2010 Annual Revision Cycle

Report on Proposals

A compilation of NFPA® Technical
Committee Reports on Proposals
for public review and comment

Public Comment Deadline: September 4, 2009

NOTE: The proposed NFPA documents addressed in this Report on Proposals (ROP) and in a follow-up Report on Comments (ROC) will only be presented for action when proper Amending Motions have been submitted to the NFPA by the deadline of April 9, 2010. The June 2010 NFPA Conference & Expo will be held June 7–10, 2010 at the Mandalay Bay Convention Center, Las Vegas, NV. During the meeting, the Association Technical Meeting (Tech Session) will be held June 9–10, 2010. Documents that receive no motions will not be presented at the meeting and instead will be forwarded directly to the Standards Council for action on issuance. For more information on the rules and for up-to-date information on schedules and deadlines for processing NFPA documents, check the NFPA website (www.nfpa.org) or contact NFPA Standards Administration.

NFPA®
National Fire Protection Association®
1 BATTERYMARCH PARK, QUINCY, MA 02169-7471

ISSN 1079-5332

Information on NFPA Codes and Standards Development

I. Applicable Regulations. The primary rules governing the processing of NFPA documents (codes, standards, recommended practices, and guides) are the NFPA *Regulations Governing Committee Projects (Regs)*. Other applicable rules include NFPA *Bylaws*, NFPA *Technical Meeting Convention Rules*, NFPA *Guide for the Conduct of Participants in the NFPA Standards Development Process*, and the NFPA *Regulations Governing Petitions to the Board of Directors from Decisions of the Standards Council*. Most of these rules and regulations are contained in the *NFPA Directory*. For copies of the *Directory*, contact Codes and Standards Administration at NFPA Headquarters; all these documents are also available on the NFPA website at "www.nfpa.org."

The following is general information on the NFPA process. All participants, however, should refer to the actual rules and regulations for a full understanding of this process and for the criteria that govern participation.

II. Technical Committee Report. The Technical Committee Report is defined as "the Report of the Technical Committee and Technical Correlating Committee (if any) on a document. A Technical Committee Report consists of the Report on Proposals (ROP), as modified by the Report on Comments (ROC), published by the Association."

III. Step 1: Report on Proposals (ROP). The ROP is defined as "a report to the Association on the actions taken by Technical Committees and/or Technical Correlating Committees, accompanied by a ballot statement and one or more proposals on text for a new document or to amend an existing document." Any objection to an action in the ROP must be raised through the filing of an appropriate Comment for consideration in the ROC or the objection will be considered resolved.

IV. Step 2: Report on Comments (ROC). The ROC is defined as "a report to the Association on the actions taken by Technical Committees and/or Technical Correlating Committees accompanied by a ballot statement and one or more comments resulting from public review of the Report on Proposals (ROP)." The ROP and the ROC together constitute the Technical Committee Report. Any outstanding objection following the ROC must be raised through an appropriate Amending Motion at the Association Technical Meeting or the objection will be considered resolved.

V. Step 3a: Action at Association Technical Meeting. Following the publication of the ROC, there is a period during which those wishing to make proper Amending Motions on the Technical Committee Reports must signal their intention by submitting a Notice of Intent to Make a Motion. Documents that receive notice of proper Amending Motions (Certified Amending Motions) will be presented for action at the annual June Association Technical Meeting. At the meeting, the NFPA membership can consider and act on these Certified Amending Motions as well as Follow-up Amending Motions, that is, motions that become necessary as a result of a previous successful Amending Motion. (See 4.6.2 through 4.6.9 of *Regs* for a summary of the available Amending Motions and who may make them.) Any outstanding objection following action at an Association Technical Meeting (and any further Technical Committee consideration following successful Amending Motions, see *Regs* at 4.7) must be raised through an appeal to the Standards Council or it will be considered to be resolved.

VI. Step 3b: Documents Forwarded Directly to the Council. Where no Notice of Intent to Make a Motion (NITMAM) is received and certified in accordance with the Technical Meeting Convention Rules, the document is forwarded directly to the Standards Council for action on issuance. Objections are deemed to be resolved for these documents.

VII. Step 4a: Council Appeals. Anyone can appeal to the Standards Council concerning procedural or substantive matters related to the development, content, or issuance of any document of the Association or on matters within the purview of the authority of the Council, as established by the *Bylaws* and as determined by the Board of Directors. Such appeals must be in written form and filed with the Secretary of the Standards Council (see 1.6 of *Regs*). Time constraints for filing an appeal must be in accordance with 1.6.2 of the *Regs*. Objections are deemed to be resolved if not pursued at this level.

VIII. Step 4b: Document Issuance. The Standards Council is the issuer of all documents (see Article 8 of *Bylaws*). The Council acts on the issuance of a document presented for action at an Association Technical Meeting within 75 days from the date of the recommendation from the Association Technical Meeting, unless this period is extended by the Council (see 4.8 of *Regs*). For documents forwarded directly to the Standards Council, the Council acts on the issuance of the document at its next scheduled meeting, or at such other meeting as the Council may determine (see 4.5.6 and 4.8 of *Regs*).

IX. Petitions to the Board of Directors. The Standards Council has been delegated the responsibility for the administration of the codes and standards development process and the issuance of documents. However, where extraordinary circumstances requiring the intervention of the Board of Directors exist, the Board of Directors may take any action necessary to fulfill its obligations to preserve the integrity of the codes and standards development process and to protect the interests of the Association. The rules for petitioning the Board of Directors can be found in the *Regulations Governing Petitions to the Board of Directors from Decisions of the Standards Council* and in 1.7 of the *Regs*.

X. For More Information. The program for the Association Technical Meeting (as well as the NFPA website as information becomes available) should be consulted for the date on which each report scheduled for consideration at the meeting will be presented. For copies of the ROP and ROC as well as more information on NFPA rules and for up-to-date information on schedules and deadlines for processing NFPA documents, check the NFPA website (www.nfpa.org) or contact NFPA Codes & Standards Administration at (617-984-7246).

2010 Annual Revision Cycle ROP Contents

by NFPA Numerical Designation

Note: Documents appear in numerical order.

TYPES OF ACTION

P Partial Revision **C** Complete Revision **N** New Document **R** Reconfirmation **W** Withdrawal

2010 Annual Revision Cycle ROP
Committees Reporting

COMMITTEE MEMBER CLASSIFICATIONS[1,2,3,4]

The following classifications apply to Committee members and represent their principal interest in the activity of the Committee.

1. M Manufacturer: A representative of a maker or marketer of a product, assembly, or system, or portion thereof, that is affected by the standard.

2. U User: A representative of an entity that is subject to the provisions of the standard or that voluntarily uses the standard.

3. IM Installer/Maintainer: A representative of an entity that is in the business of installing or maintaining a product, assembly, or system affected by the standard.

4. L Labor: A labor representative or employee concerned with safety in the workplace.

5. RT Applied Research/Testing Laboratory: A representative of an independent testing laboratory or independent applied research organization that promulgates and/or enforces standards.

6. E Enforcing Authority: A representative of an agency or an organization that promulgates and/or enforces standards.

7. I Insurance: A representative of an insurance company, broker, agent, bureau, or inspection agency.

8. C Consumer: A person who is or represents the ultimate purchaser of a product, system, or service affected by the standard, but who is not included in (2).

9. SE Special Expert: A person not representing (1) through (8) and who has special expertise in the scope of the standard or portion thereof.

NOTE 1: “Standard” connotes code, standard, recommended practice, or guide.

NOTE 2: A representative includes an employee.

NOTE 3: While these classifications will be used by the Standards Council to achieve a balance for Technical Committees, the Standards Council may determine that new classifications of member or unique interests need representation in order to foster the best possible Committee deliberations on any project. In this connection, the Standards Council may make such appointments as it deems appropriate in the public interest, such as the classification of “Utilities” in the National Electrical Code Committee.

NOTE 4: Representatives of subsidiaries of any group are generally considered to have the same classification as the parent organization.

FORM FOR COMMENT ON NFPA REPORT ON PROPOSALS
2010 ANNUAL REVISION CYCLE
FINAL DATE FOR RECEIPT OF COMMENTS: 5:00 pm EDST, September 4, 2009

For further information on the standards-making process, please contact the Codes and Standards Administration at 617-984-7249 or visit www.nfpa.org/codes.

For technical assistance, please call NFPA at 1-800-344-3555.

FOR OFFICE USE ONLY

Log #: ____

Date Rec'd: ____

Please indicate in which format you wish to receive your ROP/ROC ☐ **electronic** ☐ **paper** ☒ **download**

(Note: If choosing the download option, you must view the ROP/ROC from our website; no copy will be sent to you.)

Date 8/1/200X **Name** John B. Smith **Tel. No.** 253-555-1234

Company ____ **Email** ____

Street Address 9 Seattle St. **City** Tacoma **State** WA **Zip** 98402

******If you wish to receive a hard copy, a street address MUST be provided. Deliveries cannot be made to PO boxes.***

Please indicate organization represented (if any) Fire Marshals Assn. of North America

1. (a) NFPA Document Title National Fire Alarm Code **NFPA No. & Year** NFPA 72, 200X ed.

(b) Section/Paragraph 4.4.1.1

2. Comment on Proposal No. (from ROP): 72-7

3. Comment Recommends (check one): ☐ new text ☐ revised text ☒ deleted text

4. Comment (include proposed new or revised wording, or identification of wording to be deleted): [Note: Proposed text should be in legislative format; i.e., use underscore to denote wording to be inserted (<u>inserted wording</u>) and strike-through to denote wording to be deleted (~~deleted wording~~).]

Delete exception.

5. Statement of Problem and Substantiation for Comment: (Note: State the problem that would be resolved by your recommendation; give the specific reason for your Comment, including copies of tests, research papers, fire experience, etc. If more than 200 words, it may be abstracted for publication.)

A properly installed and maintained system should be free of ground faults. The occurrence of one or more ground faults should be required to cause a 'trouble' signal because it indicates a condition that could contribute to future malfunction of the system. Ground fault protection has been widely available on these systems for years and its cost is negligible. Requiring it on all systems will promote better installations, maintenance and reliability.

6. Copyright Assignment

(a) ☒ **I am the author of the text or other material (such as illustrations, graphs) proposed in the Comment.**

(b) ☐ **Some or all of the text or other material proposed in this Comment was not authored by me. Its source is as follows:** (please identify which material and provide complete information on its source)

I hereby grant and assign to the NFPA all and full rights in copyright in this Comment and understand that I acquire no rights in any publication of NFPA in which this Comment in this or another similar or analogous form is used. Except to the extent that I do not have authority to make an assignment in materials that I have identified in (b) above, I hereby warrant that I am the author of this Comment and that I have full power and authority to enter into this assignment.

Signature (Required) ____

PLEASE USE SEPARATE FORM FOR EACH COMMENT

Mail to: Secretary, Standards Council · National Fire Protection Association
1 Batterymarch Park · Quincy, MA 02169-7471 OR
Fax to: (617) 770-3500 OR Email to: proposals_comments@nfpa.org

FORM FOR COMMENT ON NFPA REPORT ON PROPOSALS
2010 ANNUAL REVISION CYCLE
FINAL DATE FOR RECEIPT OF COMMENTS: 5:00 pm EDST, September 4, 2009

For further information on the standards-making process, please contact the Codes and Standards Administration at 617-984-7249 or visit www.nfpa.org/codes.

For technical assistance, please call NFPA at 1-800-344-3555.

FOR OFFICE USE ONLY

Log #: ____________

Date Rec'd: ____________

Please indicate in which format you wish to receive your ROP/ROC ☐ **electronic** ☐ **paper** ☒ **download**
(Note: If choosing the download option, you must view the ROP/ROC from our website; no copy will be sent to you.)

Date ____________ **Name** ____________ **Tel. No.** ____________

Company ____________ **Email** ____________

Street Address ____________ **City** ____________ **State** ________ **Zip** ________

******If you wish to receive a hard copy, a street address MUST be provided. Deliveries cannot be made to PO boxes.***

Please indicate organization represented (if any) ____________

1. (a) NFPA Document Title ____________ **NFPA No. & Year** ____________

(b) Section/Paragraph ____________

2. Comment on Proposal No. (from ROP): ____________

3. Comment Recommends (check one): ☐ new text ☒ revised text ☐ deleted text

4. Comment (include proposed new or revised wording, or identification of wording to be deleted): [Note: Proposed text should be in legislative format; i.e., use underscore to denote wording to be inserted (inserted wording) and strike-through to denote wording to be deleted (~~deleted wording~~).]

5. Statement of Problem and Substantiation for Comment: (Note: State the problem that would be resolved by your recommendation; give the specific reason for your Comment, including copies of tests, research papers, fire experience, etc. If more than 200 words, it may be abstracted for publication.)

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(b) ☐ **Some or all of the text or other material proposed in this Comment was not authored by me. Its source is as follows:** (please identify which material and provide complete information on its source)

____

I hereby grant and assign to the NFPA all and full rights in copyright in this Comment and understand that I acquire no rights in any publication of NFPA in which this Comment in this or another similar or analogous form is used. Except to the extent that I do not have authority to make an assignment in materials that I have identified in (b) above, I hereby warrant that I am the author of this Comment and that I have full power and authority to enter into this assignment.

Signature (Required) ____________

PLEASE USE SEPARATE FORM FOR EACH COMMENT

Mail to: Secretary, Standards Council · National Fire Protection Association
1 Batterymarch Park · Quincy, MA 02169-7471 OR
Fax to: (617) 770-3500 OR Email to: proposals_comments@nfpa.org

5/27/2009

Sequence of Events Leading to Issuance of an NFPA Committee Document

Step 1 Call for Proposals

▼ Proposed new document or new edition of an existing document is entered into one of two yearly revision cycles, and a Call for Proposals is published.

Step 2 Report on Proposals (ROP)

▼ Committee meets to act on Proposals, to develop its own Proposals, and to prepare its Report.

▼ Committee votes by written ballot on Proposals. If two-thirds approve, Report goes forward. Lacking two-thirds approval, Report returns to Committee.

▼ Report on Proposals (ROP) is published for public review and comment.

Step 3 Report on Comments (ROC)

▼ Committee meets to act on Public Comments to develop its own Comments, and to prepare its report.

▼ Committee votes by written ballot on Comments. If two-thirds approve, Report goes forward. Lacking two-thirds approval, Report returns to Committee.

▼ Report on Comments (ROC) is published for public review.

Step 4 Association Technical Meeting

▼ *"Notices of intent to make a motion"* are filed, are reviewed, and valid motions are certified for presentation at the Association Technical Meeting. ("Consent Documents" that have no certified motions bypass the Association Technical Meeting and proceed to the Standards Council for issuance.)

▼ NFPA membership meets each June at the Association Technical Meeting and acts on Technical Committee Reports (ROP and ROC) for documents with "certified amending motions."

▼ Committee(s) vote on any amendments to Report approved at NFPA Annual Membership Meeting.

Step 5 Standards Council Issuance

▼ Notification of intent to file an appeal to the Standards Council on Association action must be filed within 20 days of the NFPA Annual Membership Meeting.

▼ Standards Council decides, based on all evidence, whether or not to issue document or to take other action, including hearing any appeals.

The Association Technical Meeting

The process of public input and review does not end with the publication of the ROP and ROC. Following the completion of the Proposal and Comment periods, there is yet a further opportunity for debate and discussion through the Association Technical Meeting that takes place at the NFPA Annual Meeting.

The Association Technical Meeting provides an opportunity for the final Technical Committee Report (i.e., the ROP and ROC) on each proposed new or revised code or standard to be presented to the NFPA membership for the debate and consideration of motions to amend the Report. The specific rules for the types of motions that can be made and who can make them are set forth in NFPA's rules, which should always be consulted by those wishing to bring an issue before the membership at an Association Technical Meeting. The following presents some of the main features of how a Report is handled.

The Filing of a Notice of Intent to Make a Motion. Before making an allowable motion at an Association Technical Meeting, the intended maker of the motion must file, in advance of the session, and within the published deadline, a Notice of Intent to Make a Motion. A Motions Committee appointed by the Standards Council then reviews all notices and certifies all amending motions that are proper. The Motions Committee can also, in consultation with the makers of the motions, clarify the intent of the motions and, in certain circumstances, combine motions that are dependent on each other together so that they can be made in one single motion. A Motions Committee report is then made available in advance of the meeting listing all certified motions. Only these Certified Amending Motions, together with certain allowable Follow-Up Motions (that is, motions that have become necessary as a result of previous successful amending motions) will be allowed at the Association Technical Meeting.

Consent Documents. Often there are codes and standards up for consideration by the membership that will be noncontroversial and no proper Notices of Intent to Make a Motion will be filed. These "Consent Documents" will bypass the Association Technical Meeting and head straight to the Standards Council for issuance. The remaining documents are then forwarded to the Association Technical Meeting for consideration of the NFPA membership.

What Amending Motions Are Allowed. The Technical Committee Reports contain many Proposals and Comments that the Technical Committee has rejected or revised in whole or in part. Actions of the Technical Committee published in the ROP may also eventually be rejected or revised by the Technical Committee during the development of its ROC. The motions allowed by NFPA rules provide the opportunity to propose amendments to the text of a proposed code or standard based on these published Proposals, Comments, and Committee actions. Thus, the list of allowable motions include motions to accept Proposals and Comments in whole or in part as submitted or as modified by a Technical Committee action. Motions are also available to reject an accepted Comment in whole or part. In addition, Motions can be made to return an entire Technical Committee Report or a portion of the Report to the Technical Committee for further study.

The NFPA Annual Meeting, also known as the NFPA Conference & Expo, takes place in June of each year. A second Fall membership meeting was discontinued in 2004, so the NFPA Technical Committee Report Session now runs once each year at the Annual Meeting in June.

Who Can Make Amending Motions. NFPA rules also define those authorized to make amending motions. In many cases, the maker of the motion is limited by NFPA rules to the original submitter of the Proposal or Comment or his or her duly authorized representative. In other cases, such as a Motion to Reject an accepted Comment, or to Return a Technical Committee Report or a portion of a Technical Committee Report for Further Study, anyone can make these motions. For a complete explanation, the NFPA Regs should be consulted.

Action on Motions at the Association Technical Meeting. In order to actually make a Certified Amending Motion at the Association Technical Meeting, the maker of the motion must sign in at least an hour before the session begins. In this way a final list of motions can be set in advance of the session. At the session, each proposed document up for consideration is presented by a motion to adopt the Technical Committee Report on the document. Following each such motion, the presiding officer in charge of the session opens the floor to motions on the document from the final list of Certified Amending Motions followed by any permissible Follow-Up Motions. Debate and voting on each motion proceeds in accordance with NFPA rules. NFPA membership is not required in order to make or speak to a motion, but voting is limited to NFPA members who have joined at least 180 days prior to the Association Technical Meeting and have registered for the meeting. At the close of debate on each motion, voting takes place, and the motion requires a majority vote to carry. In order to amend a Technical Committee Report, successful amending motions must be confirmed by the responsible Technical Committee, which conducts a written ballot on all successful amending motions following the meeting and prior to the document being forwarded to the Standards Council for issuance.

Standards Council Issuance

One of the primary responsibilities of the NFPA Standards Council, as the overseer of the NFPA codes and standards development process, is to act as the official issuer of all NFPA codes and standards. When it convenes to issue NFPA documents, it also hears any appeals related to the document. Appeals are an important part of assuring that all NFPA rules have been followed and that due process and fairness have been upheld throughout the codes and standards development process. The Council considers appeals both in writing and through the conduct of hearings at which all interested parties can participate. It decides appeals based on the entire record of the process as well as all submissions on the appeal. After deciding all appeals related to a document before it, the Council, if appropriate, proceeds to issue the document as an official NFPA code or standard. Subject only to limited review by the NFPA Board of Directors, the decision of the Standards Council is final, and the new NFPA code or standard becomes effective twenty days after Standards Council issuance.

Report of the Committee on

Handling and Conveying of Dusts, Vapors, and Gases

Walter L. Frank, ***Chair***
Frank Risk Solutions, Inc., DE [SE]

Joe R. Barton, Fountaintown, IN [SE]
Walter S. Beattie, AXA Corporate Solutions/Matrix Risk Consultants, PA [I]
John M. Cholin, J. M. Cholin Consultants Inc., NJ [SE]
Vahid Ebadat, Chilworth Technology Inc., NJ [SE]
Henry L. Febo, Jr., FM Global, MA [I]
Henry W. Garzia, Kidde-Fenwal, Inc., MA [M]
Joseph P. Gillis, Westboro, MA [SE]
Dan A. Guaricci, ATEX Explosion Protection L.P., FL [M]
Paul F. Hart, XL Global Asset Protection Services, IL [I]
William C. Hilton, Georgia-Pacific, GA [U]
Mark L. Holcomb, Kimberly-Clark Corporation, WI [U]
Ray Hunter, Ray Hunter & Associates Inc., AL [M]
Rep. American Air Filter
Gregory I. Hurst, National Starch, IN [U]
Jerry J. Jennett, Georgia Gulf Sulfur Corporation, GA [M]
David C. Kirby, Baker Engineering & Risk Consultants, WV [SE]
James F. Koch, The Dow Chemical Company, MI [U]
Rep. American Chemistry Council
Guillermo A. Navas, Sheet Metal & Air Conditioning Contractors National Assn., VA [M]
Jack E. Osborn, Airdusco, Inc., TN [M]
James L. Roberts, Fluor Enterprises, Inc., SC [SE]
Mark L. Runyon, Marsh USA Inc., OR [I]
Thomas C. Scherpa, DuPont, NH [U]
Richard F. Schwab, Honeywell, Inc., NJ [U]
Thomas J. Slavin, Navistar International Corporation, IL [U]
Rep. American Foundry Society, Inc.
Bill Stevenson, CV Technology, Inc., FL [M]
Jeffery W. Sutton, Global Risk Consultants Corporation, MN [SE]
Erdem A. Ural, Loss Prevention Science & Technologies, Inc., MA [SE]
Harold H. Weber, Jr., The Sulphur Institute, DC [U]
(Vote Limited to Document: 655)

Alternates

Paul A. Cera, Marsh Risk Consulting, CT [I]
(Alt. to Mark L. Runyon)
Brice Chastain, Georgia-Pacific, GA [U]
(Alt. to William C. Hilton)
C. James Dahn, Safety Consulting Engineers Inc., IL [SE]
(Alt. to Vahid Ebadat)
Robert L. Gravell, E. I. duPont de Nemours & Company, Inc., NJ [U]
(Alt. to Thomas C. Scherpa)
Albert I Ness, Rohm and Haas Company
(Alt. to James F. Koch)
Samuel A. Rodgers, Honeywell, Inc., VA [U]
(Alt. to Richard F. Schwab)

Nonvoting

Matthew I. Chibbaro, US Department of Labor, DC [E]
(Alt to William R. Hamilton)
William R. Hamilton, US Department of Labor, DC [E]
(Alt. to Matthew I. Chibbaro)
Harry Verakis, US Department of Labor, WV [E]
Jeffrey J. Wanko, US Chemical Safety & Hazard Investigation Board, DC [SE]

Staff Liaison: **Guy R. Colonna**

Committee Scope: This Committee shall have primary responsibility for documents on the prevention, control, and extinguishment of fires and explosions in the design, construction, installation, operation, and maintenance of facilities and systems processing or conveying flammable or combustible dusts, gases, vapors, and mists.

This list represents the membership at the time the Committee was balloted on the text of this edition. Since that time, changes in the membership may have occurred. A key to classifications is found at the front of this book.

The Report of the Technical Committee on **Handling and Conveying of Dusts, Vapors, and Gases** is presented for adoption.

This Report was prepared by the **Technical Committee on Handling and Conveying of Dusts, Vapors, and Gases** and proposes for adoption, amendments to NFPA 654, **Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids**, 2006 edition. NFPA 654-2006 is published in Volume 10 of the 2009 National Fire Codes and in separate pamphlet form. This Report has been submitted to letter ballot of the **Technical Committee on Handling and Conveying of Dusts, Vapors, and Gases**, which consists of 28 voting members. The results of the balloting, after circulation of any negative votes, can be found in the report.

