing	R905.5		
Slate and slate-type shingles	R905.6		
Wood shingles	R905.7		
Wood shakes	R905.8		
Metal panels	R905.10		
Photovoltaic shingles	R905.16	For roof slopes from two units vertical in 12 units horizontal (2:12), up to four units vertical in 12 units horizontal (4:12), underlayment shall be two layers applied in the following manner: apply a 19-inch strip of underlayment felt parallel to and starting at the eaves. Starting at the eave, apply 36-inch-wide sheets of underlayment, overlapping successive sheets 19 inches. Distortions in the underlayment shall not interfere with the ability of the shingles to seal. End laps shall be 4 inches and shall be offset by 6 feet. For roof slopes of four units vertical in 12 units horizontal (4:12) or greater, underlayment shall be one layer applied in the following manner: underlayment shall be applied shingle fashion, parallel to and starting from the eave and lapped 2 inches. Distortions in the underlayment shall not interfere with the ability of the shingles to seal. End laps shall be 4 inches and shall be offset by 6 feet.	~~Same as Maximum Ultimate Design Wind Speed, V_{ult} < 140 mph, except all laps shall be not less than 4 inches.~~ Underlayment shall be two layers applied in the followingmanner: apply a 19-inch strip of underlayment felt parallel to and starting at the eaves. Starting at the eave, apply 36-inch- wide sheets of underlayment, overlapping successive sheets 19 inches. Distortions in the underlayment shall not interfere with the ability of the shingles to seal. End laps shall be 4 inches and shall be offset by 6 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s.

TABLE R905.1.1(3)
UNDERLAYMENT APPLICATION

ROOF COVERING	SECTION	AREAS WHERE WIND DESIGN IS NOT REQUIRED IN ACCORDANCE WITH FIGURE R301.2(4)B ~~MAXIMUM ULTIMATE DESIGN WIND SPEED, V_{ult} < 140 MPH~~	AREAS WHERE WIND DESIGN IS REQUIRED IN ACCORDANCE WITH FIGURE R301.2(4)B ~~MAXIMUM ULTIMATE DESIGN WIND SPEED, V_{ult} ≥ 140 MPH~~
Asphalt shingles	R905.2	Fastened sufficiently to hold in place	The underlayment shall be attached with corrosion-resistant fasteners in a grid pattern of 12 inches between side laps witha 6-inch spacing at side and end laps. Underlayment shall be attached using annular ring or deformed shank nails with 1 inch diameter metal or plastic cap s ~~nails or cap staples with a nominal cap diameter of not less than 1 inch~~. Metal caps shall have a thickness of not less than 32-gage sheet metal. Power-driven metal caps shall have a minimum thickness of 0.010 inch. Minimum thickness of the outside edge of plastic caps shall be 0.035 inch. The cap nail shank shall be not less than 0.083 inch ~~for ring shank cap nailsand 0.091 inch for smooth shank cap nails. Staples shall benot less than 21 gage.~~ The ~~C~~ cap nail shank ~~and cap staple legs~~ shall have a length sufficient to penetrate through the roof sheathing or not less than $^3/_4$ inch into the roof sheathing.
Clay and concrete tile	R905.3		
Photovoltaic	R905.16		
Metal roof shingles	R905.4	Manufacturer's installation instructions.	The underlayment shall be attached with corrosion-resistant fasteners in a grid pattern of 12 inches between side laps witha 6-inch spacing at side and end laps. Underlayment shall be attached using annular ring or deformed shank nails with 1 inch diameter metal or plastic cap s ~~nails or cap staples with a nominal cap diameter of not lessthan 1 inch~~. Metal caps shall have a thickness of not less than32-gage sheet metal. Power-driven metal caps shall have aminimum thickness of 0.010 inch. Minimum thickness of theoutside edge of plastic caps shall be 0.035 inch. The cap nail shank shall be not less than 0.083 inch ~~for ring shank cap nailsand 0.091 inch for smooth shank cap nails. Staples shall benot less than 21 gage.~~ The ~~C~~ cap nail shank ~~and cap staple legs~~ shall have a length sufficient to penetrate through the roof sheathing or not less than $^3/_4$ inch into the roof sheathing.
Mineral-surfaced roll roofing	R905.5		
Slate and slate-type shingles	R905.6		
Wood shingles	R905.7		
Wood shakes	R905.8		
Metal panels	R905.10		

For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s.

Reason: This code change simply requires an extra layer of 30# roofing felt (ASTM D 226 Type II, or ASTM D 4869 Types III or IV) for areas vulnerable to roof covering loss and subsequent water intrusion in the hurricane-prone regions. The fastening of the underlayment remains the same as required in the 2018 IRC except the use of staples as a fastening method has been removed. The effectiveness of staples in keeping the underlayment in place when subjected to hurricane-level wind loads has not been tested. Additionally, the trigger for the enhanced underlayment has been changed to where wind design is required in accordance with Figure

R301.2(4)B. The wind design required trigger is consistent with other limitations in the IRC and would also capture areas impacted by Hurricane Michael where design wind speeds currently range from 130 mph to 140 mph. However, for the northeastern U.S. and Alaska, where the wind design required region is based on the 140 mph wind speed contour, the trigger remains the same. This proposal would also remove the enhanced underlayment requirements from the Special Wind Regions.
Water infiltration due to wind driven rain has been well documented from post-hurricane damage assessments where hurricane winds were strong enough to blow off the primary roof covering, but not strong enough to blow off roof sheathing. In such instances, significant property damage and extended occupant displacement routinely occur due to water intrusion. In many cases, the building will appear relatively undamaged from the exterior except for roof covering loss. However, a closer inspection would reveal significant interior and contents damage.

Water entry can occur where it is able to infiltrate through the roof, walls, vents, windows, and/or doors, or at interfaces between these items. Water intrusion can cause extensive damage to interior finishes, furnishings, and other contents, and can lead to ceiling collapse when attic insulation is saturated. When power is lost and/or a building cannot otherwise be dried out within 24–48 hours, additional issues such as mold can develop, potentially extending the period during which the property may not be available for use. An insurance closed claims study for residential properties conducted following Hurricane Charley in 2004 indicated interior losses and additional living expeses were 27% of the total loss costs.

Recent hurricanes have not been an exception. The following photographs show buildings damaged due to Hurricane Michael which impacted Mexico Beach and the Panama City area of Florida (other areas as well). While structurally, the buildings performed well, each had extensive interior damage likely due to wind driven rain and roof covering loss. Also, parts of North Carolina that were hit by Hurricane Florence in 2018 are in areas where the design wind speed is around 145 mph. However, these arease suffered substantial residential roof damage at winds whcih measured only at around 100 mph.

Tests performed by IBHS at the Research Center have consistently shown that the secondary roof underlayment strategies recommened by the IBHS Fortified Home^{TM} - Hurricane program consistently show significantly reduced water intrusion rates when one of these strategies was employed. Two of these strategies are already recognized by the code in Exceptions 1 and 2 to Section R905.1.1. A 2011 hurricane demonstration clearly showed the benefit of sealing the seams of the roof deck sheathing which is one of the strategies recognized in Exception 2 to Section R905.1.1.

A summary of the results of the demonstration can be viewed at the following link:
http://ibhstest.wpengine.com/ibhs-news-releases/ibhs-hurricane-demonstration-illustrates-importance-of-sealed-roof-deck-3/.

The wind driven rain demonstration can be viewed at the following link:
https://disastersafety.org/thunderstorms/wind-driven-rain-demo/.

A more recent study included an assessment of a new approach where the roof is covered with two layers of high-quality underlayment attached with cap nails. Based on the performance achieved with this system, it has now been added to the FORTIFIED Home–Hurricane program as a fifth option for achieving a sealed roof deck. This report is identified in the bibliography and has been included as an attachment to this code change. All of the mitigation strategies, including the two layers of felt underlayment reduced water entry into the attic space by 70% or more.

Bibliography: Brown, T.M., Quarles, S.L., Giammanco, I.M., Brown, R., Insurance Institute for Business and Home Safety, "Building Vulnerability to Wind-Driven Rain Entry and Effectiveness of Mitigation Techniques." 14th International Conference on Wind Engineering (ICWE).

Cost Impact: The code change proposal will increase the cost of construction
If one of the methods in Exceptions 1 or 2 of Section R905.1.1 are used, this proposal will not increase the cost of construction.

If the double layer of underlayment option is used, for areas where wind design is required, the cost of the additional layer of underlayment will vary by region. However, for a 2000 square foot roof, the cost increase for the additional layer of underlayment will be between $100 to $200. For areas where the design wind speed is less than 140 mph but equal to or greater than 130 mph in the wind design required region, additional fasteners will be reqired in addition to the additionaly layer of underlayment.

Proposal # 4669

RB275-19

RB276-19

IRC®: TABLE R905.1.1(1), ASTM Chapter 44 (New)

Proponent: Gregory Keeler, representing Owens Corning (greg.keeler@owenscorning.com)

2018 International Residential Code

Revise as follows:

TABLE R905.1.1(1)
UNDERLAYMENT TYPES

ROOF COVERING	SECTION	MAXIMUM ULTIMATE DESIGN WIND SPEED, V_{ult} < 140 MPH	MAXIMUM ULTIMATE DESIGN WIND SPEED, V_{ult} ≥ 140 MPH
Asphalt shingles	R905.2	ASTM D226 Type I ASTM D4869 Type I, II, III or IV ASTM D6757 ASTM WK51913	ASTM D226 Type II ASTM D4869 Type III or Type IV ASTM D6757 ASTM WK51913
Clay and concrete tile	R905.3	ASTM D226 Type II ASTM WK51913 ASTM D2626 Type I ASTM D6380 Class M mineral-surfaced roll roofing	ASTM D226 Type II ASTM WK51913 ASTM D2626 Type I ASTM D6380 Class M mineral-surfaced roll roofing
Metal roof shingles	R905.4	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV ASTM WK51913	ASTM D226 Type II ASTM D4869 Type III or Type IV ASTM WK51913
Mineral-surfaced roll roofing	R905.5	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV ASTM WK51913	ASTM D226 Type II ASTM D4869 Type III or Type IV ASTM WK51913
Slate and slate-type shingles	R905.6	ASTM D226 Type I ASTM D4869 Type I, II, III or IV ASTM WK51913	ASTM D226 Type II ASTM D4869 Type III or Type IV ASTM WK51913

Wood shingles	R905.7	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV ASTM WK51913	ASTM D226 Type II ASTM D4869 Type III or Type IV ASTM WK51913
Wood shakes	R905.8	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV ASTM WK51913	ASTM D226 Type II ASTM D4869 Type III or Type IV ASTM WK51913
Metal panels	R905.10	Manufacturer's instructions	ASTM D226 Type II ASTM D4869 Type III or Type IV ASTM WK51913
Photovoltaic shingles	R905.16	ASTM D4869 Type I, II, III or IV ASTM D6757 ASTM WK51913	ASTM D4869 Type III or Type IV ASTM D6757 ASTM WK51913

For SI: 1 mile per hour = 0.447 m/s.

Add new text as follows:

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428

ASTM WK51913 - ????: New Specification for Mechanically Attached Polymeric Roof Underlayment Used in Steep Slope Roofing

Reason: This proposal references an ASTM Work Item for a new ASTM Standard that will appply exclusively to synthetic underlayments. The proposal simply stipulates new performance requirements for products that are already in widespread use.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal references a proposed ASTM Standard that will, for the first time, apply specific performance requirements to synthetic underlayment products that are already in widespread use and will therefore not affect the cost of construction.

Staff Analysis: A review of the standard proposed for inclusion in the code, ASTM WK51913-????, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 2, 2019.

Proposal # 5319

RB276-19

RB282-19

IRC®: TABLE R905.9.2, ASTM Chapter 44 (New)

Proponent: Chadwick Collins, Kellen Company, representing Asphalt Roofing Manufacturers Association (Ccollins@kellencompany.com)

2018 International Residential Code

Revise as follows:

TABLE R905.9.2
BUILT-UP ROOFING MATERIAL STANDARDS

MATERIAL STANDARD	STANDARD
Acrylic coatings used in roofing	ASTM D6083
Aggregate surfacing	ASTM D1863; D7655
Asphalt adhesive used in roofing	ASTM D3747
Asphalt cements used in roofing	ASTM D2822; D3019; D4586
Asphalt-coated glass fiber base sheet	ASTM D4601
Asphalt coatings used in roofing	ASTM D1227; D2823; D2824; D4479
Asphalt glass felt	ASTM D2178
Asphalt primer used in roofing	ASTM D41
Asphalt-saturated and asphalt-coated organic felt base sheet	ASTM D2626
Asphalt-saturated organic felt (perforated)	ASTM D226
Asphalt used in roofing	ASTM D312
Coal-tar cements used in roofing	ASTM D4022; D5643
Coal-tar primer used in roofing, dampproofing and waterproofing	ASTM D43
Coal-tar saturated organic felt	ASTM D227
Coal-tar used in roofing	ASTM D450, Type I or II
Glass mat, coal tar	ASTM D4990
Glass mat, venting type	ASTM D4897
Mineral-surfaced inorganic cap sheet	ASTM D3909
Thermoplastic fabrics used in roofing	ASTM D5665; D5726

Add new text as follows:

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428

D7655/D7655M—12: Standard Classification for Size of Aggregate Used as Ballast for Roof Membrane Systems

Reason: This proposal adds an accepted ASTM standard for specification of aggregate for built-up roofs. It also coordinates with a separate proposal providing improved provisions for parapet height and aggregate size

to control aggregate blow-off in extreme wind events.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal adds an already listed aggregate standard from the referenced standard list to the table.

Staff Analysis: The referenced standard, ASTM D7655/D7655M-12, is currently referenced in other 2018 I-codes.

Proposal # 5457

RB282-19

RB283-19

IRC®: R906.1, NFPA Chapter 44 (New)

Proponent: Mike Fischer, Kellen Company, representing The Center for the Polyurethanes Industry of the American Chemistry Council (mfischer@kellencompany.com)

2018 International Residential Code

Revise as follows:

R906.1 General. ~~The use of~~ Where above-deck thermal insulation is installed, such insulation shall be ~~permitted provided that such insulation is~~ covered with an *approved* roof covering and ~~complies with FM 4450~~ shall comply with NFPA 276 or UL 1256.

Add new standard(s) as follows:

NFPA

National Fire Protection Association
1 Batterymarch Park
Quincy MA 02169-7471

276-15: Standard Method of Fire Tests for Determining the Heat Release Rate of Roofing Assemblies with Combustible Above-deck Roofing Components

Reason: During the development of the 2012 IBC, FM 4450 was removed from the IBC requirements for roof insulation and replaced with NFPA 276. This proposal will make the code consistent with IBC Section 1508.1. FM 4450 is no longer applicable for this use. NFPA 276 is referenced in the IBC.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The proposal is editorial in nature to align with IBC requirements.

Staff Analysis: The referenced standard, NFPA 276-15, is currently referenced in other 2018 I-codes.

Proposal # 5615

S3-19

IBC: 1511.6.1 (New)

Proponent: Bill McHugh, The McHugh Company, representing Chicago Roofing Contractors Association (bill@mc-hugh.us)

2018 International Building Code

1511.6 Flashings. Flashings shall be reconstructed in accordance with *approved* manufacturer's installation instructions. Metal flashing to which bituminous materials are to be adhered shall be primed prior to installation.

Add new text as follows:

1511.6.1 Flashing Heights. Wall and curb flashings shall be not less than 8 inches (203 mm) above the roof covering surface. A reduction of the required roof assembly thickness to accommodate the limited heights shall be in accordance with the roof covering manufacturer's instructions.

Reason: The purpose of this code proposal is to provide the code official guidance when roofing work takes place on existing buildings. When the scope of work is to replace the roof covering, (See 202 definition for roof covering replacement), the building owner and manager should not have to rebuild the rooftop to accommodate thick roofing components.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This code proposal will provide the building owner and manager with the option to not have to rebuild the roof assembly in some cases. In other cases, it does not provide cost savings.

Proposal # 2088

S4-19

IBC: 1511.5 (New)

Proponent: Bill McHugh, The McHugh Company, representing Chicago Roofing Contractors Association (Bill@mc-hugh.us)

2018 International Building Code

Add new text as follows:

1511.5 Roof Covering Replacement. Where an existing roof covering is removed, exposing insulation or sheathing and only a new roof covering is installed.

Reason: The purpose of this proposal is to put code language that ties in with the new definition in section 202 for Roof Covering Replacement. This provides guidance to code users for an area that is not covered at all by the code. This situation, roof covering replacement, is a question that's asked about frequently. This is where the roof covering system life can be extended by adding a new roof covering material alone by 'peeling' off' the old roof covering material. There are situations where this method is not only practical but preferred. In fact, the City of Chicago added this definition through it's 2016 Roofing Memorandum.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This code proposal provides an option not available to the building owner and manager. The result is it will be no increase in the cost of construction where or a big savings in cost due to not having to rework the roof assembly to accommodate roofing component thicknesses.

Proposal # 2100

S5-19

IBC: 1511.3 (IEBC 705.3)

Proponent: Mike Fischer, Kellen Company, representing The Polyisocyanurate Insulation Manufacturers Association (mfischer@kellencompany.com); Marcin Pazera, representing The Polyisocyanurate Insulation Manufacturers Association (mpazera@pima.org)

2018 International Building Code

Revise as follows:

1511.3 Roof replacement. *Roof replacement* shall include the removal of all existing layers of roof coverings and roof assembly materials down to the roof deck.

Exception: Where the existing roof assembly includes an ice barrier membrane that is adhered to the roof deck, the existing ice barrier membrane shall be permitted to remain in place and covered with an additional layer of ice barrier membrane in accordance with Section 1507.

Reason: The current code language instructs the user to remove all roofing materials down to the deck when performing a roof replacement. The exception for ice barrier membrane illustrates that fact. The definition of roof replacement includes instructions to repair damaged substrate (such as the roof deck and supporting structure):

ROOF REPLACEMENT. The process of removing the existing *roof covering*, repairing any damaged substrate and installing a new *roof covering*.

IBC Section 1511.1 reads:

Materials and methods of application used for recovering or replacing an existing roof covering shall comply with the requirements of Chapter 15.

Requirements for roof assemblies in Chapter 15 include assembly testing for wind and fire resistance. The assembly tests typically include all materials including fasteners, insulation, and cover boards. There have been indications of a practice known as “peel and replace” where only the outermost layer (roof covering membrane) is removed, and another membrane subsequently applied. This practice makes it impossible to meet the IBC provisions for repairing damaged substrate because the deck will not be exposed for inspection. It also conflicts with 1511.3 because the requirements for wind and fire testing are based on assembly tests with known materials, not an assembly of new and existing materials that may or may not comply with current material properties and standards.
This proposal is a clarification of the current code provisions, industry recommendations, and test requirements. The need to install new roof assembly materials in a roof replacement in a manner that is consistent with tested assemblies is necessary to demonstrate code compliance and ensure that the system will perform as intended. This interpretation of the intent of the code is consistent with industry guidance on the subject.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The proposal is a clarification to current requirements.

Proposal # 5588

S6-19

IBC: SECTION 1511 (IEBC 706), 1511.3.1.1 (IEBC 705.3.1.1)

Proponent: Wanda Edwards, Wanda Edwards Consulting, Inc., representing RCI, Inc. (wedwards@rci-online.org)

2018 International Building Code

SECTION 1511
REROOFING

Revise as follows:

1511.3.1.1 Exceptions. A *roof recover* shall not be permitted where any of the following conditions occur:

1. Where the existing roof or roof covering is water soaked or has deteriorated to the point that the existing roof or roof covering is not adequate as a base for additional roofing.
2. Where the existing roof covering is slate, clay, cement or asbestos-cement tile.
3. Where the existing roof has two or more applications of any type of roof covering and the roof coverings are not removed down to the deck.

Reason: This code proposal is for clarification that when there are two or more roof coverings, a new roof covering can not be installed until the coverings are removed to the roof deck. Often, the contractor does not remove coverings down to the deck and this will remind the contractor that it is required.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This code proposal is a clarification of the current code requirements and with not effect the cost of construction.

Proposal # 5585

S7-19

IBC: 1511.3.1.1 (IEBC 705.3.1.1), 1511.4 (IEBC 705.4)

Proponent: Wanda Edwards, Wanda Edwards Consulting, Inc., representing RCI, Inc. (wedwards@rci-online.org)

2018 International Building Code

SECTION 1511
REROOFING

1511.3.1 Roof recover. The installation of a new roof covering over an existing roof covering shall be permitted where any of the following conditions occur:

1. Where the new roof covering is installed in accordance with the roof covering manufacturer's approved instructions.
2. Complete and separate roofing systems, such as standing-seam metal roof panel systems, that are designed to transmit the roof loads directly to the building's structural system and that do not rely on existing roofs and roof coverings for support, shall not require the removal of existing roof coverings.
3. Metal panel, metal shingle and concrete and clay tile roof coverings shall be permitted to be installed over existing wood shake roofs when applied in accordance with Section 1511.4.
4. The application of a new protective roof coating over an existing protective roof coating, metal roof panel, built-up roof, spray polyurethane foam roofing system, metal roof shingles, mineral-surfaced roll roofing, modified bitumen roofing or thermoset and thermoplastic single-ply roofing shall be permitted without tear off of existing roof coverings.

Revise as follows:

1511.3.1.1 Exceptions. A *roof recover* shall not be permitted where any of the following conditions occur:

1. Where the existing roof or roof covering is water soaked or has deteriorated to the point that the existing roof or roof covering is not adequate as a base for additional roofing.
2. Where the existing roof covering is slate, clay, cement or asbestos-cement tile.
3. Where the existing roof has two or more applications of any type of roof covering.
4. Where the existing roof covering is wood shakes or shingles and the roof covering was not installed in accordance with Section 1511.4

1511.4 Roof recovering. Where the application of a new roof covering over wood shingle or shake roofs creates a combustible concealed space, the entire existing surface shall be covered with gypsum board, mineral fiber, glass fiber or other *approved* materials securely fastened in place. The installation of a new roof covering over wood shakes or shingles shall require the entire existing surface be covered with gypsum board or other approved rigid materials to provide for secure fastening.

Reason: Most manufacturers recommend the installation of a rigid decking material over the wood shakes or shingles to provide a solid surface for the securement of the new roof cover. The roof is being recovered because of deterioration of the wood shake or shingles and may be rotten and unable to provide a solid surface for fasteners to maintain attachment. Without a rigid deck and rotten or decayed shakes or shingles the fasteners will not keep the new roof covering attached. The installation of rigid deck also prevents seeing undulations in the new roof covering.

Cost Impact: The code change proposal will increase the cost of construction
There may be some increase in the cost of construction if the manufacturers installation instructions do not require the installation of a rigid decking material over the wood shakes or shingles. If the manufactuers installation instructions require the rigid decking material there is no increase in cost.

Proposal # 5569

S8-19

IBC: SECTION 1511 (IEBC 705), 1511.1 (IEBC 705.1)

Proponent: Mark Graham, representing National Roofing Contractors Association (NRCA) (mgraham@nrca.net)

2018 International Building Code

SECTION 1511
REROOFING

Revise as follows:

1511.1 General. Materials and methods of application used for recovering or replacing an existing roof covering shall comply with the requirements of ~~Chapter 15.~~ this section and Sections 1503 through 1509.

~~Exceptions~~ Exception:

~~1.~~ *Roof replacement* or *roof recover* of existing low-slope roof coverings shall not be required to meet the minimum design slope requirement of one-quarter unit vertical in 12 units horizontal (2-percent slope) in Section 1507 for roofs that provide positive roof drainage.

~~2. Recovering or replacing an existing roof covering shall not be required to meet the requirement for secondary (emergency overflow) drains or scuppers in Section 1503.4 for roofs that provide for positive roof drainage. For the purposes of this exception, existing secondary drainage or scupper systems required in accordance with this code shall not be removed unless they are replaced by secondary drains or scuppers designed and installed in accordance with Section 1503.4.~~

Reason: This code change proposal is intended to clarify the code's intent regarding reroofing, including roof re-covering and roof replacement. A reroofing project is not intended to require the need to upgrade any rooftop structures (Section 1510-Rooftop Structures) to the edition of the code that is current at the time of reroofing. A literal interpretation of the code's current requirement in Section 1511.1-General can be interpreted to require any rooftop structures to be upgraded when reroofing.

Similarly, a reroofing project is not intended to require the need to upgrade the roof area's roof drainage (Section 1502-Roof Drainage) to the edition of the code that is current at the time of reroofing. This is already addressed, in part, in Section 1511.1, Exception 2.

Limiting the sections of Chapter 15 applicable to reroofing addresses these issues and allows for eliminating Section 1511.1's Exception 2.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This code change proposal clarifies the code's intent; it is not intended to increase or decrease the stringency of the code.

Proposal # 5414

S9-19

IBC: 1511.1 (IEBC 705.1)

Proponent: Wanda Edwards, Wanda Edwards Consulting, Inc., representing RCI, Inc. (wedwards@rci-online.org)

2018 International Building Code

SECTION 1511
REROOFING

Revise as follows:

1511.1 General. Materials and methods of application used for recovering or replacing an existing roof covering shall comply with the requirements of Chapter 15.

~~Exceptions~~**Exception:**

~~1.~~*Roof replacement* or *roof recover* of existing low-slope roof coverings shall not be required to meet the minimum design slope requirement of one-quarter unit vertical in 12 units horizontal (2-percent slope) in Section 1507 for roofs that provide positive roof drainage.
~~2.Recovering or replacing an existing roof covering shall not be required to meet the requirement for secondary (emergency overflow) drains or scuppers in Section 1503.4 for roofs that provide for positive roof drainage. For the purposes of this exception, existing secondary drainage or scupper systems required in accordance with this code shall not be removed unless they are replaced by secondary drains or scuppers designed and installed in accordance with Section 1503.4.~~

Reason: In 2015 the IBC added Exception #2 to Section 1511.1. This exception allows a roof replacement or roof recover to omit secondary drainage if none is present on the existing roof and the roof provides positive drainage. Roofs that provide positive roof drainage do not meet the minimum slope code requirement of ¼" inch per foot. This exception has created a serious life safety issue because roofs that do not provide adequate slope are prone to collapse when the rainwater accumulation exceeds the design values.
There are several reasons for roof collapses. First, many existing buildings were built before the code addressed requirements related to roof slope, roof drains or scuppers. Existing roofs may not have adequate slope or an adequate secondary drainage system and what exists does not meet any code. Most roof collapses are due to inadequate overflow drainage or inadequate slope. Frequently, the structural engineer is not involved in the drainage design nor is a ponding analysis performed, and this exception does not require the installation of secondary drainage.

In a white paper presented at the 2018 RCI Annual Convention, Dr. Steve Patterson, PE and Dr. Medan Mehta, PE details the problems of not installing secondary roof drainage and the failures that they have investigated. The paper gives an in-depth analysis of roof drainage design and how water accumulates on the roof and results in collapse. The paper also reviews the code history of drainage design and requirements. Their research confirmed that secondary drainage has been a code requirement since the 80's. Exception #2 of Section 1511.1 represents the deletion of a long-standing code requirement. Roof drainage is one of the most important roof design elements and the overflow drainage is its most part – the function of the overflow drainage is to prevent the roof from collapsing – an important life safety issue. For these reasons, secondary drainage should once again be required in the code.

Bibliography: Steve Patterson and Medan Mehta. Roof Drainage Design, Roof Collapses and the Codes. March 2018, 32nd Annual RCI Convention proceedings, page 122.

Cost Impact: The code change proposal will increase the cost of construction
When compared to the 2018 IBC, the proposal will increase the cost of construction. However, comparing the proposal to the 2012 IBC, there will be no increase in cost.

S10-19

IBC: 1511.5 (IEBC 705.5)

Proponent: Mark Graham, National Roofing Contractors Association (NRCA), representing National Roofing Contractors Association (NRCA) (mgraham@nrca.net)

2018 International Building Code

Revise as follows:

1511.5 Reinstallation of materials. Existing slate, clay or cement tile shall be permitted for reinstallation, except that damaged, cracked or broken slate or tile shall not be reinstalled. Existing vent flashing, metal edgings, drain outlets, collars and metal counterflashings shall not be reinstalled where rusted, damaged or deteriorated. ~~Aggregate~~ Existing ballast that is damaged, cracked or broken shall not be reinstalled. Existing aggregate surfacing materials from built-up roofs shall not be reinstalled.

Reason: This proposal is intended to clarify the intent of the code.
Small diameter aggregate, such as that used as surfacing on built-up roof membranes, is generally considered not appropriate for re-use because the aggregate is contaminated with the existing roof's bitumen flood coat; this is already addressed in the last sentence of Sec. 1511.5. However, it is recognized in the roof industry existing aggregate ballast and pavers, such as that used on ballasted single-ply membrane roof systems, is appropropriate for re-use, provided the pavers are not damanged, cracked or broken. Since the code's current language prohibiting the re-use of aggregate surfacing can be interpreted as also applying to aggregate and paver ballast, aggregate and paver ballast is sometimes disposed of unnecessarily.

This proposal is intended to provide differentiation between aggregate and paver ballast, and aggregate surfacing using the code's already existing terminology and is intended to eliminate the need for unnecessarily disposing of roof ballast materials.

Cost Impact: The code change proposal will decrease the cost of construction
In situations where existing aggreate or paver ballast is re-used, the material cost of the aggregate or paver ballast is saved.

Proposal # 4822

S15-19

IBC®: 1504.4, 1504.8

Proponent: Amanda Hickman, The Hickman Group, representing The Single-Ply Roofing Industry (SPRI) (amanda@thehickmangroup.com); Jay Crandell, P.E., ARES Consulting, representing self (jcrandell@aresconsulting.biz)

2018 International Building Code

Revise as follows:

1504.4 Ballasted low-slope single-ply roof systems. Ballasted low-slope (roof slope < 2:12) single-ply roof system coverings installed in accordance with Sections 1507.12 and 1507.13 shall be designed in accordance with ~~Section 1504.8 and~~ ANSI/SPRI RP-4.

1504.8 Surfacing and ballast materials in hurricane-prone regions. For a building located in a hurricane-prone region as defined in Section 202, or on any other building with a mean roof height exceeding that permitted by Table 1504.8 based on the exposure category and basic wind speed at the site, the following materials shall not be used on the roof:

1. Aggregate used as surfacing for roof coverings.
2. Aggregate, gravel or stone used as ballast.

Exception: Ballasted single-ply roof systems complying with Section 1504.4

Reason: This proposal makes a much-needed correction to section 1504.4 for ballasted roof systems for low-slope single-ply roofs. This proposal revises Section 1504.4 so that ballasted roofs comply with ANSI/SPRI RP-4 and not 1504.8. The requirements in RP-4 were developed for the appropriate application, installation and to prevent ballast scour for this specific type of single-ply ballasted system. The scour wind speed is below that at which blowoff would occur. It also provides design options for various conditions.
Section 1504.8 is based on the wind speeds for blow-off and only deals with smaller aggregate used for surfacing of built up roofs (BUR) and sprayed polyurethane foam (SPUF) roofs, which are completely different systems than ballasted roofs. For this reason an exception has been added in Section 1504.8 for ballasted single-ply roof systems complying with Section 1504.4.

The requirements in ANSI/SPRI RP-4 are based on a complete set of wind tunnel tests conducted in the largest commercially available wind tunnel in North America located at the National Research Council Canada. In this test series all variables that would impact the wind performance of ballasted single ply roof assemblies were evaluated, including stone size and size distribution as specified in ASTM D7655 Standard Classification for Size of stone used as ballast for membrane roof systems.

In this series of tests three critical windspeeds were identified for each condition of parapet height and stone size, windspeed 1 is the speed at which the stone distribution first begins to move, windspeed 2 is the speed is that which if maintained would result in stone scouring, and windspeed three is the speed at which stone blow-off occurs. The requirements in the Design Table of ANSI/SPRI RP-4 are based on windspeed 2, or the windspeed at which stone scour would occur.

The requirements of this standard have been updated based on field performance and in the most recent edition the design tables have been revised to reflect current methodology for interpreting wind tunnel data. Section 1504.8 does not consider the critical variables of parapet height and stone size and should not be applicable to ballasted single ply roof systems.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal only clarifies what design requirements are to be used for ballasted single-ply roof systems.

Proposal # 4545

S18-19

IBC®: 1504.7

Proponent: Mike Fischer, representing The Asphalt Roofing Manufacturers Association (mfischer@kellencompany.com)

2018 International Building Code

Revise as follows:

1504.7 Impact resistance. Roof coverings installed on low-slope roofs (roof slope < 2:12) in accordance with Section 1507 shall resist impact damage based on the results of tests conducted in accordance with ASTM D3746, ASTM D4272 or the "Resistance to Foot Traffic Test" in ~~Section 5.5 of~~ FM 4470.

Reason: The proposal removes the section reference to avoid correlation issues should the referenced standard section numbering be revised in the future. The correct refernce is section 4.6 of FM 4470 which has been corrected from section 5.5 per the errata for IBC 2018.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The proposal is editorial.

Proposal # 5681

S19-19

IBC: 1504.8, 1607.13.6 (New)

Proponent: Edwin Huston, representing National Council of Structural Engineers' Associations (NCSEA (huston@smithhustoninc.com)

2018 International Building Code

Revise as follows:

1504.8 Surfacing and ballast materials in hurricane-prone regions. For a building located in a hurricane-prone region as defined in Section 202, or on any other building with a mean roof height exceeding that permitted by Table 1504.8 based on the exposure category and basic wind speed at the site, the following materials shall not be used on the roof:

1. Aggregate used as surfacing for roof coverings.
2. Aggregate, gravel or stone used as ballast.

Exception: A roof that complies with all of the following:

1. A parapet is placed on all exterior sides of the roof.
2. The parapet is tall enough to retain the volume of roofing material, regardless of wind direction.
3. The roof and parapet are designed for the additional live load of the retained aggregate at the edge of the roof.

Add new text as follows:

1607.13.6 Surfacing and ballast materials. For a building located in a hurricane-prone region, or on any other building with a mean roof height exceeding that permitted by Table 1504.8 based on the exposure category and basic wind speed at the site, where aggregate is used as surfacing for roof coverings or aggregate, gravel or stone is used as ballast and a parapet is placed on all exterior sides of the roof to retain the volume of roofing material, the roof and parapet shall be designed for the additional live load of the retained aggregate, regardless of wind direction.

Reason: In the 2018 code change cycle, S20-16 proposed the replacement of Table 1504.8 with a table that would allow aggregate roofing systems to be used on roofs in various wind speed and wind exposure conditions if the building being designed had a parapet whose minimum height equaled or exceeded the parapet height noted in the revised table.
The reason statement for the 2018 code change S20-16 implies that this proposal was based on "the K-W design method (Kind Wardlaw 1976), the wind tunnel studies underlying the KW design method (Kind 1977), or a quantitative analysis of observed good and bad roofing system performances in real wind events".

NCSEA opposed S20-16. The proposal was revised by a public comment from the proponents, which was unsuccessful. However, members of the Structural Committee appeared to be in favor of using parapets to retain roofing aggregate.

Aggregate blow-off from roofs was reported in Houston, TX during Hurricane Alicia in 1982, in Miami-Dade County, FL during Hurricane Andrew, in New Orleans, LA during Hurricane Katrina, and in other cities during these and other events. After Hurricane Katrina, the NCSEA Code Advisory Committee witnessed the damage to the glazing systems of The New Orleans Shopping Center Office Building and The Amoco Building both of which were on Poydrus Street in New Orleans, LA. The glazing systems of these buildings were damaged by aggregate blown off buildings on the north side of Poydrus Street. We also witnessed the damage to the glazing system of the Hyatt Regency Hotel from the vantage point of the roof of the Amoco Building. The Amoco Building previously had an aggregate ballasted roof. Most of the aggregate had been blown off of the roof. Much of the aggregate that remained on the roof was ramped up against the parapet on the south side of the building. Once the aggregate ramp height equaled the parapet height, the remaining aggregate was swept up the ramp and off the roof. Directly south of the Amoco Building, windows of the Hyatt Regency Hotel had been broken (see Figure 1), and aggregate was retrieved from the bedrooms of the hotel.

Figure 1 - Glazing failures in Hyatt Regency Hotel, New Orleans, LA following Hurricane Katrina.

Source NCSEA Code Advisory Committee

Wind speeds in New Orleans, LA during Hurricane Katrina were reported as being less than the design wind speeds from ASCE7.

In the 2006 Public Comment Hearing John Loscheider testified that the national roofing Contractors Association's magazine reported aggregate roofing blow-off damage to other buildings in New Orleans after Hurricane Katrina.

The presence of aggregate ramps and aggregate blow-off has been reported previously. For example, aggregate ramps were observed against the six-foot tall parapets of the National Hurricane Center in Miami after Hurricane Andrew. We understand that aggregate blow-off from this roof was also reported.

This code change proposal would allow buildings, whose height exceeds the limitations of Table 1504.8, to be constructed using an aggregate surfaced or aggregate ballasted roof, if the building had a parapet that was of sufficient height that it could retain the volume of aggregate.

We note that there are other alternates to aggregate used as surfacing for roof coverings or for aggregate, gravel or stone used as ballast. They are probably more expensive, but we believe that they are almost certainly less expensive than the window replacement costs due to aggregate blow-off.

If the aggregate is transported to the edge of the roof, there may be the need for additional gravity load capacity. This requirement is dealt with by adding section 1607.13.6.

Bibliography: Crandell, J. H. and Smith, T.L. (2010) Design Method Improvements to Prevent Roof Aggregate Blow-Off, Hugo Conference International Building Code. Falls Church, VA

Kind, R.J. and Wardlaw R.L. (1976). Design of Rooftops Against Gravel Blow-Off. National Aeronautical Establishment, National Research Council, Canada. Kind, R.J. (1977). Further Wind Tunnel Tests on Building Models to Measure Wind Speeds at Which Gravel is Blown Off Rooftops. LTR-LA-189. National Aeronautical Establishment, National Research Council, Canada.

National Institute of Standards and Technology, Technical Note 1476 (2006) Performance of Physical Structures in Hurricane Katrina and Hurricane Rita: A Reconnaissance Report

Federal Emergency Management Agency FIA-22 (1993, Building Performance: Hurricane Andrew in Florida

Federal Emergency Management Agency FEMA 548 (2006), Summary Report on Building Performance Hurricane Katrina 2005

Cost Impact: The code change proposal will increase the cost of construction

Increasing parapet height may increase the cost of construction if the parapet retention system is used, but it is not mandated, it is listed as an alternate. Another roofing alternative may be less expensive.

Proposal # 5465

S19-19

S20-19

IBC®: 1504.8

Proponent: Jay Crandell, P.E., ARES Consulting, representing self (jcrandell@aresconsulting.biz); Ellen Thorp, EPDM Roofing Association; Mike Fischer (mfischer@kellencompany.com)

2018 International Building Code

Revise as follows:

1504.8 Surfacing and ballast materials in hurricane-prone regions. For a building located in a hurricane-prone region as defined in Section 202, or on any other building with a mean roof height exceeding that permitted by Table 1504.8 based on the exposure category and basic wind speed at the site, the following materials shall not be used on the roof:

1. Aggregate used as surfacing for roof coverings.
2. Aggregate, gravel or stone used as ballast.

Exception: Where the aggregate surfaced roof system and parapets shall be designed by a *registered design professional* to control aggregate blow-off.

Reason: There are proven and accepted design methods to control aggregate blow-off from roofs which are superior to those in Table 1504.8. These include the prescribed provisions in the code-referenced ANSI/SPRI RP-4 standard and also the design methodology used to develop those provisions (Kind and Wardlaw, 1976). Newer methodologies based on Kind and Wardlaw (1976) are explained and verified as being effective based on comparison to numerous sources of field data (Crandell and Smith, 2009; Crandell and Fischer, 2010; Morrison, 2011).
Why is this important? The provisions of existing Table 1504.8 lack any requirement for use of parapets for building heights of up to 170-feet in height because the science and design approach behind the table is seriously flawed. Consequently, the requirements in Table 1504.8 are incomplete and potentially unsafe. For these reasons, alternative solutions by registered design professionals should be explicitly permitted. This proposal is also compatible with a separate proposal (by the same proponents) to fix the many problems with existing Table 1504.8 and Section 1504.8 as explained in the reason statement to that proposal.

Bibliography: Crandell, J. H. and Smith, T.L.. (2010) Design Method Improvements to Prevent Roof Aggregate Blow -Off, Hurricane Hugo 20th Anniversary Symposium on Building Safer Communities – Improving Disaster Resistance, ATC-77, North Charleston, SC, October 22-23, 2009
Kind, R.J. and Wardlaw R.L. (1976). Design of Rooftops Against Gravel Blow -Off. National Aeronautical Establishment, National Research Council, Canada.

Crandell, J. H. and Fischer, M. (2010). Winds of Change: Resolving Roof Aggregate Blow -Off, RCI 25th International Convention and Trade Show, March 25-30, 2010, RCI, Inc., Raleigh, NC

Morrison, R.V. (2011). Field Investigation of Aggregate Blow-off of Spray Polyurethane Foam Roofs, *RCI Interface*, Technical Journal of RCI, Inc. (presented at RICOWI Fall Symposium, November 11, 2010)

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The proposed exception provides an alternative to Table 1504.8 and does not replace or change it.