654-1 Log #CP1 **Final Action: Accept**
(Entire Document)

Submitter: Technical Committee on Handling and Conveying of Dusts, Vapors, and Gases,
Recommendation: Review entire document to: 1) Update any extracted material by preparing separate proposals to do so, and 2) review and update references to other organizations documents, by preparing proposal(s) as required.
Update Extracted material found in Chapter 3, Definitions as shown:
~~3.3.10 Duct. Pipes, tubes, or other enclosures used for the purpose of pneumatically conveying materials. [91, 2004]~~
~~3.3.13* Hybrid Mixture. A mixture of a flammable gas with either a combustible dust or a combustible mist. [68, 2002]~~
3.3.13* Hybrid Mixture. A mixture of a flammable gas at greater than 10 percent of its lower flammable limit with either a combustible dust or a combustible mist. [68, 2007]
3.3.20 Replacement-in-Kind. A replacement that satisfies the design specifications. [484, 200~~6~~9]
3.3.24 Vent Closure. A pressure-relieving cover that is placed over a vent. [68, 200~~2~~7]
3.3.26.1 Fire Barrier Wall. A wall, other than a fire wall, having a fire resistance rating. [221, 200~~6~~9]
3.3.26.2 Fire Wall. A wall separating buildings or subdividing a building to prevent the spread of fire and having a fire resistance rating and structural stability. [221, 200~~6~~9]
Update references for NFPA and other organization documents as shown:
2.1 General.
The documents or portions thereof listed in this chapter are referenced within this standard and shall be considered part of the requirements of this document.
2.2 NFPA Publications.
National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.
NFPA 10, Standard for Portable Fire Extinguishers, 200~~2~~7 edition.
NFPA 11, Standard for Low-, Medium-, and High-Expansion Foam, 2005 edition.
NFPA 12, Standard on Carbon Dioxide Extinguishing Systems, 200~~5~~8 edition.
NFPA 12A, Standard on Halon 1301 Fire Extinguishing Systems, 200~~4~~9 edition.
NFPA 13, Standard for the Installation of Sprinkler Systems, 200~~2~~7 edition.
NFPA 14, Standard for the Installation of Standpipe and Hose Systems, 200~~3~~7 edition.
NFPA 15, Standard for Water Spray Fixed Systems for Fire Protection, 200~~1~~7 edition.
NFPA 16, Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems, 200~~3~~7 edition.
NFPA 17, Standard for Dry Chemical Extinguishing Systems, 200~~2~~9 edition.
NFPA 25, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems, 200~~2~~8 edition.
NFPA 30B, Code for the Manufacture and Storage of Aerosol Products, 200~~2~~7 edition.
NFPA 51B, Standard for Fire Prevention During Welding, Cutting, and Other Hot Work, 200~~3~~9 edition.
NFPA 61, Standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities, 200~~2~~8 edition.
NFPA 68, Standard on Explosion Protection by Deflagration Venting, 2007 edition.
NFPA 69, Standard on Explosion Prevention Systems, 200~~2~~8 edition.
NFPA 70, National Electrical Code®, 200~~5~~8 edition.
NFPA 72®, National Fire Alarm Code®, 200~~2~~7 edition.
NFPA 80, Standard for Fire Doors and Fire Windows, ~~1999~~2007 edition.
NFPA 85, Boiler and Combustion Systems Hazards Code, 200~~4~~7 edition.
NFPA 86, Standard for Ovens and Furnaces, 200~~3~~7 edition.
NFPA 91, Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Noncombustible Particulate Solids, 2004 edition.
NFPA 101®, Life Safety Code®, 200~~6~~9 edition.
NFPA 120, Standard for Fire Prevention and Control in Coal Mines, 2004 edition.
NFPA 220, Standard on Types of Building Construction, 200~~6~~9 edition.
NFPA 221, Standard for High Challenge Fire Walls, Fire Walls, and Fire Barrier Walls, 200~~6~~9 edition.
NFPA 432, Code for the Storage of Organic Peroxide Formulations, 2002 edition.
NFPA 484, Standard for Combustible Metals, 200~~6~~9 edition.
NFPA 495, Explosive Materials Code, 2006 edition.
NFPA 496, Standard for Purged and Pressurized Enclosures for Electrical Equipment, 200~~3~~8 edition.
NFPA 505, Fire Safety Standard for Powered Industrial Trucks Including Type Designations, Areas of Use, Conversions, Maintenance, and Operations, 2006 edition.
NFPA 655, Standard for Prevention of Sulfur Fires and Explosions, 200~~1~~7 edition.
NFPA 664, Standard for the Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities, 200~~2~~7 edition.
NFPA 750, Standard on Water Mist Fire Protection Systems, 200~~3~~6 edition.
NFPA 780, Standard for the Installation of Lightning Protection Systems, 200~~4~~8 edition.
NFPA 1124, Code for the Manufacture, Transportation, Storage, and Retail Sales of Fireworks and Pyrotechnic Articles, 2006 edition.
NFPA 1125, Code for the Manufacture of Model Rocket and High Power Rocket Motors, 200~~1~~7 edition.
NFPA 2001, Standard on Clean Agent Fire Extinguishing Systems, 200~~4~~8 edition.
2.3 Other Publications.
2.3.1 ASME Publications.
American Society of Mechanical Engineers, Three Park Avenue, New York, NY 10016-5990.
ASME B31.3, Process Piping, 200~~2~~8.
ASME Boiler and Pressure Vessel Code, 200~~1~~7.
2.3.2 ISA Publication.
Instrumentation, Systems, and Automation Society, P.O. Box 12277, Research Triangle Park, NC 27709.
ISA 84.00.01, Functional Safety: Application of Safety Instrumented Systems for the Process Industry Sector, 2004.
2.3.3 Other Publication.
Merriam-Webster's Collegiate Dictionary, 11th edition, Merriam-Webster, Inc., Springfield, MA, 2003.
2.4 References for Extracts in Mandatory Sections.
NFPA 68, ~~Guide for Venting of Deflagrations~~ Standard on Explosion Protection by Deflagration Venting, 200~~2~~7 edition.
~~NFPA 91, Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Noncombustible Particulate Solids, 2004 edition.~~
NFPA 221, Standard for High Challenge Fire Walls, Fire Walls, and Fire Barrier Walls, 200~~6~~9 edition.
NFPA 484, Standard for Combustible Metals, 200~~6~~9 edition.
G.3 References for Extracts in Informational Sections.
NFPA 68, ~~Guide for Venting of Deflagrations~~ Standard on Explosion Protection by Deflagration Venting, 200~~2~~7 edition.
Substantiation: To conform to the NFPA Regulations Governing Committee Projects. NFPA 68 was added to the list of references as it is now a standard and has been included in mandatory references in several places within the standard. The extracted definition for duct was deleted and its reference extract source, NFPA 91, as a result of the Committee's action on Committee Proposal 654-8 (Log #CP15). The Committee updated the definition for hybrid mixture based upon the reference document version in NFPA 68-2007. The updated definition does not include extract of the NFPA 68 annex material. The existing NFPA 654 annex material remains unchanged by this revision to the definition.
Committee Meeting Action: Accept
Number Eligible to Vote: 28
Ballot Results: Affirmative: 23
Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

654-2 Log #15 **Final Action: Reject**
(1.1.3)

Submitter: Peter Levitt, Sternvent Company, Inc.
Recommendation: Add new text as follows:
1.1.2 This standard shall apply to operations that occupy areas of more than 465m^2 (5000 ft^2) or where dust-producing equipment requires an aggregate dust collection flow rate of more than 2549 m^3/hr (1500 ft^3/min).
(Re-number existing 1.1.2 to 1.1.3)
Substantiation: There are many small companies that polish jewelry, dental labs that polish dental items, bakeries that mix flour, shipping departments that cut cardboard tubes, antique sellers who buff metal, etc. & have a small dust collector, typically 1500 cfm or less. Sternvent's experience is that, historically there have been few incidents of fires or explosions, in small dust collectors. Sternvent has been selling small dust collectors for over thirty years. If small dust collectors are "accidents waiting to happen", then Grainger, McMaster Carr & Sternvent would have stopped selling them years ago. Often the dust collector is located near the work area and not near an exterior wall & can not be located outdoors. The concept of exempting small dust collectors, from the standard, comes from my committee work on NFPA 664.
Committee Meeting Action: Reject
Committee Statement: The Committee does not agree with the submitter's substantiation that the hazards are a function of the scale of the operation. The Committee is aware of incidents in small scale operations that could have been prevented by application of the principles in this standard.
Number Eligible to Vote: 28
Ballot Results: Affirmative: 22 Negative: 1
Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.
Explanation of Negative:
CHOLIN, J.: NFPA 664 has included a de minimus exclusion similar to the submitted text with no adverse consequences. In most cases the proposed language allows the exclusion of schools, pilot and experimental facilities and other occasionally used facilities where the risk is acceptably low due to the relatively small time during which the systems are actually in use.

654-3 Log #11 **Final Action: Reject**
(1.5.1)

Submitter: John M. Cholin, J. M. Cholin Consultants Inc.
Recommendation: Revise text as follows:
1.5.1 Unless otherwise specified, where used as a reference document for building code enforcement, the provisions of this standard shall not apply to facilities, equipment, structures.....retroactive.
Substantiation: The general duty clause of the OSH Act of 1970 requires employers to provide employees with a work place free of know recognized hazards that can cause injury or death. There is no "grandfather clause" in the OSH Act of 1970. The apparent intent of Congress was to have in law a requirement that kept pace with the times; as knowledge increased and our recognition of hazards increased that the obligation to protect employees from those hazards would also increase.
Where OSHA has not already written its own standard it looks to nationally recognized concensus standards to establish what is deemed to be a hazard and what are the feasible abatement methods. Thus OSHA looks to NFPA 654 as the nationally recognized consensus standard to establish what constitutes a hazard and what are the feasible abatement methods. Without the proposed revision to section 1.5.1 employees working in old facilities are deserving of less protection from hazards in employment than those that work in newer facilities. The proposed revision makes it clear that the retroactivity provisions are ONLY relevant to building code enforcement and that NFPA standards are not intended to establish a "grandfather provision" into federal workplace safety law.
Furthermore, there is no hope of ever having NFPA standards adopted as federally recognized safety standards as long section 1.5.1 remains as it is currently stated.
Committee Meeting Action: Reject
Committee Statement: The Committee agreed that this proposed change is outside the scope of its authority to change NFPA boilerplate language and the proposal would complicate the application of the retroactivity clause.
Number Eligible to Vote: 28
Ballot Results: Affirmative: 21 Negative: 1 Abstain: 1
Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.
Explanation of Negative:
CHOLIN, J.: With the emergence of OSHA as a federal enforcement agency, enforcing a federal law which does NOT have a grandfather clause as do the model building codes it is necessary to make this amendment of the standard "boiler-plate" language in the NFPA Standards. Failure to do so creates a conflict of law environment relative to the enforcement of NFPA Standards.
Explanation of Abstention:
GUARICCI, D.: I agree in principal with Mr. Cholins contention, but also understand the committees position. Committee should review a method to consider Mr. Cholins position within the NFPA frame work and not reject his reasonable position out of hand.

654-4 Log #28 **Final Action: Accept in Principle in Part**
(Chapter 3 Various Definitions (New))

Submitter: Mark L. Holcomb, Kimberly-Clark Corporation
Recommendation: Add new text to read as follows:
Hazardous Dust Cloud – a dust cloud composed of a combustible dust suspended in air or other oxidizing medium that exceeds a concentration of 25% of the minimum explosive concentration (MEC).
Maximum Allowable Dust Accumulation – The amount of dust accumulation in a manufacturing environment that creates a fire or explosion hazard. Exceeding the maximum allowable dust accumulation level triggers cleaning as determined by section 6.2.3.2. The maximum allowable dust accumulation is determined by the characteristics of the dust, the size of the room, and the amount of the area within the room where dust accumulates.
Ignition sources and hot surfaces capable of igniting a dust cloud or dust layer – Ignition sources of sufficient energy to ignite a dust cloud (>75% of the MIE for the dust cloud or dust layer) or hot surfaces with temperatures hot enough to ignite a dust cloud or layer (>75% of the minimum ignition temperature of the dust cloud or dust layer).
Substantiation: The hazardous dust cloud, maximum allowable dust accumulation, and Ignition sources and hot surfaces concepts are referred to in the standard but are not defined.
Committee Meeting Action: Accept in Principle in Part
Do not add the proposed 1st definition, Hazardous Dust Cloud, or the proposed 3rd definition, Ignition sources and hot surfaces capable of igniting a dust cloud or dust layer.
See the action on Committee Proposal 654-15 (Log #CP4) regarding the 2nd proposed definition, Maximum Allowable Dust Accumulation.
Committee Statement: The Committee addressed the concept of maximum allowable dust accumulation with the revisions to 6.1 of the standard as proposed in Committee Proposal 654-15 (Log #CP4). The Committee believes its action accomplishes the intent of the submitter for this item.
The Committee did not accept the proposed definition for Hazardous Dust Cloud as the term is not used in this standard and the concept of a hazardous area has been addressed by the Committee's action on Proposal 654-69 (Log #7). See Committee action and Committee statement on 654-69 (Log #7).
The Committee did not accept the proposed definition for Ignition sources and hot surfaces as this term is not used in the standard.
Number Eligible to Vote: 28
Ballot Results: Affirmative: 23
Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

654-5 Log #CP2 **Final Action: Accept**
(3.2.2 and A.3.3.2 Air–Material Separator (AMS))

Submitter: Technical Committee on Handling and Conveying of Dusts, Vapors, and Gases,
Recommendation: Revise the existing definition of Air Material Separator as shown:
3.3.2* Air–Material Separator (AMS). A ~~collector~~ device designed to separate the conveying air from the material being conveyed.
Delete existing definitions 3.3.2.1 and 3.3.2.2
Revise existing Annex A.3.3.2 as shown:
A.3.3.2 Air–Material Separator (AMS). Examples include ~~cyclones, bag filter houses, and electrostatic precipitators.~~the following:
Cyclonic Separator (Cyclone) is a device utilizing centrifugal forces and geometry to separate the conveying air/gas from the majority of the conveyed material. The efficiency of this separation is based upon many factors such as geometry of the cyclone, material particle size and density, and air/gas mass flow. Generally, this unit is considered only an initial or primary separator and additional separation devices are applied to meet air pollution control requirements.
Dust Collector is a device utilizing filter media to separate fine dust particles from the conveying air/gas stream. Such devices often have automatic methods for continuous filter cleaning in order to maintain the operational efficiency of the device. Typically the filter media is either cartridges or bags. This operating pressure of this device is usually limited by its shape and physical construction.
Filter Receiver is similar to a "dust collector" but designed for higher differential pressure applications.
Scrubber is a device utilizing geometry, physical barriers and/or absorption methods, along with a fluid (e.g. sprays, streams, etc.) to separate and collect gases and/or dusts.
Electrostatic Precipitator is a device utilizing differences in electrical charges to remove fine particulates from the air stream.
Final Filter is a high-efficiency device commonly utilizing a pre-filter and secondary filter within an enclosure to provide the last particulate removal step before the air is discharged from the system. Such devices are commonly used when recirculating the air stream to occupied areas. This device can provide protection against the failure of a dust collector or filter receiver upstream of the device. High Efficiency Particulate Aerosol (HEPA) filter is an example.
Substantiation: The Committee has revised the definition of Air-Material Separator to more correctly reflect what devices are included and also provided a more comprehensive explanatory section in the annex to the definition.
Committee Meeting Action: Accept
Number Eligible to Vote: 28
Ballot Results: Affirmative: 23
Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

654-6 Log #CP8 **Final Action: Accept**
(3.3.4 Combustible Dust)

Submitter: Technical Committee on Handling and Conveying of Dusts, Vapors, and Gases,
Recommendation: Revise the definition of Combustible Dust as shown:
3.3.4* Combustible Dust. A combustible particulate solid that has a surface area to volume ratio greater than that of a 420 micron diameter sphere and presents a fire or deflagration hazard when suspended in air or some other oxidizing medium over a range of concentrations, regardless of particle size or shape.
Annex A.3.3.4 remains unchanged.
Substantiation: The Committee revised the definition for combustible dust to include the surface area to volume ratio consideration as an important characteristic when determining whether a combustible particulate solid is a combustible dust. This concept is currently included in the annex but has been incorporated into the definition to highlight its relevance when characterizing combustible particulate solids as potential combustible dusts.
Committee Meeting Action: Accept
Number Eligible to Vote: 28
Ballot Results: Affirmative: 21 Negative: 2
Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.
Explanation of Negative:
KIRBY, D.: I think air should be the oxidant in this definition. Also, regardless of size or shape should be dropped.
URAL, E.: The revised text is useless because it produces incredible results. For example:
1) Consider a piece of string, 279 microns (11 mils) diameter and 1 kilometer long. The revised text makes it a combustible dust.
2) Consider a metal or plastic sheet 139 microns (5.5 mils) thick and a square mile area. The revised text makes it a combustible dust.
3) Consider a Porous or Rough Sphere of 4200 microns ($^5/_{32}$ inch) diameter that has actual surface equal to 10 times the smooth enveloping surface area. The revised text makes it a combustible dust.

654-7 Log #13 **Final Action: Accept in Principle**
(3.3.8 Deflagration Hazard)

Submitter: John M. Cholin, J. M. Cholin Consultants Inc.
Recommendation: Add new text as follows:
Deflagration Hazard. Any location where either of the following conditions exist as a normal part of operations, during routine maintenance or as a result of production upset:
a.) a combustible dust exists in suspension in the atmosphere at a concentration above 25% of the Minimum Explosible Concentration (MEC) or
b.) a layer of accumulated combustible dust in excess of the threshold depth exists.
The threshold depth shall be:
a.) $^{1}/_{32}$nd inch (0.8 mm) for dusts of unknown bulk density, or
b.) Calculated form the following relation:
Threshold Depth = [($^{1}/_{32}$) (75)] / (bulk density)
Where bulk density is expressed in pounds per cubic foot.
Delete Section 6.2.3.1 and Section 6.2.3.2. Attach A.6.2.3.1 to the new definition.
Substantiation: Section 6.2.3 has been used to define where an explosion hazard exists, in lieu of actually defining the term in Chapter 3. This proposal, along with a companion proposal, defines both "deflagration hazard" as well as "explosion hazard" in a manner that is consistent with the manual of style, and NFPA 69.
A deflagration can occur where a combustible dust exists in suspension in the atmosphere at concentration above the MEC and a competent igniter is present. Personnel injuries can occur in buildings where deflagrations occur even when the deflagration does not cause the building enclosure to fail. The 14 employees injured in the Malden Mills explosion and fire were all in a portion of the building that did NOT suffer rupture of the enclosure envelop! Other examples exist. Since one objective of NFPA 654 is life safety NFPA 654 should identify clearly where the hazard to life from a deflagration exists so that other sections of the standard can be brought to bear to manage the hazard. Since NFPA 69 requires that the concentration be controlled to 25% of the MEC where concentration monitoring is not in place this definition adopts that concentration criterion for the sake of internal consistency. By placing this definition in Chapter 3, NFPA 654 will begin to clearly establish where measures to manage the deflagration hazard must be in place.
Furthermore, many sections of NFPA 654 begin with the phrase "Where and explosion hazard exists..." yet no where in NFPA 654 does the document clearly state what constitutes and "explosion hazard". This proposal along with its companion proposal provide the necessary definitions to make the rest of the document meaningful.
Committee Meeting Action: Accept in Principle
See Committee Action on Committee Proposal 654-15 (Log #CP4).
Committee Statement: The concept of a threshold has been incorporated along with bulk density adjustments in Committee Proposal 654-15 (Log #CP4).
The proposed definition of deflagration hazard is addressed in a different manner in Committee Proposal 654-15 (Log #CP4) from what is proposed by the submitter in this proposal. See Proposal 654-15 (Log #CP4) where the Committee has developed requirements applicable to the submitter's recommendations.
The hazard within equipment is currently addressed in 4.2.1 dealing with process hazard analysis. See also Committee Action and Committee Statement on Proposal 654-69 (Log #7).
Number Eligible to Vote: 28
Ballot Results: Affirmative: 22 Negative: 1
Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.
Explanation of Negative:
CHOLIN, J.: The proposal along with its companion proposals provide a simple, logical format that enables the facility operator to recognize hazards if they exist. The actions of the TC do not provide a workable solution.

654-8 Log #CP15 **Final Action: Accept**
(3.3.10 Duct)

Submitter: Technical Committee on Handling and Conveying of Dusts, Vapors, and Gases,
Recommendation: Delete definition of duct in 3.3.10:
~~3.3.10 Duct. Pipes, tubes, or other enclosures used for the purpose of pneumatically conveying materials. [91, 2004]~~
Substantiation: The definition of duct is not needed in NFPA 654. For specific applications regarding duct construction, design and installation, NFPA 91 is the source. NFPA 654 (Section 7.6) refers to NFPA 91.
Committee Meeting Action: Accept
Number Eligible to Vote: 28
Ballot Results: Affirmative: 23
Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

654-9 Log #CP16 **Final Action: Reject**
(3.3.11 Dust Collection System (Various))

Submitter: Technical Committee on Handling and Conveying of Dusts, Vapors, and Gases,
Recommendation: Revise the following as shown:
3.3.11* Dust Collection System ~~Collector~~. ~~See 3.3.2, Air–Material Separator (AMS).~~ A system used to contain, capture, and control airborne dusts.
A.3.3.11 Dust Collection System. A dust collection system is generally comprised of one or more hoods with duct, an Air-Material Separator (AMS) and an Air-Moving Device (AMD). The amount of dust collected and conveyed is not considered as part of the design criteria for a dust collection system. Dust collection systems always operate at pressures below atmospheric pressure.
3.3.19* Pneumatic Conveying System. A system comprised of a material feeding device, piping or tubing, an air-material separator, and an air-moving device used to transfer a controlled flow of material from one location to another. ~~A material feeder, an air–material separator, an enclosed ductwork system, or an air-moving device in which a combustible particulate solid is conveyed from one point to another with a stream of air or other gases.~~
~~3.3.19.1* Negative-Pressure Pneumatic Conveying System. A pneumatic conveying system that transports material by utilizing gas at less than atmospheric pressure.~~
~~3.3.19.2* Positive-Pressure Pneumatic Conveying System. A pneumatic conveying system that transports material by utilizing gas at greater than atmospheric pressure.~~
A.3.3.19 Pneumatic Conveying System. The amount of material conveyed is considered in the design criteria for a pneumatic conveying system. Pneumatic conveying systems can utilize either positive or negative pressure, or both, to convey the material. ~~Pneumatic Conveying System. Pneumatic conveying systems include dust collection systems.~~
3.3.30* Vacuum Cleaning System: A stationary or portable system comprised of vacuum cleaning tools, tubing or piping, an air-material separator and an air-moving device to allow an operator to capture and convey materials from surfaces.
A.3.3.30 The number of simultaneous operators and the amount of material conveyed per operator is considered in the system design. These systems always use pressures below atmospheric conditions for operation.
7.3.2 Pneumatic Conveying, Dust Collection, and Vacuum Cleaning Systems.
7.3.2.1 No existing system shall be changed without considering the effects of those changes on the system performance. This requires a re-design of the system to incorporate the proposed changes. Such changes shall be fully documented.~~The addition of branch lines shall not be made to an existing system without redesigning the entire system.~~
~~7.3.2.2 Branch lines shall not be disconnected and unused portions of the system shall not be blanked off without providing a means to maintain required and balanced airflow.~~
7.3.2.2: The system shall be designed and maintained to assure that the air/gas velocity used shall at all times meet or exceed the minimum required to keep the interior surfaces of all duct free of accumulations.
7.3.2.3: The system shall be equipped with adequate monitoring devices to allow continuous monitoring of the system performance
7.3.2.4 Specific Requirements for Dust Collection Systems
7.3.2.4.1 Each dust collection source or hood shall have a documented minimum air volume required for proper dust collection performance.
7.3.2.4.2 The minimum acceptable duct air/gas velocity for the transport of combustible dusts in a ducting system for a dust collection system is 4000 fpm. The system shall be designed to maintain this conveying air/gas velocity at all times in all branch lines.
7.3.2.4.3 No system shall include manually adjustable control devices (e.g. slide gates, butterfly valves, etc.), except for exclusively maintenance purposes, that allow personnel to adjust the air flow into the system.
~~7.3.2.3 The rate of airflow at each hood or other pickup point shall be designed so as to convey and control the material.~~
~~7.3.2.4* All ductwork shall be sized to provide the air volume and air velocity necessary to keep the duct interior clean and free of residual material.~~
7.3.2.5 The design of the pneumatic conveyance system shall be documented, including the following information:
(1) Data on the range of particulate size
(2) Concentration in conveyance air stream
(3) Potential for reaction between the transported particulate and the extinguishing media used to protect process equipment
(4) Conductivity of the particulate
(5) Other physical and chemical properties that affect the fire protection of the process
7.3.2.6 Pneumatic conveying systems that remove material from operations that generate flames, sparks, or hot material shall not be interconnected with pneumatic conveying systems that transport combustible particulate solids or hybrid mixtures.
7.12 Air-Moving Devices (Fans and Blowers).
7.12.1 Air-moving devices shall conform to the requirements of NFPA 91, Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Noncombustible Particulate Solids, except as amended by the requirements of this chapter.