Proposal # 5001

S21-19

IBC®: 1504.8, TABLE 1504.8

Proponent: Jay Crandell, P.E., ARES Consulting, representing self; Mike Fischer (mfischer@kellencompany.com); Ellen Thorp, EPDM Roofing Association

2018 International Building Code

Delete and substitute as follows:

~~**1504.8 Surfacing and ballast materials in hurricane-prone regions.** For a building located in a hurricane-prone region as defined in Section 202, or on any other building with a mean roof height exceeding that permitted by Table 1504.8 based on the exposure category and basic wind speed at the site, the following materials shall not be used on the roof:~~

~~1. Aggregate used as surfacing for roof coverings.~~
~~2. Aggregate, gravel or stone used as ballast.~~

1504.8 Wind resistance of aggregate-surfaced roofs. Aggregate surfaced roofs shall comply with Table 1504.8.

~~**TABLE 1504.8**~~
~~**MAXIMUM ALLOWABLE MEAN ROOF HEIGHT PERMITTED FOR BUILDINGS WITH AGGREGATE ON THE ROOF IN AREAS OUTSIDE A HURRICANE-PRONE REGION**~~

~~NOMINAL DESIGN WIND SPEED, V_{asd} (mph)[b, d]~~	~~MAXIMUM MEAN ROOF HEIGHT (ft)[a, c]~~		
	~~Exposure category~~		
	~~B~~	~~C~~	~~D~~
~~85~~	~~170~~	~~60~~	~~30~~
~~90~~	~~110~~	~~35~~	~~15~~
~~95~~	~~75~~	~~20~~	~~NP~~
~~100~~	~~55~~	~~15~~	~~NP~~
~~105~~	~~40~~	~~NP~~	~~NP~~
~~110~~	~~30~~	~~NP~~	~~NP~~
~~115~~	~~20~~	~~NP~~	~~NP~~
~~120~~	~~15~~	~~NP~~	~~NP~~
~~Greater than 120~~	~~NP~~	~~NP~~	~~NP~~

~~For SI:1 foot = 304.8 mm; 1 mile per hour = 0.447 m/s.~~

~~a. Mean roof height as defined in ASCE 7.~~
~~b. For intermediate values of V_{asd}, the height associated with the next higher value of V_{asd} shall be used, or direct interpolation is permitted.~~
~~c. NP = gravel and stone not permitted for any roof height.~~
~~d. V_{asd} shall be determined in accordance with Section 1609.3.1.~~

TABLE 1504.8
MINIMUM REQUIRED PARAPET HEIGHT (INCHES) FOR AGGREGATE SURFACED ROOFS[a,b,c]

AGGREGATE SIZE	MEAN ROOF HEIGHT (ft)	WIND EXPOSURE AND BASIC DESIGN WIND SPEED (MPH)																		
		Exposure B									Exposure C[d]									
		<=95	100	105	110	115	120	130	140	150	<=95	100	105	110	115	120	130	140	150
ASTM D1863 (No.7 or No.67) or ASTM D7655 (No.4)	15	2	2	2	2	12	12	16	20	24	2	13	15	18	20	23	27	32	37
	20	2	2	2	2	12	14	18	22	26	12	15	17	19	22	24	29	34	39
	30	2	2	2	13	15	17	21	25	30	14	17	19	22	24	27	32	37	42
	50	12	12	14	16	18	21	25	30	35	17	19	22	25	28	30	36	41	47
	100	14	16	19	21	24	27	32	37	42	21	24	26	29	32	35	41	47	53

	150	17	19	22	25	27	30	36	41	46	23	26	29	32	35	38	44	50	56
ASTM D1863 (No.6)	15	2	2	2	2	12	12	12	15	18	2	2	2	13	15	17	22	26	30
	20	2	2	2	2	12	12	13	17	21	2	2	12	15	17	19	23	28	32
	30	2	2	2	2	12	12	16	20	24	2	12	14	17	19	21	26	31	35
	50	12	12	12	12	14	16	20	24	28	12	15	17	19	22	24	29	34	39
	100	12	12	14	16	19	21	26	30	35	16	18	21	24	26	29	34	39	45
	150	12	14	17	19	22	24	29	34	39	18	21	23	26	29	32	37	43	48

For SI: 1 inch = 25.4 mm; 1 foot = 304.8 mm; 1 mile per hour = 0.447 m/s.

a.Interpolation shall be permitted for mean roof height and parapet height.

b. Basic design wind speed, V, and wind exposure shall be determined in accordance with Section 1609.

c. Where the minimum required parapet height is indicated to be 2 inches (51 mm), a gravel stop shall be permitted and shall extend not less than 2 inches (51 mm) from the roof surface and not less than the height of the aggregate.

d. For Exposure D, add 8 inches (203 mm) to the parapet height required for Exposure C and the parapet height shall not be less than 12 inches (305 mm).

Reason: In summary, this proposal has the following features:
1. Updates Table 1504.8 to a “basic design wind speed” basis and eliminates use of ASD wind speed to be consistent with changes made throughout the IBC in previous cycle to correlate with newer wind maps based on “ultimate” wind speeds (now called basic design wind speed).

2. Provides an engineering and scientific basis for roof design to prevent aggregate blow-off based on over 200 wind tunnel tests coupled with subsequent field studies from several different hurricane events with documented conditions and performance. See Bibliography (Kind-Wardlaw, 1976; Kind, 1977; Crandell & Smith, 2009; Crandell & Fischer, 2010; etc.)

3. Corrects unsafe conditions that the current Table 1504.8 allows based on scientifically incorrect assumptions (e.g., allows 170’ tall buildings with aggregate surfaced roofs and NO PARAPET).

4. Accounts for aggregate size distribution in the referenced ASTM aggregate standards, including the minimum permitted aggregate size in the referenced mixes as addressed in the referenced wind tunnel studies for this proposal which replicated actual aggregate size distribution (Kind, 1977) as also confirmed in field studies (e.g., Crandell & Smith, 2009).

5. Has been independently confirmed by later field study subsequent to the original research with the purpose of verifying the accuracy and effectiveness of the design methodology based on actual performance of real buildings and real hurricane events (Morrison, 2011).

This proposal is consistent with S19-16 and a public comment (PC#2) that was submitted in response to the structural committee’s direction in 2016. The public comment was approved at public hearing only to be spuriously overturned during the on-line governmental vote. What follows, for the record, are the reason statements from the original S19-16 proposal and PC#2 (with modest editing to fit the context of this proposal):

A) From the original S19-16 proposal (excerpt slightly edited):

The current provisions in Section 1504.8, and specifically Table 1504.8, are not based on the Kind-Wardlaw (K-W) design method (Kind Wardlaw 1976), the wind tunnel studies underlying the K-W design method (Kind 1977), or a quantitative analysis of observed good and bad roofing system performances in real wind events. Instead, current building code requirements are based on variation in surface pressure with building height which is known to be an inappropriate predictor of aggregate blow -off or scour due to pressure equalization effects (Smith, 1997). Furthermore, these recent requirements do not address critical parameters such as aggregate size and parapet height which govern performance. This code change proposal replaces the current Table 1504.8 with one based on the K-W design method and new research by the Asphalt Roofing Manufacturers Association (ARMA) (Crandell and Fischer, 2010). Results demonstrate that the use of aggregate-surfaced roofing systems is a viable option in high wind areas with appropriate aggregate sizing and parapet design. The K-W design method has been simplified, improved, and calibrated to a number of field observations from actual hurricane events to refine its application to low-slope, built-up roof (BUR) and sprayed polyurethane foam (SPF) roof systems (Crandell Smith, 2009).

B) From PC2 on S19-16 (slightly edited):

In response to the structural committee's comments and indication that “this proposal is headed in the right direction”, this public comment addresses the committee's recommendation to simplify and improve readability of the table (which was partly a font size or CDP access table

formatting issue). These revisions are technically consistent with the original S19-16 proposal and the referenced research.

The 2016 committee also mentioned that questions were raised with regard to how the provisions were developed from the referenced research. The methodology (and design procedure) is clearly documented in the referenced research in an understandable, repeatable, and scientific manner (see original S19-16 proposal's reason statement (above) and bibliography (below) for referenced research reports and papers. The procedure used is consistent with the findings of many wind tunnel studies and uses the same principles as applied in the ANSI/SPRI RP-4 standard currently referenced in the code. It is also consistent with the treatment of aggregate blow-off as incorporated in wind risk models. Furthermore, the analytical procedure was evaluated by comparison to numerous documented field studies of successful and failed loose aggregate surfaced roofs systems in various high wind events to confirm its ability to reliably predict performance as a means to design roofs (or develop prescriptive provisions as proposed) to prevent roof aggregate blow-off. Thus, a robust combination of current engineering practice, wind tunnel data, and field research was used to support development of the requirements as proposed for Table 1504.8.

However, this proposal does not merely provide a more academic solution. It is necessary to correct deficiencies in the current code provisions. For example, the current Table 1504.8 allows buildings up to 170' tall or buildings in areas with design wind speeds up to 120 mph with NO PARAPET which creates a general safety hazard (e.g., falling debris from the roof) and unacceptable wind damage vulnerability (i.e., aggregate blow-off risk). This proposal corrects this safety and building performance issue based on correct scientific principles and sound engineering practices.

If implemented, this proposal will serve to prevent many past observations of roof aggregate blow-off from being repeated. Simply put, this proposal is implementing lessons learned in a rational, scientific manner based on real-world and wind tunnel laboratory data to prevent history from repeating itself in an unfavorable manner. Any argument against this proposal as being inadequate is an argument to leave the code in a far worse condition from a building safety and performance standpoint.

In closing, the following quote from Morrison (2011) provides independent, confirmation of the design methodology used for this proposal and is based on the documented performance (and aggregate and parapet conditions) of 20 buildings with aggregate surfaced roofs experiencing Hurricanes Francis and Jeanne in 2004:

"The major intent of this study was to determine the validity of Crandell's Modified Kind-Wardlaw Design Method for Buildings of All Heights [Crandell & Smith, 2009; Crandell & Fischer, 2010].

An X-value calculation was determined to compare the adjusted critical wind speed (Vcr') to the actual estimated wind speed (Vroof). Per Crandell's Method, a positive X-value would be "safe" from the standpoint of aggregate blow-off. Indeed, this was consistent with the observations.

In fact, Crandell's Method appears to be quite conservative since 12 of the 20 roofs observed had negative X-values but no observed or reported aggregate blow-off. The single roof that did experience blow-off had an X-value of -52. While this might suggest that Crandell's Method has a "safety factor" of about 50 mph wind speed, this is only one sample, and there were multiple uncertainties in this analysis."

In summary, this proposal is a significant improvement of the existing provisions in the code and will result in better performing and safer aggregate surfaced roofs based on a proven and robust design approach.

Bibliography: Crandell, J. H. and Smith, T.L.. (2009) Design Method Improvements to Prevent Roof Aggregate Blow -Off, Hurricane Hugo 20th Anniversary Symposium on Building Safer Communities – Improving Disaster Resistance, ATC-77, North Charleston, SC, October 22-23, 2009 Kind, R.J. and Wardlaw R.L. (1976). Design of Rooftops Against Gravel Blow -Off. National Aeronautical Establishment, National Research Council, Canada.

Kind, R.J. (1977). Further Wind Tunnel Tests on Building Models to Measure Wind Speeds at Which Gravel is Blow n Off Rooftops. LTR-LA-189. National Aeronautical Establishment, National Research Council, Canada.

Smith, T.L. (June 1997). Aggregate Blow -Off from BUR and SPF Roofs: Recognizing the Potential Hazards and Avoiding Problems. Proceedings of The 8th U.S. Conference on Wind

Engineering, AAWE.

ANSI/SPRI RP-4 (2013). Wind Design Standard for Ballasted Single-Ply Roofing Systems. SPRI, Waltham, MA (www.spri.org)

Crandell, J. H. and Fischer, M. (2010). Winds of Change: Resolving Roof Aggregate Blow -Off, RCI 25th International Convention and Trade Show, March 25-30, 2010, RCI, Inc., Raleigh, NC

Morrison, R.V. (2011). Field Investigation of Aggregate Blow-off of Spray Polyurethane Foam Roofs, *RCI Interface*, Technical Journal of RCI, Inc. (presented at RICOWI Fall Symposium, November 11, 2010)

Cost Impact: The code change proposal will increase the cost of construction

Overall, the proposed new Table 1504.8 will provide additional options for use of aggregate surfaced roofs that are safer than the current provisions and which may reduce cost. In some cases, depending on current practice and the basic design wind speed condition for a building site, a parapet (or taller parapet) and/or larger aggregate may be required for compliance. In these cases, an incremental cost increase can be expected.

Proposal # 5005

S21-19

S22-19

IBC®: SECTION 1506 (New), 1506.1

Proponent: Mark Graham, National Roofing Contractors Association (NRCA), representing National Roofing Contractors Association (NRCA) (mgraham@nrca.net)

2018 International Building Code

SECTION 1506
MATERIALS

Revise as follows:

1506.1 Scope. The requirements set forth in this section shall apply to the application of roof-covering materials specified herein. Roof coverings shall be applied in accordance with this chapter and the ~~manufacturer's installation instructions.~~ roof covering listing. Installation of roof coverings shall comply with the applicable provisions of Section 1507.

Reason: This code change proposal is intended to clarify the intent of the code.
The requirement for roof coverings "...be applied in accordance with... the manufacturer's installation instructions." is unnecessary and redundant in this section because this is already required in Section 1507-Requirements for Roof Coverings.

A requirement for the roofing covering to be applied according to the listing is added here for clarity. Section 1505-Fire Classification already requires roof assemlbies and roof coverings to be listed and Section 1506.3 requires materials and product packaging to bear testing agency labels.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The strigency of the code is not increased or decreased by this code change proposal.

Proposal # 4961

S23-19

IBC®: 1507.1.1, TABLE 1507.1.1(1), ASTM Chapter 35 (New)

Proponent: Gregory Keeler, representing Owens Corning (greg.keeler@owenscorning.com)

2018 International Building Code

Revise as follows:

1507.1.1 Underlayment. Underlayment for asphalt shingles, clay and concrete tile, metal roof shingles, mineral-surfaced roll roofing, slate and slate-type shingles, wood shingles, wood shakes, metal roof panels and *photovoltaic shingles* shall conform to the applicable standards listed in this chapter. Underlayment materials required to comply with ASTM D226, D1970, D4869, ~~and~~ D6757 and ASTM WK51913 shall bear a label indicating compliance with the standard designation and, if applicable, type classification indicated in Table 1507.1.1(1). Underlayment shall be applied in accordance with Table 1507.1.1(2). Underlayment shall be attached in accordance with Table 1507.1.1(3).

Exceptions:

1. As an alternative, self-adhering polymer modified bitumen underlayment complying with ASTM D1970 and installed in accordance with the manufacturer's installation instructions for the deck material, roof ventilation configuration and climate exposure for the roof covering to be installed shall be permitted.
2. As an alternative, a minimum 4-inch-wide (102 mm) strip of self-adhering polymer modified bitumen membrane complying with ASTM D1970 and installed in accordance with the manufacturer's installation instructions for the deck material shall be applied over all joints in the roof decking. An approved underlayment for the applicable roof covering for design wind speeds less than 120 mph (54 m/s) shall be applied over the 4-inch-wide (102 mm) membrane strips.
3. As an alternative, two layers of underlayment complying with ASTM D226 Type II ~~or~~ , ASTM D4869 Type IV , ASTM WK51913 shall be permitted to be installed as follows: Apply a 19-inch (483 mm) strip of underlayment parallel with the eave. Starting at the eave, apply 36-inch-wide (914 mm) strips of underlayment ~~felt~~, overlapping successive sheets 19 inches (483 mm). The underlayment shall be attached with corrosion-resistant fasteners in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at side and end laps. End laps shall be 4 inches (102 mm) and shall be offset by 6 feet (1829 mm). Underlayment shall be attached using metal or plastic cap nails with a nominal cap diameter of not less than 1 inch (25.4 mm). Metal caps shall have a thickness of not less than 32-gage sheet metal. Power-driven metal caps shall have a thickness of not less than 0.010 inch (mm). Thickness of the outside edge of plastic caps shall be not less than 0.035 inch (mm). The cap nail shank shall be not less than 0.083 inch for ring shank cap nails and 0.091 inch (mm) for smooth shank cap nails. The cap nail shank shall have a length sufficient to penetrate through the roof sheathing or not less than $^3/_4$ inch (19.1 mm) into the roof sheathing.
4. Structural metal panels that do not require a substrate or underlayment.

TABLE 1507.1.1(1)
UNDERLAYMENT TYPES

ROOF COVERING	SECTION	MAXIMUM BASIC DESIGN WIND SPEED, V < 140 MPH	MAXIMUM BASIC DESIGN WIND SPEED, V ≥ 140 MPH
Asphalt shingles	1507.2	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV ASTM D6757 ASTM WK51913	ASTM D226 Type II ASTM D4869 Type IV ASTM D6757 ASTM WK51913
Clay and concrete tiles	1507.3	ASTM D226 Type II ASTM WK51913 ASTM D2626 Type I ASTM D6380 Class M mineral surfaced roll roofing	ASTM D226 Type II ASTM WK51913 ASTM D2626 Type I ASTM D6380 Class M mineral surfaced roll roofing
Metal panels	1507.4	Manufacturer's instructions	ASTM D226 Type II ASTM D4869 Type IV ASTM WK51913

Metal roof shingles	1507.5	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV ASTM WK51913	ASTM D226 Type II ASTM D4869 Type IV ASTM WK51913
Mineral-surfaced roll roofing	1507.6	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV ASTM WK51913	ASTM D226 Type II ASTM D4869 Type IV ASTM WK51913
Slate shingles	1507.7	ASTM D226 Type II ASTM D4869 Type III or IV ASTM WK51913	ASTM D226 Type II ASTM D4869 Type IV ASTM WK51913
Wood shingles	1507.8	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV ASTM WK51913	ASTM D226 Type II ASTM D4869 Type IV ASTM WK51913
Wood shakes	1507.9	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV ASTM WK51913	ASTM D226 Type II ASTM D4869 Type IV ASTM WK51913
Photovoltaic shingles	1507.17	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV ASTM D6757 ASTM WK51913	ASTM D226 Type II ASTM D4869 Type IV ASTM D6757 ASTM WK51913

Add new text as follows:

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428-2959

WK51913: New Specification for Mechanically Attached Polymeric Roof Underlayment Used in Steep Slope Roofing

Reason: This proposal references an ASTM Work Item for a new ASTM Standard that will apply exclusively to synthetic underlayments. The proposal simply stipulates new performance requirements for products that are already in widespread use.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal references a proposed ASTM Standard that will, for the first time, apply specific performance requirements to synthetic underlayment products that are already in widespread use and will therefore not affect the cost of construction.

Staff Analysis: A review of the standard proposed for inclusion in the code, ASTM WK51913, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 2, 2019.

Proposal # 5322

S23-19

S24-19

IBC®: 1507.1.1

Proponent: Mike Fischer, Kellen Company, representing The Asphalt Roofing Manufacturers Association (mfischer@kellencompany.com)

2018 International Building Code

Revise as follows:

1507.1.1 Underlayment. Underlayment for asphalt shingles, clay and concrete tile, metal roof shingles, mineral-surfaced roll roofing, slate and slate-type shingles, wood shingles, wood shakes, metal roof panels and *photovoltaic shingles* shall conform to the applicable standards listed in this chapter. Underlayment materials required to comply with ASTM D226, D1970, D4869 and D6757 shall bear a label indicating compliance with the standard designation and, if applicable, type classification indicated in Table 1507.1.1(1). Underlayment shall be applied in accordance with Table 1507.1.1(2). Underlayment shall be attached in accordance with Table 1507.1.1(3).

Exceptions:

~~1.~~ ~~As an alternative, self-adhering polymer modified bitumen underlayment complying with ASTM D1970 and installed in accordance with the manufacturer's installation instructions for the deck material, roof ventilation configuration and climate exposure for the roof covering to be installed shall be permitted.~~

~~2.~~1. As an alternative, a minimum 4-inch-wide (102 mm) strip of self-adhering polymer modified bitumen membrane complying with ASTM D1970 and installed in accordance with the manufacturer's installation instructions for the deck material shall be applied over all joints in the roof decking. An approved underlayment for the applicable roof covering for design wind speeds less than 120 mph (54 m/s) shall be applied over the 4-inch-wide (102 mm) membrane strips.

~~3.~~2. As an alternative, two layers of underlayment complying with ASTM D226 Type II or ASTM D4869 Type IV shall be permitted to be installed as follows: Apply a 19-inch (483 mm) strip of underlayment parallel with the eave. Starting at the eave, apply 36-inch-wide (914 mm) strips of underlayment felt, overlapping successive sheets 19 inches (483 mm). The underlayment shall be attached with corrosion-resistant fasteners in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at side and end laps. End laps shall be 4 inches (102 mm) and shall be offset by 6 feet (1829 mm). Underlayment shall be attached using metal or plastic cap nails with a nominal cap diameter of not less than 1 inch (25.4 mm). Metal caps shall have a thickness of not less than 32-gage sheet metal. Power-driven metal caps shall have a thickness of not less than 0.010 inch (mm). Thickness of the outside edge of plastic caps shall be not less than 0.035 inch (mm). The cap nail shank shall be not less than 0.083 inch for ring shank cap nails and 0.091 inch (mm) for smooth shank cap nails. The cap nail shank shall have a length sufficient to penetrate through the roof sheathing or not less than $^3/_4$ inch (19.1 mm) into the roof sheathing.

~~4.~~3. Structural metal panels that do not require a substrate or underlayment.

Reason: The requirements for ASTM D1970 underlayment are redundant as the standard is listed in Section 1507.1.1.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The proposal is editorial.

Proposal # 5678

S30-19

IBC®: TABLE 1507.10.2

Proponent: Chadwick Collins, Kellen Company, representing Asphalt Roofing Manufacturers Association (Ccollins@kellencompany.com)

2018 International Building Code

Revise as follows:

TABLE 1507.10.2
BUILT-UP ROOFING MATERIAL STANDARDS

MATERIAL STANDARD	STANDARD
Acrylic coatings used in roofing	ASTM D6083
Aggregate surfacing	ASTM D1863; D7655
Asphalt adhesive used in roofing	ASTM D3747
Asphalt cements used in roofing	ASTM D2822; D3019; D4586
Asphalt-coated glass fiber base sheet	ASTM D4601
Asphalt coatings used in roofing	ASTM D1227; D2823; D2824; D4479
Asphalt glass felt	ASTM D2178
Asphalt primer used in roofing	ASTM D41
Asphalt-saturated and asphalt-coated organic felt base sheet	ASTM D2626
Asphalt-saturated organic felt (perforated)	ASTM D226
Asphalt used in roofing	ASTM D312
Coal-tar cements used in roofing	ASTM D4022; D5643
Coal-tar saturated organic felt	ASTM D227
Coal-tar pitch used in roofing	ASTM D450; Type I or II
Coal-tar primer used in roofing, dampproofing and waterproofing	ASTM D43
Glass mat, coal tar	ASTM D4990
Glass mat, venting type	ASTM D4897
Mineral-surfaced inorganic cap sheet	ASTM D3909
Thermoplastic fabrics used in roofing	ASTM D5665, D5726

Reason: This proposal adds an accepted ASTM standard for specification of aggregate for built-up roofs. It also coordinates with a separate proposal providing improved provisions for parapet height and aggregate size to control aggregate blow-off in extreme wind events.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The proposal lists an additional aggregate ASTM standard, which is already listed in the referenced standards, and therefore would not impact current construction costs.

Proposal # 5454

CE252-19

IECC: C503.1

Proponent: Darren Meyers, P.E., IECC_LLC representing the National Roofing Contractors Association, representing the National Roofing Contractors Association (dmeyers@ieccode.com)

2018 International Energy Conservation Code

Revise as follows:

C503.1 General. Alterations to any building or structure shall comply with the requirements of Section C503 and the code for new construction. Alterations shall be such that the existing building or structure is not less conforming to the provisions of this code than the existing building or structure was prior to the alteration. Alterations to an existing building, building system or portion thereof shall conform to the provisions of this code as those provisions relate to new construction without requiring the unaltered portions of the existing building or building system to comply with this code. Alterations shall not create an unsafe or hazardous condition or overload existing building systems.
Alterations complying with ANSI/ASHRAE/IESNA 90.1. need not comply with Sections C402, C403, C404 and C405.

Exception: The following alterations need not comply with the requirements for new construction, provided that the energy use of the building is not increased:

1. Storm windows installed over existing fenestration.
2. Surface-applied window film installed on existing single-pane fenestration assemblies reducing solar heat gain, provided that the code does not require the glazing or fenestration to be replaced.
3. Existing ceiling, wall or floor cavities exposed during construction, provided that these cavities are filled with insulation.
4. Construction where the existing roof, wall or floor cavity is not exposed.
5. Roof recover.
6. <u>Removal and replacement of a roof membrane where there is existing roof insulation integral to or below the roof deck.</u>
7. Air barriers shall not be required for roof recover and roof replacement where the alterations or renovations to the building do not include alterations, renovations or repairs to the remainder of the building envelope.

Reason: The intent of this proposal is to provide clarity and consistency in the IECC with ASHRAE Standard 90.1-2016, Section 5.1.3, Exception 6.

Bibliography: ASHRAE 90.1—2016: Energy Standard for Buildings Except Low-rise Residential Buildings ... In 2018 IECC Sections ... C401.2, Table C402.1.3, Table C402.1.4, C406.2, Table C407.6.1, C502.1, C503.1, C504.1

Cost Impact: The code change proposal will decrease the cost of construction
This change better positions the IECC to be clearer, more easily applied to removal and replacement operations, and competitive with the 90.1 Standard alternative; thereby no cost impact when compared with current provisions.

Proposal # 5257

CE255-19 Part I

PART I — IECC: C202, C503.1

PART II — IECC: R202 (N1101.6) , R503.1.1 (IRC N1109.1.1)

Proponent: Bill McHugh, The McHugh Company, representing Chicago Roofing Contractors Association (bill@mc-hugh.us)

2018 International Energy Conservation Code

Add new definition as follows:

ROOF MEMBRANE PEEL AND REPLACEMENT. Where an existing roof membrane alone is removed, exposing insulation or sheathing, and only a new weather resisting roof membrane is installed.

Revise as follows:

C503.1 General. *Alterations* to any *building* or structure shall comply with the requirements of Section C503 and the code for new construction. *Alterations* shall be such that the existing *building* or structure is not less conforming to the provisions of this code than the existing building or structure was prior to the *alteration*. *Alterations* to an existing building, building system or portion thereof shall conform to the provisions of this code as those provisions relate to new construction without requiring the unaltered portions of the existing building or building system to comply with this code. *Alterations* shall not create an unsafe or hazardous condition or overload existing *building* systems.
Alterations complying with ANSI/ASHRAE/IESNA 90.1. need not comply with Sections C402, C403, C404 and C405.

Exception: The following *alterations* need not comply with the requirements for new construction, provided that the energy use of the building is not increased:

1. Storm windows installed over existing *fenestration*.
2. Surface-applied window film installed on existing single-pane *fenestration* assemblies reducing solar heat gain, provided that the code does not require the glazing or *fenestration* to be replaced.
3. Existing ceiling, wall or floor cavities exposed during construction, provided that these cavities are filled with insulation.
4. Construction where the existing roof, wall or floor cavity is not exposed.
5. *Roof recover*.
6. *Air barriers* shall not be required for *roof recover* and roof replacement where the *alterations* or renovations to the building do not include *alterations*, renovations or *repairs* to the remainder of the building envelope.
7. . Roof membrane peel and replacement.

Proposal # 5334

CE255-19 Part II

IECC: R202 (N1101.6) , R503.1.1 (IRC N1109.1.1)

Proponent: William McHugh, The McHugh Company, representing Chicago Roofing Contractors Association (billmchugh-jr@att.net)

2018 International Energy Conservation Code

SECTION R202 (IRC N1101.6)
GENERAL DEFINITIONS

Add new definition as follows:

ROOF MEMBRANE PEEL AND REPLACEMENT. Where an existing roof membrane alone is removed, exposing insulation or sheathing, and only a new weather resisting roof membrane is installed.

Revise as follows:

R503.1.1 (IRC N1109.1.1) Building envelope. Building envelope assemblies that are part of the alteration shall comply with Section R402.1.2 or R402.1.4, Sections R402.2.1 through R402.2.13, R402.3.1, R402.3.2, R402.4.3 and R402.4.5.

Exception: The following alterations shall not be required to comply with the requirements for new construction provided that the energy use of the building is not increased:

1. Storm windows installed over existing fenestration.
2. Existing ceiling, wall or floor cavities exposed during construction provided that these cavities are filled with insulation.
3. Construction where the existing roof, wall or floor cavity is not exposed.
4. Roof re-cover.
5. Roofs without insulation in the cavity and where the sheathing or insulation is exposed during reroofing shall be insulated either above or below the sheathing.
6. Surface-applied window film installed on existing single pane fenestration assemblies to reduce solar heat gain provided that the code does not require the glazing or fenestration assembly to be replaced.
7. Roof membrane peel and replacement.

Reason: This new definition and accompanying technical requirement adds a subset of the Roof Recover operation to the International Energy Conservation Code. The operation means that the buildng owner and manager can re-use the existing insulation providing sustainabilty to the insulation products in place. The operation provides the buildling owner and manager with a code approved, economical option that does not increase the energy use of existing buildings, meeting the bolded intent of the 503.1 General Section of the IECC.
For convenience, the C503.1 General section is below, bolded for emphasis:

C503.1 General. Alterations to any building or structure shall comply with the requirements of Section C503 and the code for new construction. Alterations shall be such that the existing building or structure is not less conforming to the provisions of this code than the existing building or structure was prior to the alteration. Alterations to an existing building, building system or portion thereof shall conform to the provisions of this code as those provisions relate to new construction without requiring the unaltered portions of the existing building or

building system to comply with this code. Alterations shall not create an unsafe or hazardous condition or overload existing building systems.

Cost Impact: The code change proposal will decrease the cost of construction
The code change proposal will decrease the cost of construction. This type of re-roofing operation is where the roof covering membrane is peeled off, and a new roof covering membrane installed over a prepared surface. This operation is not currently allowed by the International Energy Conservation Code. If allowed, Roof Membrane Peel and Replacement will decrease the cost of construction becuase the operation does not trigger meeting the minimum R-30 c.i. insulation requirements for new construction, as it would today. The operation does not increase the energy usage of the building, consistent with Section C503.1 General's statements, of the IECC.

Proposal # 5363

CE255-19 Part II

Attendance

Frank Klink	3M
Dennis Mathes	Lomanco, Inc.
Jonathan MacBride	Specialty Granules LLC
Jacques Martin	Building Products of Canada
Mark Harner	CertainTeed Corporation
Walt McIntosh	Firestone Building Products Company
Ming Shiao	GAF
Marty Ward	GAF
Jay Keating	IKO Production, Inc.
William Liu	IKO Production, Inc.
Brendan Dineen	Malarkey Roofing
Eileen Dutton	Malarkey Roofing
John Kouba	Malarkey Roofing
Robert Sheffield	Mid-States Asphalt
Ed Harrington	Owens Corning
Sid Dinwiddie	PABCO Roofing Products
Jean-Francois Cote	SOPREMA, Inc.
Aaron Phillips	TAMKO Building Products, Inc.
Jim Hilyard	ARMA Consultant
Reed Hitchcock	ARMA Executive Vice President
Mike Fischer	ARMA Staff
Chadwick Collins	ARMA Staff
Sam Furlong	ARMA Staff

Call to Order

Aaron Phillips, TAMKO Building Products, Inc., called the meeting to order at 2:02pm ET. Sam Furlong, ARMA Staff, read the roll call and reminded all that the meeting would be subject to ARMA's Antitrust Compliance Policy. Mike Fischer, ARMA Staff, provided an overview of the agenda for the call.

MOTION (Dinwiddie / Keating) To approve the ARMA Codes Steering Group minutes from February 27, 2019 as presented with an edit to the attendee list to include Archana Nandakumar. The motion passed unanimously.

Codes and Standards Update

Mike Fischer provided an overview and timeline of the ICC 2021 Code Development cycle. Fischer discussed upcoming priorities in the code proposals as they relate to ARMA. It was noted that Aaron Phillips submitted a number of ballot items to ASTM D7158 to clarify certain issues raised by negative voters last cycle, including the use of terrain multipliers to align with ASCE7-16 requirements. Fischer noted that ARMA staff has not received feedback on issues related to ASTM D7158. Phillips stated that any concerns related to ASTM D7158 should be sent directly to staff. It was noted that there is a potential for confusion by end users and specifiers around the values in the ASTM wind speed conversion tables not being aligned with the standard.

ACTION: ARMA CSG members to send input on ASTM D7158 or wind speed conversions directly to Mike Fischer or Chadwick Collins.

Chadwick Collins provided an overview of the latest NRCC activities, noting that NRCC has indicated that they will begin a more holistic approach for requirements related to steep and low slope. It was noted that that NRCC will take action, but the organization has not made clear exactly what that action will be. Collins stated that NRCC's current priority is to gather feedback from those who attended the previous meeting. Collins noted that the next NRCC meeting is tentatively scheduled for May.

State and Local Code Activity

Mike Fischer provided an overview of changes to the 2020 Florida Building Code. Fischer reported that he attended the Florida Building Commission TAC hearings, and that ARMA was successful on all priorities with the exception of an HVHZ cleanup item related to combustible decks, which was not a major ARMA priority. Fischer stated that 4 modifications advocated for by ARMA were recommended for approval by the Florida Building Commission. Fischer further discussed that the FBC TAC advised to move forward with ASCE7-16 without any changes for structural retrofit for roofing replacement projects. With regard to Monroe County, Florida, Fischer reported that ARMA has retained Mike Fischer to monitor new bills or bills that could be modified to include a provision to require metal roofing or otherwise adversely impact asphalt roofing. He reported that a bill has been introduced last minute in Florida to increase impact resistance and other hurricane-related requirements that are supported by the insurance industry. ARMA staff has been in communication with other industry stakeholders, including the American Wood Council and FRSA. Fischer stated that the bill is not likely to become law, but that ARMA is monitoring the situation. Fischer stated that ARMA has postponed the Monroe County roofing summit due to recent activities in the legislature, including the resilience bill mentioned above . It was discussed that ARMA will track activity in the Florida Panhandle as there may be new hurricane-related proposals. It was reported a California legislator had introduced a bill to increase steep slope solar reflective requirements, but that it was not likely to move forward due in part to lack of support from the CEC staff and even environmental groups.

ACTION: Reed Hitchcock to reach out to the Executive Director of Climate Resolve to discuss common stance on California legislative proposal.

ACTION: Reed Hitchcock to reach out to CEC to discuss same.

Reed Hitchcock stated that ARMA has contacted the law firm of Greenberg-Traurig to consider a lobbying effort in California should one become necessary.

There was discussion on the call about concerns being raised about the California Energy Conservation Code, including potential future implications for how to quantify cost efficiency and assigning a dollar value to the urban heat island effect.

ACTION: CSG members to brief EC members from their company on CA AB660 to enable the EC to decide whether to move forward with lobbying effort which is not budgeted.

Chadwick Collins provided an update on the Denver Green/Cool Roof issue, and stated that the meeting scheduled for March 14 was cancelled and rescheduled to April 11. Collins reported that he expects the agenda to be posted by April 4 and that he will share any updates related to the issue if they are included on the agenda. Collins provided an overview of proposed cool roof requirement in Hawaii that involves a

change to the energy code to require a high level of reflectivity for steep slope roofs. The language brought to ARMA's attention is not yet on the state website, which still references EnergyStar.

There was discussion on whether ARMA should more aggressively encourage the use of recycled asphalt in paving, as it relates to the Fort Collins, Colorado impact resistance ordinance and the discontinuation of asphalt shingle recycling in Dubuque, Iowa.

Stakeholder Discussion

George Fischer provided an overview of the Hurricane Michael FEMA memo that was shared with the ARMA Codes Steering Group.

New/Other Business

Chadwick Collins reported that he has been coordinating with Paul Bove of the Texas Department of Insurance on presentation topics and will provide an update on the TDI presentation slides during the Chicago CSG committee meeting. It was noted that Darrel Higgs will provide an update on the sunsetting of EnergyStar in Chicago.

Action Item Review

ACTION: ARMA CSG members to send input on ASTM D7158 or wind speed conversions directly to Mike Fischer or Chadwick Collins.

ACTION: Reed Hitchcock to reach out to the Executive Director of Climate Resolve to discuss common stance on California legislative proposal.

ACTION: Reed Hitchcock to reach out to CEC to discuss same.

ACTION: CSG members to brief EC members from their company on CA AB660 to enable the EC to decide whether to move forward with lobbying effort which is not budgeted.

Adjournment

MOTION (Dutton / Dinwiddie) to adjourn the meeting of the ARMA Codes Steering Group at 3:26pm ET. The motion passed unanimously.

ARMA Health, Safety, & Environment Committee

Asphalt Roofing Manufacturers Association
Health, Safety, and Environment Committee Agenda
Tuesday, April 9- Wednesday, April 10, 2019

Health, Safety, and Environment Committee Meeting
Chair: Devlin Whiteside, Owens Corning
Vice-Chair: Bob Hockman, TAMKO

Tuesday, April 9, 2019		
Time	Session	Back-up Materials
12:00 p.m. – 1:00 p.m. (60 minutes)	Lunch	
1:00 p.m. – 1:15 p.m. (15 minutes)	**Introduction and Opening Remarks** -Call to Order -Review of Antitrust Policy -Housekeeping -Review of Meeting Agenda-	-Antitrust Quick Reference -HSE Committee Meeting Agenda
1:15 p.m. – 1:45 p.m. (30 minutes)	**Industrial Hygiene Quality Assurance/Control Update** -Led by: Mark Klein, GAF Update on IH QA/QC Task Force,	
1:45 p.m. -2:15 p.m. (30 minutes)	**A review of the OSHA Silica Standard FAQ document** Presented by Mark Klein, GAF	
2:15 p.m. – 2:30 p.m. (15 minutes)	Break	
3:00 p.m. – 4:15 p.m. (75 minutes)	**Regulatory Update** -Led by: Art Sampson, ARMA Regulatory Counsel Update of current regulatory issues being addressed by ARMA HSE committee	
4:15 p.m. 4:30 p.m. (15 minutes)	Break	
4:30 pm -5:00 p.m. (30 minutes)	**HSE Committee 2019 Discussion** -Led by: Devlin Whiteside, Owens Corning Discuss current HSE ARMA projects, upcoming projects, and project suggestions. • Emissions Factors Database Update • Washington Stormwater Roofing Research Update	
5:00pm	Recess	
Wednesday, April 10, 2019		
7:30 a.m. - 8:00 a.m. (30 minutes)	ARMA Breakfast	
8:00 a.m. - 10:00 a.m. (2 hours)	**Washington State Stormwater Runoff Study Review** Presented by Dr. William Warren-Hicks of EcoStat via go to meeting	
10:00 a.m. – 10:15 a.m. (15 minutes)	Break	
10:15 a.m. -11:45 a.m. (90 minutes)	**ISO 45001: The New Gold Standard of Workplace Safety** Presented by Ed Foulke	
11:45 a.m. -11:50 a.m. (10 minutes)	Questions/discussion	
11:55 a.m. - 12:00 p.m. (5 minutes)	Thank you and Adjournment	

Spring 2019 Health, Safety and Environment Committee Meeting

ISO 45001: The New Gold Standard of Workplace Safety

Presented by:

Edwin G. Foulke, Jr.
Attorney at Law

Wednesday, April 10, 2019, 10:15-11:45am

Overview:

In March 2018, after a five year process involving more than 70 countries, a new international Occupational Health & Safety (OH&S) standard, ISO 45001, was published. The standard seeks to set a new benchmark in global OH&S and will result in companies significantly reducing their workplace injuries and illnesses while dramatically improving employee productivity and quality which will led to increased profitability. It provides a framework to significantly improve organizational safety and health performance through a risk management system, while increasing operational excellence and positively impacting a company's sustainability and social responsibility programs. This interactive panel discussion will examine the benefits of becoming ISO 45001 – certified and provide a detailed overview on how to achieve this status.

What You Will Learn From This Program:

- What ISO 45001 is and how it will enhance a company's existing OH&S programs
- What are the benefits of being ISO 45001 certified
- How ISO 45001 will impact corporate culture
- What will be the impact of ISO 45001 to a company's workforce
- How ISO 45001 will reduce company costs
- How ISO 45001 will positively impact the public image of a company, especially with sustainability and social responsibility

Nov 02, 2018

MEMORANDUM FOR:

REGIONAL ADMINISTRATORS

FROM:

KIMBERLY STILLE, Acting Director
Directorate of Enforcement Programs

SUBJECT:

Enforcement Policy for Respiratory Hazards Not Covered by OSHA Permissible Exposure Limits

As you are aware, Section 5(a)(1) of the Occupational Safety and Health Act (OSH Act) is occasionally used to cite respiratory hazards from exposure to an air contaminant that is not covered by an OSHA permissible exposure limit (PEL). This memorandum serves to clarify existing Agency enforcement policy for developing these citations.

Specifically, Section 5(a)(1) of the OSH Act requires each employer to "furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm." As explained in the OSHA Field Operations Manual (FOM) (CPL 02-00-160), when enforcing this requirement, the Occupational Safety and Health Review Commission and court precedent have determined that the following elements must be established in order for OSHA to prove a violation of the general duty clause:

1. The employer failed to keep the workplace free of a hazard to which employees of that employer were exposed;
2. The hazard was recognized;
3. The hazard was causing or was likely to cause death or serious physical harm; and,
4. There was a feasible and useful method to correct the hazard.

When applying these elements to respiratory hazards, it is important for Area Directors to *ensure that 5(a)(1) citations are not based solely on evidence that a measured exposure exceeded a recommended occupational exposure limit (OEL)*, such as a Threshold Limit Value (TLV)[1], or based on the fact that there is a documented exposure to a recognized carcinogen.[2] Unless the case file evidence proves *all four* of the above elements, the Area Office should issue a hazard alert letter (HAL). The HAL should advise the employer that one or more employees at the establishment was being, or had been, exposed to a potentially serious respiratory hazard from a chemical that exceeded an OEL, and provide a series of recommended exposure control suggestions. For your information, attached is a sample HAL for a respiratory hazard.

However, if the evidence *does* provide sufficient proof of the four elements listed above, then the general duty clause should be cited, following the general guidance in the FOM, Chapter 4. We

are providing the following additional guidance for developing evidence for each of these elements when specifically applied to *respiratory* hazards:

a. *The employer failed to keep the workplace free of a hazard to which employees of that employer were exposed* - Evidence that documents this element includes personal air sampling results, written workplace observations, photographs, and witness statements noting how workers were exposed to the chemical, and descriptions of any implemented engineering, work practice, and administrative control measures, and personal protective equipment. The evidence should also substantiate that regular and continuing employee exposure to the chemical at the measured levels could reasonably occur. However, if the exposed employees were wearing appropriate respiratory protection with no deficiencies in the respirator program, then the likelihood that OSHA could establish a respiratory hazard covered by the general duty clause would be low.

b. *The hazard was recognized* - OSHA can establish this element in one of two ways. (1) For employer recognition: Evidence may include employee complaints to management, illness and injury logs, consultant reports, a previous HAL, internal safety and health policies related to workplace operations involving the chemical that may refer to an OEL, or information from a manufacturer describing safety and health precautions for equipment or chemicals used in the workplace such as the chemical manufacturers' safety data sheet (SDS). (2) For industry recognition: Evidence may include an industry or trade association's guidance document, or an assessment from an industry expert describing the work practice or operation used at the establishment and explaining the particular health hazards and recommended control measures. Alternatively, a similar publication from a (non-OSHA) federal, state, or local government agency, or from a professional organization, may also provide good evidence. Some examples of government agencies include the National Institute for Occupational Safety and Health (NIOSH), the National Toxicology Program (NTP), and the U.S. Environmental Protection Agency (EPA). Examples of organizations include The Center for Construction Research and Training (CPWR, formerly The Center to Protect Workers' Rights), the American Conference of Governmental Industrial Hygienists (ACGIH™), and the Occupational Alliance for Risk Science (OARS).

c. *The hazard was causing or was likely to cause death or serious physical harm* - Although an illness or injury from the measured exposure need not have occurred yet, the strongest evidence is an employee illness/injury, hospitalization, fatality, or medical diagnosis related to workplace exposure. In the absence of this, the evidence must include more than just the fact that a measured exposure exceeded a TLV or REL, because these recommended limits may be much lower than the level at which a serious heath effect may be experienced. In most cases, proving this element will require an expert or industry-related peer reviewed study to document that serious physical harm could occur at the measured level with continuing employee exposure. Additionally, establishing serious physical harm for some respiratory hazards may be particularly difficult if the resulting illness, such as cancer, would require a substantial period of time to occur.

d. *There was a feasible and useful method to correct the hazard* - Evidence may include the SDS describing work practices for safe handling, engineering controls, and personal protective equipment, or published industry and/or NIOSH studies (e.g., health hazard

evaluations (HHEs)) involving similar chemical processes or operations. Proving that feasible abatement measures would eliminate or materially reduce workplace exposure to a level that no longer presents a serious health hazard will likely require expert testimony.