7.12.2* Air moving devices shall not be inside the clean air plenum of the dust collector.

A.7.12.2 Dust collector filters are not 100% efficient and will eventually fail in all dust collectors. Also, the fan packages that are typically located inside the clean air plenum are typically not of spark resistant construction, not designed for material handling, and the power source is usually a direct drive motor. By locating the fan package inside the clean air plenum (most typical in smaller "packaged" dust collectors) the environment becomes hazardous upon a filter failure due to the creation of a contained dust cloud with multiple ignition sources. In addition, such a failure, if not detected in a reasonable time period, may result in fan failure which can create additional ignition sources. Locating the fan package outside the clean air plenum minimizes this exposure and will be more likely to alert operators to an upset condition.

Retain and renumber subsequent sections in 7.12

Revise the title of Section 4.4 (existing, becomes 4.5 when renumbered per action of 654-12 (Log #CP11).

4.4* Pneumatic Conveying, Dust Collection and Vacuum System Design

Revise first sentence of A.4.4 as shown:

A.4.4 The design of the pneumatic conveying, dust collection and vacuum system should be coordinated with the architectural and structural designs.

Revise 1.1.1 as shown:

1.1.1 This standard shall apply to all phases of the manufacturing, processing, blending, pneumatic conveying, dust collection, and vacuum system design, repackaging, and handling of combustible particulate solids or hybrid mixtures, regardless of concentration or particle size, where the materials present a fire or explosion hazard.

Revise 10.2.2 as shown:

10.2.2 Where fire detection systems are incorporated into pneumatic conveying systems, dust collection and vacuum system design, an analysis shall be conducted to identify safe interlocking requirements for air-moving devices and process operations.

Revise 10.2.3.1 as shown:

10.2.3.1 Where fire detection systems are incorporated into the pneumatic conveying system, dust collection and vacuum system design, the fire detection systems shall be interlocked to shut down any active device feeding materials to the pneumatic conveying system on actuation of the detection system.

Revise 9.1.2.1 as shown:

9.1.2.1 Where the process is configured such that the pneumatic conveying system, dust collection and vacuum system conveys materials that can act as an ignition source, means shall be provided to minimize the hazard.

Revise 6.1.6 as shown:

6.1.6 All components of pneumatic conveying, dust collection and vacuum systems that handle combustible particulate solids shall be designed to be dusttight, except for openings designed for intake and discharge of air and material.

Revise 7.3.3 as shown:

7.3.3.1 Sequence of Operation. Pneumatic conveying, dust collection and vacuum systems shall be designed with the operating logic, sequencing, and timing outlined in 7.3.3.2 and 7.3.3.3.

7.3.3.2* Startup. Pneumatic conveying, dust collection and vacuum systems shall be designed such that, on startup, the system achieves and maintains design air velocity prior to the admission of material to the system.

7.3.3.3 Shutdown. Pneumatic conveying, dust collection and vacuum systems shall be designed such that, on shutdown of the process, the system maintains design air velocity until material is purged from the system.

Revise 7.4.1 as shown:

7.4.1 General. This section shall apply to facilities that operate pneumatic conveying, dust collection and vacuum systems for metal particulates.

Revise 7.8.3.1 as shown:

7.8.3.1 Airflow control valves that are installed in pneumatic systems, dust collection and vacuum systems shall be of both airtight and dusttight construction.

Substantiation: This revision to dust collector more appropriately defines dust collection systems in order to differentiate them from pneumatic conveying systems. This definition and explanatory material for pneumatic conveying system differentiates pneumatic conveying systems from dust collection systems. This definition and explanatory material for vacuum cleaning system differentiates vacuum cleaning systems from pneumatic conveying systems and dust collection systems.

Due to the lack of differentiation between Pneumatic Conveying, Dust Collection, and Vacuum Cleaning systems that currently exists within the standard, there is some apparent confusion within the equipment manufacturer, designer, and installer segments of the industry. **Each** type of system has unique hazards and also should be "protected" for deflagrations in varying ways. By separating the "systems" this allows a **more definitive** approach in the standard and other, related, documents. The existing requirement in paragraph **7.3.2.1** is not applicable, as worded, to pneumatic transfer lines as they do not have "branch lines" in the true sense (only applies to dust collection and vacuum cleaning as written). The change to 7.3.2.1 should eliminate the need for 7.3.2.2 as the changed wording inherently includes such changes.

The proposed requirement for locating the air moving devices addresses a specific hazard that was not addressed in previous editions of this standard.

Committee Meeting Action: Reject

Committee Statement: The Committee has rejected the proposed changes in this Committee developed proposal in order to seek input from the pneumatic conveying, dust collection, and vacuum system design, manufacturing and installation segment of the industry. The Committee seeks further evidence that the proposed changes are needed at this time to eliminate confusion and difficulty applying the standard. The Committee is not aware of any specific situations where the use of current terminology to describe air-moving devices, air-material separators, or pneumatic conveying has resulted in misapplication of the standard or inability to apply the standard. The Committee encourages comment on this item during the Public Comment period. These actions are provided in this proposal to stimulate review and comment.

Number Eligible to Vote: 28

Ballot Results: Affirmative: 22 Negative: 1

Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

Explanation of Negative:

SCHERPA, T.: The proposed changes will reduce the potential for misapplication and were generated by a task group with a representative from the air handling industry.

654-10 Log #10 **Final Action: Reject**
(3.3.13 Explosion Hazard)

Submitter: John M. Cholin, J. M. Cholin Consultants Inc.

Recommendation: Add new text as follows:

Explosion Hazard. Any vessel, duct, building compartment, room or other enclosure containing a deflagration hazard.

Substantiation: Section 6.2.3 has been used to define where an explosion hazard exists, in lieu of actually defining the term in Chapter 3. This proposal, along with a companion proposal, defines both deflagration hazard as well as explosion hazard in a manner that is consistent with the manual of style, and NFPA 69.

Many sections of NFPA 654 begin with the phrase "Where and explosion hazard exists…" Yet no where in NFPA 654 does the document establish what constitutes an "explosion hazard". This proposal along with its companion proposal provide the necessary definitions to make the rest of the document meaningful.

Furthermore, the definition of "explosion" requires the rupture or bursting of an enclosure. Yet we know that personnel injuries can occur in buildings where deflagrations occur that do not cause the building enclosure to fail. The 14 employees injured in the Malden Mills explosion and fire were all in a portion of the building that did NOT suffer rupture of the enclosure envelop! Since one objective of NFPA 654 is life safety, NFPA 654 should address the distinction between the deflagration and the explosion. The proposed definitions assist in drawing this distinction.

Committee Meeting Action: Reject

Committee Statement: The proposed definition does not propose a threshold for when a deflagration hazard occurs and does not properly distinguish between a dust fire hazard and dust explosion hazard. See Proposal 654-15 (Log #CP4) where the Committee has developed requirements that describe this difference.

Number Eligible to Vote: 28

Ballot Results: Affirmative: 22 Negative: 1

Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

Explanation of Negative:

CHOLIN, J.: The proposed definition is internally consistent with the definitions in NFPA 68, NFPA 69 and fulfills the need to define what is deemed an explosion hazard as necessitated by the requirements of the prescriptive design criteria in chapter 7 and noted in the proposal.

654-11 Log #35 **Final Action: Accept in Principle in Part**
(4.2 and 8.2.1.2)

Submitter: Erdem A. Ural, Loss Prevention Science & Technologies, Inc.

Recommendation: Revise text to read as follows:

4.2 Process Hazard Analysis.

4.2.1* The design of the fire and explosion safety provisions shall be based on a process hazard analysis of the facility, the process, and the associated fire or explosion hazards.

4.2.2 The results of the process hazard analysis shall be documented and maintained for the life of the process.

4.2.3 If the process, equipment, or the operation does not permit elimination of dust deposits at all times, then the process hazard analysis shall specify and document maximum allowable layer thickness (or area density), maximum allowable deposit surface area, and minimum PPE requirements

4.2.4 It shall be permitted to use the partial volume deflagration analysis method described in NFPA 68 to satisfy the requirements of Section 4.2.3(NEW) for enclosure or building heights of up to 30 ft (BLDG HEIGHT SUBJECT TO COMMITTEE CONSENSUS).

4.2.5 ~~4.2.3~~ The process hazard analysis shall be reviewed and updated at least every 5 years.

8.2.1.2 Regular cleaning frequencies shall be established for walls, floors, and horizontal surfaces, such as equipment, ducts, pipes, hoods, ledges, beams, and above suspended ceilings and other concealed surfaces, to ensure ~~minimize~~ dust accumulations never exceed the maximum quantities specified in process hazard analysis (see Section 4.2.3(NEW)) ~~within operating areas of the facility.~~

Substantiation: Additional information is available for review at NFPA Headquarters.
Committee Meeting Action: Accept in Principle in Part

Revise text to read as follows:

4.2 Process Hazard Analysis.

4.2.1* The design of the fire and explosion safety provisions shall be based on a process hazard analysis of the facility, the process, and the associated fire or explosion hazards.

4.2.2 The results of the process hazard analysis shall be documented and maintained for the life of the process.

4.2.3* If the process, equipment, or the operation does not permit elimination of dust deposits at all times, then the process hazard analysis shall specify and document maximum allowable layer thickness (or area density), maximum allowable deposit surface area, and minimum PPE requirements

A.4.2.3 See Chapter 6 for some methods to evaluate the dust layer thickness.

Do not add 4.2.4 as proposed. See Committee action on Committee Proposal 654-15 (Log #CP4).

4.2.45 ~~4.2.3~~ The process hazard analysis shall be reviewed and updated at least every 5 years.

Do not revise 8.2.1.2 as proposed; see Committee Action on Proposal 654-46 (Log #30).

Committee Statement: The Committee accepted the inclusion of a new 4.2.3 and related annex item. The Committee did not add the new 4.2.4 as it conflicts with requirements introduced by the Committee's action on Committee Proposal 654-15 (Log #CP4). See Committee Action and Substantiation for 654-15 (Log #CP4). The Committee did not accept the proposed revision to 8.2.1.2 as similar changes were made as part of the Committee's Action on 654-46 (Log #30). See Committee Action and Statement for 654-46 (Log #30).
Number Eligible to Vote: 28
Ballot Results: Affirmative: 23
Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

654-12 Log #CP11 **Final Action: Accept**
(4.4 (New))

Submitter: Technical Committee on Handling and Conveying of Dusts, Vapors, and Gases,
Recommendation: Add a new 4.4 on Incident Investigation and renumber remaining sections:

4.4 Incident Investigation.

4.4.1* Every incident that results in a fire or explosion shall be investigated and recorded.

4.4.2* Once the scene has been released by the authority having jurisdiction, incident investigations shall be promptly initiated by management personnel or their designee who has a good working knowledge of the facility and processes.

Add the following annex material:

A.4.4.1 The size and extent of the incident that triggers this requirement should be proportional to the hazard. For example, a spark in a protected duct with a spark detection system would likely not require an investigation unless a significant increase in sparks per unit time was noted or the spark fails to be extinguished. This incident is considered "recorded" with the spark detection system. For every hazard area, there is a de minimis level below which recording cannot be justified. It is up to the owner/operator to determine that level.

A.4.4.2 Incident reports should include the following information:

(1) Date of the incident
(2) Location of the incident and equipment/process involved
(3) Description of the incident, contributing factors, and the suspected cause
(4) Operation of automatic/manual fire protection systems and emergency response
(5) Recommendations and corrective actions taken or to be taken to prevent a reoccurrence

The incident report should be reviewed with appropriate management personnel and retained on file for future reference. The recommendations should be addressed and resolved.

Substantiation: The Committee acknowledges industry best practice by incorporating a new provision on incident investigation.
Committee Meeting Action: Accept
Number Eligible to Vote: 28
Ballot Results: Affirmative: 22 Negative: 1
Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.
Explanation of Negative:

GUARICCI, D.: An incident that results in a fire and/or an explosion needs investigation regardless as to whether a protection system is present or not. The very protection system in question may have failed in its objective. Appendix A4.4.4 should be removed as it leads to an understanding that existing protection methods should not be reviewed.

Comment on Affirmative:

SCHERPA, T.: The proposed new A.4.4.1 should be revised to read:
"A.4.4.1 The size and extent of the investigation triggered by this requirement..." instead of
"A.4.4.1 The size and extent of the incident that triggers this requirement..."

654-13 Log #16 **Final Action: Reject**
(4.5.4)

Submitter: Peter Levitt, Sternvent Company, Inc.
Recommendation: Revise text as follows:

4.5.4 Mitigation of Fire Spread and ~~Explosions~~ Deflagrations

Substantiation: I believe deflagration is the correct term. It needs to be changed in the text of this section & others in both the front & appendix.

NFPA 664 made a similar edit in recent years.

Committee Meeting Action: Reject
Committee Statement: The recommendation is not consistent with the title and scope of the standard.
Number Eligible to Vote: 28
Ballot Results: Affirmative: 21 Negative: 2
Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.
Explanation of Negative:

CHOLIN, J.: The proposal is technically correct. The fire is a process which results in consequences such as smoke damage, building collapse, etc. The deflagration is the process that produces a result we call explosion. The proposal is consistent with the definitions in this document as well as NFPA 68 and 69.

GUARICCI, D.: A great deal of this document is devoted to prevent the propagation of a deflagration and not an explosion. The term deflagration better suits many objectives of the standard than the definition of explosion prevention. We want to stop explosions by mitigating the effects of the deflagration.

654-14 Log #57 **Final Action: Accept in Principle in Part**
(Chapter 6, 7, and 8)

Submitter: Samuel A. Rodgers, Honeywell, Inc.
Recommendation: Revise as follows:

The current building codes do not establish when a building or room must be protected against a dust explosion. Nor do they set the allowable quantity of a hazardous (combustible) dust in a control area, above which automatic fire suppression is required. Similar to NFPA-30 for liquids, NFPA-654 should establish these limits for dusts. Also, similar to NFPA-30, NPFA-654 should establish an acceptable amount of material in process, in this case, escaped dust.

This proposal clarifies when a Dust Explosion hazard and a Dust Fire Hazard exist in an operation handling combustible dust. The current text mentions these situations but provides no quantitative method to determine how much dust or what distribution of dust results in the hazard. In addition, the current text does not clearly differentiate between dust accumulations requiring electrical classification or those presenting a dust explosion hazard.

This proposal does not set a maximum amount of dust accumulation in a facility. Instead, just as for other materials, it establishes additional protection requirements when a certain amount of accumulation is exceeded.

The criteria for a dust explosion hazard is based on the ability to produce overpressure sufficient to cause building structural failure in the absence of some explosion protection method, typically venting. This is based on the worst case dust concentration, meaning that concentration and its associated maximum deflagration pressure, P_{max}, which give the largest building fill fraction. The worst case fill fraction would come from NFPA-68, section 8.3.4.

$$X_r = \frac{\bar{M}_f}{A_{fs} c_w H} + \frac{\bar{M}_s A_{sur}}{A_{ss} V c_w} + \frac{M_e}{V c_w}$$

Where:

X_r = worst-case building partial fraction

$\overline{M}_f$ = average mass (gram) of floor samples

A_{fs} = measured floor areas

c_w = worst-case dust concentration

H = ceiling height of the building

$\overline{M}_s$ = average mass (gram) of surface samples

A_{sur} = total area of surfaces with dust deposits

A_{ss} = measured sample areas of surfaces with dust deposits

V = building volume

M_e = total mass of combustible dust that could be released from the process equipment in the building

Use of this NFPA-68 equation should be clarified in order that unopened shipping containers or bags are not counted in the "process equipment". This should also be clarified to mean the dust accumulation between routine scheduled cleaning. Therefore, if the elevated and concealed surfaces are cleaned less frequently than the floor, these higher amounts would be included in the calculation. NFPA-68 then includes a method to determine P_{red} as a function of P_{max} and the fill fraction, X_r.

The committee should be aware that this analytical approach includes dust in process equipment and, therefore, housekeeping alone can not prevent the installation of an explosion vent. However, housekeeping can prevent the need for extensive fire protection and classified electrical equipment.

The criteria for a dust fire hazard area is based on local fugitive dust accumulation exceeding a mass of 1 kg/m^2 on a single square meter of surface between routine scheduled cleaning. This amount of dust, if dispersed, could create an explosible dust cloud to 2 to 4 meters height in a local area. Such a cloud would present a potential for a flash fire with personnel injury as well as ignition of other combustibles. Engineered dust collection and a sufficient routine housekeeping schedule can minimize dust fire hazard areas. When fugitive equipment leaks, then a local accumulation exceeding the 1 kg/m^2 criteria between scheduled general cleaning would be cleaned up in shorter times as the local accumulation rate increases.

A small dust fire hazard area would require manual fire protection. If the process results in more than 5% of the fire-separated area (room or floor) exceeding the criteria between routine cleaning, effectively a minimum average of 0.05 kg/m^2 or 10%-20% of the MEC, the entire area would protected with automatic fire suppression. This includes all the areas which experience short term accumulations beyond 1 kg/m^2 in a typical 24 hour operation, the longest allowed local cleaning period.

The need for electrically classified equipment for ignition prevention is clearly separated from the explosion and fire hazards. The dust layer thickness, that is accumulation, used to determine electrical classification, is different than those for provision of automatic fire suppression or explosion protection.

My suggestion for inserted text is as follows:

Definitions:

Fill Fraction, Xr: Fraction of the building or enclosure volume which could reach the dust concentration associated with the maximum explosion pressure, Pmax, in an unvented explosion.

6.1 General.

The provisions of this section shall apply to the overall design of systems that handle combustible ~~particulate solids~~ dusts.

6.1.1* Those portions of the process and facility where a dust explosion ~~deflagration~~ hazard or fire hazard exists shall be protected from the effects of these hazards ~~dust deflagrations~~ in accordance with this section as well as Sections 6.2, 6.3, and 6.4 and Chapter 7.

6.1.2* Dust Explosion Hazard Volume. (all of Kirby annex)

6.1.2.1 Dust explosion hazard volumes shall include those room or building volumes where an unvented deflagration of the worst case explosible dust fill fraction, Xr, can result in a reduced pressure, P_{red}, exceeding the ultimate dynamic strength of the weakest structural element not intended to fail.

6.1.2.x Dust quantities used to evaluate the dust fill fraction shall include all combustible dusts in the room or building volume, including that in open and closed containers, except as modified by 6.1.2.2 to 6.1.2.4.

6.1.2.2 Where dust accumulations exceed the dust layer control criterion over more than 0.5% of the surface area within the room/building, an engineering analysis shall be performed to determine acceptability of construction with respect to explosion protection in accordance with NFPA 68, Explosion Protection by Deflagration Venting, 2007 Edition, Chapter 8.3.4.

6.1.2.3 Quantities of dust in otherwise explosion-protected equipment or in sealed shipping containers shall not be included in the determination of the fill fraction for the room or building.

6.1.2.4 Dust accumulation amounts shall reflect the worst case for routinely scheduled cleaning, and not include short term accumulations cleaned within the times allowed in Chapter 8.

6.1.2.x For existing installations, the actual dust accumulation between routinely scheduled cleaning shall be documented.

6.1.2.x For new installations, the anticipated dust accumulation shall be permitted to be estimated for purposes of determining dust fill fraction.

6.1.2.x.1 If dust accumulation is initially estimated, the owner/operator shall document the actual dust accumulation within one month after the new installation is operational

6.1.2.x.2 If dust accumulation is initially estimated, the owner/operator shall either adjust routine cleaning schedule or modify dust containment methods to achieve at most the estimated dust accumulation within 6 months after the new installation is operational.

6.1.2.5 Small volume enclosures or gallery-type enclosures shall have lower limits of acceptable dust accumulation, based on an evaluation acceptable to the authority having jurisdiction (see A.6.1.2)

6.1.2.5 Dust explosion hazard volumes shall be segregated or detached from other volumes in the same occupancy.

6.1.3 Dust Fire Hazard Area.

6.1.3.1* Dust fire hazard areas shall include those areas where combustible dust accumulation on exposed or concealed surfaces, outside of equipment or containers, exceeds the dust layer control criterion, as well as areas where dust clouds of a hazardous concentration exist during normal operation.

6.1.3.2* The dust layer control criterion shall be 1 kg/m^2 of horizontal floor area beneath the accumulation for a nominal 3 meter room/building height and shall be ratioed up or down as a function of room/building height to a maximum of 4 kg/m^2 for a 12 meter room/building height.

A.6.1.3.2 The following equation provides a means to estimate an equivalent depth from a known value of settled bulk density.

Eqn A.6.1.3.2

$$Equivalent\_Depth(mm) = \frac{1000 \cdot Accumulation(kg/m^2)}{BulkDensity(kg/m^3)}$$

6.1.3.3 Dust fire hazard areas shall be segregated or separated from other areas in the same occupancy.

6.1.3.4 The extent of fire protection and control that is provided for those portions of a facility containing a dust fire hazard area shall be determined by means of an engineering evaluation of the facility and application of sound fire/explosion protection and process engineering principles. This evaluation shall include, but not be limited to, the following:

- Analysis of the fire hazards of the operation and dust accumulations
- Analysis of facility and system designs and special fire protection in other parts of this chapter, and in Chapter 10
- Analysis of the emergency response capabilities of the local emergency services.

6.1.4 Recycling of Air–Material Separator Exhaust. Recycling of air–material separator exhaust to buildings shall be permitted if the system is designed to prevent both return of dust with an efficiency of 99.9 percent at 10 m and transmission of energy from a fire or explosion to the building.

6.1.4.1 Recycling of air–material separator exhaust to the building shall not be permitted under any circumstances when combustible gases or vapors or hybrid mixtures are involved.

6.1.4.2* Recycling of air–material separator exhaust to the building shall not be permitted when the recycled stream reduces the concentration of oxygen below 19.5 percent by volume in the work area.

A.6.1.4.2 (renumbered A.6.1.3.2)

(Repeated in Chapter 10)

6.1.5* Where a pneumatic conveying system or any part of such systems operates as a positive-pressure-type system and the air-moving device's gauge discharge pressure is 15 psi (103 kPa) or greater, the system shall be designed in accordance with Section VIII of the ASME Boiler and Pressure Vessel Code or ASME B31.3, Process Piping.

6.1.6 All components of pneumatic conveying systems that handle combustible particulate solids shall be designed to be dusttight, except for openings designed for intake and discharge of air and material.

6.2 Segregation, Separation, or Detachment of Combustible Dust Handling and Processing Areas.

6.2.1 General. Areas in which combustible dusts are produced, processed, handled, or collected shall be detached, segregated, or separated from other occupancies to minimize damage from a fire or explosion.

6.2.2 Use of Segregation.

6.2.2.1 Physical barriers that are erected to segregate dust fire hazard areas shall be a minimum 1 hour fire separation assembly, including seals at all penetrations of floors, walls, ceilings, or partitions.

6.2.2.2 Physical barriers that are erected to segregate dust explosion hazard volumes shall be designed to preclude failure of those barriers during a dust explosion per NFPA-68, Standard on Explosion Protection by Deflagration Venting.

6.2.2.3 Doors and openings shall not be permitted in physical barriers unless they are normally closed and have at least the strength and fire endurance rating required of as the physical barrier.

6.2.3 Use of Separation.

6.2.3.1* When separation is used to limit the dust fire hazard area, the required separation distance between the fire hazard area identified in 6.1.3 and surrounding exposures shall be determined by the following:

(1) Engineering evaluation that addresses the properties of the materials

(2) Type of operation

(3) Amount of material likely to be present outside the process equipment

(4) Building design

(5) Nature of surrounding exposures

6.2.3.2 In no case shall the separation distance be less than 30 ft (9 m).

6.2.3.3 When separation is used, housekeeping, fixed dust collection systems employed at points of release, and compartmentation shall be permitted to be used to limit the extent of the dust fire hazard area.

6.3 Building Construction.

6.3.1 All buildings shall be of Type I or Type II construction, as defined in NFPA 220, Standard on Types of Building Construction.

6.3.2 Where local, state, or national building codes are more restrictive, modifications shall be permitted for conformance to those codes.

6.3.3* Interior surfaces where dust accumulations can occur shall be designed and constructed so as to facilitate cleaning and to minimize combustible dust accumulations.

6.3.4 Spaces inaccessible to housekeeping shall be sealed to prevent dust accumulation.

6.3.5 Interior walls erected for the purpose of limiting fire spread shall have a minimum 1-hour fire resistance rating and shall be designed in accordance with NFPA 221, Standard for High Challenge Fire Walls, Fire Walls, and Fire Barrier Walls.

6.3.6 Fire Doors.

6.3.6.1 Openings in fire walls and in fire barrier walls shall be protected by self-closing fire doors that have a fire resistance rating equivalent to the wall design.

6.3.6.2 Fire doors shall be installed according to NFPA 80, Standard for Fire Doors and Fire Windows, and shall normally be in the closed position.

6.3.7 Egress. Means of egress shall comply with NFPA 101, Life Safety Code.

6.3.8 Penetrations. Where floors, walls, ceilings, and other partitions have been erected to control the spread of fire or deflagrations, penetrations in these structures shall be sealed to maintain their fire endurance rating and maintain physical integrity in a deflagration. (See 7.6.5.)

6.3.9 Fire Resistance Rating.

6.3.9.1 Interior stairs, elevators, and manlifts shall be enclosed in dusttight shafts that have a minimum fire resistance rating of 1 hour.

6.3.9.2 Doors that are the automatic-closing or self-closing type and have a fire resistance rating of 1 hour shall be provided at each landing.

6.3.9.3 Stairs, elevators, and manlifts that serve only open-deck floors, mezzanines, and platforms shall not be required to be enclosed.

6.3.10* Floors and load-bearing walls that are exposed to dust explosion hazards volumes shall be designed to preclude failure during a dust explosion as determined according to NFPA-68, Standard on Explosion Protection by Deflagration Venting.

6.4* Explosion Protection.

6.4.1* A dust hazard explosion volume, as specified in 6.1.2, shall be provided with explosion protection in accordance with NFPA-69, Standard on Explosion Prevention Systems

A.6.4.1 For buildings or rooms, the typical explosion protection method is deflagration venting. The need for building deflagration venting is a function of equipment design, particle size, deflagration characteristics of the dust, and housekeeping results. As a rule, deflagration venting is recommended unless there can be reasonable assurance that hazardous quantities of combustible and dispersible dusts will not be permitted to accumulate outside of explosion-protected equipment.

Where building explosion venting is needed, detaching the operation to an open structure or to a building of damage-limiting construction is the preferred method of protection. Damage-limiting construction involves a room or building that is designed such that certain interior walls are pressure resistant (can withstand the pressure of the deflagration) to protect the occupancy on the other side and some exterior wall areas are pressure relieving to provide deflagration venting. It is preferable to make maximum use of exterior walls as pressure-relieving walls (as well as the roof wherever practical), rather than to provide the minimum recommended. Further information on this subject can be found in NFPA 68, Standard on Explosion Protection by Deflagration Venting.

Deflagration vent closures should be designed such that, once opened, they remain open to prevent failure from the vacuum following the pressure wave.

Updates are suggested here to be in compliance with NFPA 69, which recently eliminated chokes as an acceptable isolation device and introduced design limitations for rotary valves alone, as opposed to rotary valves with an additionally maintained material layer above the valve.

7.1.4* Isolation of Equipment.

7.1.4.1 Where an explosion hazard exists, isolation devices shall be provided to prevent deflagration propagation between pieces of equipment connected by ductwork.

7.1.4.2 Isolation devices shall include, but shall not be limited to, the following:

~~(1)* Chokes~~

(2)* Rotary valves in accordance with NFPA 69, Standard on Explosion Prevention Systems

(3)* Automatic fast-acting valve systems in accordance with NFPA 69, Standard on Explosion Prevention Systems

Updates here are to provide clear instructions for suitable routine housekeeping and spill cleanup.

8.2 Housekeeping.

The requirements of 8.2.1 through 8.2.3 shall be applied retroactively.

8.2.1* General.

8.2.1.1 Equipment shall be maintained and operated in a manner that minimizes the escape of dust.

8.2.1.2 Regular cleaning frequencies shall be established for walls, floors, and horizontal surfaces, such as equipment, ducts, pipes, hoods, ledges, beams, and above suspended ceilings and other concealed surfaces, to minimize dust accumulations within operating areas of the facility.

8.2.1.3 Wherever a local spill or short-term accumulation of combustible dust on the surfaces listed in 8.2.1.2 exceeds the dust layer control criterion between regular cleaning, determined on the basis of a single square meter of surface collecting the accumulation, un-scheduled housekeeping shall be performed according to 8.2.1.4.

8.2.1.4* Un-scheduled housekeeping shall be performed in accordance with Table 8.2.1.4 to limit the time that a local spill or short-term accumulation of dust is allowed to remain before cleaning the local area to less than the dust layer control criterion.

Table 8.2.1.4 Un-Scheduled Housekeeping

Accumulation on the worst single square meter of surface	Longest Time to Complete Un-scheduled Local Cleaning of Floor-Accessible Surfaces	Longest Time to Complete Un-scheduled Local Cleaning of Remote Surfaces
>1 to 2 times dust layer control criterion	8 hours	24 hours
>2 to 4 times dust layer control criterion	4 hours	12 hours
> 4 times dust layer control criterion	1 hour	3 hours

A.8.2.1.4 Table A.8.2.1.4 shows approximate equivalent depths for the accumulation values in Table 8.2.1.4 when the dust layer control criterion is 1 kg/m^2. The owner/operator can use an approximate depth to facilitate communication of housekeeping needs.

Table A.8.2.1.4 Un-Scheduled Housekeeping

Accumulation on the worst single square meter of surface	Average Depth at 75 lb/ft^3	Average Depth at 30 lb/ft^3
>1 to 2 kg/m^{2f}	>$^1/_{32}$-$^1/_{16}$ in. (0.8-1.7 mm)	>$^5/_{64}$-$^5/_{32}$ in. (2.1-4.2 mm)
>2 to 4 kg/m^2	>$^1/_{16}$-$^1/_8$ in. (1.7-3.3 mm)	>$^5/_{32}$-$^5/_{16}$ in. (4.2-8.3 mm)
> 4 kg/m^2	> $^1/_8$ in. (>3.3 mm)	> $^5/_{16}$ in. (>8.3 mm)

Substantiation: This proposal clarifies when a Dust Explosion Hazard and a Dust Fire Hazard exist in an operation handling combustible dust. The current text mentions these situations but provides no quantitative method to determine how much dust or what distribution of dust results in the hazard. In addition, the current text does not clearly differentiate between dust accumulations requiring electrical classification or those presenting a dust explosion hazard.

This proposal does not set a maximum amount of dust accumulation in a facility. Instead, just as for other materials, it establishes additional protection requirements when a certain amount of accumulation is exceeded.

The proposal includes prior additions and seeks to clarify the question of initial dust accumulation estimates for new installations.

Committee Meeting Action: Accept in Principle in Part

For action on the recommendation to address dust layer accumulation, see Committee Action on Committee Proposal 654-15 (Log #CP4).

For action on the proposed revision to 7.1.4, see Committee Action on Proposal 654-25 (Log #41).

For action on the proposed revision to 8.2 on housekeeping, see Committee Action on Proposal 654-46 (Log #30).

For action on the proposed revision to 6.1.3 on recycling air, see Committee Action on Proposal 654-17 (Log #12).

The following changes proposed in the submitter's recommendation have been accepted as submitted:

Revise 6.2, 6.3 and 6.4 as shown.

6.2 Segregation, Separation, or Detachment of Combustible Dust Handling and Processing Areas.

6.2.1 General. Areas in which combustible dusts are produced, processed, handled, or collected shall be detached, segregated, or separated from other occupancies to minimize damage from a fire or explosion.

6.2.2 Use of Segregation.

6.2.2.1 Physical barriers that are erected to segregate dust fire hazard areas shall be a minimum 1 hour fire separation assembly, including seals at all penetrations of floors, walls, ceilings, or partitions.

6.2.2.2 Physical barriers that are erected to segregate dust explosion hazard volumes shall be designed to preclude failure of those barriers during a dust explosion per NFPA 68, Standard on Explosion Protection by Deflagration Venting.

6.2.2.3 Doors and openings shall not be permitted in physical barriers unless they are normally closed and have at least the strength and fire resistance rating required of ~~as~~ the physical barrier.

6.2.3 Use of Separation.

6.2.3.1* When separation is used to limit the dust fire hazard area, the required separation distance between the fire hazard area identified in 6.1.3 and surrounding exposures shall be determined by the following:

(1) Engineering evaluation that addresses the properties of the materials
(2) Type of operation
(3) Amount of material likely to be present outside the process equipment
(4) Building design
(5) Nature of surrounding exposures

6.2.3.2 When separation is used to limit the dust fire hazard area, in no case shall the separation distance be less than 30 ft (9 m).

6.2.3.3 When separation is used, housekeeping, fixed dust collection systems employed at points of release, and compartmentation shall be permitted to be used to limit the extent of the dust fire hazard area.

6.3 Building Construction.

6.3.1 All buildings shall be of Type I or Type II construction, as defined in NFPA 220, Standard on Types of Building Construction.

6.3.2 Where local, state, or national building codes are more restrictive, modifications shall be permitted for conformance to those codes.

6.3.3* Interior surfaces where dust accumulations can occur shall be designed and constructed so as to facilitate cleaning and to minimize combustible dust accumulations.

6.3.4 Spaces inaccessible to housekeeping shall be sealed to prevent dust accumulation.

6.3.5 Interior walls erected for the purpose of limiting fire spread shall have a minimum 1-hour fire resistance rating and shall be designed in accordance with NFPA 221, Standard for High Challenge Fire Walls, Fire Walls, and Fire Barrier Walls.

6.3.6 Fire Doors.

6.3.6.1 Openings in fire walls and in fire barrier walls shall be protected by self-closing fire doors that have a fire resistance rating equivalent to the wall design.

6.3.6.2 Fire doors shall be installed according to NFPA 80, Standard for Fire Doors and Fire Windows, and shall normally be in the closed position.

6.3.7 Egress. Means of egress shall comply with NFPA 101, Life Safety Code.

6.3.8 Penetrations. Where floors, walls, ceilings, and other partitions have been erected to control the spread of fire or deflagrations, penetrations in these structures shall be sealed to maintain their fire endurance rating and maintain physical integrity in a deflagration. (See 7.6.5.)

6.3.9 Fire Resistance Rating.

6.3.9.1 Interior stairs, elevators, and manlifts shall be enclosed in dusttight shafts that have a minimum fire resistance rating of 1 hour.

6.3.9.2 Doors that are the automatic-closing or self-closing type and have a fire resistance rating of 1 hour shall be provided at each landing.

6.3.9.3 Stairs, elevators, and manlifts that serve only open-deck floors, mezzanines, and platforms shall not be required to be enclosed.

6.3.10* Floors and load-bearing walls that are exposed to dust explosion hazard~~s~~ volumes shall be designed to preclude failure during a dust explosion as determined according to NFPA-68, Standard on Explosion Protection by Deflagration Venting.

6.4* Explosion Protection.

6.4.1* A dust explosion hazard volume, as specified in 6.1.2, shall be provided with explosion protection in accordance with NFPA 69, Standard on Explosion Prevention Systems or NFPA 68, Standard on Explosion Protection by Deflagration Venting.

A.6.4.1 For buildings or rooms, the typical explosion protection method is deflagration venting. The need for building deflagration venting is a function of equipment design, particle size, deflagration characteristics of the dust, and housekeeping results. As a rule, deflagration venting is recommended unless there can be reasonable assurance that hazardous quantities of combustible and dispersible dusts will not be permitted to accumulate outside of explosion-protected equipment.

Where building explosion venting is needed, detaching the operation to an open structure or to a building of damage-limiting construction is the preferred method of protection. Damage-limiting construction involves a room or building that is designed such that certain interior walls are pressure resistant (can withstand the pressure of the deflagration) to protect the occupancy on the other side and some exterior wall areas are pressure relieving to provide deflagration venting. It is preferable to make maximum use of exterior walls as pressure-relieving walls (as well as the roof wherever practical), rather than to provide the minimum recommended. Further information on this subject can be found in NFPA 68, Standard on Explosion Protection by Deflagration Venting.

Deflagration vent closures should be designed such that, once opened, they remain open to prevent failure from the vacuum following the pressure wave.

Committee Statement: See Committee Action and Substantiation on Committee Proposal 654-15 (Log #CP4) regarding the Committee's revision to the requirements for dust accumulation thresholds. See Committee Action and Statement on Proposal 654-25 (Log #41) regarding the Committee revision to the explosion isolation requirements. See Committee Action and Statement on Proposal 654-46 (Log #30) regarding the Committee revision of the housekeeping requirements in 8.2 of the standard. See Committee Action and Statement on Proposal 654-17 (Log #12) regarding the Committee revision to the requirements for recycling air. These actions address all the areas proposed by the submitter in the recommendation, and the Committee believes its actions satisfy the intent of the submitter in each instance.

Number Eligible to Vote: 28

Ballot Results: Affirmative: 23

Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

Comment on Affirmative:

CHOLIN, J.: The proposal introduces the term "dust fire" which is not defined nor is it distinguished from the term "deflagration" that has been used for decades in this and numerous other NFPA documents. The submitter has not substantiated the need or advisability for introducing this new term.

JENNETT, J.: 8.2.1.4 This could require facilities to pay unnecessary overtime.

A clause that would allow clean-up of a spill or dust accumulation which occurs but does not create a hazard to the facility or personnel during off hours to be completed before the start of the next shift.

Table 8.2.1.4 Un-scheduled Housekeeping Table should include in each box (or before the start of the next shift).

654-15 Log #CP4 **Final Action: Accept**
(6.1)

Submitter: Technical Committee on Handling and Conveying of Dusts, Vapors, and Gases,
Recommendation:

Add the following new definitions:

3.3.x Dust explosion hazard volumes: those room or building volumes where an unvented deflagration of the entrainable dust mass can result in a reduced pressure, P_{red}, exceeding the ultimate dynamic strength of the weakest structural element not intended to fail.

3.3.x Dust fire hazard areas: those areas where combustible dust accumulation on exposed or concealed surfaces, outside of equipment or containers, can result in personnel injury from thermal dose during a dust deflagration, as well as areas where dust clouds of a hazardous concentration exist during normal operation.

Replace existing 6.1 with the following and renumber as needed:

6.1 General. The provisions of this section shall apply to the overall design of systems that handle combustible dusts.

6.1.1* Those portions of the process and facility where a dust explosion hazard or fire hazard exists shall be protected from the effects of these hazards in accordance with this section as well as Sections 6.2, 6.3, and 6.4 and Chapter 7.

6.1.2* Unless supported by calculations per 6.1.3 and 6.1.4, respectively, dust explosion hazard volumes and dust fire hazard areas shall be deemed to exist when total accumulated dust mass exceeds 1 kg/m^2 multiplied by 5% of the building or room footprint.

A.6.1.2 This is equivalent to 0.8 mm ($^1/_{32}$ in.) based upon a settled bulk density of 1200 kg/m^3 (75 lb/ft^3). The following equation provides a means to estimate an equivalent depth from a known value of settled bulk density.

$$Equivalent\_Depth(mm) = \frac{1000 \cdot Accumulation(kg/m^2)}{BulkDensity(kg/m^3)} \quad \text{Eqn A.6.1.2}$$

6.1.2.1 All dust accumulated on structures above the lowest footprint shall be evaluated as if accumulated on the lowest footprint.

6.1.2.2 The maximum footprint to be used to calculate the total dust mass shall not exceed 2000 m^2.

6.1.3 It shall be permitted to evaluate the threshold dust mass establishing a building or room as a dust explosion hazard volume, m_i, per equation 6.1.3.

$$M_{exp} = P_{red} \cdot \left[\frac{Cw}{P_{max}}\right] \cdot \frac{A_{Floor} \cdot H}{\eta_D} \quad \text{Eqn 6.1.3}$$

where

M_{exp} is the threshold dust mass (g) based upon building damage criterion,
c_w is the worst case dust concentration (g/m^3) at which the maximum rate-of-pressure-rise results in tests conducted per ASTM E1226,
P_{red} is the allowable pressure (bar g) developed during a deflagration per NFPA 68,
P_{max} is the maximum pressure (bar g) developed in ASTM E1226 tests with the accumulated dust sample,
A_{floor} is the enclosure floor area (m^2),
η_D is the entrainment fraction
and H is the enclosure ceiling height (m).

6.1.4 It shall be permitted to evaluate the threshold dust mass establishing an area as a dust fire hazard area, per equation 6.1.4

$$M_{fire} = 0.05 \cdot \left[\frac{C_w}{1+P_{max}}\right] \cdot \frac{A_{Floor} \cdot \delta}{\eta_D} \quad \text{Eqn 6.1.4}$$

Where, M_{fire} is the threshold dust mass (g) based upon personnel fire exposure criterion.

6.1.5* It shall be permitted to assume a default value of 0.25 for the entrainment fraction (η_D).

A.6.1.5 A higher value for η_D is more appropriate for ducts and small enclosures less than 100 m^3 and for enclosures with L/D ratios greater than 5, such as galleries. Research activities are currently in progress to define a technical basis for estimating η_D.

6.1.6 It shall be permitted to use a lower value of η_D based on a risk evaluation that is acceptable to the authority having jurisdiction.

6.1.7 Dust accumulation amounts shall reflect the conditions resulting from routinely scheduled cleaning, and not include short term accumulations cleaned in accordance with Chapter 8.

Substantiation: The current building codes do not establish when a building or room must be protected against a dust explosion. Nor do they set the allowable quantity of a hazardous (combustible) dust in a control area, above which automatic fire suppression is required. Similar to NFPA-30 for liquids, NFPA-654 should establish these limits for dusts. Also, similar to NFPA-30, NFPA-654 should establish an acceptable amount of material in process, in this case, escaped dust.

This proposal clarifies when a Dust Explosion hazard and a Dust Fire Hazard exist in an operation handling combustible dust. The current text mentions these situations but provides no quantitative method to determine how much dust or what distribution of dust results in the hazard. In addition, the current text does not clearly differentiate between dust accumulations requiring electrical classification or those presenting a dust explosion hazard.

This proposal does not set a maximum amount of dust accumulation in a facility. Instead, just as for other materials, it establishes additional protection requirements when a certain amount of accumulation is exceeded.

The criteria for a dust explosion hazard is based on the ability to produce overpressure sufficient to cause building structural failure in the absence of some explosion protection method, typically venting. This is based on the worst case dust concentration, meaning that concentration and its associated maximum deflagration pressure, P_{max}, which give the largest building fill fraction. The worst case fill fraction would come from NFPA-68, section 8.3.4.

The criteria for a dust fire hazard area is based on local fugitive dust accumulation exceeding a mass of 1 kg/m^2 on a single square meter of surface between routine scheduled cleaning. This amount of dust, if dispersed, could create an explosible dust cloud of 2 to 4 meters height in a local area. Such a cloud would present a potential for a flash fire with personnel injury as well as ignition of other combustibles. Engineered dust collection and a sufficient routine housekeeping schedule can minimize dust fire hazard areas. When fugitive equipment leaks, then a local accumulation exceeding the 1 kg/m2 criteria between scheduled general cleaning would be cleaned up in shorter times as the local accumulation rate increases.

A small dust fire hazard area would require manual fire protection. If the process results in more than 5% of the fire-separated area (room or floor) exceeding the criteria between routine cleaning, effectively a minimum average of 0.05 kg/m^2 or 10%-20% of the MEC, the entire area would be protected with automatic fire suppression. This includes all the areas which experience short term accumulations beyond 1 kg/m2 in a typical 24 hour operation, the longest allowed local cleaning period.

The need for electrically classified equipment for ignition prevention is clearly separated from the explosion and fire hazards. The dust layer thickness, that is accumulation, used to determine electrical classification, is different than those for provision of automatic fire suppression or explosion protection.

Committee Meeting Action: Accept
Number Eligible to Vote: 28
Ballot Results: Affirmative: 20 Negative: 3
Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.
Explanation of Negative:

CHOLIN, J.: The proposal introduces the term “dust fire” which is not defined nor is it distinguished from the term “deflagration” that has been used for decades in this and numerous other NFPA documents. The submitter has not substantiated the need or advisability for introducing this new term.

The committee proposal is too complex to be routinely enforced by non-engineers for determining if a has are exists or not. The proposed material should be included in an annex to Chapter 5 as a manual of practice.

The committee proposal calculations rely on the concentration producing the maximum pressure, not the minimum concentration that propagates a deflagration flame front, MEC. This leads to under-assessment of the hazard.

SUTTON, J.: While I agree with the concept of establishing hazard areas based on the amounts of dust, I do not agree with using an entrainment factor of 0.25 in these equations as this would result in an increase in the amount of dust allowed in an area and there is not an adequate technical basis for using a 0.25 entrainment factor.

URAL, E.: Change eta[sub]D value to 1.0 for elevated deposits, and 0.25 for ordinary floor deposits

Comment on Affirmative:

BEATTIE, W.: The.25 factor is not substantiated. This may permit higher than acceptable levels of dust. If any factors less than 1 is used, the use of the factor should be substantiated by tests.

654-16 Log #1 **Final Action: Accept in Principle in Part**
(6.1.2 and A.6.1.2)

Submitter: David C. Kirby, Baker Risk
Recommendation: Revise as follows:

The following is a reorganization and clarification of portions of paragraph 6.1.2 from the NFPA 654 Pre Rop meeting of June 17, 18, 2008. Succeeding paragraphs from the pre ROP should be included and renumber as applicable:

6.1.2 Room/Building Dust Explosion Hazard.

6.1.2.1 A dust explosion hazard shall be deemed to exist in those rooms or building volumes where a deflagration of the worst credible case explosible dust fill fraction, Xr, can result in a pressure exceeding the ultimate dynamic strength of the weakest structural element not intended to fail.

6.1.2.2* The dust layer control criterion shall be a maximum of 1 kg/m^2 (0.2 lbs/ft^2) accumulation for a nominal 3 meter high room/building, and shall be ratioed up or down as a function of room/building height to a maximum of 4 kg/m^2 (0.8 lbs/ft^2) for a 12 meter and higher (40 ft and higher) room/building. Where settled bulk density is known it shall be permissible to base dust layer control criterion on the following equation:

$$\text{Equivalent Depth (mm)} = \frac{1000 \bullet \text{Accumulation}\left(\text{kg/m}^2\right)}{\text{Bulk Density}\left(\text{kg/m}^3\right)}$$

6.1.2.3 Where dust accumulations exceed the dust layer control criterion over more than 5% of the surface area within the room/building, an engineering analysis shall be performed to determine acceptability of construction with respect to explosion protection in accordance with NFPA 68, Explosion Protection by Deflagration Venting, 2007 Edition, Section 8.3.4.

6.1.2.4* Small volume enclosures less than 100 m^3 (3,500 ft^3) or gallery-type enclosures with a length-to-diameter (L/D) ratio greater than 5 shall have lower limits of acceptable dust accumulation, based on an evaluation acceptable to the authority having jurisdiction.

A.6.1.2.2 A relatively small initial dust deflagration can disturb and suspend in air dust that has been allowed to accumulate on the surfaces of a building or equipment. When dispersed into a dust cloud and ignited, a deflagration can ensue, potentially causing damage. This is know as a secondary deflagration (explosion). Reducing significant additional dust accumulations is therefore a major factor in reducing the hazard in areas where a dust explosion hazard can exist. (See Annex D).

When structures are higher than 3 meters the meters the maximum allowable accumulation between cleaning (housekeeping) can be scaled upwards, not to exceed the dispersed limit of 330 grams/m^3. For example, a 20 ft (6 m) high building could have a maximum allowable accumulation of 2 kg/m^2; -3.6 mm ($^3/_{16}$ in.) - if settled bulk density = 560 g/m^3 (35 lbs/ft^3), but any building higher than about 40 ft (12 m) would have a maximum allowable accumulation of 3..5 kg/m^2, 6.25 mm ($^1/_4$ in.) — bulk density of 35 lbs/ft^3. However, for those high or unusually large structures, an engineering analysis should be performed to determine requirements for deflagration venting (see 6.2.3.4).

1 kg/m^2 accumulation (3.6 mm ($^1/_{16}$ in.) accumulation for a dust having a settled bulk density of 560 g/m^3 (35 lbs/ft^3) of a combustible dust in a 3 meter high enclosure, when totally and uniformly dispersed, represents a concentration of 333 grams/m^3. This is well above the minimum explosive concentration (MEC) for most dusts. In typical room-size, settled density, per cent moisture, room size, continuity of fuel loading, congestion, and strength of the ignition source. Flame-jet ignition from explosions within equipment that rupture and emit flame and pressure inside the room can result in a highly efficient entrainment factor. It is extremely important that processing/storage equipment be protected against venting flame/pressure into the room. This scenario can also eject unburned fuel into the room that can add to the secondary explosion violence.