For technical assistance in developing the required evidence related to the above elements, OSHA compliance officers may coordinate with their Regional Office to contact the Directorate of Technical Support and Emergency Management's (DTSEM) Salt Lake Technical Center (SLTC) at (801) 233-4900 and the Office of Occupational Medicine and Nursing (OOMN) at (202) 693-2323. For additional guidance for compliance officers, the Directorate of Training and Education's (DTE) OSHA Training Institute (OTI) has developed a job aid on this subject, which also includes tips for writing chemical 5(a)(1) citations.

Please distribute this memorandum to all health compliance officers. If you have any questions on this, please contact the Office of Health Enforcement at (202) 693-2190.

Attachment

Endnote (1) - Per 29 CFR 1910.1200, *Hazard Communication*, chemical manufacturers must list on their product's safety data sheet (SDS) all known exposure limits. Specifically, Section 8 of the SDS must include: "OSHA permissible exposure limit (PEL), American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV), and any other exposure limit used or recommended by the chemical manufacturer, importer, or employer preparing the safety data sheet, where available." [*See* Table D.1, 1910.1200 Appendix D]. For evaluating respiratory hazards of chemicals without a PEL, compliance officers may refer to applicable published OELs, which include, but are not limited to, the following:

a. Recommended Exposure Limits (RELs) issued by the National Institute for Occupational Safety and Health (NIOSH);

b. Threshold Limit Values™ (TLVs™) published by the American Conference of Governmental Industrial Hygienists (ACGIH™); and

c. Workplace Environmental Exposure Levels™ (WEELs™) published by the Occupational Alliance for Risk Science (OARS), which is managed by Toxicology Excellence for Risk Assessment (TERA™).

d. Other recommended exposure limits from chemical manufacturers or industry/trade associations, such as may be provided on SDSs or in industry guidance publications.

Endnote (2) - Per 29 CFR 1910.1200, *Hazard Communication*, chemical manufacturers must also list on their product's SDS all known carcinogenic ingredients when greater than 0.1% of the product mixture. Specifically, Section 11 of the SDS must include all known toxicological information, including: "Whether the hazardous chemical is listed in the National Toxicology Program (NTP) Report on Carcinogens (latest edition) or has been found to be a potential carcinogen in the International Agency for Research on Cancer (IARC) Monographs (latest edition), or by OSHA." [*See* Table D.1, 1910.1200 Appendix D].

Attachment - Sample Hazard Alert Letter for a Chemical with no PEL

[Date]

ABC Company
[Address]

RE: Inspection Number XXXXXXX

Dear Company Owner:

An inspection of your workplace at [address], initiated on [date], disclosed conditions that are consistent with employee exposure to 1-bromopropane. 1-bromopropane (CAS: 106-94-5), as covered in this inspection, was used as a solvent in your vapor degreasing operations. Symptoms of exposure to 1-bromopropane (or 1BP) include irritation and damage to the nervous system. Neurological damage can appear as headaches, dizziness, loss of consciousness, slurred speech, confusion, difficulty walking, and/or loss of feeling in the arms and legs. Exposure to employees can occur by inhalation and absorption through skin contact. Studies have shown that health effects from exposure to this chemical may present within as little as two days, however most serious effects are more commonly associated with prolonged exposure.

Currently, Federal OSHA does not have a specific exposure standard for 1BP. However, OSHA and the National Institute for Occupational Safety and Health (NIOSH) jointly issued a hazard alert for occupational exposure to 1BP in 2013. (*See* enclosed copy). In 2014, the American Conference of Governmental Industrial Hygienists (ACGIH™) adopted a Threshold Limit Value™ (TLV™) for 1-bromopropane of 0.1 parts per million (ppm), or 0.5 milligrams per cubic meter (0.5 mg/m^3), as an 8-hour time-weighted average (TWA).

Monitoring Results: Measured employee exposures to 1-bromopropane were well above the AGCIH 8-hour TLV of 0.1 ppm as discussed in the below sampling results.

During the inspection at your facility, three employees were monitored to determine their exposure to 1BP. On [date], one employee spraying the interior of metal parts with different concentrations of 1BP solutions in the [spray area] was exposed to [xx] ppm of 1BP, as an 8-hr TWA. The employee conducting the spraying was sampled for [aaa] minutes, with zero exposure assumed for the remainder of the 480-minute shift. On [date], one employee manually coating the exterior of metal parts with various 1BP solutions in the [coating area] was exposed to [YY] ppm 1BP as an 8-hr TWA. The employee conducting the coating was sampled for [bbb] minutes, with zero exposure assumed for the remainder of the 480-minute shift. On [date], one employee operating the flush-and-blow system in close proximity to the degreaser was exposed to [ZZ] ppm 1BP as an 8-hr TWA. The flush-and-blow operator was sampled for [ccc] minutes, with zero exposure assumed for the remainder of the 480-minute shift. All three employees' 8-hr TWAs for 1BP was significantly greater than the ACGIH TLV of 0.1 ppm.

We recommend that you voluntarily take the necessary steps to materially reduce or eliminate your employees' exposures to the conditions listed above.

While the risk of health hazards associated with exposure to 1BP can be reduced or eliminated by implementing a single means of abatement, in most cases a variety of abatement methods will

provide a more effective method of addressing these hazards. These include workplace analysis of jobs and tasks to assess hazards associated with those jobs and tasks and the steps to abate them: product substitutions; engineering, administrative, and work practice controls; accurate injury and illness recordkeeping; medical surveillance; medical management of occupational illnesses and injuries; education and training of employees; and management oversight.

We have examined available information on the hazards associated with the degreasing operation conducted at your facility. The evaluation suggests that one or more of the following additional methods of abatement should be implemented.

1. Engineering Controls.

   Engineering controls are the first line of defense in employee protection. Therefore, your company should provide appropriate engineering controls throughout the facility. Employees should be trained on the use of the engineering controls to ensure that occupational exposure to 1BP is maintained below levels that are hazardous to employees. The following engineering controls are recommended:

   - Engineering of the spray and coating areas so that employees are isolated from the operation where 1BP is applied to the interior or exterior of the metal parts. This could include a system that automatically coats the parts or by means of increasing the distance between the employees and the spray operation.

   - Installation of local exhaust ventilation systems where the employees conduct the operations to reduce the amount of exposure. For the spray area, a local ventilation should be located where the employee is spraying the interior of the parts, and for the coating area, a local hood ventilation system should be set up such that any vapors from the rags are collected before reaching the employee's breathing zone. Additionally, ventilation should be considered around the degreasing tank in order to capture fugitive 1BP vapors escaping from the degreasing tank during the degreasing process.

2. Administrative and Work Practices Controls.

   The following work practices should be used to reduce occupational exposure to 1BP during degreasing operations:

   - Evaluation of employee body positioning during the various operations. By observing and evaluating the operator's location during various points in the coating operations, it may be possible to prevent the operator from standing in an area where exposure to fugitive 1BP vapors is likely. This includes consideration for where the fans are located in relation to the employees, as well.

   - Revise the coating operation's standard operating procedure to document how often the spray hood requires cleaning, how to effectively conduct the cleaning with less employee exposure, and how much solution is required on a rag to effectively coat the exterior of the parts.

   - Instituting a job rotation schedule for the spray area and activities around the

degreaser. Other company employees should be trained on these operations so that employees could rotate in and out during the course of the day.

- Ensuring appropriate preventative maintenance is conducted on the degreaser and still according to the manufacturer's recommendations.

- Conducting personal air monitoring on a regular basis to determine employee exposure levels to 1BP, ensuring that personal air samples are taken from the employee's breathing zone. Breathing zone samples provide the best indication of the concentration of contaminants in the air the employee is actually breathing.

- Ensuring employees immediately and thoroughly wash their skin with soap and flowing water if dermal contact with 1BP occurs.

3. Personal Protective Equipment.

   To be effective, personal protective equipment must be individually selected, properly fitted and periodically refitted, conscientiously and properly worn, regularly maintained, and replaced as necessary. In addition, employers must:

   - Perform a revised workplace hazard assessment in accordance with 29 CFR 1910.132(d) to determine if hazards are present, or are likely to be present which necessitate the use of personal protective equipment (PPE), and identify and evaluate respiratory hazards as required by 29 CFR 1910.134(d)(1)(iii).

   - Establish, implement, and maintain a written respiratory protection program in accordance with 29 CFR 1910.134(c) in any workplace where respirators are necessary to protect employee health.

   - Provide and ensure that employees use appropriate respiratory protection where necessary to protect employee health.

   - Provide and ensure the use of the appropriate gloves (e.g., butyl, nitrile), goggles, and protective clothing when necessary to protect employees from workplace hazards (e.g., exposure to contaminated equipment, chemical containers).

   - Train employees on the limitations and proper use and maintenance of required PPE in accordance with 29 CFR 1910.132(f).

4. Training and Information.

   Employers must comply with the OSHA Hazard Communication standard, 29 CFR 1910.1200. In particular, employers must ensure that employees exposed to 1BP are trained in and have access to the following information:

   - The operations in their workplace where hazardous chemicals are present;

   - Safety data sheets (SDSs) for chemicals containing 1BP, which must include information about the signs and symptoms of exposure and the hazards of dermal contact with 1BP;

- Any protective measures the employer is using to reduce employee exposures to 1BP;
- Specific work practices employees can use to reduce exposure to 1BP;
- Appropriate use of personal protective equipment;
- Methods that may be used to detect the presence of the 1BP in the workplace, such as workplace monitoring.

You may voluntarily provide this Area Office with progress reports on your efforts to address these conditions. OSHA may return to your work site in one year to further examine employee exposures to 1BP.

Enclosed is the above-mentioned OSHA publication that may be of assistance to you in preventing work-related injuries and illnesses in your workplace. If you have any questions, please feel free to call [###].

Sincerely,

Area Director

Occupational Exposure to Respirable Crystalline Silica
29 C.F.R. § 1910.1053

Frequently Asked Questions for General Industry

On March 25, 2016, the Occupational Safety and Health Administration (OSHA) published a final rule regulating occupational exposure to respirable crystalline silica (silica) in general industry (the standard). 81 Fed. Reg. 16286. OSHA developed these Frequently Asked Questions (FAQs) about the standard in consultation with industry and union stakeholders.

These FAQs provide guidance to employers and employees regarding the standard's requirements. This document is organized by topic. A short introductory paragraph is included for each group of questions and answers to provide background information about the underlying regulatory requirements.

The following acronyms are used throughout this document:

AL – action level (25 μg/m^3 as an 8-hour time-weighted average)
HEPA filter – high-efficiency particulate air filter
PEL – permissible exposure limit (50 μg/m^3 as an 8-hour time-weighted average)
PLHCP – physician or other licensed health care professional
SAE – sampling and analytical error
TWA – time-weighted average

Scope and Application (29 C.F.R. § 1910.1053(a))

OSHA's silica standard for general industry applies to all occupational exposures to respirable crystalline silica, with the following exceptions. First, the general industry standard does not apply to construction work as defined in 29 C.F.R. § 1910.12(b); occupational exposures to silica in construction are covered under 29 C.F.R. § 1926.1153. Second, the general industry standard does not apply to agricultural operations covered under 29 C.F.R. part 1928. Third, the general industry standard does not apply to silica exposures that result from the processing of sorptive clays. And finally, the general industry standard does not apply where the employer has objective data demonstrating that employee exposure to silica will remain below the AL of 25 μg/m^3 measured as an 8-hour TWA under any foreseeable conditions. 29 C.F.R. § 1910.1053(a)(1), (2). This last exception does not apply where exposures below 25 μg/m^3 as an 8-hour TWA are expected or achieved, but only because controls are being used to limit exposures. The exception for scenarios in which employers have objective data demonstrating that exposures will be below the AL under all foreseeable conditions ensures that the standard does not apply to employees with only minimal silica exposures. *See* 81 Fed. Reg. at 16705-06.

Under the general industry standard, an employer can elect to comply with the construction standard at 29 C.F.R. § 1926.1153, instead of the general industry standard at 29 C.F.R.

§ 1910.1053, if the task performed is indistinguishable from a construction task listed on Table 1 in 29 C.F.R. § 1926.1153(c), and the task will not be performed regularly in the same environment and conditions. 29 C.F.R. § 1910.1053(a)(3).

1. In determining whether the standard applies, does the objective data used to demonstrate that employee exposure to silica will remain below 25 μg/m^3 measured as an 8-hour TWA under any foreseeable conditions have to reflect exposures that exist in the absence of controls?

Generally, yes. The intent of the standard is to exempt conditions where employees will be exposed to minimal levels of silica under any foreseeable conditions. Although engineering controls are usually a reliable means of limiting employee exposures, equipment does occasionally fail (*e.g.*, due to a gradual deterioration in effectiveness attributable to poor maintenance or failure to follow standard operating procedures). Because OSHA considers the failure of most controls to be a foreseeable condition, the exception usually applies only where exposures below 25 μg/m^3 as an 8-hour TWA are expected or achieved without the use of controls. Operations where engineering controls have been implemented specifically for the purpose of reducing exposures to silica will typically be covered by the standard, because the failure to properly implement, operate, and maintain those controls would generally be expected to result in exposures at or above 25 μg/m^3 as an 8-hour TWA. For example, if an employer controls employee silica exposures using local exhaust ventilation or a conveyor containment system, OSHA considers the failure of those controls to be a foreseeable condition, and the employer will not be exempt from the standard on the basis of data showing that exposures are below 25 μg/m^3 as an 8-hour TWA when the ventilation or containment system is used.

However, failure of some types of controls (*e.g.*, substitution of non-silica-containing materials for materials that contain silica, fixed walls that are a permanent part of a building's structure) is not possible or so improbable that it is not a foreseeable condition, and therefore employers need not account for the potential failure of such controls when determining whether employee exposure to silica will remain below 25 μg/m^3 measured as an 8-hour TWA under any foreseeable conditions. Furthermore, in determining whether the standard applies, employers do not need to disable, remove, or otherwise account for the potential failure of measures that may contribute, in a limited fashion, to reducing silica exposures, but that are not adopted for that specific purpose, *i.e.*, general building ventilation or heating, ventilation, and air conditioning (HVAC) systems.

Thus, with very limited exceptions, any objective data used to demonstrate that employee exposure to silica will remain below 25 μg/m^3 measured as an 8-hour TWA under any foreseeable conditions must represent employee exposures that exist in the absence of controls.

2. Does the standard cover employees who perform silica-generating tasks for only 15 minutes or less a day?

The standard does not include a specific exemption for tasks with only short-term exposures (*e.g.*, tasks with exposure for 15 minutes a day or less). However, the standard does not apply where the employer has objective data demonstrating that employee exposure to respirable

crystalline silica will remain below 25 μg/m^3 as an 8-hour TWA under any foreseeable conditions. Short-term silica exposures must be very high in order for those exposures to reach or exceed 25 μg/m^3 as an 8-hour TWA; for example, if an employee is exposed for only 15 minutes, his or her exposure would have to be higher than 800 μg/m^3 for that 15-minute period before the 8-hour TWA exposure would be at or above 25 μg/m^3. *See* 81 Fed. Reg. at 16706. Some examples of tasks that could generate very high short-term exposures include abrasive blasting and grinding engineered stone countertops, which are typically associated with high levels of visible dust.

Workers may perform maintenance tasks involving occasional, brief exposures to silica that are incidental to their primary work. Provided that these employees perform these tasks in isolation from activities that generate significant exposures to silica, and perform them for no more than 15 minutes throughout the work day, their exposures will usually fall below the AL of 25 μg/m^3 as an 8-hour TWA under all foreseeable conditions. When employers obtain or develop objective data showing that exposures will remain below the AL under any foreseeable conditions, these employees will not be covered by the standard.

3. If general industry employees are not covered by the standard because their exposures will remain below the AL under any foreseeable conditions, does the employer need to document this determination?

Yes. The standard's exception for exposures below the AL applies *only* if the employer has documentation (*i.e.*, objective data) demonstrating that employees' silica exposures will remain below the AL of 25 μg/m^3 as an 8-hour TWA under any foreseeable conditions. (Note that documentation is required only when employees have *some level* of occupational exposure to silica. The standard does not apply to employees who have no occupational exposure.) Also, nothing in the silica standard alters employers' duty to maintain employee exposure records under 29 C.F.R. § 1910.1020.

4. If an employer has objective data demonstrating that employee exposure will remain below the AL of 25 μg/m^3 as an 8-hour TWA under any foreseeable conditions, does the standard require employers to complete a written exposure control plan for the worksite?

No. None of the standard's requirements apply where the employer has objective data demonstrating that all employees' exposures to silica will remain below the AL of 25 μg/m^3 as an 8-hour TWA under any foreseeable conditions.

Definitions (29 C.F.R. § 1910.1053(b))

The standard defines certain key terms used in the rule. For example, the standard defines such terms as "action level" (a concentration of airborne respirable crystalline silica of 25 μg/m^3, calculated as an 8-hour TWA) and "employee exposure" (exposure to airborne respirable crystalline silica that would occur if the employee were not using a respirator). 29 C.F.R. § 1910.1053(b).

5. Some provisions in the standard refer to high-efficiency particulate air (HEPA) filters. The standard defines a HEPA filter as a "filter that is at least 99.97 percent efficient in removing mono-dispersed particles of 0.3 micrometers in diameter." May an employer rely on a manufacturer's representation of the effectiveness of a filter?

Yes. The standard does not require employers to independently test the effectiveness of filters to determine if they meet the definition in paragraph (b). Employers can rely on a manufacturer's representation that a filter is at least 99.97 percent efficient in removing mono-dispersed particles of 0.3 micrometers in diameter or that it is compliant with the OSHA definition of a "HEPA filter." However, employers must properly select, use, maintain, and replace HEPA filters in order to ensure that they continue to function according to the manufacturer's specifications.

Exposure Assessments (29 C.F.R. § 1910.1053(d))

The standard requires employers to ensure that no employee is exposed to an airborne concentration of silica in excess of the PEL of 50 $\mu g/m^3$, calculated as an 8-hour TWA. 29 C.F.R. § 1910.1053(c). Employers must assess the exposure of each employee who is or may reasonably be expected to be exposed to respirable crystalline silica at or above the AL using either a performance option or a scheduled monitoring option. 29 C.F.R. § 1910.1053(d)(1). Under the performance option, employers must assess the 8-hour TWA exposure for each employee based on any combination of air monitoring data or objective data sufficient to accurately characterize employees' current silica exposures. 29 C.F.R. § 1910.1053(d)(2). Under the performance option, the burden is on the employer to demonstrate that the data accurately characterize employee exposure. 81 Fed. Reg. at 16763-64. Under the scheduled monitoring option, employers must conduct initial monitoring to assess the 8-hour TWA exposure for each employee on the basis of one or more personal breathing zone air samples that reflect the exposures of employees on each shift, for each job classification, in each work area, and then conduct follow-up monitoring at specified intervals based upon the results of the initial monitoring. 29 C.F.R. § 1910.1053(d)(3). Under both the performance and scheduled monitoring options, employers must reassess exposures whenever a change in the production, process, control equipment, personnel, or work practices may reasonably be expected to result in new or additional exposures at or above the AL, or when there is any reason to believe that new or additional exposures at or above the AL have occurred. 29 C.F.R. § 1910.1053(d)(4).

The standard's recordkeeping provisions require employers to make and maintain accurate records of all exposure measurements and all objective data taken or relied upon to assess employee exposure. 29 C.F.R. § 1910.1053(k)(1)(i), (2)(i). Records of exposure measurements taken to assess employee silica exposure, as prescribed in paragraph (d) of the standard, must include at least the following information: (1) the date of measurement for each sample taken; (2) the task monitored; (3) sampling and analytical methods used; (4) number, duration, and results of samples taken; (5) identity of the laboratory that performed the analysis; (6) type of personal protective equipment, such as respirators, worn by the employees monitored; and (7) name and job classification of all employees represented by the monitoring, indicating which employees were actually monitored. 29 C.F.R. § 1910.1053(k)(1)(ii). Records of objective data relied upon to comply with the standard must include at least the following information: (1) the crystalline silica-containing material in question; (2) the source of the objective data; (3) the

testing protocol and results of testing; (4) a description of the process, task, or activity on which the objective data were based; and (5) other data relevant to the process, task, activity, material, or exposures on which the objective data were based. 29 C.F.R. § 1910.1053(k)(2)(ii).

6. Paragraph (d)(1) of the silica standard allows employers to use either the performance option in (d)(2) or the scheduled monitoring option in (d)(3) to satisfy their obligation to assess employee exposures to silica. Can an employer use a combination of these two exposure assessment approaches in a single facility?