A.6.1.2.4 Enclosures smaller than 100 m^3, or gallery-type enclosures that have a length to diameter ratio (hydraulic diameter) L/D greater than 5 are more efficient in entraining dust into a secondary explosion from shock or pressure waves from a primary explosion. When the enclosure is smaller than 100 m^3, acceptable maximum accumulations between cleaning cycle should be scaled down in ratio of the volume of the enclosure to a lower limit equal to 100% of the MEC for a 1 m^3 enclosure. For volumes between 1 m^3 and 100 m^3 direct scaling can be applied. Take for example a material having a MEC of 60 g/m^3 in a room 4.6 m (15 ft) × 6.1 m (20 ft) × 21. m (7 ft) high = 59 m^3 (2,100 ft^3). Solving from 1 m^3 @ 60g/m^3 to 100 m^3 @ 330/gm^3 at a point of 59 m^3, allowable accumulation is 220 g/m^3. This is a maximum allowable accumulation of 1.2 mm ($^3/_{64}$ in.) for a material having a bulk density of 560 kg/m^3 (35 lbs/ft^3).

Gallery-type enclosures with a length-to-diameter of 5 or less should be calculated on the basis of regular enclosures (typically these will be less than 100 m^3). Gallery-type enclosures with a length-to-diameter greater than 5 should have average accumulations, when totally entrained, less than the MEC. Galleries typically contain conveyors which are difficult to design to contain all fugitive emissions. Therefore, it is recommended that strong consideration be given controlling dust at transfer points, and providing means to wash down with water spray on a frequent basis. As noted below, keeping one side of a conveyor open along one side (aboveground) is highly recommended.

Gallery-type elongated enclosures where the L/D exceeds 5 shall be subject to smaller allowable accumulations between cleaning. This is especially important for underground tunnels where no explosion venting can occur (except from the ends). Unless testing is done to represent actual conditions, it is recommended that an L/D of 5 and greater, average accumulations of dispersible dust not exceed that which would, if dispersed, result in a cloud with a density greater than the MEC. Where it is not possible to maintain accumulations below the MEC, and where explosion effects can be communicated between work areas, or between equipment and work areas (such as between silos and processing rooms) consideration should be given to providing other explosion protection measures, such as deflagration isolation. Where feasible, gallery type construction (such as elevated conveyor structures) should have one side at least 25% open along the entire length. For this case an engineering analysis may determine that greater accumulations are not unsafe, but fire protection should still be a consideration. Note that testing has shown that very low combustible dust accumulations on gallery floors can propagate flame throughout the gallery, even at concentrations below the MEC if the dust is uniformly dispersed throughout the gallery, even at concentrations below the MEC if the dust is uniformly dispersed throughout the gallery volume. However, there is little pressure build-up for this (flash-fire) scenario. Experience has shown that railcar and truck unloading bunker-conveyor-tunnels that transition to above-ground galleries within a short distance (12 m (40 ft) can, in general, tolerate accumulations greater than the MEC (see 6.1.2.2 for recommended limitations).

Local combustible dust accumulations, such as localized dust accumulations as may accumulate in the upper structure of a high-bay building, may not constitute a building explosion hazard, but can pose a flash-fire risk. Cleaning should be performed prior to performing tasks that disturb the dust deposits and/or introduce ignition sources. The high-bay section should be considered a Hazardous Work Permit Area. The hazardous work permit should consider the need for personnel protective equipment (fire retardant clothing, face shields, etc.) as appropriate. Fire retardant personnel protection clothing can provide significant protection for credible scenarios of low explosion overpressure, and flash-fires. the use of clothing made from synthetic materials should be avoided.

Substantiation: The proposed revisions to 6.1.2 and the accompanying annex text are based upon task group work completed following the Committee's pre-ROP discussion of the upcoming revision to NFPA 654. The changes proposed are a reorganization and clarification of portions of paragraph 6.1.2 as developed during the NFPA 654 pre-ROP meeting of June 17-18, 2008.
Committee Meeting Action: Accept in Principle in Part

See Committee Action on Committee Proposal 654-15 (Log #CP4).

Committee Statement: See Committee Action and Substantiation on Committee Proposal 654-15 (Log #CP4). The Committee addressed the question of determining dust layer accumulation using a different approach from that proposed by the submitter; intent of the submitter was accomplished by the action of the Committee. The Committee did not add the annex material supporting the limits applicable for gallery-type enclosures as more research is required to support the basis for any specific provisions.
Number Eligible to Vote: 28
Ballot Results: Affirmative: 22 Negative: 1
Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.
Explanation of Negative:

CHOLIN, J.: The submitter does not deal with circumstances where the occupants are at elevations other than at floor level. There have been numerous instances where employees on cat-walks, mezzanines, etc. have been killed or injured by deflagrations.

654-17 Log #12 **Final Action: Accept in Principle**
(6.1.3)

Submitter: John M. Cholin, J. M. Cholin Consultants Inc.
Recommendation: Revise text as follows:

6.1.3 Recycling of Air-Material Separator Exhaust. Cleaned, exhaust air from air material separators shall not be returned back into the facility unless provision are in place to divert the return air flow to the building exterior in the event of a fire in the air-material separator.

This language is to replace the text of 6.1.3. The text in 6.1.3.1 and 6.1.3.2 is to remain.

Substantiation: The proposed text removes an industrial hygiene requirement that the TC is not qualified to establish and clarifies the intent of the TC.
Committee Meeting Action: Accept in Principle
Delete existing 6.1.3, 6.1.3.1 and 6.1.3.2 as shown and replace with the following new text:

6.1.3 ~~**Recycling of Air-Material Separator Exhaust.** Recycling of air-material separator exhaust to building shall be permitted if the system is designed to prevent both return of dust with an efficiency of 99.9 percent at 10 um and transmission of energy from a fire or explosion to the building.~~

~~6.1.3.1 Recycling of air-material separator exhaust to the building shall not be permitted under any circumstances when combustible gases or vapors or hybrid mixtures are involved.~~

~~6.1.3.2 Recycling of air-material separator exhaust to the building shall not be permitted when the recycled stream reduces the concentration of oxygen below 19.5 percent by volume in the work area.~~

6.1.3* **Recycling of Air -Material Separator Exhaust.** Recycling of air-material separator exhaust shall be permitted when all of the following requirements are met:

1. Combustible or flammable gases or vapors are not present either in the intake or the recycled air in concentrations above applicable industrial hygiene exposure limits or 1% of the LFL, whichever is lower.
2. *Combustible particulate solids are not present in the recycled air in concentrations above applicable industrial hygiene exposure limits or 1% of the MEC, whichever is lower.
3. The oxygen concentration of the recycled air stream is between 19.5 percent and 23.5% by volume.
4. Explosion isolation is provided on the recycle stream per the requirements of 7.1.4.
5. The system includes a method for detecting air-material separator malfunctions.
6. The building where the recycled air is returned meets the fugitive dust control and housekeeping requirements of this standard (chapter 8).
7. Recycle air ducts are inspected and cleaned at least annually.

A 6.1.3. Recommended design, maintenance, and operating guidelines for recirculation of industrial exhaust systems, as described in chapter 7 of the American Conference of Governmental Industrial Hygienists (ACGIH) Industrial Ventilation Manual should be followed.

A.6.1.3 (2) The system should be designed, maintained, and operated according to accepted engineering practice and the air-material separator efficiency should be sufficient to prevent dust in the recycled air from causing hazardous accumulations of combustible dust in any area of the building.

Add a new 6.1.4 as shown:

6.1.4 The provisions of 6.1.3 (3) shall not be applicable for situations where intentional inerting for combustion control is provided.

Renumber 6.1.4 and beyond as needed.

Committee Statement: The Committee accomplished the intent of the submitter by including both a safety and industrial hygiene provision for both recycled gas or vapor and combustible particulate air streams. The Committee restructured the existing provisions and included explanatory guidance in annex items added.

Number Eligible to Vote: 28

Ballot Results: Affirmative: 22 Negative: 1

Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

Explanation of Negative:

CHOLIN, J.: The amended text would prohibit the use of abort gates which have an excellent record of preventing smoke, flame and burning material form entering the facility in the event of a dust collector fire. There is evidence to support the conclusion that most dust collector explosions are the result of a pre-existing dust collector fire which transitioned to a deflagration when the bag-cleaning cycle commenced. While limiting the return air diversion means to explosion isolation would respond to the pressure front produced by a deflagration it will not prevent the ingress of flame smoke and burning material from a dust collector fire that does not produce a pressure increase in excess of the actuation threshold of the pressure sensors, typically 0.5 psi.

Comment on Affirmative:

SCHERPA, T.: Suggest adding the phrase “in a closed loop system” to the end of the proposed 6.1.4.

654-18 Log #2 **Final Action: Accept**
(6.2.2.1)

Submitter: Marcelo M. Hirschler, GBH International

Recommendation: Revise text as follows:

6.2.2.1 Physical barriers that are erected to segregate dust hazards shall have all penetrations of floors, walls, ceilings, or partitions sealed dusttight, and, where structural assemblies have a fire <u>resistance</u> ~~endurance~~ rating, the seal shall maintain that rating.

Substantiation: The correct terminology is fire resistance rating. It is therefore recommended, in order to improve consistency within NFPA documents that the change gets made as shown.

I am the chairman of the NFPA Advisory Committee on the Glossary on Terminology. The committee was created by NFPA Standards Council to provide consistency in terminology throughout the NFPA documents. The committee not had an opportunity to review this recommendation on terms. Therefore, this proposal is being submitted in my name and not in the name of the committee.

Committee Meeting Action: Accept

Number Eligible to Vote: 28

Ballot Results: Affirmative: 23

Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

654-19 Log #33 **Final Action: Accept in Principle**
(6.2.3)

Submitter: Brice Chastain, Georgia-Pacific

Recommendation: Revise text to read as follows:

New paragraph 6.2.3.3 An alternative method to 6.2.3.2 for determining allowable thickness that addresses large, tall buildings is provided in the following equation.

$$\mathbf{M_{dmax} = (0.031 * C_{opt} * 20{,}000 * H)/A_{dust}}$$

Where:

- $\times_{disp}$ - fraction of accumulated dust that is actually suspended to form a dust cloud.
- F_{pv} - maximum allowable partial room volume fraction
- $\mathbf{\times_{disp}\ F_{pv} = 15.5/\ C_{opt} = 15.5/500 = 0.031}$
- M_{dmax}, g/m² is the maximum allowable mass accumulation over the dust collection surface area. Not to exceed 3.5 kg/m², regardless of the room dimensions and dust parameters.
- C_{op}**t**, g/m³ is the dust concentration that produces the maximum pressure rise in the ASTM 1226 test. Default value is 500 g/m³.
- **H**, meters is the room height in meters

A_{dust}, ft² is the area of the surfaces where dust collects

Substantiation:

Present paragraph 6.2.3.2 does not address building height (e.g. 70 feet in height) or large buildings (110 ft width x 340 ft long) in determination of allowable dust accumulation thickness. Suggest an alternative equation developed by Bob Zalosh be considered in addition to the bulk density equation present.

*******Additionally, the present 6.2.3.2 equation or the proposed alternative equation above does not addresses dust “dispersibility” or dust cohesiveness. This factor should also be addressed and included in the revised 654 standard for determining allowable dust accumulation thickness due to some dust propensity to clump together and not disperse easily into individual particles as compared to other dusts. (e.g. tissue paper dusts compared to wood flour or starch; tissue dust is not as easily dispersed into suspension as is wood flour or starch due to its cohesiveness. Tissue dust tends to clump together when suspended or lifted off a horizontal surface; wood flour and starch separates into thousands of discrete particles).**

Committee Meeting Action: Accept in Principle

See Committee Action on Committee Proposal 654-15 (Log #CP4).

Committee Statement: See Committee Action and Committee Statement for Committee Proposal 654-15 (Log #CP4). The Committee addressed the question of determining dust layer accumulation using a different approach from that proposed by the submitter; however, the intent of the submitter was accomplished by the action of the Committee.

Number Eligible to Vote: 28

Ballot Results: Affirmative: 23

Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

654-20 Log #56 **Final Action: Accept in Principle**
(6.2.3.1 and 6.2.3.2)

Submitter: Robert G. Zalosh, Firexplo

Recommendation: Replace current 6.2.3.1 and 6.2.3.2 with wording in the following:

6.2.3.1 When the separate area is normally unoccupied and is enclosed by physical barriers per 6.2.2.2, the allowable total accumulated combustible dust mass in the enclosure, m_{Dmax} (in grams), is given by

$$m_{D\max} = \frac{4c_{opt}\,P_{red}\,A_{floor}H}{P_{\max}}$$

where

c_{opt} is the optimum dust concentration (g/m³) at which the maximum rate-of-pressure-rise results in tests conducted per ASTM E1226,

P_{red} is the allowable pressure (bar g) developed during a deflagration per NFPA 68 (normally equal to 2/3rd the enclosure strength),

P_{max} is the maximum pressure (bar g) developed in ASTM E1226 tests with the accumulated dust sample,

A_{floor} is the enclosure floor area (m²), and H is the enclosure ceiling height (m).

6.2.3.2 When the separate area is normally occupied, m_{Dmax} is given by

$$m_{D\max} = \frac{4c_{opt}\left(0.05P_a\right)A_{floor}H}{P_{\max}+P_a}$$

where P_a is the atmospheric pressure in bar.

6.2.3.3 When the total amount of dust in the room, m_{Dmax}, cannot be reliably estimated but representative accumulated dust samples can be collected from measured areas and then weighed to obtain the dust surface mass density m_D” = $m_{Dsample}/A_{Dsample}$, the maximum allowable value of m_D” in g/m² is given by

$$m''_{D\max} = {m_{D\max}}\big/{A_{Dust}}$$

where

m_{Dmax} is obtained from the equations in either 6.2.3.1 for unoccupied enclosures or 6.2.3.2 for occupied areas,

A_{Dust} is the estimated total surface area (m^2) in the enclosure on which dust has accumulated,

$m_{Dsample}$ is the average measured mass (g) of the collected samples, and

$A_{Dsample}$ is the average surface area (m^2) from which the samples were collected.

6.2.3.4 When representative dust samples cannot reliably be collected and weighed, but the dust bulk density is known and reliable measurements of dust layer thickness can be made, the maximum allowable dust layer thickness, t_{Dmax} (mm), can be calculated from

$$t_{D\max} = 1000\left(m''_{D\max} / \rho_{bulk}\right)$$

where ρ_{bulk} is the bulk density in g/m^3, and m''_{Dmax} is obtained from 6.2.3.3

Substantiation: The current requirements to limit combustible dust layer thicknesses to 0.8 mm for bulk densities of 1200 kg/m^3 or greater, and to allow larger thicknesses for lighter dusts by the ratio of 75 lb/ft^3 to the actual dust bulk density in lb/ft^3, is difficult to implement because of highly non-uniform dust layers and difficulty in accurate measurements of layer thickness. Furthermore, it does not account for the explosibility properties of the combustible dust.

The proposed revision provides a way to estimate the total allowable accumulated mass of dust based either on the maximum allowable pressure developed in an unoccupied enclosure or the maximum allowable flame volume for a deflagration or flash fire in an unoccupied area. The basis and derivation of the equations can be shown in a revised Appendix D. For now, the key assumptions are that 25% of the accumulated dust gets disperse as a dust cloud of optimal concentration, and that the allowable flame volume after accounting for expansion due to burning, is about 5% of the room volume.

Committee Meeting Action: Accept in Principle

See Committee Action on Committee Proposal 654-15 (Log #CP4).

Committee Statement: See Committee Action and Committee Statement for Committee Proposal 654-15 (Log #CP4). The Committee addressed the determination of the accumulated dust layer as proposed by the submitter, using a different methodology. However, the intent of the submitter has been satisfied with the inclusion of a new methodology for determining the dust layer thickness in a more uniform manner.

Number Eligible to Vote: 28

Ballot Results: Affirmative: 23

Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

654-21 Log #29 **Final Action: Accept in Principle**
(6.2.3.2)

Submitter: Mark L. Holcomb, Kimberly-Clark Corporation

Recommendation: Add new text to read as follows:

The following equation is an alternative method for determining the maximum allowable dust accumulation for combustible dust density is less than 15 lbs/ft^3:

$$\mathbf{M_{dmax} = (0.031 * C_{opt} * 20{,}000 * H)/A_{dust}}$$

Where:

$\times_{disp}$ - fraction of accumulated dust that is actually suspended to form a dust cloud.

F_{pv} - maximum allowable partial room volume fraction

$\times_{disp}$ $\mathbf{F_{pv}}$ **= 15.5/ Copt = 15.5/500 = 0.031**

M_{dmax}, g/m^2 is the maximum allowable mass accumulation over the dust collection surface area. Not to exceed 3.5 kg/m^2, regardless of the room dimensions and dust parameters.

C_{opt}, g/m^3 is the dust concentration that produces the maximum pressure rise in the ASTM 1226 test. Default value is 500 g/m^3.

H, meters is the room height in meters

A_{dust}, ft^2 is the area of the surfaces where dust collects

Substantiation: Existing equations do not apply to combustible dusts with densities below 15 lb/ft^3. Determination of bulk density can be difficult to measure for some low-density materials that agglomerate when disturbed. This method relies instead on maximum mass accumulations. The method also factors in the optimum concentration which is an important parameter for determining the hazard a specific dust presents.

Committee Meeting Action: Accept in Principle

See the Committee's Action on Committee Proposal 654-15 (Log #CP4).

Committee Statement: See the Committee's Action and Substantiation on Committee Proposal 654-15 (Log #CP4). The Committee addressed the question of determining dust layer accumulation using a different approach from that proposed by the submitter; however, the intent of the submitter was accomplished by the action of the Committee.

Number Eligible to Vote: 28

Ballot Results: Affirmative: 23

Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

654-22 Log #39 **Final Action: Accept in Part**
(7.1.2)

Submitter: Thomas C. Scherpa, E. I. DuPont de Nemours & Company

Recommendation: Revise text to read as follows:

7.1.2 Explosion Protection for Equipment.

7.1.2.1 The design of explosion protection for equipment shall incorporate one or more of the following methods of protection:

(1) Oxidant concentration reduction in accordance with NFPA 69, Standard on Explosion Prevention Systems

(a) Where oxygen monitoring is used, it shall be installed in accordance with ISA 84.00.01, Functional Safety: Application of Safety Instrumented Systems for the Process Industry Sector.

(b)* Where the chemical properties of the material being conveyed require a minimum concentration of oxygen to control pyrophoricity, that level of concentration shall be maintained.

(2)* Deflagration venting <u>in accordance with NFPA 68, Standard on Explosion Protection by Deflagration Venting</u>

(3) Deflagration pressure containment in accordance with NFPA 69, Standard on Explosion Prevention Systems

(4) Deflagration suppression systems in accordance with NFPA 69, Standard on Explosion Prevention Systems

(5)* Dilution with a noncombustible dust to render the mixture noncombustible (See 7.1.2.2.)

(6)* Deflagration venting through a listed dust retention and flame-arresting device

7.1.2.2 If the method in 7.1.2.1(5) is used, test data for specific dust and diluent combinations shall be provided and shall be acceptable to the authority having jurisdiction.

<u>7.1.2.3* A risk evaluation in accordance with 7.1.1 shall be permitted to determine the appropriate level of protection. This evaluation may supersede the requirements of 7.1.2.1.</u>

Substantiation: Several sections in this chapter reference section 7.1.2 for protection requirements, yet in the current edition the provision for a risk evaluation is not explicitly included in section 7.1.2. This revision adds a reference to the risk evaluation statement into 7.1.2, so that it is incorporated by reference in other sections in this chapter.

Also, NFPA 68 has become a standard and so it can now be referenced directly from the body of the document rather than in the appendix.

Committee Meeting Action: Accept in Part

The Committee accepted the recommended revision to 7.1.2.1 (2) as shown here:

(2)* Deflagration venting <u>in accordance with NFPA 68, Standard on Explosion Protection by Deflagration Venting</u>

The Committee rejected the recommended addition of a new paragraph 7.1.2.3. Do not accept proposed new paragraph 7.1.2.3.

Committee Statement: The Committee rejected the addition of the new paragraph 7.1.2.3 as it would be redundant with paragraph 7.1.1.

Number Eligible to Vote: 28

Ballot Results: Affirmative: 23

Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

654-23 Log #34 **Final Action: Accept in Principle in Part**
(7.1.4)

Submitter: Erdem A. Ural, Loss Prevention Science & Technologies, Inc.

Recommendation: Revise text to read as follows:

7.1.4.2 Isolation devices shall include, but shall not be limited to, the following:

(1)*Chokes

(2)*Rotary valves <u>in accordance with NFPA 69, Standard on Explosion Prevention Systems</u>

(3)*Automatic fast-acting valve systems in accordance with NFPA 69, Standard on Explosion Prevention Systems

~~(4)*Flame front diverters in accordance with NFPA 69, Standard on Explosion Prevention Systems~~

(5)*Chemical isolation systems in accordance with NFPA 69, Standard on Explosion Prevention Systems

A.7.1.4.2(4) Figure A.7.1.4.2(4) illustrates an example of deflagration propagation using flame front diversion. <u>This device provides relief against pressure build-up, but does not count as an explosion isolation device.</u>

7.1.4.3 Isolation devices shall not be required when oxidant concentration <u>in pieces of equipment and connecting ductwork</u> has been reduced <u>below the inerting concentration</u> or when the dust has been rendered noncombustible in accordance with 7.1.2.1(1) or 7.1.2.1(5).

Substantiation: * New edition of NFPA 69 provides a greatly expanded section on isolation devices

* New edition of NFPA 69 specifies requirements for rotary valves being used as isolation devices

* NFPA 69 precludes use of flame front diverters as explosion isolation devices.

Committee Meeting Action: Accept in Principle in Part

See Committee Action on Proposal 654-25 (Log #41).

Committee Statement: In addition to the edits proposed by the submitter, paragraph 7.1.4.2 has been further modified to delete (1) chokes as they are not permitted as explosion isolation in NFPA 69.

With the deletion of (4) on flame front diverters per the recommendation, the annex should also be deleted, so the Committee has rejected the proposed modifications to A.7.1.4.2(4) and has recommended in Proposal 654-25 (Log #41) that this annex item be deleted.

The Committee has accomplished the intent of the submitter in the recommended modification of 7.1.4.3 by moving the existing references to 7.1.2 that address oxidant concentration reduction (1) from the end of this requirement.

The final text for all changes to paragraph 7.1.4 are shown with all changes from related proposals in Proposal 654-25 (Log #41). See Committee action and statement in Proposal 654-25 (Log #41).

Number Eligible to Vote: 28

Ballot Results: Affirmative: 23

Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

654-24 Log #36 **Final Action: Reject**

(7.1.4)

Submitter: Erdem A. Ural, Loss Prevention Science & Technologies, Inc.

Recommendation: Insert the following new text before current section 7.1.4.3, renumber current 7.1.4.3 and 7.1.4.4 accordingly:

7.1.4.3 (NEW) Active (as opposed to passive) explosion isolation system design package shall specify the data or correlation used to determine the maximum speed the explosion flame front travels from the point of detection to the isolation device.

7.1.4.4 (NEW) The equation proposed in section 3.1.15 of Reference G.1.2.5 (FMGR Publication 7-76 dated May 2008) shall not be used for active isolation system design.

7.1.4.5 (NEW) Active explosion isolation system design package shall also specify the maximum time required for deflagration detection and that for the full operation of the isolation device.

Substantiation: These are key parameters which decide the success or failure of active isolation devices.

If permitted to be used, the equation proposed in FMDS 7-76 will result in unsafe active isolation system designs.

Note: Supporting material is available for review at NFPA Headquarters.

Committee Meeting Action: Reject

Committee Statement: The Committee rejected the proposed revision, because changes to 7.1.4 already direct the user to the required documentation and tests to be provided per NFPA 69. See also Committee Action on Proposals 654-23 (Log #34), 654-26 (Log #40), and 654-25 (Log #41).

Number Eligible to Vote: 28

Ballot Results: Affirmative: 21 Negative: 2

Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

Explanation of Negative:

GUARICCI, D.: The placement of components in explosion isolation systems is critical to the proper functioning of a system. All systems are not equal and component functional speeds are critical for proper system functioning. In the previous log Explosion Diverters were rejected as isolation devices because they did not provide a flame blockage yet a slow acting or improperly placed valve will not provide any isolation. Today many devices are located too close to protected vessels. Engineers are not aware of the parameters needed for proper system functioning. In an active system a sensor located in a vessel and one located in the duct work could require significant distance differences. If the design package required this information users and designers would be understanding of the proper placement of devices. Mr. Urals requirement while not with full design specifics is a step in the right direction.