Yes, as long as the employer ensures that each employee's exposures are adequately assessed. The employer may determine the optimal approach for assessing each employee's silica exposures. This means that, for each individual employee, the employer may choose to use either the performance option under paragraph (d)(2) or the scheduled monitoring option under paragraph (d)(3).

7. Can an employer use the scheduled monitoring option, but then switch to the performance option?

Yes. The employer has the option of switching to the performance option, and can use air monitoring data generated during scheduled monitoring to fulfill assessment requirements under the performance option, provided that the air monitoring data relied on is sufficient to accurately characterize employee exposures. Whether an employer's air monitoring data accurately reflect current exposures depends on several factors, including the degree to which exposures vary by day, shift, or process; work practices used; or the condition of equipment. Furthermore, when following *either* exposure assessment option under the silica standard, the employer must reassess exposures following any changes in the production, process, control equipment, personnel, or work practices that may reasonably be expected to result in new or additional exposures to silica at or above the AL, or when the employer has any reason to believe that new or additional exposures at or above the AL have occurred. *See* 29 C.F.R. § 1910.1053(d)(4).

8. What type of information can an employer use to assess exposures using the performance option?

Under the performance option, the employer must assess each employee's 8-hour TWA exposure using any combination of air monitoring data or objective data, provided that the data is sufficient to accurately characterize employee exposures to silica. *See* 29 C.F.R. § 1910.1053(d)(2). Any data used to assess exposures under the performance option must accurately reflect existing workplace conditions. *See* 81 Fed. Reg. at 16764.

The term "air monitoring data" refers to any monitoring conducted by the employer to comply with the requirements of this standard, including the prescribed accuracy and confidence requirements (*see* 29 C.F.R. § 1910.1053(d)(5), Appendix A).

The term "objective data" means information, such as air monitoring data from industry-wide surveys or calculations based on the composition of a substance, demonstrating employee exposure to silica associated with a particular product or material or a specific process, task, or

activity. The data must reflect workplace conditions closely resembling, or with a higher exposure potential than, the processes, types of material, control methods, work practices, and environmental conditions in the employer's current operations. *See* 29 C.F.R. § 1910.1053(b). Types of data and exposure assessment strategies that may qualify as objective data include:

- Data from industry-wide surveys;
- Data provided by equipment manufacturers;
- Data provided by trade or professional associations;
- Exposure mapping (determining exposures associated with particular locations based on information obtained from sources that may include personal samples, area samples, and direct- reading instruments);
- Calculations based on the composition of a substance;
- Calculations based on the chemical and physical properties of a substance (in those instances where a substance's physical and chemical properties demonstrate employee exposure to silica associated with a particular product or material or a specific process, task, or activity); and
- The employer's historical air monitoring data, including data obtained prior to the effective date of the standard.

The preamble to the standard provides more ideas about data and exposure assessment strategies that could qualify as or generate objective data. *See* 81 Fed. Reg. at 16763. OSHA notes that the same types of objective data that can be used to assess employee exposures under the performance option may be used to demonstrate that employee exposure to silica will remain below the AL of 25 $\mu g/m^3$ measured as an 8-hour TWA under any foreseeable conditions for purposes of ascertaining coverage under paragraph (a)(2). Objective data, such as an employer's historical air monitoring data, reflecting "worst case" conditions, in particular, may be helpful in characterizing exposures for purposes of determining coverage under the standard.

When employers rely on objective data generated by others as an alternative to developing their own air monitoring data, they remain responsible for ensuring that the data relied upon accurately characterize each employee's current exposures.

9. Given the potential for variability in silica exposures in some industries, how can an employer using the performance option for assessing exposures "accurately characterize" exposures?

An employer may characterize employee exposures within a range. For example, an employer following the performance option could determine that an employee is exposed below the AL or between the AL and the PEL. *See* 81 Fed. Reg. at 16763. An employer using the performance option could also determine that exposures exceed the PEL by a certain level, such as less than 10 times the PEL. In addition, an employer using the performance option could characterize exposures using a "worst-case" assessment of the highest exposure levels expected during an employee's workday. OSHA notes that employers must reassess exposures when a change occurs that could reasonably be expected to result in new or additional exposures at or above the AL. *See* 29 C.F.R. § 1910.1053(d)(4).

10. Can an employer use old sampling data for its exposure assessment?

Yes. Old sampling data, or historical air monitoring data, may qualify as "objective data" if the data demonstrate employee exposure to silica associated with a particular product or material or a specific process, task, or activity. Like all objective data, old sampling data can be used to assess current exposures only if the data reflect workplace conditions closely resembling or with a higher exposure potential than the processes, types of material, control methods, work practices, and environmental conditions in the employer's current operations. *See* 29 C.F.R. § 1910.1053(b). Any historical air monitoring data (or other objective data) an employer uses to meet its exposure assessment obligations under the performance option must, alone or in combination with other objective data, enable the employer to accurately characterize employee exposures. *See* 29 C.F.R. § 1910.1053(d)(2). Employers must characterize employees' exposure as an 8-hour TWA in micrograms per cubic meter of air ($\mu g/m^3$).

11. Can employers use data from real-time monitoring and exposure mapping to assess employee exposures under the performance option?

Yes. Data generated by real-time monitoring of respirable dust levels (conducted using direct-reading instruments) can be combined with exposure mapping to assess employee exposures under the performance option, provided that the data can be correlated with individual employee exposures and otherwise meet the requirements for objective data. OSHA notes that in order to estimate the level of respirable crystalline silica in the air using real-time monitoring data, employers must also know the percentage of silica in the dust (*e.g.*, from the analysis of a bulk sample or information from a safety data sheet). If an employer does not know the percentage of silica in the dust, it can assume 100% of the respirable dust is silica for purposes of determining worst case exposures from real-time monitoring data under the standard.

12. If an employer characterizes employee exposures under the performance option using objective data from real-time monitoring and exposure mapping, how often does the employer need to repeat the monitoring and mapping process?

The goal of the performance option is to give employers flexibility to accurately characterize employee exposures using whatever combination of air monitoring data or objective data is most appropriate for their circumstances. Therefore, OSHA has not specified exactly how often data should be collected for these purposes. Employers may rely on existing data as long as the data continues to be sufficient to accurately characterize employee exposures. OSHA notes, however, that accurately characterizing employee exposures is an ongoing duty, and employers must reassess exposures whenever a change in the production, process, control equipment, personnel, or work practices may reasonably be expected to result in new or additional exposures at or above the AL, or when the employer has any reason to believe that new or additional exposures at or above the AL have occurred. *See* 29 C.F.R. § 1910.1053(d)(4).

13. If an employer using the performance option elects to characterize exposures using area samples or other exposure mapping approaches, how many specific testing locations/positions are required?

OSHA has not specified or recommended a particular number of testing locations or positions. If an employer chooses to characterize exposures using area samples or other exposure mapping approaches, it must determine which testing locations or positions will provide it with the data needed to accurately characterize the exposure of each employee. *See* 29 C.F.R. § 1910.1053(d)(2). Care must be taken when extrapolating data from area samples or other exposure mapping approaches to avoid mischaracterizing an employee's personal TWA exposure.

14. Under the performance option in paragraph (d)(2) of the standard, can data reflecting conditions that are standard across an industry be used to assess exposures of employees at individual facilities?

Yes, provided that the requirements in the standard are met. First, the data must meet the definition of "objective data." Specifically, the data must demonstrate employee exposure to silica associated with a particular product or material or a specific process, task, or activity, and reflect workplace conditions closely resembling or with a higher exposure potential than the processes, types of material, control methods, work practices, and environmental conditions in the employer's current operations. *See* 29 C.F.R. § 1910.1053(b). Objective data could be, for example, air monitoring data developed by an industry trade association based on standard products and processes in that industry. Second, the data must be sufficient to accurately characterize employee exposures to silica at the specific worksite. *See* 29 C.F.R. § 1910.1053(d)(2).

In order to determine whether the data meet these requirements, an evaluation of silica-generating tasks must be performed by each employer at each facility. This evaluation would generally involve determining whether the conditions under which the objective data were generated are similar enough to, or have a higher exposure potential than, the conditions at the employer's worksite such that the data "accurately characterize" exposures for each employee performing the tasks in question. Employers that rely on objective data generated by others are responsible for ensuring that the data relied upon accurately characterize their own employees'

exposures. And employers must keep records of any objective data used to characterize their employees' exposures, in accordance with paragraph (k)(2).

15. Does an employer using the performance option to assess exposures have ongoing exposure assessment obligations?

Yes. The duty to assess employee exposures under the performance option is ongoing. There is no set schedule for reassessment of exposures under the performance option. However, in order for an employer to continue to accurately characterize its employees' exposures, reassessment must occur whenever a change in the production, process, control equipment, personnel, or work practices may reasonably be expected to result in new or additional exposures at or above the AL, or when the employer has any reason to believe that new or additional exposures at or above the AL have occurred. *See* 29 C.F.R. § 1910.1053(d)(4). For example, reassessment would be required if the flow rate of the employer's ventilation system decreases. Not all changes in the workplace, however, will trigger the reassessment requirement. For example, reassessment would not be required if a personnel change is made that is not expected to impact the magnitude of employee exposure to silica.

If an employer wants to minimize the frequency with which it needs to reassess employee silica exposures, the employer can, at the outset, characterize exposures within a range, *e.g.*, between the AL and the PEL, or using the worst case (or highest exposure) scenario.

16. Assume that one facility produces two similar products – Products A and B – on different days. When determining employee exposures for days when the facility is producing product B, can the employer rely on employee exposure data generated on days when the facility is producing product A?

It depends. Under the performance option, objective data may be used to characterize employee exposures when that data reflects workplace conditions closely resembling or with a higher exposure potential than the processes, types of material, control methods, work practices, and environmental conditions in the employer's current operations. *See* 29 C.F.R. § 1910.1053(b). If the workplace conditions under which product A is produced are the same or have a higher exposure potential than the conditions that will exist when product B is produced, then the employer could reasonably determine that the exposure information generated based on product A can be used to characterize exposures for the days when product B is produced. In order to make this determination, the employer must consider the processes, types of material, control methods, work practices, and environmental conditions that exist when producing both products, The employer must be able to demonstrate that, in both cases, the employee exposure information relied upon is sufficient to accurately characterize exposures under paragraph (d)(2).

An employer using the scheduled monitoring option must reassess employee exposures whenever a change in the production, process, control equipment, personnel, or work practices may reasonably be expected to result in new or additional exposures at or above the AL, or when the employer has any reason to believe that new or additional exposures at or above the AL have occurred. *See* 29 C.F.R. § 1910.1053(d)(4). If an employer has performed exposure monitoring when the facility is producing product A, and plans to switch production to product B, the

employer will need to determine if any changes made as a result of the change in product are reasonably expected to result in new or additional silica exposures at or above the AL. If such new or additional exposures are reasonably expected, the employer must perform additional monitoring during production of product B. If new or additional exposures above the AL are not reasonably expected, the employer may rely on the sampling data collected during production of product A.

17. Do employers need to sample *every* employee when using the scheduled monitoring option?

No. Employers using the scheduled monitoring option must assess the 8-hour TWA exposure for each employee on the basis of one or more personal breathing zone air samples that reflect the exposures of employees on each shift, for each job classification, in each work area. But, where several employees perform the same tasks on the same shift and in the same work area, employers may sample a representative fraction of these employees in order to meet this requirement. Representative sampling involves monitoring the employee or employees reasonably expected to have the highest exposure (for example, the employee closest to an exposure source). *See* 29 C.F.R. § 1910.1053(d)(3)(i). This exposure is then assigned to the other employees in the group who perform the same tasks on the same shift and in the same work area.

Employers should remember that the general industry standard requires employers to individually notify each affected employee in writing of the results of the exposure assessment or post the assessment results in an appropriate location accessible to all affected employees. *See* 29 C.F.R. § 1910.1053(d)(6)(i). The term "affected" includes all employees whose exposures were assessed, even those employees whose exposures were determined by representative sampling of other employees.

18. What if an employee refuses to wear a personal sampler?

The silica standard does not prohibit employers from requiring employees to wear personal samplers as a condition of employment, however, other state or federal laws or regulations, or collective bargaining agreements, may apply. OSHA notes that the standard does not require employers to sample every employee at each worksite. For example, under the scheduled monitoring option, employers may use representative sampling to assess the exposure of employees. *See* 29 C.F.R. § 1910.1053(d)(3)(i).

19. Do employers need to report sampling results to OSHA?

No. However, employers must make and maintain accurate records of all exposure measurements taken to assess employee exposure and all objective data relied upon to comply with the standard. *See* 29 C.F.R. § 1910.1053(k)(1), (2). These records must be provided to OSHA upon request. *See* 29 C.F.R. § 1910.1020(e)(3)(i).

20. Under Appendix A to the standard, employers must ensure that each laboratory used to analyze their silica air samples "[i]mplements an internal quality control (QC)

program that evaluates analytical uncertainty and provides employers with estimates of sampling and analytical error" (SAE). 29 C.F.R. § 1910.1053, Appendix A; 29 C.F.R. § 1910.1053(d)(5). May employers consider the laboratory's estimated SAE when determining their employees' silica exposure levels?

Considering the SAE associated with employers' air sampling results can enhance employers' understanding of exposures that occur in their workplaces by providing an indication of the extent to which random measurement error can affect sampling results. Employers considering the SAE reported by their labs should, however, consider both the lower *and* upper ends of the range of exposures described using the SAE. Employers can be confident that a measured exposure is below the PEL if the sum of the sampling result and the result times the SAE is below the PEL. For example, an employer that receives a sample result of 40 $\mu g/m^3$ with a reported SAE of 18 percent can be confident that the exposure is below the PEL because the upper end of the exposure range is below 50 $\mu g/m^3$ (*i.e.*, 40 + (40 x .18) = 47.2). However, where requirements of the standard are triggered by exposure levels (*i.e.*, the AL or the PEL), these requirements are triggered by the measured exposure level, without regard to SAE.

21. How does OSHA take into account the SAE when evaluating compliance with the PEL?

OSHA uses its own SAE (*i.e.*, the SAE calculated by OSHA's lab) in its enforcement of PELs, including the silica PEL. The sample result being analyzed by OSHA's lab must exceed the PEL by more than the PEL multiplied by the SAE to be considered an overexposure (*see* Section II, Chapter 1, IV.D of the OSHA Technical Manual, https://www.osha.gov/dts/osta/otm/otm_ii/otm_ii_1.html). For example, given the silica PEL of 50 $\mu g/m^3$ and assuming an SAE of 17 percent, an air sample result would have to be greater than 58.5 $\mu g/m^3$ (*i.e.*, 50 + (50 x 0.17)) to be considered to have exceeded the PEL. This policy gives employers the benefit of the doubt because it assumes that a sample result that is above the PEL, but below the PEL adjusted for the SAE (*i.e.*, PEL + (PEL x SAE)), is not a violation of the standard. OSHA does not cite an employer for a violation of the exposure limit unless the Agency has obtained a sample measurement that is above the PEL after accounting for SAE.

22. Are employers required to include employees' social security numbers in air monitoring records?

The silica standard, like many of OSHA's health standards, requires that records of air monitoring data include the affected employees' social security numbers. *See* 29 C.F.R. § 1910.1053(k)(1)(ii)(G). The standard also requires social security numbers on medical records. *See* 29 C.F.R. § 1910.1053(k)(3)(ii)(A). OSHA has historically required social security numbers on these records because social security numbers, which do not change over time, are unique and constant personal identifiers that offer a useful method for linking records with individual employees. However, increasingly widespread concerns about identity theft have prompted OSHA to reexamine whether requiring social security numbers on records is still appropriate. Recognizing the seriousness of the threat of identity theft, and the availability of other methods for tracking employees for research purposes, if needed, OSHA has recently reexamined the social security number collection requirements in its standards. OSHA has

published a proposed rule, entitled *Standards Improvement Project (SIP)-Phase IV*, proposing to comprehensively remove from OSHA health standards all requirements for employers to include employee social security numbers on exposure monitoring, medical surveillance, and other records. *See* 81 Fed. Reg. 68504 (Oct. 4, 2016).

Although *SIP-Phase IV* is still in the final rule development stage, if an employer complies with a proposed OSHA standard rather than with the standard in effect at the time of the inspection, and the employer's action clearly provides equal or greater employee protection, OSHA will treat the employer's actions as a *de minimis* violation (*i.e.*, a condition in which an employer has implemented a measure different from one specified in a standard that has no direct or immediate relationship to safety or health). *See* OSHA Field Operations Manual (CPL-02-00-160, chapter 4, section VIII, p. 4-24 (8/2/2016)). Thus, OSHA will consider it a *de minimis* violation of the silica standard if an employer does not include employees' social security numbers in otherwise compliant air monitoring or medical records.

23. Do employers need to post social security numbers along with exposure assessment results?

No. Paragraph (d)(6)(i) of the standard requires employers to notify affected employees of exposure assessment results. Employers can do so either by individually notifying each affected employee of the results in writing *or* by posting the results in an appropriate location accessible to all affected employees. If an employer chooses to notify employees by posting the results, the employer can use any employee identification method that ensures affected workers can identify their results, *e.g.*, by using the employees' names, identification numbers, or specific job titles and work shifts.

24. The standard requires employers to notify employees of the results of an exposure assessment within 15 working days after completing the assessment. What if an employer relies on sampling results and it takes longer than 15 working days to receive the results?

If an employer conducts exposure monitoring to assess employee exposures, the period for employee notification of assessment results does not begin to run until the employer receives the monitoring results.

Regulated Areas (29 C.F.R. § 1910.1053(e))

The standard requires employers to establish regulated areas wherever an employee's exposure to airborne concentrations of respirable crystalline silica is, or can reasonably be expected to be, in excess of the PEL. 29 C.F.R. § 1910.1053(e)(1). Employers must demarcate regulated areas from the rest of the workplace in a manner that minimizes the number of employees exposed to silica in those areas and post signs (with a specified legend) at all entrances to regulated areas. 29 C.F.R. § 1910.1053(e)(2), (j)(2). The standard also requires employers to limit access to regulated areas to: (1) persons authorized by the employer and required by work duties to be in those areas; (2) persons entering those areas as designated representatives of employees for the purpose of exercising the right to observe monitoring procedures under paragraph (d) of the standard; and (3) persons authorized to be in such areas by the Occupational Safety and Health

Act and OSHA regulations. 29 C.F.R. § 1910.1053(e)(3). Employers must provide, and require use of, an appropriate respirator for each employee and designated representative who enters a regulated area. 29 C.F.R. § 1910.1053(e)(4).

25. If employees could be exposed above the PEL in a given area, but no employees actually enter the area, or work in the area for a long enough period of time that it would be reasonable to expect their 8-hour TWA exposures to exceed the PEL, does the employer need to establish a regulated area?

No. The term "regulated area" is defined as an area where an employee's silica exposure exceeds, or can reasonably be expected to exceed, the PEL. *See* 29 C.F.R. § 1910.1053(b). If an employer has, and adequately enforces, work rules precluding employees from entering a particular area, then the employer does not need to treat that location as a regulated area. Furthermore, an area does not need to be designated as a regulated area if the employer has and enforces work rules limiting employees' time in the area so that there is no reasonable expectation that their 8-hour TWA exposures will exceed the PEL. OSHA notes, however, that if one or more employees will enter the area long enough that it is reasonable to expect their 8-hour TWA exposures to exceed the PEL, the employer must establish a regulated area and *all* employees entering the area must wear respirators (even those not in the area long enough for their exposures to exceed the PEL). *See* 29 C.F.R. § 1910.1053(e)(4).

26. In some facilities, *e.g.*, a foundry that produces large castings, employees do not perform the same functions every day, and employee exposures are expected to exceed the PEL on some days, *e.g.*, when casting cleaning is performed, but not others. Does the relevant area have to be designated as a regulated area on days when all exposures are below the PEL?

No. In some facilities, exposures above the PEL may be associated with an intermittent activity. Employers do not need to treat an area as a regulated area on days when employee exposures are not reasonably expected to exceed the PEL. In such cases, employers may elect to demarcate the regulated area on a temporary basis, on days when exposures are reasonably expected to exceed the PEL, by means of movable stanchions, portable cones, or barricade tape, as long as the required warning sign with prescribed hazard language is posted at all entrances. *See* 29 C.F.R. § 1910.1053(e)(2), (j)(2).

27. What are the standard's requirements for demarcating a regulated area?

Employers must demarcate (mark off) regulated areas from the rest of the workplace in a manner that minimizes the number of employees exposed to silica within those areas. *See* 29 C.F.R. § 1910.1053(e)(2)(i). However, the standard does not require a specific method of demarcation. Employers can determine how to demarcate regulated areas based on their knowledge of the specific conditions of their workplaces. Traffic cones, stanchions, tape, barricades, lines, or textured flooring may all be effective means of demarcating the boundaries of regulated areas. In determining how to demarcate regulated areas, employers may consider factors such as the configuration of the area, whether the regulated area is permanent, the airborne respirable

crystalline silica concentration, the number of employees in adjacent areas, and the period of time the area is expected to have exposure levels above the PEL.

Employers must also post signs at all entrances to regulated areas that bear the legend specified in paragraph (j)(2) of the standard:

DANGER
RESPIRABLE CRYSTALLINE SILICA
MAY CAUSE CANCER
CAUSES DAMAGE TO LUNGS
WEAR RESPIRATORY PROTECTION IN THIS AREA
AUTHORIZED PERSONNEL ONLY.