URAL, E.: FM Correlation is dangerously unconservative, and people needs to be warned against it. The other proposals pertaining to active suppression systems are not fully covered by NFPA 69 as the committee thinks. Buyers of these systems rely strictly on the expertise of the vendors for system design and pay large sums of money. The committee should not be stripping the buyers from their natural right to receive complete documentation of design and methodology.

654-25 Log #41 **Final Action: Accept in Principle in Part**

(7.1.4)

Submitter: Thomas C. Scherpa, E. I. DuPont de Nemours & Company

Recommendation: Add new text to read as follows:

7.1.4.1 Where an explosion hazard exists, isolation devices shall be provided to prevent deflagration propagation between pieces of equipment connected by ductwork.

7.1.4.2 The requirement of 7.1.4.1 shall not apply where all of the following conditions are met:

(1) The material being conveyed is not a metal dust or hybrid mixture

(2) The connecting ductwork is smaller than 4 inches in diameter

(3) The maximum concentration of dust conveyed through the duct is less than 25% of the MEC of the material

(4) The conveying velocity is high enough to prevent accumulation of combustible dust in any portion of the duct

(5) All connected equipment is properly designed for explosion protection.

Substantiation: The current requirement applies to all connecting ductwork regardless of size. The AIChE CCPS Guidelines for Safe Handling of Powders and Bulk Solids states that the probability of propagation is low if the first three criteria above are met. The fourth criteria is supported by text in the FM Global datasheet FM 7-76. The fifth criteria is supported by the current Appendix E.3.1

By adding this exemption, users would be able to exclude some ductwork from the isolation requirement without requiring the risk assessment per section 7.1.4.4

Committee Meeting Action: Accept in Principle in Part

Revise Annex to 7.1.4 by adding the following to the existing annex at the end:

A.7.1.4 Methods of explosion protection using containment, venting, and suppression protect the specific process equipment on which they are installed. For details on deflagration propagation, see Annex E.

Chokes, flame front diverters, and abort gates are not acceptable devices for explosion isolation due to lack of specific test standards to validate the design. However, these devices can still provide benefits such as reducing pressure transmitted to connected equipment.

Revise 7.1.4.1 to read as follows:

Add new text to read as follows:

7.1.4.1 Where an explosion hazard exists, isolation devices shall be provided to prevent deflagration propagation between ~~pieces of~~ connected equipment ~~connected by ductwork~~.

7.1.4.2* The requirement of 7.1.4.1 shall not apply where all of the following conditions are met:

(1) The material being conveyed is not a metal dust or hybrid mixture

(2) The connection between equipment is smaller than 4 inches in diameter

(3) All connected equipment is provided with explosion protection in accordance with 7.1.2.

_Add Annex to A.7.1.4.2 as shown below:

A.7.1.4.2 Process equipment, such as mills, spray dryers, dust collectors, blowers, and vacuum pumps, is regularly connected together by piping, ducts, chutes, conveyors, and so forth. An explosion beginning in one point in the process can propagate through these interconnections to other parts of the process, both upstream and downstream. Generally isolation techniques are necessary unless a qualified risk analysis is performed and a determination is made based on both probability and consequence that the risk is acceptable to the AHJ. Flame spread via propagation inside ducting or piping is somewhat unpredictable for dusts. Tests have shown that propagation is much less likely under certain conditions. Piping less than 100 mm (4 in.) diameter is far less likely to provide a conduit for flame spread than larger diameters. Systems operating at air velocities down near 183 m/min (600 fpm), and solids to air mass ratios greater than 30 are also much less likely to provide a conduit for flame spread propagation than air velocities in the region of 672 m/min to 1098 m/min (2200 fpm to 3600 fpm), and solids to air mass ratios not greater than 15. It has been reported by Pineau that it is not uncommon for propagation to occur as few as one time in ten in controlled experiments for 150 mm piping even for dilute phase systems. However, recent testing has shown that propagation is more likely with dust concentrations in the lean region. Metal dusts are more likely to propagate deflagrations. For organic dusts, where small diameter pipes with dense phase transfer are utilized, the need for isolation techniques could be obviated if the hazard analysis is acceptable to the authority having jurisdiction. For interconnected vessels that are relatively close together, measures to reduce Pred for each interconnected vessel, taking into account that propagation could occur, would eliminate the need for isolation techniques.

Renumber existing text.

Incorporate the following changes per Proposals 654-23 (Log #34) and 654-14 (Log #57):

7.1.4.~~2~~3 Isolation devices shall include, but shall not be limited to, the following:

~~(1)* Chokes~~

(1~~2~~)* Rotary valves in accordance with NFPA 69,Standard on Explosion Prevention Systems

(2~~3~~)* Automatic fast-acting valve systems in accordance with NFPA 69, Standard on Explosion Prevention Systems

~~(4)* Flame front diverters in accordance with NFPA 69, Standard on Explosion Prevention Systems~~

(4~~5~~)* Chemical isolation systems in accordance with NFPA 69, Standard on Explosion Prevention Systems

Delete Annex to deleted 7.1.4.2 (1) and (4).

7.1.4.4~~3~~ Isolation devices shall not be required when oxidant concentration in the connected equipment has been reduced in accordance with 7.1.2.1(1) or when the dust has been rendered noncombustible in accordance with ~~7.1.2.1(1)~~ or 7.1.2.1(5).

As per 654-26 (Log #40), delete 7.1.4.4 as shown:

~~7.1.4.4* Isolation devices shall not be required if a documented risk evaluation that is acceptable to the authority having jurisdiction determines that deflagration propagation will not occur.~~

Committee Statement: Annex material was added to existing 7.1.4 to explain why chokes, flame front diverters, and abort gates are not acceptable devices for explosion isolation based upon the requirements in the current edition of NFPA 69. Consistent with this action, the Committee accepted in principle the revisions proposed in Proposals 654-23 (Log #34) and 654-14 (Log #57) to existing paragraph 7.1.4.2 and have incorporated those changes in this proposal to show all the revisions to 7.1.4.

The Committee did not accept the recommendation in this proposal to add Items (3) and (4) to the new proposed 7.1.4.2 as these items are not supported by the references as stated in the substantiation.

The Committee changed "ductwork" to "equipment" in (2) for clarification and added new Annex material to 7.1.4.2 that explains the basis for the restriction on the connection between equipment to be limited to smaller than 4 inches (this is based upon A.11.2 in NFPA 69-2007).

7.1.4.2(3) as shown in the Committee action was modified editorially to require that connected equipment be protected versus designed against explosions and referred to 7.1.2 in the standard where this requirement is stated.

Existing 7.1.4.3 (now shown as 7.1.4.4) has been modified editorially to accomplish what the submitter proposed in Proposal 654-23 (Log #34).

Existing paragraph 7.1.4.4 is deleted since it is redundant to 7.1.1. This accomplishes the intent of the submitter of Proposal 654-26 (Log #40) since 7.1.1 already requires the documented risk evaluation to determine the level of protection to be provided.

Number Eligible to Vote: 28

Ballot Results: Affirmative: 21 Negative: 2

Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

Explanation of Negative:

FEBO, JR., H.: Flame front diverters are permitted by NFPA 69 so rejecting them here presents an unwarranted conflict.

STEVENSON, B.: Flame front diverters are covered in NFPA 69. They have proven to be effective even if propagation interruption was not achieved by relieving pressure. It is important that they be properly designed and constructed (see FM Global 7-76). Moreover, there are situations where due to space limitations they are the only available option.

Comment on Affirmative:

GUARICCI, D.: What test data was provided to indicate that 4" or under prevented deflagration propagation? A11.2 "Piping less than 100 mm (4 in.) diameter is far less likely to provide a conduit for flame spread than larger diameters" does not appear to be a firm statement.

SUTTON, J.: Although items 7.1.4.2 (3) and (4) may not have been supported by the submitter's substantiation, they are both excellent criteria that should be included in this proposal.

654-26 Log #40 **Final Action: Accept in Principle**
(7.1.4.4)

Submitter: Thomas C. Scherpa, E. I. DuPont de Nemours & Company

Recommendation: Revise text to read as follows:

7.1.4.4 Isolation devices shall not be required if a documented risk evaluation that is acceptable to the authority having jurisdiction determines that the risk from deflagration propagation is acceptable. ~~deflagration propagation will not occur.~~

Substantiation: The purpose of a risk assessment is not to determine that an event will not occur; rather, the purpose is to determine the appropriate controls necessary to reduce the risk to an acceptable value.

Committee Meeting Action: Accept in Principle

Delete paragraph 7.1.4.4 and the related annex item as shown:

~~7.1.4.4* Isolation devices shall not be required if a documented risk evaluation that is acceptable to the authority having jurisdiction determines that deflagration propagation will not occur.~~

~~A.7.1.4.4 See A.7.1.1 for an explanation of the considerations in a documented risk evaluation.~~

Committee Statement: The Committee recommends deleting the existing paragraph 7.1.4.4 as it is redundant with paragraph 7.1.1. This action accomplishes the intent of the submitter. See also Committee Action and Committee Statement on Proposal 654-25 (Log #41).

Number Eligible to Vote: 28

Ballot Results: Affirmative: 23

Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

654-27 Log #42 **Final Action: Accept in Principle**
(7.1.5.3)

Submitter: Thomas C. Scherpa, E. I. DuPont de Nemours & Company

Recommendation: Revise text to read as follows:

7.1.5.3 Isolation devices shall not be required if a documented risk evaluation that is acceptable to the authority having jurisdiction determines that the risk from deflagration propagation is acceptable. ~~deflagration propagation will not occur.~~

−A.7.1.5.3 Several common design factors can reduce the risk of explosion propagation, such as:

(1) The material being conveyed is not a metal dust or hybrid mixture

(2) The connecting ductwork is smaller than 4 inches in diameter

(3) The maximum concentration of dust conveyed through the duct is less than 25% of the MEC of the material

(4) The conveying velocity is high enough to prevent accumulation of combustible dust in any portion of the duct

(5) The air-material separator is properly designed for explosion protection by means other than explosion containment

(6) The upstream work areas do not contain large quantities of dust that can be entrained by a pressure pulse from an explosion in the dust collector.

Substantiation: The purpose of a risk assessment is not to determine that an event will not occur; rather, the purpose is to determine the appropriate controls necessary to reduce the risk to an acceptable value.

The proposed appendix material gives examples of some conditions that can yield a low probability of explosion propagation. The AIChE CCPS "Guidelines for Safe Handling of Powders and Bulk Solids" states that the probability of propagation is low if the first three criteria above are met. The fourth criteria is supported by text in the FM Global datasheet FM 7-76. The fifth criteria is supported by the current Appendix E.3.1. The sixth criteria highlights the increased risk of secondary explosions in and around work areas where significant quantities of entrainable dust are present.

Committee Meeting Action: Accept in Principle

Revise text to read as follows:

Revise title of 7.1.5 as shown:

7.1.5* Isolation of Upstream Work Areas

Revise 7.1.5.3 as shown by deleting existing and replacing with the following text and annex:

7.1.5.3* Isolation devices shall be permitted to be omitted if the criteria in 7.1.5.3.1 are met.

7.1.5.3.1 A documented risk evaluation has determined the level of risk from deflagration propagation and the evaluation is acceptable to the authority having jurisdiction.

A.7.1.5.3 Several common design factors can reduce the risk of explosion propagation, such as:

(1) The material being conveyed is not a metal dust or hybrid mixture

(2) The connecting ductwork is smaller than 4 inches in diameter

(3) The maximum concentration of dust conveyed through the duct is less than 25% of the MEC of the material

(4) The conveying velocity is high enough to prevent accumulation of combustible dust in any portion of the duct

(5) Explosion protection provided for the air-material separator is designed to minimize pressure developed in the event of a deflagration

(6) The upstream work areas do not contain large quantities of dust that can be entrained by a pressure pulse from an explosion in the dust collector.

Committee Statement: The Committee made minor modifications to the submitter's recommended changes. The intent of the submitter's proposal has been satisfied by the action of the Committee.

Number Eligible to Vote: 28

Ballot Results: Affirmative: 23

Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

Comment on Affirmative:

GUARICCI, D.: What test data was provided to indicate that 4" or under prevented deflagration propagation? A11.2 "Piping less than 100 mm (4 in.) diameter is far less likely to provide a conduit for flame spread than larger diameters" does not appear to be a firm statement.

URAL, E.: Can the isolation requirements be eliminated by replacing a large diameter pipe with a bunch of 3.999" diameter pipes?

654-28 Log #43 **Final Action: Accept in Principle in Part**
(7.2.3)

Submitter: Thomas C. Scherpa, E. I. DuPont de Nemours & Company

Recommendation: Revise text to read as follows:

7.2.3 Explosion Hazards.

7.2.3.1 Where an explosion hazard exists, intertank or interbin venting shall not be permitted.

~~7.2.3.2 Fixed Bulk Storage Location.~~

~~7.2.3.2.1 Where an explosion hazard exists, fixed bulk storage containers shall be located outside of buildings.~~

~~7.2.3.2.2 Fixed bulk storage containers shall be permitted to be located inside of buildings where one of the following applies:~~

~~(1) Fixed bulk storage containers are protected in accordance with 7.1.2.1(1), 7.1.2.1(3), 7.1.2.1(4), 7.1.2.1(5), or 7.1.2.1(6).~~

~~(2)* Fixed bulk storage containers meet all of the following criteria:~~

~~(a) They are equipped with deflagration vents that are vented through ducts to the outside.~~

~~(b) The reduced venting efficiency due to the duct has been taken into account.~~

~~(c) The ducts are designed to withstand the effects of the deflagration.~~

~~(3)* Fixed bulk storage containers are 8 ft^3 (0.2 m^3) or less.~~

7.2.3.3 Fixed Bulk Storage Protection.

7.2.3.3.1 Where an explosion hazard exists, fixed bulk storage containers shall be protected in accordance with 7.1.2.

~~7.2.3.3.2 For fixed bulk storage containers that are located outside of buildings, a risk evaluation shall be permitted to be conducted to determine the level of explosion protection to be provided.~~

7.2.3.3.3* The explosion protection requirements of 7.1.2 shall not be required provided that the volume of the fixed bulk storage container is less than 8 ft^3 (0.2 m^3).

7.2.3.3.4 The requirements of 7.2.3.3 shall not apply to storage and receiving containers that are used for transportation of the material.

Substantiation: The deleted text in this section will not be necessary if NFPA 68 is included by reference in section 7.1.2.1(2). In the current edition, NFPA 68 is included in the appendix because it was a guideline document at the time the current edition was written. Now that it is a standard, it can be referenced in the body of the text. NFPA 68 provides requirements for vent ducts, and so it would be redundant to provide those requirements here. By removing the vent duct requirements from the current 7.2.3.2.2, the requirements in this section would become identical to section 7.1.2 and so the entire section 7.2.3.2 can be deleted.

If a new risk evaluation statement is added to 7.1.2 (per a separate proposal), then it would be incorporated by reference and therefore section 7.2.3.3.2 would become redundant.

Committee Meeting Action: Accept in Principle in Part

See Committee Action on Committee Proposal 654-29 (Log #CP6)

Committee Statement: See Committee Action and Substantiation for Committee Proposal 654-29 (Log #CP6). The Committee did not delete existing 7.2.3.2.2 (3) as recommended since this provision is still relevant for certain equipment in specific applications.

Number Eligible to Vote: 28

Ballot Results: Affirmative: 22 Negative: 1

Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

Explanation of Negative:

URAL, E.: There is no scientific justification for the 8 ft3 rule of thumb. The correct number depends on the details of the equipment design, process, pressure resistance and how close the people come to it. The correct number can be determined by consequence analysis or by performance based design.

654-29 Log #CP6 **Final Action: Accept**
(7.2.3)

Submitter: Technical Committee on Handling and Conveying of Dusts, Vapors, and Gases,

Recommendation: Revise text to read as follows:

7.1.1* Risk Evaluation. A documented risk evaluation acceptable to the authority having jurisdiction shall be permitted to be conducted to determine the level of protection to be provided per this chapter.

7.2.3.2 Fixed Bulk Storage Location.

7.2.3.2.1 Where an explosion hazard exists, fixed bulk storage containers shall be located outside of buildings.

7.2.3.2.2 Fixed bulk storage containers shall be permitted to be located inside of buildings where one of the following applies:

(1) Fixed bulk storage containers are protected in accordance with 7.1.2~~.1(1), 7.1.2.1(3), 7.1.2.1(4), 7.1.2.1(5), or 7.1.2.1(6)~~.

~~(2)* Fixed bulk storage containers meet all of the following criteria:~~

~~(a) They are equipped with deflagration vents that are vented through ducts to the outside.~~

~~(b) The reduced venting efficiency due to the duct has been taken into account.~~

~~(c) The ducts are designed to withstand the effects of the deflagration.~~

(~~3~~2)* Fixed bulk storage containers are less than 8 ft^3 (0.2 m^3) ~~or less~~.

7.2.3.3 Fixed Bulk Storage Protection.

7.2.3.3.1 Where an explosion hazard exists, fixed bulk storage containers shall be protected in accordance with 7.1.2.

~~7.2.3.3.2 For fixed bulk storage containers that are located outside of buildings, a risk evaluation shall be permitted to be conducted to determine the level of explosion protection to be provided.~~

7.2.3.3.~~3~~2* The explosion protection requirements of 7.1.2 shall not be required provided that the volume of the fixed bulk storage container is less than 8 ft^3 (0.2 m^3).

7.2.3.3.~~4~~3 The requirements of 7.2.3.3 shall not apply to storage and receiving containers that are used for transportation of the material.

Substantiation: The deleted text in this section is not necessary as NFPA 68 has been included by reference in section 7.1.2.1(2) through other action by the Committee. In the current edition, NFPA 68 is included in the annex because it was a guideline document at the time the current edition was written. Now that it is a standard, it can be referenced in the body of the text. NFPA 68 provides requirements for vent ducts, and so it would be redundant to provide those requirements here. By removing the vent duct requirements from 7.2.3.2.2, the requirements in this section would become identical to section 7.1.2.

The new risk evaluation statement was added to 7.1.2 (per a separate proposal), and that action incorporates NFPA 68 by reference and therefore section 7.2.3.3.2 would become redundant.

See also Proposal 654-38 (Log #6) regarding the editorial revision to the 8 ft^3 specification.

Committee Meeting Action: Accept

Number Eligible to Vote: 28

Ballot Results: Affirmative: 22 Negative: 1

Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

Explanation of Negative:

URAL, E.: There is no scientific justification for the 8 ft^3 rule of thumb. The correct number depends on the details of the equipment design, process, pressure resistance and how close the people come to it. The correct number can be determined by consequence analysis or by performance based design.

654-30 Log #8 **Final Action: Reject**
(7.2.3.3.4)

Submitter: Bill Stevenson, CV Technology, Inc.

Recommendation: Add new text as follows:

This is not suggested wording, rather it is a suggested approach. Could we add annex material to explain the rationale for the exclusion of transportable containers from the requirement for protection?

Substantiation: The rationale for the exemption from protection requirements for transportable containers is not clear.

Committee Meeting Action: Reject

Committee Statement: The submitter has provided no specific technical recommendation on which the Committee can act. The submitter is encouraged to review the ROP and consider submitting specific recommendations for the Committee to review during the Public Comment period.

Number Eligible to Vote: 28

Ballot Results: Affirmative: 23

Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

654-31 Log #44 **Final Action: Accept in Principle**
(7.3.3)

Submitter: Thomas C. Scherpa, E. I. DuPont de Nemours & Company

Recommendation: Revise text to read as follows:

7.3.3 Operations

7.3.3.1 Sequence of Operation. Pneumatic conveying systems shall be designed with the operating logic, sequencing, and timing outlined in 7.3.3.2 and 7.3.3.3.

7.3.3.2* Startup. Pneumatic conveying systems shall be designed such that, on startup, the system achieves and maintains design air velocity prior to the admission of material to the system.

7.3.3.3 Shutdown.

7.3.3.3.1 Pneumatic conveying systems shall be designed such that, on normal shutdown of the process, the system maintains design air velocity until material is purged from the system.

7.3.3.3.2 The requirements of 7.3.3.3.1 shall not apply during emergency shutdown of the process, such as by activation of an emergency stop button or by activation of an automatic safety interlocking device. The system shall be designed such that, upon restart after an emergency shutdown, residual materials can be cleared and design air velocity can be achieved prior to admission of new material to the system.

Substantiation: Depending on the reason for activation of an emergency shutdown device, maintaining design air velocity could potentially cause or contribute to a hazard. For example, in the event of a fire in or around the pneumatic conveying system, all material movement should be stopped immediately so as to avoid introducing more fuel into the area of the fire.

Committee Meeting Action: Accept in Principle

Revise text to read as follows:

7.3.3* Operations

A.7.3.3 The requirements in this section are applicable to dilute phase pneumatic conveying systems. Dense phase systems require a separate analysis.

7.3.3.1 Sequence of Operation. Pneumatic conveying systems shall be designed with the operating logic, sequencing, and timing outlined in 7.3.3.2 and 7.3.3.3.

7.3.3.2* Startup. Pneumatic conveying systems shall be designed such that, on startup, the system achieves and maintains design air velocity prior to the admission of material to the system.

7.3.3.3 Shutdown.

7.3.3.3.1 Pneumatic conveying systems shall be designed such that, on normal shutdown of the process, the system maintains design air velocity until material is purged from the system.

7.3.3.3.2 The requirements of 7.3.3.3.1 shall not apply during emergency shutdown of the process, such as by activation of an emergency stop button or by activation of an automatic safety interlocking device.

7.3.3.3.3 Dilute phase pneumatic conveying systems shall be designed such that, upon restart after an emergency shutdown, residual materials can be cleared and design air velocity can be achieved prior to admission of new material to the system.

Committee Statement: The Committee made an editorial change to separate multiple requirements into separate paragraphs. The Committee also added an annex item explaining the application of these requirements for pneumatic conveying systems is limited to dilute phase operations. The Committee is aware that the requirements for dense phase systems would be different and require a separate analysis. The Committee invites review of the current requirements and further input on both dense phase and dilute phase operations.