See 29 C.F.R. § 1910.1053(e)(2)(ii). The purpose of these signs, which supplement the training employees receive under other provisions of the standard, is to minimize the number of employees in a regulated area by alerting them that they must be authorized to enter, and to ensure that employees take appropriate protective measures when entering.

28. If personal sampling results show that one employee, who works in a small, non-enclosed area of a large building, is exposed above the PEL, but another employee, who is only a short distance away, is exposed below the PEL, how does the employer decide how far to extend the regulated area?

Because there is an exposure above the PEL, the facility must determine which task or operation is creating the overexposure and create a regulated area around that task or operation. In the example provided, the regulated area may include only the first employee's work station. If the second employee is not exposed above the PEL and is not reasonably expected to be exposed above the PEL, the regulated area does not have to cover that employee's work area. An employer could choose to use area sampling, real-time monitoring, or exposure mapping to assist in identifying the boundaries of a regulated area.

29. May an employer alter the language specified in paragraph (j)(2) for the warning signs required at entrances to regulated areas?

Signs bearing all of the specific cautionary wording specified in the standard must be posted at entrances to all regulated areas. *See* 29 C.F.R. § 1910.1053(e)(2)(ii). Thus, the signs must say: "DANGER – RESPIRABLE CRYSTALLINE SILICA – MAY CAUSE CANCER – CAUSES DAMAGE TO LUNGS – WEAR RESPIRATORY PROTECTION IN THIS AREA – AUTHORIZED PERSONNEL ONLY." 29 C.F.R. § 1910.1053(j)(2). Additional words or information may be included on the sign provided that the additional material is not confusing or misleading and does not detract from the language required by the standard. For example, employers may choose to include information about other silica-related health hazards, *e.g.*, kidney damage, or a heading at the top of the sign designed to draw workers' attention, *e.g.*, "Notice for Employees" or "Worker Alert."

Methods of Compliance (29 C.F.R. § 1910.1053(f))

The standard requires employers to use engineering and work practice controls to reduce and maintain employee exposure to silica to or below the PEL, unless they can demonstrate that such controls are not feasible. Wherever feasible engineering and work practice controls are not sufficient to reduce employee exposure to or below the PEL, the employer must reduce exposures to the lowest feasible level through these methods, and then provide appropriate respiratory protection. 29 C.F.R. § 1910.1053(f)(1).

30. Are employers permitted to use administrative controls to comply with the PEL?

Yes. Administrative controls, which are a type of work practice control, are an acceptable means of reducing employee exposures under 29 C.F.R. § 1910.1053(f)(1). For example, an employer could schedule high-exposure tasks to be conducted when employees are not working in adjacent areas. The standard does not prohibit the rotation of employees (a type of administrative control) to limit employee exposures. However, OSHA discourages this practice as a means of avoiding implementation of engineering and other work practice controls. It can be administratively difficult to maintain employees' exposures at or below the PEL solely using rotation. Moreover, the use of rotation may require the employer to provide medical surveillance to additional workers and to train many workers on multiple jobs.

31. Under 29 C.F.R. § 1910.1053(f)(1), employers must implement feasible engineering and work practice controls to reduce and maintain silica exposures to or below the PEL. If such controls are not sufficient to reduce exposures to that level, employers are nevertheless required to implement controls that reduce exposures to the lowest feasible level. Do the two uses of the term "feasible" in this paragraph impose separate requirements?

No. Paragraph (f)(1) requires employers to use feasible engineering and work practice controls to reduce and maintain exposures to or below the PEL. If the use of engineering and work practice controls results in exposures at or below the PEL, the employer need not use additional controls (even if feasible) to lower exposures further (*i.e.*, to an even lower level). On the other hand, if exposures are *above the PEL*, but the employer can demonstrate that it has implemented all feasible engineering and work practice controls, then the employer is in compliance with paragraph (f)(1) (assuming the provision and use of required respiratory protection in accordance with paragraph (g)).

Written Exposure Control Plan (29 C.F.R. § 1910.1053(f)(2))

The standard requires employers to establish and implement a written exposure control plan that contains at least the following elements: (1) a description of the tasks in the workplace that involve exposure to silica; (2) a description of the engineering controls, work practices, and respiratory protection used to limit employee exposure to silica for each task; and (3) a description of the housekeeping measures used to limit employee exposure to silica. 29 C.F.R. § 1910.1053(f)(2)(i). The plan must be reviewed and evaluated for effectiveness at least annually and updated as necessary. 29 C.F.R. § 1910.1053(f)(2)(ii).

32. Does the standard require employers to list all of the tasks that could involve *any* exposure to silica in their written exposure control plans?

No. Tasks that are not covered by the standard, *e.g.*, because the employer has objective data demonstrating that employee exposures will remain below the AL under any foreseeable conditions, do not need to be included in the written exposure control plan.

33. In the written exposure control plan, what level of detail is required for the description of workplace tasks that involve silica exposures?

The written exposure control plan must describe the tasks that involve silica exposures in sufficient detail to enable the employer and employees to consistently identify and control silica-related hazards. *See* 29 C.F.R. § 1910.1053(f)(2)(i)(A); 81 Fed. Reg. at 16800-1. Thus, for example, if the materials being disturbed or the conditions under which the tasks are performed are relevant to the level of exposure related to the particular task, that information must be included. Employers may develop a single comprehensive plan for each worksite that includes all of the silica-generating tasks that employees will perform at the worksite (*i.e.*, employers do not need separate exposure control plans for different operations, processes, or shifts at the same worksite). However, using a broad term that could describe multiple tasks, such as "foundry operations" or "manufacturing," would not be sufficiently descriptive.

Note that in addition to describing the silica-generating tasks, the exposure control plan must also include a description of the engineering controls, work practices, and respiratory protection used to limit exposure to respirable crystalline silica. *See* 29 C.F.R. § 1910.1053(f)(2)(i)(B).

34. Does the standard require employers to document their review and evaluation of the written exposure control plan?

No. The standard requires employers to review and evaluate the effectiveness of the written exposure control plan at least annually, and to update it as necessary, because work conditions can change (*e.g.*, the employer purchases a new type of equipment). However, the standard does not require that the review and evaluation be in writing or documented. Any updates to the plan adopted as a result of the review will need to be documented by incorporation in the written plan, and employers may document the review and evaluation process as a best practice. Retaining such documentation can help employers verify that they have reviewed and evaluated the plan, as required.

Housekeeping (29 C.F.R. § 1910.1053(h))

The standard includes requirements related to housekeeping. Under the standard, employers must not allow dry sweeping or dry brushing "where such activity could contribute to employee exposure to respirable crystalline silica unless wet sweeping, HEPA-filtered vacuuming or other methods that minimize the likelihood of exposure are not feasible." 29 C.F.R. § 1910.1053(h)(1). In addition, employers must not allow compressed air to be used to clean clothing or surfaces where such activity could contribute to employee exposure to respirable crystalline silica unless (1) the compressed air is used in conjunction with a ventilation system

that effectively captures the dust cloud created by the compressed air, or (2) no alternative method is feasible. 29 C.F.R. § 1910.1053(h)(2).

In addition, the employer's exposure control plan must include a description of the housekeeping measures used to limit employee exposure to respirable crystalline silica. 29 C.F.R. § 1910.1053(f)(2)(i)(C).

35. If an employer has objective data demonstrating that employee exposure will remain below the AL of 25 µg/m^3 as an 8-hour TWA under any foreseeable conditions, does the prohibition on dry sweeping, dry brushing, and the use of compressed air for cleaning clothing and surfaces apply?

No, none of the standard's requirements apply if the employer has objective data demonstrating that exposures will remain below the AL under any foreseeable conditions. Employers should note, however, that dry sweeping, dry brushing, and the use of compressed air, either alone or in combination with other tasks, *can* result in exposures at or above the AL. Employers should consider the duration of the dry sweeping, dry brushing, or use of compressed air; the location and frequency of the tasks; and other factors in developing objective data to demonstrate that employee exposures will remain below the AL under any foreseeable conditions. (Note that the standard's housekeeping provisions apply in areas where dry sweeping, dry brushing, or the use of compressed air could contribute to the exposures of any employees who *are* covered by the standard.)

36. Some employers use drivable powered industrial sweepers equipped with rotating brushes that lift dirt and dust from the floor and feed the dirt and dust into a vacuum located on the underside of the equipment. Some of these sweepers are equipped with HEPA filters. Do the housekeeping provisions in the silica standard prohibit the use of this type of equipment?

When these types of sweepers are equipped with HEPA filters, and effectively remove dirt and dust, their use is considered "HEPA-filtered vacuuming" for purposes of paragraph (h)(1) of the standard, and they are not prohibited by the rule. When these types of sweepers are *not* equipped with HEPA filters, their use is considered an "other [housekeeping] method[]," and they are not prohibited by the standard's housekeeping provisions, as long as they are operated and maintained properly so as to minimize the likelihood of employee exposure. *See* 29 C.F.R. § 1910.1053(h)(1).

For *all* such sweepers (HEPA or non-HEPA), the employer using the sweeper must ensure compliance with *all* applicable provisions of the silica standard, including the PEL. Thus, the employer must assess the exposures of employees operating or working in the vicinity of the sweeper in accordance with paragraph (d) of the standard. And if any of those employees are exposed to silica levels above the PEL, the employer must use feasible engineering and work practice controls to reduce and maintain each employee's exposure to or below the PEL in accordance with paragraphs (c) and (f)(1) of the standard. Such controls could include appropriate modifications to the sweepers (*e.g.*, installing a shroud around the bottom of the equipment to limit escaping dust) or establishing new, appropriate work practices. If feasible engineering and work practice controls are not sufficient to reduce exposures to or below the PEL, the employer must use them to reduce employee exposure to the lowest feasible level and provide appropriate respiratory protection that complies with the requirements of paragraph (g). *See* 29 C.F.R. § 1910.1053(f)(1).

OSHA encourages employers to acquire industrial sweepers equipped with HEPA filters when their existing sweepers need to be replaced.

37. Under the standard, an employer may not allow the use of dry sweeping or dry brushing where such activity could contribute to employee exposure to silica unless wet sweeping, HEPA-filtered vacuuming, or other methods that minimize the likelihood of exposure are not "feasible." 29 C.F.R. § 1910.1053(h)(1). The standard contains a similar prohibition on the use of compressed air to clean clothing or surfaces; such use is prohibited unless the compressed air is used in conjunction with a ventilation system that effectively captures the dust cloud created by the compressed air or "[n]o alternative method is feasible." 29 C.F.R. § 1910.1053(h)(2). What is the definition of "feasible" in this context?

The standard does not require employers to demonstrate that wet methods, a HEPA-filtered vacuum, or other methods are *impossible* to use in order to establish "infeasibility" for purposes of paragraph (h). As explained in the preamble to the standard, the limited "infeasibility" exceptions included in these housekeeping provisions are intended to encompass situations where wet methods, HEPA-filtered vacuuming, and other exposure-minimizing methods are not effective, would cause damage, or would create a hazard in the workplace. *See* 81 Fed. Reg. at 16795-96. For example, an employer can establish infeasibility for these purposes by demonstrating that wet sweeping, using a HEPA-filtered vacuum, and other methods that minimize the likelihood of exposure would negatively impact the quality of the work being done. However, even in cases where one of the acceptable cleaning methods may not be feasible, employers may be able to use another acceptable cleaning method. Irrespective of the housekeeping method used, employers must always assess and limit the silica exposures of employees, as required by paragraphs (c) and (d)(1).

A. What are some examples of situations where wet sweeping may be considered infeasible under paragraph (h)?

In some cases, wet sweeping may be infeasible where:

- The use of water would make an elevated surface slick and create a fall hazard;
- The water could come into contact with electrical panels, outlets, and other electrical equipment and such contact could damage the equipment or pose an electrical hazard;
- The water could come into contact with molten metal and create an explosion hazard;
- The water would cause the dust to harden (such as can occur with Portland cement dust or fly ash); or
- The use of water would adversely affect the quality of the final product.

B. What are some examples of situations where HEPA-filtered vacuuming may be infeasible under paragraph (h)?

In some cases, HEPA-filtered vacuuming may be infeasible where:

- Tight or obstructed spaces prevent a vacuum, hose, or nozzle from accessing or effectively cleaning the space (such as around some pipes, meters, and gauges); or

- Very large amounts of silica-containing materials must be cleaned, and the volume of material cannot effectively be cleaned by vacuuming.

With respect to A and B above, employers should note that, even in cases where one of the standard's acceptable cleaning methods is not feasible, employers may be able to use another acceptable cleaning method. Employers that use dry sweeping or dry brushing must be able to demonstrate that *none* of the alternative acceptable housekeeping methods (wet sweeping, HEPA-filtered vacuuming, or other methods that minimize the likelihood of exposure) are feasible. *See* 29 C.F.R. § 1910.1053(h)(1).

Paragraph (h) does not prohibit the use of tools such as shovels or floor scrapers to clean silica-containing materials from floors and other surfaces, so these tools may be used without the employer first demonstrating the infeasibility of other cleaning methods. Employers must, however, assess and limit the silica exposures (if any) of employees performing tasks with shovels or floor scrapers, as required by paragraphs (c) and (d)(1).

C. **What are some examples of situations where the use of compressed air without a ventilation system may be permissible (*i.e.*, because the compressed air cannot be used with a ventilation system that effectively captures the dust cloud a*nd* no other alternatives are feasible)?**

In some situations, use of a ventilation system in conjunction with compressed air may be infeasible because of the size or configuration of the equipment, and alternative cleaning methods may not be available. In those cases, employers may use compressed air *without* a ventilation system. Examples may include:

- Cleaning the inside of electrical control panels; and
- Cleaning machine assemblies, in cases where removing dust from tight spaces, nooks, and crannies is required.

Note that even for these tasks, employers may only use compressed air without a ventilation system if no alternative cleaning methods are feasible. Employers must always consider the feasibility of alternative cleaning methods, including wet sweeping, HEPA-filtered vacuuming, and compressed air in conjunction with an adequate ventilation system, before determining that the use of compressed air without a ventilation system is necessary. *See* 29 C.F.R. § 1910.1053(h)(2). For example, employers may use compressed air without a ventilation system where a ventilation system cannot be used with the compressed air, and the use of all other cleaning methods would damage the equipment (such as where the manufacturer indicates that compressed air is the only acceptable cleaning method).

38. Does the standard prohibit the use of commercially-available dust-suppression sweeping compounds in conjunction with dry sweeping and dry brushing?

No. The proper use of commercially-available dust-suppression sweeping compounds in accordance with the manufacturer's instructions is a cleaning "method[] that minimize[s] the

likelihood of exposure" for purposes of paragraph (h)(1). Thus, it is an acceptable housekeeping method under the standard.

39. If a commercially-available dust-suppression sweeping compound contains crystalline silica, does the standard permit employers to use it in conjunction with dry sweeping and brushing?

Yes, provided the compound is used properly and effectively suppresses the generation of *respirable* crystalline silica dust during dry sweeping or dry brushing.

40. If an employer uses water spray to wet dust before sweeping, is that considered "wet sweeping" or "dry sweeping"?

OSHA considers this wet sweeping, permitted under the housekeeping provisions of the standard, as long as the dust is still wet when it is swept.

41. Is shoveling large clumps of dirt or clay materials from the floor into wheelbarrows or other containers considered dry sweeping under 29 C.F.R. § 1910.1053(h)(1)?

No. Shoveling is not considered dry sweeping, regardless of the type or amount of material being shoveled, and is not subject to the restrictions on dry sweeping in the standard. Instead, employers would need to assess exposures and follow the hierarchy of controls to reduce and maintain exposures to or below the PEL, as required by paragraphs (c) and (d)(1).

42. Does the standard prohibit an employer from using compressed air as part of a task not related to cleaning clothing or surfaces?

No. The standard generally prohibits the use of compressed air "to clean clothing or surfaces" where that activity can contribute to employee silica exposures. 29 C.F.R. § 1910.1053(h)(2). It does not prohibit the use of compressed air for purposes other than cleaning clothing or surfaces, *e.g.*, for operating a pneumatic tool. Employers may also use compressed air for housekeeping purposes when the compressed air is used in conjunction with a ventilation system that effectively captures the dust cloud created by the compressed air, or if no alternative method for cleaning clothes or surfaces is feasible. *See* 29 C.F.R. § 1910.1053(h)(2)(i), (ii). When the standard permits the use of compressed air, and the employer does not have objective data demonstrating that the employee exposures resulting from the use of compressed air will remain below the AL under any foreseeable conditions, the employer must comply with exposure control requirements and other applicable provisions of the standard.

43. The standard allows the use of compressed air to clean clothing or surfaces when the compressed air is used in conjunction with a ventilation system that effectively captures the dust cloud created by the compressed air. What type of ventilation system is acceptable to use?

The standard does not specify the use of a particular ventilation system for these purposes. Whatever type of system is selected, it must be able to effectively capture any dust cloud created

by the use of compressed air, thereby preventing the dust cloud from entering employees' breathing zones and contributing to silica exposures. For example, in the preamble to the standard, OSHA noted that the use of clothes-cleaning booths would be permitted because although such booths use compressed air to clean clothes, the dust is "blown out of the employee's breathing zone and is captured by a filter." 81 Fed. Reg. at 16797.

44. Do all vacuums need HEPA filters?

No. The general industry standard does not require vacuums to be equipped with HEPA filters. However, when vacuums are used without HEPA filtration, they may contribute to employee silica exposures. Employers should consider any such exposures for purposes of compliance with all of the provisions of the standard. For example, if fugitive dust from non-HEPA-filtered vacuuming or other discharge from vacuums contributes to employee exposures that exceed the PEL, then the employer would need to follow the hierarchy of controls to reduce and maintain exposures to or below the PEL. In such situations, employers might consider fitting vacuums with HEPA filters or using vacuum systems that discharge outside the facility.

45. Does the standard prohibit the use of a vacuum to clean silica dust from employees' clothing? Are vacuums required to be equipped with HEPA filters?

The answer to both questions is no. The standard does not prohibit the use of a vacuum to remove silica dust from employees' clothes (*e.g.*, before employees leave the worksite for lunch or at the end of their shift), nor does it require vacuums to be equipped with HEPA filters. However, when vacuums without HEPA filtration are used to clean clothing, they may contribute to employee silica exposures. Employers should consider any such exposures for purposes of compliance with all of the provisions of the standard. For example, if fugitive dust from non-HEPA-filtered vacuuming or other discharge from vacuums contributes to employee exposures that exceed the PEL, then the employer would need to follow the hierarchy of controls to reduce and maintain exposures to or below the PEL. In such situations, employers might consider fitting vacuums with HEPA filters or using vacuum systems that discharge outside the facility.

46. Does the standard prohibit the use of pneumatic hand-held tools that exhaust compressed air, *e.g.*, through the handle or side barrel ports, or along the tool?

No. With some exceptions, the standard prohibits the use of compressed air for cleaning clothing and surfaces. It does not address compressed air exhausted from hand-held tools. However, employers should remember to consider any exposures created by the exhausted air to ensure compliance with all provisions of the standard. For example, if the exhausted air contributes to silica exposures that exceed the PEL, the employer would need to follow the hierarchy of controls to reduce and maintain exposures to or below the PEL. *See* 29 C.F.R. § 1910.1053(f)(1).

Medical Surveillance (29 C.F.R. § 1910.1053(i))

The general industry standard requires employers to make medical surveillance available at no cost, and at a reasonable time and place, to any employee who will be occupationally exposed to respirable crystalline silica at or above the AL (or, before June 23, 2020, above the PEL) for 30 or more days a year. 29 C.F.R. § 1910.1053(i)(1)(i), (l)(4). All required medical examinations and procedures must be performed by a physician or other licensed health care professional (PLHCP), defined as an individual whose legally permitted scope of practice allows him or her to independently provide or be delegated the responsibility to provide some or all of the particular health care services required by paragraph (i) of the standard. 29 C.F.R. § 1910.1053(b), (i)(1)(ii). An examination must be offered within 30 days of initial assignment, unless the employee has received a medical examination that meets the requirements of the standard within the last three years. 29 C.F.R. § 1910.1053(i)(2). Thereafter, the employee must be offered a follow-up examination at least every three years, or more frequently if recommended by the PLHCP. 29 C.F.R. § 1910.1053(i)(3).

The examinations must include a medical and work history, a physical examination, a chest x-ray, a pulmonary function test, a test for latent tuberculosis infection (initial exam only), and any other tests deemed appropriate by the PLHCP. 29 C.F.R. § 1910.1053(i)(2). *See* paragraph (i)(2) of the standard for more detailed information about the content of required medical exams. The employee will receive a written medical report from the PLHCP within 30 days of each exam that includes: (1) a statement indicating the results of the medical examination; (2) any recommended limitations on the employee's use of respirators; (3) any recommended limitations on the employee's exposure to silica; and (4) a statement, if applicable, that the employee should be examined by a specialist. 29 C.F.R. § 1910.1053(i)(5). *See* paragraph (i)(5) for more detailed information about the required content of written medical reports provided to employees.

The employer must also obtain a written medical opinion from the PLHCP within 30 days of each exam; this opinion contains more limited information than the report to the employee. The PLHCP's opinion to the employer contains the date of the examination, a statement that the examination has met the requirements of the standard, and any recommended limitations on the employee's use of respirators. 29 C.F.R. § 1910.1053(i)(6)(i). If the employee gives written authorization, the written opinion for the employer must also contain any recommended limitations on the employee's exposure to silica and/or a statement that the employee should be seen by a specialist (if applicable). 29 C.F.R. § 1910.1053(i)(6)(ii). The employer must ensure that each employee receives a copy of the written medical opinion provided to the employer within 30 days of his or her exam. 29 C.F.R. § 1910.1053(i)(6)(iii).

47. Does the silica standard preclude in-house health care providers from performing the required medical surveillance examinations?

No. For initial and periodic examinations, employers may choose to use any health care provider that meets the definition of a PLHCP in paragraph (b) of the standard, including a qualified in-house health care professional. Similarly, if an additional examination by a specialist is required by 29 C.F.R. § 1910.1053(i)(7), an employer with a specialist on staff may elect to have the additional examination(s) performed by that in-house physician. Employers must ensure that in-

house PLHCPs, like all PLHCPs performing medical surveillance examinations and procedures under the silica standard, adhere to the standard's confidentiality requirements. *See* 29 C.F.R. § 1910.1053(i)(6)(ii), (7)(iv).

48. Under the standard, can an employer require employees who participate in medical surveillance to see a health care professional of the employer's choice?

Yes, the silica standard permits employers to select a health care professional to perform the medical examinations required by the standard. Employers must ensure that all the medical examinations required by the standard are performed by a PLHCP, *i.e.*, "an individual whose legally permitted scope of practice (*i.e.*, license, registration, or certification) allows him or her to independently provide or be delegated the responsibility to provide some or all of the particular health care services required by paragraph (i)." 29 C.F.R. § 1910.1053(b), *see also* 29 C.F.R. § 1910.1053(i)(1)(ii). Employers should consult state or local laws for relevant requirements.

49. Does the standard require employees to participate in medical surveillance?

No, although the standard requires employers to make medical surveillance available to qualifying employees, the standard does not require qualifying employees to participate in medical surveillance. However, the employer must offer the examination fairly and in good faith, at no cost to employees, and at a reasonable time and place, and must make another examination available if the employee requests it, or, at a minimum, the next time an examination is due (*i.e.*, within three years). *See* 29 C.F.R. § 1910.1053(i). In addition, the standard requires employers to train employees on the purpose of the medical surveillance program. *See* 29 C.F.R. § 1910.1053(j)(3)(i)(E). If an employer wishes to document an employee's decision to decline a medical examination, the employer could ask the employee to sign a statement affirming that he or she was offered the benefits and declined to participate.

Note that the medical examination under the silica standard is different than the medical evaluations required under the respiratory protection standard. If an employee declines a medical evaluation under the respiratory protection standard, then the employer may not assign him or her a task requiring respirator use.

50. Although the standard does not require employees to participate in medical surveillance, can an employer make such participation mandatory?

Nothing in the silica standard precludes an employer from requiring participation in medical surveillance programs, as appropriate under other applicable laws or collective bargaining agreements.

51. The silica standard limits the information that can be included in a PLHCP's or specialist's written medical opinion for the employer without the employee's written consent. *See* 29 C.F.R. § 1910.1053(i)(6)(ii), (7)(iv). Does the standard prohibit an employer from receiving any of the information described in 29 C.F.R. § 1910.1053(i)(6)(ii) from sources outside of the medical surveillance examination process, such as via a workers' compensation claim?

No. The standard limits only the information that can be included in the PLHCP's or specialist's written medical opinion for the employer following an examination offered to an employee for purposes of compliance with the medical surveillance provisions of the standard. If an employer uses the same individual or entity to manage medical surveillance and workers' compensation records, there must be separate procedures for maintaining and managing the separate sources of information.

52. Can an employer send an employee for a second opinion after receiving the PLHCP's written medical opinion for the employee's initial or periodic medical surveillance examination?

The standard does not preclude employers from offering employees a second medical surveillance examination that meets the requirements of paragraph (i). However, if *any* of the written medical opinions provided to the employer as a result of the first or subsequent medical surveillance examinations contains a statement that the employee should be examined by a specialist, or a statement that the employee should receive more frequent periodic examinations, then the employer must make the required examination(s) available, in accordance with 29 C.F.R. § 1910.1053(i)(7) or (i)(3), respectively. Any second examination must also be provided at a reasonable time and place and at no cost to the employee, and the restrictions on information that can be provided to the employer without the employee's authorization would apply equally to the second written medical opinion.

53. If a PLHCP recommends that an employee see a specialist, but the employee does not authorize the PLHCP to include that recommendation in the written medical opinion for the employer, does the employer need to make the specialist examination available?

No. The standard requires the employer to make available an additional examination with a specialist only if the PLHCP's written medical opinion for the employer indicates that the employee should be examined by a specialist. *See* 29 C.F.R. § 1910.1053(i)(7)(i). And the employee must provide written authorization before the PLHCP's written medical opinion for the employer may include a recommendation for a specialist examination. *See* 29 C.F.R. § 1910.1053(i)(6)(ii)(B). Thus, if the PLHCP's opinion for the employer does not contain the PLHCP's recommendation for a specialist examination because the employee did not authorize the employer to receive it, then the employer is not responsible for offering additional examinations. *See* 81 Fed. Reg. at 16837.

54. The standard requires respirator use under certain circumstances. Under OSHA's respiratory protection standard, employees must be medically able to use a respirator. What are the employer's responsibilities for employees who are assigned a task that requires the use of a respirator under the standard, but are not medically able to use a negative pressure respirator?

Among other things, OSHA's respiratory protection standard requires employers to provide a medical evaluation to determine the employee's ability to use a respirator, before the employee is fit tested or required to use the respirator in the workplace. *See* 29 C.F.R. § 1910.134(e)(1). It also requires employers to obtain a written recommendation from the PLHCP on whether the employee is medically able to use a respirator. *See* 29 C.F.R. § 1910.134(e)(6)(i)(A). If an employee receives medical surveillance under the silica standard, the PLHCP's written medical opinion for the employer also must include any recommended limitations on the employee's use of respirators. *See* 29 C.F.R. § 1910.1053(i)(6)(i)(C). If a PLHCP determines through either a medical evaluation under the respiratory protection standard, or medical surveillance under the silica standard, that an employee has a medical condition that places the employee's health at increased risk if a negative pressure respirator is used, but the employee can use a powered air purifying respirator (PAPR), then the employer must provide a PAPR. *See* 29 C.F.R. § 1910.134(e)(6)(ii). OSHA believes many workers who are medically unable to use a negative pressure respirator will be able to use a PAPR. However, if an employee cannot use either type of respirator, then the employer must not assign the employee to perform a task that would require the employee to use a respirator. In such a situation, the employer may need to consult other local, state, or federal laws and regulations and collective bargaining agreements to determine its obligations with respect to such employees.

Communication of respirable crystalline silica hazards to employees (29 C.F.R. § 1910.1053(j))

Paragraph (j)(1) of the standard requires employers to include respirable crystalline silica in their hazard communication programs in accordance with 29 C.F.R. § 1910.1200, and the program must address at least the following hazards: cancer, lung effects, immune system effects, and kidney effects. 29 C.F.R. § 1910.1053(j)(1). Paragraph (j)(2) of the standard contains requirements for the signs that must be posted at all entrances to regulated areas. 29 C.F.R. § 1910.1053(j)(2). Paragraph (j)(3) of the standard establishes requirements for employee information and training. The standard requires employers to ensure that each employee who is covered by the silica standard can demonstrate knowledge and understanding of the health hazards associated with exposure to silica, specific tasks in the workplace that could result in exposure to silica, specific measures the employer has implemented to protect employees from exposure to silica, the contents of the standard, and the purpose and a description of the medical surveillance program. 29 C.F.R. § 1910.1053(j)(3).

55. Does this standard require classroom training for employees on the required subjects of the rule?

No. Employers are in the best position to determine how training can most effectively be accomplished. Therefore, the standard does not specify how an employer needs to train

employees. Acceptable forms of training may include hands-on training, videos, slide presentations, classroom instruction, informal discussions during safety meetings, written materials, or any combination of these methods. However, to ensure that employees comprehend the material presented during training, it is critical that trainees have the opportunity to ask questions and receive answers if they do not fully understand the material presented to them. This requirement can be met in a variety of ways. For example, employers that train employees through video presentations or computer-based programs can have a qualified trainer available to address questions after the presentation, or provide a telephone hotline so that trainees have direct access to a qualified trainer. *See* 81 Fed. Reg. at 16845. Employers may also choose to designate a qualified employee to answer questions for these purposes.

56. The standard requires employers to ensure that each employee covered by the standard can demonstrate knowledge and understanding of specified subjects. How do employers ensure that their employees can demonstrate knowledge and understanding of the required subjects?

There is no set method employers must use to ensure employees demonstrate knowledge and understanding of the required subjects. Instead, the standard defines employers' training obligations in terms of performance-oriented objectives meant to ensure that employees are aware of the hazards associated with silica in their workplace and how they can help protect themselves. However, as a general matter, employers can determine whether employees have the requisite knowledge through methods such as discussion of the required training subjects, written tests, or oral quizzes. *See* 81 Fed. Reg. at 16845.

The requirement for training is performance-oriented in order to allow flexibility for employers to provide training as needed to ensure that each employee can demonstrate the knowledge and understanding required under the rule. Although the standard does not set a fixed schedule for periodic training, additional or repeated training may be necessary under certain circumstances. For example, if an employer observes an employee engaging in activities that contradict knowledge gained through training, it is a sign to the employer that the employee may require a reminder or periodic retraining on work practices. *See* 81 Fed. Reg. at 16850.

57. Does the standard require silica-related training for employees for whom the employer has objective data demonstrating that exposures will remain below the AL of 25 µg/m^3 as an 8-hour TWA under any foreseeable conditions?

The training requirements in paragraph (j)(3) apply only to employees who fall within the scope of the silica standard. *See* 29 C.F.R. § 1910.1053(j)(3)(i). However, the hazard communication standard, which includes requirements for hazard communication training, applies to hazardous chemicals (including respirable crystalline silica) regardless of the airborne exposure level. *See* 29 C.F.R. §§ 1910.1053(j)(1), 1910.1200.

Recordkeeping (29 C.F.R. § 1910.1053(k))

The standard requires that employers make and maintain records of certain information, including air monitoring data, objective data, and medical surveillance data. Required records must be maintained and made available in accordance with 29 C.F.R. § 1910.1020, which generally requires employers to ensure that these types of records are maintained for at least 30 years. 29 C.F.R. § 1910.1053(k).

58. How can employers comply with the requirement to ensure that employee medical records are maintained for the proper period of time when they do not receive a copy of the PLHCP's written medical report to the employee?

Employers are responsible for maintaining records in their possession (*e.g.*, the PLHCP's written medical opinion for the employer described in paragraph (i)(6)). Employers are also responsible for ensuring the retention of records in the possession of the PLHCP (*e.g.*, the written medical report for the employee described in paragraph (i)(5)). An employer can fulfill this second obligation by including the retention requirement in a written agreement between the employer and the PLHCP or by otherwise specifically communicating to the PLHCP the substance of OSHA's record-retention requirements. *See* 81 Fed. Reg. at 16854.

Temporary Employees

59. Sometimes employers use temporary workers from staffing agencies to supplement their regular workforces, *e.g.*, when production demand increases. Many of these workers are on site for 29 days or less. Do host employers have any obligations to these temporary workers under the silica standard?

Yes. Temporary workers are entitled to the same protections as other employees under the Occupational Safety and Health Act and OSHA health and safety standards. Therefore, temporary workers within the scope of the silica standard must be protected as required by the standard. The duration of employment does not matter, except that the requirement for medical surveillance is triggered only for employees who will be occupationally exposed to silica at or above a threshold level for 30 or more days per year (*see* question 63, below).

When a staffing agency supplies temporary workers to a business, the staffing agency and the staffing agency's client (the host employer) must coordinate to ensure that the temporary workers are fully protected by the standard. While the host employer is often better situated to assess hazards and protect temporary workers from silica-related hazards in the workplace, the staffing agency may be better positioned to offer other protections under the silica standard, such as general training and medical surveillance.

60. Are host employers required to ensure that the exposures of temporary workers are assessed under paragraph (d) of the silica standard?

Yes, host employers must ensure that the exposures of temporary workers who are or may reasonably be expected to be exposed to silica at or above the AL are assessed using either the performance option in paragraph (d)(2) or the scheduled monitoring option in paragraph (d)(3).

Host employers using the performance option may rely on the same objective and/or air monitoring data used to assess the exposures of permanent employees, as long as such data accurately characterize the exposures of the temporary workers. *See* 29 C.F.R. § 1910.1053(d)(2). Host employers using the scheduled monitoring option may rely upon representative sampling to assess the exposures of temporary workers when the temporary workers are performing the same tasks on the same shift and in the same work area as the employees whose exposures have been sampled. (Representative sampling involves sampling the employees expected to have the highest silica exposures.) *See* 29 C.F.R. § 1910.1053(d)(3)(i).

61. Are host employers required to ensure that temporary workers are not exposed to silica above the PEL?

Yes. In accordance with paragraphs (c) and (f) of the silica standard, host employers must ensure that temporary workers are not exposed to silica above the PEL, using the hierarchy of controls set forth in the standard. Where respiratory protection is required, the host employer and the staffing agency can reach agreement as to which employer will provide and pay for the respirators.

62. Are host employers required to ensure that temporary workers wear respiratory protection when they enter regulated areas?

Yes. Host employers must ensure that temporary workers who enter regulated areas use appropriate respiratory protection, in accordance with paragraphs (e)(4) and (g) of the standard, as well as 29 C.F.R. § 1910.134. Although the host employer is often better situated to assess and control workplace hazards than the staffing agency that supplies the temporary workers, the staffing agency and the host employer may agree to have the staffing agency provide the temporary workers with respirators, as well as medical evaluations and fit testing required for respirator use, in accordance with 29 C.F.R. § 1910.134.

63. Are host employers required to make medical surveillance available to temporary workers?

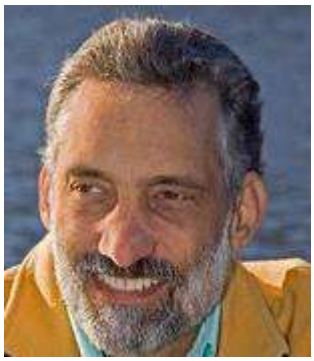
It depends. A host employer has no obligation to make medical surveillance available to temporary workers who will not be exposed at or above the AL (or, before June 23, 2020, above the PEL) for 30 or more days in a 12-month period while working for the host employer. If a worker will be exposed above the appropriate trigger for medical surveillance for 30 or more days in a 12-month period at the host site, and the worker has not had a medical examination that meets the requirements of the silica standard within the last three years, then the host employer must work with the staffing agency to make sure the worker is offered medical surveillance. The staffing agency must determine the total days of exposure at or above the AL (or, before June 23, 2020, above the PEL) during all periods of employment with all host employers within each 12-month period and must add those days together to determine whether medical surveillance must be made available to a temporary worker.

64. Are host employers required to provide silica-related training for temporary workers?

Under paragraph (j) of the silica standard, host employers must ensure that temporary workers are trained and can demonstrate knowledge and understanding of the topics listed in that paragraph. Staffing agencies may be well-positioned to offer workers some of the general training required under paragraph (j) of the standard. However, some worksite-specific training is always required, and host employers are generally better situated to provide training on worksite-specific job tasks, machinery, equipment, processes, and measures taken to protect workers. OSHA recommends that staffing agencies and host employers coordinate responsibilities for the various aspects of silica-related training and inform each other when they have fulfilled their respective training obligations. For more complete information, *see* https://www.osha.gov/Publications/OSHA3859.pdf.

HSE Committee Presenters, April 10, 2019

Evaluation of Roofing Materials Assessment: Round 3 (8:00-10:00)



Dr. William J. Warren-Hicks is CEO of EcoStat, Inc, a small woman-owned company located in Mebane, NC. He holds a Ph.D. from Duke University in environmental statistics. He has over 30 years of experience providing consulting expertise in the areas of environmental data analysis, uncertainty analysis, Bayesian inference and decision, probabilistic risk methods, survey design, time-series modeling, messy data analysis, hypothesis testing, multivariate analyses, and model validation studies. He has over 135 peer-reviewed publications, 2 books, and 8 book chapters in the areas of environmental statistics, probabilistic modeling, decision sciences, and risk assessment. In a consulting capacity, he has managed over 300 projects for clients in both industry and government. Recently, Dr. Warren-Hicks has focused on statistical issues in Natural Resource Damage (NRD) cases, including the Deepwater Horizon NRDA (where he was the lead statistician supporting BP), and the Tittabawassee River NRDA. He is currently evaluating California's zero emission vehicle rules for a private client, and the risk of MTBE in private drinking water wells to human health for a consortium of petroleum companies. He has taught courses at Duke University and Elon University to both undergraduate and graduate students. These courses focus on the analysis of environmental data in risk-based decision making, including uncertainty analysis methods. He is the lead instructor for New Advances in Ecological Risk Assessment, given under the Continuing Education Program at Duke University. He developed a course entitled Using Monte Carlo Analysis In The Probabilistic Risk Assessment of Pesticides, a course in uncertainty analysis methods that was given multiple times to EPA's Office of Pesticide Programs (OPP), individual chemical companies, and industry coalitions. Dr. Warren-Hicks was the lead statistician to the Federal Insecticide, Fungicide and Rodenticide Act Environmental Model Validation Task Force (FEMVTF) Statistics Committee in conducting an uncertainty analysis of the PRZM3.12 model. He has consulted on issues associated with the statistical analysis of pesticide data within a risk context for both EPA's OPP and industry. In addition, Dr. Warren-Hicks was an invited speaker and associated lead chapter author of six SETAC Pellston Conferences including Sediment Risk Assessment, Multiple Stressors (steering committee member), Probabilistic Risk Assessment of Pesticides, Whole Effluent Toxicity Testing, Potential Risks of Plant Protection Products to Pollinators, and Uncertainty Analysis In Ecological Risk Assessment (chair, lead editor, lead conference organizer, and creator).

ISO 45001: The New Gold Standard For Safety And Health Management (10:15-11:45)

Edwin G. Foulke, Jr. Edwin G. Foulke, Jr is a partner in the Atlanta office of Fisher & Phillips LLP, a leading national labor and employment law firm. He is also President of Fisher Phillips Safety Solutions LLC. His national practice includes workplace safety and OSHA compliance assistance and strategic safety planning, whistleblower compliance and litigation involving the 23 whistleblower statutes handled by OSHA, defense of employers in responding to workplace health and safety enforcement litigation including OSHA citations and providing advice and assistance to employers in responding to OSHA inspections, emergency response involving workplace fatalities and catastrophic accidents and in rulemaking, legislative and regulatory initiatives/ matters. Ed has extensive experience representing employers in thousands of OSHA inspections and OSHA citation contests during his 30+ year career and has assisted U.S. and international clients in developing and implementing internal safety and health compliance policies and strategic plans. Prior to joining Fisher & Phillips, Ed served as Assistant Secretary of Labor for Occupational Safety and Health, having been named to this position by President George W. Bush in September 2005. As head of the Occupational Safety and Health Administration (OSHA), Ed directed a staff of more than 2,200 safety and health professionals, whistleblower investigators and support personnel. During his tenure at OSHA, workplace injuries, illnesses and fatalities rates dropped to their lowest level in recorded history.

Nominated by President George H. W. Bush, Ed also served on the Occupational Safety and Health Review Commission from 1990 to 1995, chairing the Commission from March 1990 to February 1994. The three-member Commission is an independent federal adjudicatory agency that renders legal decisions involving workplace safety and health citations arising from OSHA inspections. He is the only person in the United States to serve as both head of OSHA and Chairman of the Review Commission.

Ed has worked in the labor and employment area for over 30 years, specializing in occupational safety and health issues, whistleblower compliance, workplace violence risk assessment and prevention, and accident and fatality prevention. He has been named one of the “50 Most Influential EHS Leaders” by EHS Today magazine for several years and named one of the “50 Most Influential EHS Leaders” in the United States by Occupational Hazards magazine. Ed has testified before U.S. Senate and U.S. House Congressional Committees on occupational safety and health issues and agency budgets. He has also conducted briefings with members of Congress and Congressional staff. Ed is recognized as one of the nation’s leading authorities on occupational safety and health and is a frequent keynote speaker and lecturer on workplace safety, leadership development and other labor and employment topics.

Ed currently serves on the EHS Today Safety Leadership Board of Directors and on safety committees for the Associated Builders and Contractors, the Georgia Association of Manufacturers, the U.S. Poultry Association, the Solid Waste Association of North American, the National Association of Tower Erectors, and the American Foundry Association. Ed is one of the most sought after speakers in the safety and health arena and has given thousands of speeches and webinars on the importance of safety to all employers. He has authored numerous articles and books on workplace safety and health for various entities, including the South Carolina Chamber of Commerce, American Bar Association, the South Carolina Bar Association, the North Carolina Citizens for Business and Industry, Bloomberg, BNA, EHS Today and the American Chamber of Commerce Resources.

A native of Perkasie, Pennsylvania, Ed graduated from North Carolina State University (with honors) in 1974, earned his law degree from Loyola University in 1978 and a Master of Law degree from Georgetown University Law School in 1993. He has served as an adjunct professor at New Orleans’ St. Mary’s Dominican College. Mr. Foulke was a high school and college All-American in swimming.

He is admitted to practice in Georgia, South Carolina, North Carolina and the District of Columbia, and is admitted in the Fourth, Eleventh, and D.C. Federal Circuit Courts of Appeals, as well as the U.S. Supreme Court. Ed can be reached directly at 404.240.4273 or efoulke@fisherphillips.com .

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