Number Eligible to Vote: 28

Ballot Results: Affirmative: 23

Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

654-32 Log #45 **Final Action: Accept in Principle**
(7.4)

Submitter: Thomas C. Scherpa, E. I. DuPont de Nemours & Company
Recommendation: Add new text to read as follows:
7.4.1 General. This section shall apply to facilities that operate pneumatic conveying systems for metal particulates.
7.4.2 Systems handling metal particulates shall be designed in accordance with NFPA 484, Standard for Combustible Metals, and the requirements of this section.
Substantiation: NFPA 484 provides additional requirements for systems handling metal particulates which should be included by reference.
This proposal would require renumbering of the subsequent sections in 7.4 and updates to any references in the remainder of the document.
Committee Meeting Action: Accept in Principle
Add new text to read as follows:
7.4.1 General. This section shall apply to facilities that operate pneumatic conveying systems for metal particulates.
7.4.2 Systems handling metal particulates shall be designed in accordance with NFPA 484, Standard for Combustible Metals, in addition to the requirements of this section.
Committee Statement: The Committee made a minor editorial revision to the submitter's recommendation.
Number Eligible to Vote: 28
Ballot Results: Affirmative: 23
Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

654-33 Log #17 **Final Action: Reject**
(7.6.2)

Submitter: Peter Levitt, Sternvent Company, Inc.
Recommendation: Add new text as follows:
7.6.2 Ductwork shall be metallic. Non-conductive ducts, such as PVC pipes shall not be permitted.
(Re-number existing 7.6.2 to 7.6.3, 7.6.3 to 7.6.4, etc.)
Substantiation: Many people are not aware that ducts that convey combustible dust should be conducive. PVC is used because it is readily available & easy to install.
Committee Meeting Action: Reject
Committee Statement: This requirement is already covered by the standard in 7.6.1 with the reference to NFPA 91 that addresses the material of construction and conductivity of such materials.
Number Eligible to Vote: 28
Ballot Results: Affirmative: 23
Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

654-34 Log #18 **Final Action: Accept in Principle in Part**
(7.6.2)

Submitter: Peter Levitt, Sternvent Company, Inc.
Recommendation: Revise text as follows:
7.6.2 Flexible hose ~~and~~ connections shall be permitted to be used for material pickup and isolation. Hose length should be kept to a minimum. To prevent static electricity discharge, hose shall be static dissipative or duct before and after the hose shall be electrically bonded and have a resistance of 1 ohm or less.
Substantiation: "And" does not seem necessary.
Flexible hoses can be a source of ignition, especially fine powders with a low MIE. This is similar to the requirement for sight glasses in 7.7.7
Committee Meeting Action: Accept in Principle in Part
Revise text as follows:
7.6.2 Flexible hose and connections shall be permitted to be used for material pickup and vibration isolation in accordance with 9.3.1.
Committee Statement: See Committee Proposal 654-51 (Log #CP5) for new requirements on static electricity protections in 9.3.1. The Committee clarified that isolation was for purposes of vibration and that the flexible hose and connections are permitted when used in accordance with provisions in 9.3.1. The Committee did not add the proposed text pertaining to hose length as it used non-mandatory language and no specific substantiation was given for this added text.
Number Eligible to Vote: 28
Ballot Results: Affirmative: 23
Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

654-35 Log #46 **Final Action: Accept in Principle**
(7.10.1)

Submitter: Thomas C. Scherpa, E. I. DuPont de Nemours & Company
Recommendation: Revise text to read as follows:
7.10.1* Deflagration Protection ~~Venting~~.
7.10.1.1 Where an explosion hazard exists, bucket elevators shall be protected in accordance with 7.1.2. ~~provided with deflagration venting.~~
~~7.10.1.2 When bucket elevators are located inside the building, deflagration vents shall be ducted to the outside.~~
~~7.10.1.3 As an alternative to deflagration venting, bucket elevators shall be permitted to be protected in accordance with 7.1.2.1(1), 7.1.2.1(3), 7.1.2.1(4), 7.1.2.1(5), 7.1.2.1(6), or 7.1.4.2(5).~~
Revise A.7.10.1 by deleting the last sentence of the 1st paragraph:
~~Vent materials should be of lightweight construction and meet the guidelines given in NFPA 68, Guide for Venting of Deflagrations.~~
Substantiation: The deleted text in this section will not be necessary if NFPA 68 is included by reference in section 7.1.2.1(2). In the current edition, NFPA 68 is included in the appendix because it was a guideline document at the time the current edition was written. Now that it is a standard, it can be referenced in the body of the text. NFPA 68 provides requirements for vent ducts, and so it would be redundant to provide those requirements here. By removing the vent duct requirements from 7.10.1.2, the requirements in this section would become identical to section 7.1.2.
Committee Meeting Action: Accept in Principle
Revise text to read as follows:
7.10.1* Deflagration Protection ~~Venting~~.
7.10.1.1 Where an explosion hazard exists, bucket elevators shall be protected in accordance with 7.1.2. ~~provided with deflagration venting.~~
~~7.10.1.2 When bucket elevators are located inside the building, deflagration vents shall be ducted to the outside.~~
~~7.10.1.3 As an alternative to deflagration venting, bucket elevators shall be permitted to be protected in accordance with 7.1.2.1(1), 7.1.2.1(3), 7.1.2.1(4), 7.1.2.1(5), 7.1.2.1(6), or 7.1.4.2(5).~~
Revise A.7.10.1 as shown:
Where deflagration vents are used on bucket elevators, they should be distributed along the casing side in pairs, opposite each other, next to the ends of the buckets.
Vent materials should be of lightweight construction. ~~and meet the guidelines given in NFPA 68, Guide for Venting of Deflagrations.~~
Committee Statement: The Committee changed the title of this section to Deflagration Protection to better reflect the requirements defined by this section. The Committee also amended the existing annex, A.7.10.1 to delete the reference to NFPA 68 as a guide, since the reference has now been moved to the mandatory portion of Chapter 7.
Number Eligible to Vote: 28
Ballot Results: Affirmative: 22 Negative: 1
Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.
Explanation of Negative:
GUARICCI, D.: Bucket elevator venting should not be an acceptable protection method on elevator legs since as with flame front diverters they do not stop flame propagation. The same principals for flame front diverters applies in greater extent here since vents do not even attempt to divert the event. Venting only protects the structural integrity of the leg casings.

654-36 Log #47 **Final Action: Accept in Principle in Part**
(7.13.1)

Submitter: Thomas C. Scherpa, E. I. DuPont de Nemours & Company
Recommendation: Revise text to read as follows:
7.13.1 General.
~~7.13.1.1 Location.~~
~~7.13.1.1.1 Where an explosion hazard exists, air–material separators shall be located outside of buildings.~~
~~7.13.1.1.2* The requirement of 7.13.1.1.1 shall not apply to the following:~~
~~(1) Air–material separators that are protected in accordance with 7.1.2.1(1), 7.1.2.1(3), 7.1.2.1(4), 7.1.2.1(5), or 7.1.2.1(6)~~
~~(2) Air–material separators that meet all of the following criteria:~~
~~(a) They are equipped with deflagration vents that are vented through ducts to the outside.~~
~~(b) The reduced venting efficiency due to the duct has been taken into account.~~
~~(c) The ducts are designed to withstand the effects of the deflagration.~~
~~(3) Air–material separators that have a volume of less than 8 ft3 (0.2 m3)~~
7.13.1.2 Where both an explosion hazard and a fire hazard exist in an air–material separator, provisions for protection for each type of hazard shall be provided.
7.13.1.3 Protection.
7.13.1.3.1 Where an explosion hazard exists, a~~A~~ir–material separators shall be protected in accordance with 7.1.2.
~~7.13.1.3.2 For air–material separators that are located outside of buildings, a risk evaluation shall be permitted to be conducted to determine the level of explosion protection to be provided.~~
Substantiation: The deleted text in this section will not be necessary if NFPA 68 is included by reference in section 7.1.2.1(2). In the current edition, NFPA 68 is included in the appendix because it was a guideline document at the time the current edition was written. Now that it is a standard, it can be referenced in the body of the text. NFPA 68 provides requirements for vent ducts, and so it would be redundant to provide those requirements here. By removing the vent duct requirements from 7.13.1.1.2, the requirements in this section would become identical to section 7.1.2.
If a new risk evaluation statement is added to 7.1.2 (per a separate proposal), then it would be incorporated by reference and therefore section 7.2.3.3.2 would become redundant.
Committee Meeting Action: Accept in Principle in Part
See Committee Action on Committee Proposal 654-37 (Log #CP7).

Committee Statement: See Committee Action and Substantiation on Committee Proposal 654-37 (Log #CP7). The action by the Committee makes the requirements for location and protection of air-material separators in 7.13 consistent with other provisions in the standard. The Committee did not delete existing 7.13.1.1.2 (3) as recommended since this provision is still relevant for certain equipment in specific applications.
Number Eligible to Vote: 28
Ballot Results: Affirmative: 23
Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

654-37 Log #CP7 **Final Action: Accept**
(7.13.1)

Submitter: Technical Committee on Handling and Conveying of Dusts, Vapors, and Gases,
Recommendation: Revise 7.13.1.1.2 as follows:
7.13.1.1.1 Where an explosion hazard exists, air-material separators with a volume of 8 ft^3 (0.2 m^3) or greater shall be located outside of buildings.
7.13.1.1.2* Air-material separators shall be permitted to be located inside of buildings where one of the following applies:
(1) Air-material separators are protected in accordance with 7.1.2~~.1(1), 7.1.2.1(3), 7.1.2.1(4), 7.1.2.1(5), or 7.1.2.1(6).~~
~~(2)* Air-material separators that meet all of the following criteria:~~
~~(a) They are equipped with deflagration vents that are vented through ducts to the outside.~~
~~(b) The reduced venting efficiency due to the duct has been taken into account.~~
~~(c) The ducts are designed to withstand the effects of the deflagration.~~
(~~3~~2)* Air-material separators that have a volume of less than 8 ft^3 (0.2 m^3)
Substantiation: The deleted text in this section is not necessary as NFPA 68 has been included by reference in section 7.1.2.1(2) through other action by the Committee. In the current edition, NFPA 68 is included in the annex because it was a guideline document at the time the current edition was written. Now that it is a standard, it can be referenced in the body of the text. NFPA 68 provides requirements for vent ducts, and so it would be redundant to provide those requirements here. By removing the vent duct requirements from 7.13.1.1.2, the requirements in this section would become identical to section 7.1.2. See also Proposal 654-38 (Log #6) for the revision pertaining to the volume specification limit of 8 ft^3 or greater for the air-material separator.
Committee Meeting Action: Accept
Number Eligible to Vote: 28
Ballot Results: Affirmative: 22 Negative: 1
Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.
Explanation of Negative:
URAL, E.: There is no scientific justification for the 8 ft3 rule of thumb. The correct number depends on the details of the equipment design, process, pressure resistance and how close the people or walls come to it. The correct number can be determined by consequence analysis or by performance based design.

654-38 Log #6 **Final Action: Accept in Principle**
(7.13.1.1.2)

Submitter: Bill Stevenson, CV Technology, Inc.
Recommendation: Add new text as follows:
7.13.1.1.1 Where an explosion hazard exists, air-material separators larger than 8 ft^3 shall be located outside of buildings.
Substantiation: The exemption for air-separators that have a volume of less than 8 ft^3 from the need for protection is not entirely clear to all users of the current edition of the document.
Committee Meeting Action: Accept in Principle
Add new text as follows:
7.13.1.1.1 Where an explosion hazard exists, air-material separators with a volume of 8 ft^3 or greater shall be located outside of buildings.
Committee Statement: The Committee made an editorial change to ensure that the volume limit was applied correctly by clarifying that the volume was 8 cubic feet or greater and not just greater than 8 cubic feet.
Number Eligible to Vote: 28
Ballot Results: Affirmative: 22 Negative: 1
Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.
Explanation of Negative:
URAL, E.: There is no scientific justification for the 8 ft^3 rule of thumb. The correct number depends on the details of the equipment design, process, pressure resistance and how close the people or walls come to it. The correct number can be determined by consequence analysis or by performance based design.

654-39 Log #19 **Final Action: Reject**
(7.13.1.1.2(3))

Submitter: Peter Levitt, Sternvent Company, Inc.
Recommendation: Revise text as follows:
~~(3) Air-material separators that have a volume of less than 8 ft^3 (0.2 m^3)~~
Substantiation: I believe this section serves no purpose.
8 cu ft = 2'X2'X2' I am not aware of any air-material separator (dust collector) that is this small. This is the size of a vacuum cleaner & covered in 8.2.3
Also, basing the exception on the physical size of the dust collector, instead of air flow (cfm) is unusual.
Committee Meeting Action: Reject
Committee Statement: The Committee disagrees with the submitter's assertion in the substantiation that this requirement is not needed because there are no air-material separators this small. That is not correct; the Committee is aware of devices this size, so the requirement is relevant and needs to be retained in the standard.
Number Eligible to Vote: 28
Ballot Results: Affirmative: 23
Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

654-40 Log #22 **Final Action: Accept in Principle**
(7.13.2.1.2)

Submitter: Robert L. Gravell, E. I. duPont de Nemours & Company, Inc.
Recommendation: Revise text as follows:
7.13.2.1.2 Filter media and supporting frames shall be permitted to be constructed of combustible material.
Substantiation: Induction charging of ungrounded conductive filter support cages can create a potential capacitive spark ignition source that has been shown to be the cause of dust explosions. The use of support cages fabricated from non-conductive material can be advantageous in preventing such a hazard. Based on current knowledge low level brush discharges from such a nonconductor will not pose an ignition hazard for a combustible dust cloud. Further, the advantage of using a non-conductive support cage outweighs the small additional fuel loading posed by such a structure in the event of an internal fire.
Committee Meeting Action: Accept in Principle
Revise text as follows:
7.13.2.1.2 Filter media and filter media support frames shall be permitted to be constructed of combustible material.
Committee Statement: Editorial modification to clarify that the supporting frames referred to support frame for filter media.
Number Eligible to Vote: 28
Ballot Results: Affirmative: 23
Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

654-41 Log #49 **Final Action: Reject**
(7.14.1.4)

Submitter: Tony L. Thomas, Flamex, Inc.
Recommendation: Add new text to read as follows:
The abort gate should be a high speed device with a reaction time of less than one second.
Substantiation: We occasionally see motorized dampers used as abort dampers on return air ducts. The reaction time of a motorized damper may be in excess of five seconds. A significant amount of burning material may be blown into the building before the damper fully diverts.
Committee Meeting Action: Reject
Committee Statement: The Committee notes that the performance of abort gates is already covered in 7.14.1.3 and the proposed additional requirement has not been suitably substantiated. No specific basis for the proposed reaction time has been provided by the submitter. The proposed recommendation also is written in non-mandatory form.
Number Eligible to Vote: 28
Ballot Results: Affirmative: 23
Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

654-42 Log #50 **Final Action: Accept**
(7.14.2.1)

Submitter: Tony L. Thomas, Flamex, Inc.
Recommendation: Revise text to read as follows:
The abort gate or abort damper shall be installed downstream of the air-moving device so that it diverts airflow to a restricted area to safely discharge combustion gases, flames, burning solids or process gases or fumes.
Substantiation: If the abort damper is installed upstream of the air-moving device it is impossible to discharge the burning material from the duct. It is the air-moving device that "blows" the burning material from the duct to a safe area.
Committee Meeting Action: Accept
Number Eligible to Vote: 28
Ballot Results: Affirmative: 23
Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

654-43 Log #51 **Final Action: Accept in Principle**
(7.14.2.2.3)

Submitter: Tony L. Thomas, Flamex, Inc.
Recommendation: Add new text to read as follows:
A powered reset is acceptable if it can only be activated manually at the damper.
Substantiation: We have seen confusion in the past of what a manual reset actually is. Large abort dampers are very heavy, and a powered reset makes it much easier to reset the damper.

Committee Meeting Action: Accept in Principle

Add the following as Annex to 7.14.2.2.1 to read as follows:

A.7.14.2.2.1 A powered reset is acceptable if it can only be activated manually at the damper.

Committee Statement: The requirements of 7.14.2.2.1 are not intended to prohibit locally actuated drivers for the reset. The Committee also believes that the proposed text was already permitted by the existing requirement in the standard and as formatted was more suitable as annex content.

Number Eligible to Vote: 28

Ballot Results: Affirmative: 23

Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

654-44 Log #20 **Final Action: Reject**
(7.17.1)

Submitter: Peter Levitt, Sternvent Company, Inc.

Recommendation: Revise text as follows:

7.17.1 Mixers and blenders shall be airtight, with the exception of the fill area that shall have a suction hood or hinged cover with duct connection for an air-material separator to capture the nuisance & prevent it from forming a dust cloud.

Substantiation: Mixers & blenders cannot be 100% airtight. The new text provides instructional information.

Committee Meeting Action: Reject

Committee Statement: The submitter has changed the existing text by replacing “dusttight” with “airtight” but has not explained the rationale. The changes proposed by the submitter are presently covered by requirements in 8.1.1 and 8.2.1.1. See Committee Proposal 654-45 (Log #CP3) for additional requirements applicable to the submitter’s recommendation.

Number Eligible to Vote: 28

Ballot Results: Affirmative: 23

Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

654-45 Log #CP3 **Final Action: Accept**
(7.17.1)

Submitter: Technical Committee on Handling and Conveying of Dusts, Vapors, and Gases,

Recommendation: Revise as shown:

7.17.1 Mixers and blenders shall be ~~dusttight~~ designed to control the release of dust. See 8.1.1 and 8.2.1.1.

Substantiation: The Committee clarified the intent for this existing requirement and added reference to existing sections in the dust control and housekeeping chapter of the standard where the need for preventing or limiting the release of dust from processes is highlighted.

Committee Meeting Action: Accept

Number Eligible to Vote: 28

Ballot Results: Affirmative: 23

Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

654-46 Log #30 **Final Action: Accept in Principle**
(Chapter 8)

Submitter: Mark L. Holcomb, Kimberly-Clark Corporation

Recommendation: Add new text to read as follows:

Chapter 8 - Fugitive Dust Control and Housekeeping

8.1 – Fugitive Dust Control

8.1.1

Equipment and processes shall be designed, maintained and operated in a manner that minimizes the release of fugitive dust into the building environment.

8.1.2 – Control Equipment Design

Processes shall be designed to minimize or eliminate the release of combustible dust. Engineering controls shall be provided for processes where combustible dust is liberated during normal operation. Ventilation controls shall be designed in accordance with criteria specified in the current edition of the American Conference of Governmental Industrial Hygienists (ACGIH) Industrial Ventilation Manual. Dust collectors or other types of air material separators, including wet collectors, shall be used to collect dust. To the extent possible, dust collector designs shall eliminate explosion hazards by reducing dust concentrations inside collector housings below the MEC. Ducts used to convey air containing dust shall be designed to maintain air transport velocities that are high enough to prevent dust from accumulating inside ducts.

8.1.3 – Control Equipment Maintenance

Engineering controls shall be maintained to the original design specifications and the performance of these systems must be initially validated after installation and periodically validated thereafter. Written operating and maintenance procedures must be developed and maintained for all engineering controls and related equipment. The frequency and method used to validate system performance should be based manufactures recommendations, operating experience, and the severity of the consequence of system or individual component failure. Both real-time instrumentation and visual inspections should be considered. A corrective action system must be implemented that prioritizes corrective actions based on risk. The corrective action system must specify closure schedules and track closure status.

8.2 – House Keeping. All housekeeping requirements shall be applied retroactively.

8.2.1 – Control of Fugitive Dust Accumulations through building structure design and ventilation.

To the extent possible, overhead building structures, process and electrical equipment, lighting and other overhead surfaces should be configured to minimize or prevent the accumulation of fugitive dust. Active methods of reducing fugitive dust accumulations in overhead building surfaces, including high-velocity HVAC and fans mounted in the overheads may also be deployed where practical. Active control methods must be operated frequently enough to ensure that accumulated dust levels that are removed by these systems never exceed 50% of the maximum allowable dust accumulation.

8.2.2 – Housekeeping Frequency

The housekeeping frequency shall be established to ensure that the accumulated dust levels on walls, floors, and horizontal surfaces do not exceed the maximum allowable dust accumulation. A planned inspection process must be implemented to periodically evaluate dust accumulation rates and determine changes in the rate that change housekeeping frequency. Factors that should be considered in establishing the housekeeping frequency include:

· Variability of fugitive dust emissions.

· Impact of process changes and non-routine activities.

· Variability of accumulations on different surfaces within the room (walls, floors, overheads).

Un-scheduled housekeeping must be conducted to clean localized dust accumulations that exceed 1 kg/m2 in any area greater than 200 square feet (19 square meters). These accumulations may result from spills, process leaks, and other process upsets. The un-scheduled housekeeping must be conducted within 24 hours.

8.2.3 – Housekeeping Methods

Combustible dust accumulations from surfaces shall be cleaned in a manner that minimizes the risk of generating a hazardous dust cloud. A written housekeeping procedure must be developed that addresses the following aspects:

1. A risk analysis that considers the specific characteristics of the dust being cleaned (particle size, moisture content, MEC, MIE) and other safety risks introduced by the cleaning methods used.
2. Personal Safety procedures and personal protective equipment (PPE)
3. Cleaning sequence.
4. Cleaning methods to be used.
5. Equipment, including lifts, vacuum systems, attachments, etc.

Compressed air must not be used to clean confined spaces, including vessels, process equipment or small rooms whose volume is less than 2000 ft^3 (57 m^3). Compressed air may be used to clean if the following conditions are met:

1. Vacuum cleaning or wet cleaning methods are used to clean surfaces that can be safely accessed prior to using compressed air.
2. Dust accumulations in the area being cleaned are less than 50% of the maximum allowable dust accumulation and no localized accumulations exceed 0.5 kg/m^2.
3. Compressed air use is limited to cleaning inaccessible surfaces or surfaces where other methods of cleaning result in a greater personal safety risk to those performing the cleaning.
4. The lowest air pressure that provides effective cleaning is used.
5. All electrical equipment potentially exposed to airborne dust in the area meets NEMA 12 (dust tight) requirements.
6. Ignition sources and hot surfaces capable of igniting a dust cloud or dust layer are shut down or removed from the area.

8.2.4 – Vacuum Cleaners

Central vacuum systems (fixed pipe suction system with remotely located exhauster and dust collector) shall be installed in conformance with Section 7.13.

Portable vacuum systems shall be certified by the manufacturer to meet the hazard classification of the area where they will be used (non-classified, class I, II, or III). Portable vacuum systems must be used in accordance with the manufacturers’ requirements to ensure that the hazard classification is maintained.

Substantiation: Chapter 8, sections 8.1.1 and 8.1.2 need to be revised to align with accepted industrial hygiene control hierarchy and ventilation system design criteria.

Section 8.1.3: This change provides practical guidance for applying recognized ventilation system design and maintenance criteria.

Section 8.2.2 - The 200 sq ft area limit is identified in FM 7-76.

Section 8.2.3 – This section was revised to provide guidance for dust accumulations that result from spills or leaks.

Section 8.2.4 - All equipment used in hazardous locations must meet the hazard class of the location. There is no technical reason to require classified vacuums for combustible dust unless it is being used in a hazardous location. Vacuuming does not generate a hazardous dust cloud in the room environment

Committee Meeting Action: Accept in Principle

Revise Section 8.2 as shown:

8.2 Housekeeping. All requirements of 8.2.1 through 8.2.3 shall be applied retroactively.

8.2.1 Cleaning Frequency

8.2.1.1* The housekeeping frequency shall be established to ensure that the accumulated dust levels on walls, floors, and horizontal surfaces, such as

equipment, ducts, pipes, hoods, ledges, beams, and above suspended ceilings and other concealed surfaces, such as interior of electrical enclosures, does not exceed the threshold dust mass/accumulation.
8.2.1.2* A planned inspection process shall be implemented to evaluate dust accumulation rates and the housekeeping frequency required to maintain dust accumulations below the threshold dust mass/accumulation.

A.8.2.1.1 Factors that should be considered in establishing the housekeeping frequency include:

- Variability of fugitive dust emissions.
- Impact of process changes and non-routine activities.
- Variability of accumulations on different surfaces within the room (walls, floors, overheads).

A.8.2.1.2* Un-scheduled housekeeping should be performed in accordance with Table A.8.2.1.2 (a) to limit the time that a local spill or short-term accumulation of dust is allowed to remain before cleaning the local area to less than the threshold dust mass/accumulation.

Table A.8.2.1.2(a) Un-Scheduled Housekeeping

Accumulation on the worst single square meter of surface	Longest Time to Complete Un-scheduled Local Cleaning of Floor-Accessible Surfaces	Longest Time to Complete Un-scheduled Local Cleaning of Remote Surfaces
>1 to 2 times threshold dust mass/accumulation	8 hours	24 hours
>2 to 4 times threshold dust mass/accumulation	4 hours	12 hours
> 4 times threshold dust mass/accumulation	1 hour	3 hours

Table A8.2.1.2 (b) shows approximate equivalent depths for the accumulation values in Table A.8.2.1.2 (a) when the threshold dust mass/accumulation is 1 kg/m^2. The owner/operator can use an approximate depth to facilitate communication of housekeeping needs.

Table A8.2.1.4 Unscheduled Housekeeping

Accumulation on the worst single square meter of surface	Average Depth at 75 lb/ft^3	Average Depth at 30 lb/ft^3
>1 to 2 kg/m^{2f}	>$^1/_{32}$-$^1/_{16}$ in. (0.8-1.7 mm)	>$^5/_{64}$-$^5/_{32}$ in. (2.1-4.2 mm)
>2 to 4 kg/m^2	>$^1/_{16}$ -$^1/_8$ in. (1.7-3.3 mm)	>$^5/_{32}$ -$^5/_{16}$ in. (4.2-8.3 mm)
> 4 kg/m^2	> 1/8 in. (>3.3 mm)	> $^5/_{16}$ in. (>8.3 mm)

8.2.2 Cleaning Methods
8.2.2.1 Surfaces shall be cleaned in a manner that minimizes the risk of generating a fire or explosion hazard.
8.2.2.2 Vacuum cleaning shall be the preferred method. Where other cleaning methods are required, water wash-downs or sweeping shall be permitted to be used.
8.2.2.3* Blow downs using compressed air or steam shall be permitted to be used for cleaning inaccessible surfaces or surfaces where other methods of cleaning result in greater personal safety risk. Where blow down using compressed air is used, the following precautions shall be followed:

1. Dust accumulations in the area being cleaned do not exceed the threshold dust mass/accumulation.
2. Vacuum cleaning or wet cleaning methods are used to clean surfaces that can be safely accessed prior to using compressed air.
3. Compressed air hoses are equipped with pressure relief nozzles meeting OSHA requirements (30 psig – 29 CFR 1910.242(b)).
4. All electrical equipment potentially exposed to airborne dust in the area meets NFPA 70, National Electrical Code (NEC) NEMA 12 (dust tight) requirements, or equivalent.
5. All ignition sources and hot surfaces capable of igniting a dust cloud or dust layer are shut down or removed from the area.

A.8.2.2.3 – All of the listed precautions might not be required for limited use of compressed air for cleaning minor accumulations of dust from machines or other surfaces between shifts. A risk assessment should be conducted to determine which precautions are required under the specific conditions that compressed air is being used.

8.2.2.4* Housekeeping procedures shall be documented in accordance with the requirements of Section 4.2 and 4.3.
A.8.2.2.4 – Items that should be included in the housekeeping procedure include:

1. A risk analysis that considers the specific characteristics of the dust being cleaned (particle size, moisture content, MEC, MIE) and other safety risks introduced by the cleaning methods used.
2. Personal safety procedures, including fall protection when working at heights
3. Personal protective equipment (PPE), including flame-resistant garments in accordance with the hazard analysis required by NFPA 2113
4. Cleaning sequence.
5. Cleaning methods to be used.
6. Equipment, including lifts, vacuum systems, attachments, etc.

8.2.3 Vacuum Cleaners
See Committee Action on Proposal 654-49 (Log #48) for revisions to 8.2.3 on vacuum cleaners.
Committee Statement: A requirement for planned inspections based on accumulation rates and factors that impact the accumulation rates is needed to ensure the housekeeping plan is adjusted to address changes in the accumulation rates.
The second requirement in the current standard (electrical equipment not meeting Class II requirements must be shut down or removed from the area) effectively establishes the requirement for the area to be classified (meet class II criteria) when compressed air is used for cleaning. This requirement is too restrictive if the amount of dust in the area where compressed air is being used is below the dust threshold. If the amount of dust is below the threshold, by definition a dust cloud hazard cannot exist.
The current requirements for compressed air pressure limited to 15 psig are not based on OSHA requirements and are too restrictive to allow effective cleaning in most circumstances. The current 15 psig restriction will result in the inability to clean fugitive dust accumulations in restricted access areas resulting in a greater risk of fire or explosion. The OSHA requirement states that when using compressed air for cleaning, pressure relief must be provided to reduce air pressure to 30 psig or less when the nozzle is deadheaded (see OSHA web site for interpretation letter). Typically, compressed air used for cleaning is at standard plant pressure. Requiring pre-vacuuming of accessible surfaces further reduces any risk by removing a portion of the dust prior to using compressed air.
The current standard does not require a written housekeeping procedure which identifies and addresses other risks introduced by the house keeping, including working at heights. A written procedure is an administrative requirement that helps ensure the plan has been well thought out and it provides a vehicle that facilitates employee communications and training.
See Committee Action and Committee Statement on Proposal 654-49 (Log #48) regarding revisions to requirements for vacuum cleaners.
Number Eligible to Vote: 28
Ballot Results: Affirmative: 23
Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.
Comment on Affirmative:
HOLCOMB, M.: I am not in agreement with inclusion of section A.8.2.1.2 0 Unscheduled Housekeeping.
JENNETT, J.: A.8.2.1.2 This could require facilities to pay unnecessary overtime.
A clause that would allow clean-up of a spill or dust accumulation which occurs but does not create a hazard to the facility or personnel during off hours to be completed before the start of the next shift.
Table A.8.2.1.2 (A) Unscheduled Housekeeping Table should include in each box (or before the start of the next shift).

654-47 Log #3 **Final Action: Reject**
(8.2.1)

Submitter: Mindy Wang, Ampco Safety Tools
Recommendation: Add new text as follows:
8.2.1.3 Tools for cleanup of fugitive dusts or collecting sweepings shall be non-sparking.
Substantiation: ● NFPA 654 can better mitigate the fire and explosions hazards by specifying the use of non-sparking tools. Without this specification, steel tools are likely to be used which can be an ignition source.
● NFPA 921, Guide for Fire and Explosion Investigations 2008 Edition, Chapter 5 Basic Fire Science Table 5.7.1.1 Reported Burning and Sparking Temperature of Selected Ignition Sources under Mechanical Sparks lists a Steel tool temperature at 2550°F. When working with flammable gases, liquids or vapors, a potential hazard arises because of the possibility that sparks produced by steel or iron tools can become an ignition source.
● Recognizing the potential for steel tools to be an ignition source in flammable environment, the Occupational Safety & Health Administration (OSHA) provides guidance in booklet 3080 Hand and Power Tools, 2002 revised, "iron and steel hand tools may produce sparks that can be an ignition source around flammable substances. Where this hazard exists, spark-resistant tools should be used."
● NFPA Fire Protection Handbook, Volume I, Chapter 8 Dusts states that ignition temperatures and ignition energies for dust explosions are much lower than the temperatures and energies of most common sources of ignition, it is not surprising that dust explosions have been caused by common sources of ignition. For this reason, the elimination of all possible sources of ignition is a basic principle of dust explosion prevention.
● On February 20, 2003, a dust explosion at the CTA Acoustics, Inc. (CTA) facility in Corbin, Kentucky, killed seven and injured 37 workers. In investigating this incident, the CSB determined that combustible resin dust that had accumulated throughout the facility fueled the explosion. Developed in 1997, job safety analyses for cleaning process line dust collectors and ducts list explosion as a potential hazard if the cleaning is done with tools capable of producing a spark. Employees reported that production line cleaning routinely created clouds of dust. They used compressed air, brooms, and metal tools to clean. The CSB concluded that the use of metal tools, brooms, compressed air, and fans during line cleaning is one of the root causes of explosion. One recommendation made by the CSB is using appropriate dust-cleaning methods and tools to minimize the dispersion of combustible dust.
● A dust explosion and fire on October 29, 2003 at the Hayes Lemmerz International-Huntington, Inc. killed one employee and injured six workers. Section 3.3.9.2 Impact Spark of the final Chemical Safety Board (CSB) investigation report stated when steel objects strike steel or an abrasive surface with enough momentum, the impact can generate a spark. A common example is the spark observed when a steel hammer strikes a steel nail. The report also stated for this reason, refineries and other workplaces that may have flammable atmospheres often use tools of bronze or other non-sparking metals. CSB investigations did not rule out an impact spark as a possible ignition source.
● As a result of catastrophic accident involving a combustible dust explosion at a sugar refinery, OSHA initiated a Combustible Dust National Emphasis Program in October 2007; reissued in March 2008. As a precautionary measure, OSHA requires Compliance, Safety and Health officers (CSHOs) uses non-sparking dust pans for collection settled dust and non-spark scoops for removing dust from cyclone containers or other ventilation equipment for the combustible dust hazards when conducting inspections under this program.
● FM Global, a large commercial and industrial property insurer, publishes guidelines to reduce or prevent dust fires and explosion. Data sheets are provided to customers and noncustomers. Data Sheet 6-9, Industrial Ovens and Dryers, addressed fire and explosion hazards from process combustibles (e.g. dust, debris), fuel, and flammable materials in industrial ovens and dryers and applies to operations such as those found at CTA. This data sheet states that scraping with non-sparking tools is probably the most widely used method for soft or easily removed deposits. Furthermore, the CSB final investigation report on explosion at CTA found that guidelines listed on FM data sheet 6-9 was not followed.
● A few more incidents:
● OSHA inspection #127357804, employee #1 was working in an infrared flare composition mixing building. He completed installation of a metal vacuum filter table in Bay #1, permanently anchoring it to the concrete floor by drilling holes in the concrete floor, installing concrete anchor bolts, and bolting down the table. Employee #1 then removed the eight anchor bolts from the concrete floor at the old table location by hitting them with a ball peen hammer until they broke. On the last anchor bolt, some residual flare composition on the bolt threads or on the floor ignited due to the impact of the hammer. According to a company representative, room evidence indicated that the ignited flare material then probably ignited the flare composition-contaminated denim filter on the vacuum table next to Employee #1, causing an explosion or deflagration. Other composition-contaminated material in the building caught on fire, resulting in two to four more explosions. Employee #1 suffered second- and third-degree burns over 80 percent of his body and later died.
● OSHA inspection #110292604, employees #1 and #2 were mixing magnesium powder (metallic), calcium carbide, and sodium chloride. Employee #3 was bringing in drums of magnesium powder. Employees #1 and #2 were using a length of steel pipe to loosen a blockage in a magnesium batching hopper. The pipe caused a spark to ignite a magnesium powder flash fire and explosion. Employees #1 and 2 were killed and Employee #3 was injured.
● OSHA inspection #114997323, employee #1 was in an area between the dust collector and the air-lay machine on the 92 line preparing to dump a bag of resin into a hopper with a forklift when the resin reclaim unit blew out and burned him on his neck, back, and arms. The dust ignited in the duct system and traveled to the reclaim unit, where the blast engulfed the area. The initial spark may have occurred in the LaRouche machine from a steel-on-metal spark or in the air-lay machine from an overheated bearing. The employee was burned.
● Listed as accident #82 on dust incident data compiled by the CSB, an explosion resulted as a spark created by a worker with an allen wrench who was turning a screw to adjust a machine. The spark ignited some propellant dust and a vacuum system carried the fire another room where a barrel of dust exploded.
● Without the specification for non-sparking tools, steel tools are likely to be used which can be a source of ignition.
Committee Meeting Action: Reject
Committee Statement: The Committee is aware of published literature from API Recommended Practice 2214, Bureau of Mines, and Eckhoff, "Dust Explosions in the Process Industries, 3rd Edition" that does not support the need for non-sparking tools in the application recommended.
The submitter's incident citations are not applicable to the operation of cleaning or sweeping as proposed in the recommendation; the incidents cited all involve use of hand tools in a maintenance application.
The submitter has not provided calculations showing that the power density produced by tool impact in probable scenarios is sufficient to ignite the particulates encompassed in the scope of NFPA 654.
Number Eligible to Vote: 28
Ballot Results: Affirmative: 23
Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

654-48 Log #32 **Final Action: Accept in Principle**
(8.2.3.1)

Submitter: Brice Chastain, Georgia-Pacific
Recommendation: Revise text to read as follows:
8.2.3.1 Vacuum cleaners shall ~~be listed for use in Class II hazardous locations~~ meet the hazard classification of the area where they will be used as determined by Section 6.6 and shall be electrically grounded and bonded or shall be a fixed-pipe suction system with remotely located exhauster and dust collector installed in conformance with Section 7.13.
Substantiation: There is no technical requirement to use Class II vacuum cleaners in an area not electrically classified as a Class II, Division 1, Group locations as defined in Article 502 of NFPA 70, National Electric Code.
Committee Meeting Action: Accept in Principle
See Committee Action on Proposal 654-49 (Log #48).
Committee Statement: See Committee Action and Statement on Proposal 654-49 (Log #48).
Number Eligible to Vote: 28
Ballot Results: Affirmative: 23
Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

654-49 Log #48 **Final Action: Accept in Principle in Part**
(8.2.3.1)

Submitter: Thomas C. Scherpa, E. I. DuPont de Nemours & Company
Recommendation: Revise text to read as follows:
8.2.3 Vacuum Cleaners.
8.2.3.1 Portable vacuum cleaners used with combustible dusts shall meet the following minimum requirements:
(1) All metal components, including wands, attachments, and hose reinforcing wires, shall be bonded and grounded
(2) Dust-laden air shall not pass over the fan or motor
(3) When liquids or wet material are picked up by the vacuum cleaner, paper filter elements shall not be used
A.8.2.3(3) Liquids or wet material can weaken paper filter elements causing them to fail, which can allow combustible dust to reach the fan and motor.
(4) Vacuum cleaners used for metal dusts shall meet the requirements of NFPA 484, Standard for Combustible Metals
(5) General purpose vacuum cleaners shall not be used to pick up bulk quantities of combustible dust
A.8.2.3(5) If a large quantity of material is spilled in an unclassified area, the bulk material should be collected by sweeping, shoveling, or with a Class II listed vacuum cleaner. General purpose vacuum cleaners can be used to clean up residual material after the bulk of the spill has been collected.
8.2.3.2~~1~~ When used in Class II areas as determined in accordance with 6.6.2, ~~V~~vacuum cleaners shall be listed for use in Class II hazardous locations or shall be a fixed-pipe suction system with remotely located exhauster and dust collector installed in conformance with Section 7.13.
8.2.3.3~~2~~ Where flammable vapors or gases are present in hazardous concentrations, vacuum cleaners shall be listed for Class I ~~and Class II~~ hazardous locations in addition to meeting the requirements in 8.2.3.1 or 8.2.3.2.

Substantiation: The current wording requires the use of Class II vacuum cleaners in all areas, including general purpose areas with low quantities of combustible dust. This requirement presents an undue burden on users, and may cause some users to resort to other means of housekeeping that are more hazardous (such as compressed air blowdowns).

While vacuum cleaners can present a potential ignition source, and a combustible dust cloud may be present in the collection drum, the proposed minimum requirements stated in this proposal should minimize the risk of ignition of a dust cloud.

Committee Meeting Action: Accept in Principle in Part

Revise text to read as follows:

8.2.3 Vacuum Cleaners.

8.2.3.1 Unless the conditions stipulated in 8.2.3.2 are met, vacuum cleaners shall be listed for use in Class II hazardous locations or shall be a fixed-pipe suction system with remotely located exhauster and dust collector installed in conformance with Section 7.13.

8.2.3.2* In locations that are not hazardous (classified) in accordance with 6.6.2, portable vacuum cleaners that meet the following minimum requirements shall be permitted to be used:

A.8.2.3.2 If a large quantity of material is spilled in an unclassified area, the bulk material should be collected by sweeping, shoveling, or with a Class II listed vacuum cleaner. General purpose vacuum cleaners can be used to clean up residual material after the bulk of the spill has been collected.

(1) Materials of construction shall comply with 7.13.2 and 9.3.1.

(2) Hoses shall be conductive or static dissipative.

(3) All conductive components, including wands and attachments, shall be bonded and grounded

(4) Dust-laden air shall not pass through the fan or blower

(5) The motor shall not be in the dust laden air stream

(6)* When liquids or wet material are picked up by the vacuum cleaner, paper filter elements shall not be used

A.8.2.3.2(6) Liquids or wet material can weaken paper filter elements causing them to fail, which can allow combustible dust to reach the fan and motor.

(7) Vacuum cleaners used for metal dusts shall meet the requirements of NFPA 484, Standard for Combustible Metals

Do not revise 8.2.3.3 (existing 8.2.3.2) as proposed; renumber to 8.2.3.3.

8.2.3.3~~2~~ Where flammable vapors or gases are present, vacuum cleaners shall be listed for Class I and Class II hazardous locations.

Committee Statement: The Committee clarified the use of vacuum cleaners in areas classified as hazardous locations and those not classified as hazardous locations. The Committee incorporated the submitter's recommendations into the provisions of 8.2.3.2 to better define the requirements when using vacuums to clean in non-classified areas.

Number Eligible to Vote: 28

Ballot Results: Affirmative: 23

Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

654-50 Log #4 **Final Action: Reject**

(9.1.5)

Submitter: Mindy Wang, Ampco Safety Tools

Recommendation: Add new text as follows:

9.1.5 Equipment. Equipment with moving parts shall be installed and maintained so that true alignment is maintained and clearance is provided to minimize friction. Non-sparking tools shall be used to make repairs or adjustment on or around any machinery where combustible dust is present.

Substantiation: ● NFPA 654 can better mitigate the fire and explosions hazards by specifying the use of non-sparking tools. Without this specification, steel tools are likely to be used which can be an ignition source.

● NFPA 921, Guide for Fire and Explosion Investigations 2008 Edition, Chapter 5 Basic Fire Science Table 5.7.1.1 Reported Burning and Sparking Temperature of Selected Ignition Sources under Mechanical Sparks lists a Steel tool temperature at 2550°F. When working with flammable gases, liquids or vapors, a potential hazard arises because of the possibility that sparks produced by steel or iron tools can become an ignition source.

● Recognizing the potential for steel tools to be an ignition source in flammable environment, the Occupational Safety & Health Administration (OSHA) provides guidance in booklet 3080 Hand and Power Tools, 2002 revised, "iron and steel hand tools may produce sparks that can be an ignition source around flammable substances. Where this hazard exists, spark-resistant tools should be used."

● NFPA Fire Protection Handbook, Volume I, Chapter 8 Dusts states that ignition temperatures and ignition energies for dust explosions are much lower than the temperatures and energies of most common sources of ignition, it is not surprising that dust explosions have been caused by common sources of ignition. For this reason, the elimination of all possible sources of ignition is a basic principle of dust explosion prevention.

● On February 20, 2003, a dust explosion at the CTA Acoustics, Inc. (CTA) facility in Corbin, Kentucky, killed seven and injured 37 workers. In investigating this incident, the CSB determined that combustible resin dust that had accumulated throughout the facility fueled the explosion. Developed in 1997, job safety analyses for cleaning process line dust collectors and ducts list explosion as a potential hazard if the cleaning is done with tools capable of producing a spark. Employees reported that production line cleaning routinely created clouds of dust. They used compressed air, brooms, and metal tools to clean. The CSB concluded that the use of metal tools, brooms, compressed air, and fans during line cleaning is one of the root causes of explosion. One recommendation made by the CSB is using appropriate dust-cleaning methods and tools to minimize the dispersion of combustible dust.

● A dust explosion and fire on October 29, 2003 at the Hayes Lemmerz International-Huntington, Inc. killed one employee and injured six workers. Section 3.3.9.2 Impact Spark of the final Chemical Safety Board (CSB) investigation report stated when steel objects strike steel or an abrasive surface with enough momentum, the impact can generate a spark. A common example is the spark observed when a steel hammer strikes a steel nail. The report also stated for this reason, refineries and other workplaces that may have flammable atmospheres often use tools of bronze or other non-sparking metals. CSB investigations did not rule out an impact spark as a possible ignition source.

● As a result of catastrophic accident involving a combustible dust explosion at a sugar refinery, OSHA initiated a Combustible Dust National Emphasis Program in October 2007; reissued in March 2008. As a precautionary measure, OSHA requires Compliance, Safety and Health officers (CSHOs) uses non-sparking dust pans for collection settled dust and non-spark scoops for removing dust from cyclone containers or other ventilation equipment for the combustible dust hazards when conducting inspections under this program.

● FM Global, a large commercial and industrial property insurer, publishes guidelines to reduce or prevent dust fires and explosion. Data sheets are provided to customers and noncustomers. Data Sheet 6-9, Industrial Ovens and Dryers, addressed fire and explosion hazards from process combustibles (e.g. dust, debris), fuel, and flammable materials in industrial ovens and dryers and applies to operations such as those found at CTA. This data sheet states that scraping with non-sparking tools is probably the most widely used method for soft or easily removed deposits. Furthermore, the CSB final investigation report on explosion at CTA found that guidelines listed on FM data sheet 6-9 was not followed.

● A few more incidents:

● OSHA inspection #127357804, employee #1 was working in an infrared flare composition mixing building. He completed installation of a metal vacuum filter table in Bay #1, permanently anchoring it to the concrete floor by drilling holes in the concrete floor, installing concrete anchor bolts, and bolting down the table. Employee #1 then removed the eight anchor bolts from the concrete floor at the old table location by hitting them with a ball peen hammer until they broke. On the last anchor bolt, some residual flare composition on the bolt threads or on the floor ignited due to the impact of the hammer. According to a company representative, room evidence indicated that the ignited flare material then probably ignited the flare composition-contaminated denim filter on the vacuum table next to Employee #1, causing an explosion or deflagration. Other composition-contaminated material in the building caught on fire, resulting in two to four more explosions. Employee #1 suffered second- and third-degree burns over 80 percent of his body and later died.

● OSHA inspection #110292604, employees #1 and #2 were mixing magnesium powder (metallic), calcium carbide, and sodium chloride. Employee #3 was bringing in drums of magnesium powder. Employees #1 and #2 were using a length of steel pipe to loosen a blockage in a magnesium batching hopper. The pipe caused a spark to ignite a magnesium powder flash fire and explosion. Employees #1 and 2 were killed and Employee #3 was injured.

● OSHA inspection #114997323, employee #1 was in an area between the dust collector and the air-lay machine on the 92 line preparing to dump a bag of resin into a hopper with a forklift when the resin reclaim unit blew out and burned him on his neck, back, and arms. The dust ignited in the duct system and traveled to the reclaim unit, where the blast engulfed the area. The initial spark may have occurred in the LaRouche machine from a steel-on-metal spark or in the air-lay machine from an overheated bearing. The employee was burned.

● Listed as accident #82 on dust incident data compiled by the CSB, an explosion resulted as a spark created by a worker with an allen wrench who was turning a screw to adjust a machine. The spark ignited some propellant dust and a vacuum system carried the fire another room where a barrel of dust exploded.

● Without the specification for non-sparking tools, steel tools are likely to be used which can be a source of ignition.

Committee Meeting Action: Reject

Committee Statement: The Committee is aware of published literature from API Recommended Practice 2214, Bureau of Mines, and Eckhoff, "Dust Explosions in the Process Industries, 3rd Edition" that does not support the need for non-sparking tools in the application recommended.

The submitter has not provided calculations showing that the power density produced by tool impact in probable scenarios is sufficient to ignite the particulates encompassed in the scope of NFPA 654.

Number Eligible to Vote: 28

Ballot Results: Affirmative: 23

Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

654-51 Log #CP5 **Final Action: Accept**
(9.3)

Submitter: Technical Committee on Handling and Conveying of Dusts, Vapors, and Gases,
Recommendation: Revise 9.3.1 as shown:
9.3.1* Conductive Components.
9.3.1.1 All system components shall be conductive.
9.3.1.2 Nonconductive system components shall be permitted where all of the following conditions are met:
(a) Hybrid mixtures are not present
(b) Conductive dusts are not handled
(c) The MIE of the material being handled is greater than 3 mJ
(d) The nonconductive components do not result in isolation of conductive components from ground
(e)* The breakdown strength across nonconductive sheets, coatings, or membranes does not exceed 4 kV when used in high surface charging processes
A.9.3.1.2(e) The potential for propagating brush discharges exists where nonconductive materials with breakdown voltages exceeding 4 kV are exposed to processes that generate strong surface charges such as pneumatic conveying. Such discharges do not occur where the breakdown voltage is less than 4 kV.
~~9.3.1.2 Where the use of conductive components is not practical, nonconductive equipment shall be permitted where one of the following criteria is met:~~
~~(1) A documented engineering analysis that is acceptable to the authority having jurisdiction has determined that no electrostatic ignition potential exists.~~
~~(2) Materials being conveyed are not compatible with metal ductwork, and other means of explosion protection are provided in accordance with 7.1.2.1(1), 7.1.2.1(3), 7.1.2.1(4), or 7.1.2.1(5).~~
Substantiation: The Committee has modified the recommendation submitted in Proposal 654-52 (Log #25) to address the conditions required when nonconductive system components are used. The Committee recommendation prohibits application of this provision for hybrid mixtures and requires that conductive dusts not be handled. The Committee solicits input during the Public Comment period on whether a specific conductivity or resistivity threshold should be defined. This revision also incorporates requirements for MIE levels and limits the breakdown voltage during high surface charging processes. The Committee also included explanatory information supporting the 4 kV limit in an annex.
Committee Meeting Action: Accept
Number Eligible to Vote: 28
Ballot Results: Affirmative: 23
Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.
Comment on Affirmative:
FEBO, JR., H.: The statement in A.9.3.1.2(e) should be replaced by the substantiation material in proposal 654-52, (Log #25) which is more complete than the proposed material.

654-52 Log #25 **Final Action: Accept in Principle**
(9.3.1, 9.3.1.1, and 9.3.1.2)

Submitter: Robert L. Gravell, E. I. duPont de Nemours & Company, Inc.
Recommendation: Revise text as follows:
9.3.1 Conductive Components
9.3.1.1 ~~All system components shall be conductive~~Non-conductive components having potential exposure to combustible dust clouds are permitted provided that the MIE of the dust being handled is >3 mJ; it must also be ensured that use of non-conductive components will not result in isolation of conductive components which could be exposed to combustible dust clouds
9.3.1.2 ~~Where the use of conductive components is not practical, nonconductive equipment shall be permitted shere one of the following criteria is met:~~
~~(1) A documented engineering analysis that is acceptable to the authority having jurisdiction has determined that no electrostatic ignition potential exists~~
~~(2) Materials being conveyed are not compatible with metal ductwork, and other means of explosion protection are provided in accordance with 7.1.2.1(1), 7.1.2.1(3), 7.1.2.1(4), or 7.1.2.1(5)~~
Due to the potential for propagating brush discharges non-conductive sheets, coatings, or layers must not be used in high surface charging processes such as pneumatic conveying unless the breakdown strength across such materials is less than 4 kV.
Substantiation: In the absence of high surface charging processes such as pneumatic conveying surface charge densities are limited to 27 microcolumbs per square meter on non-conductive surfaces in air and only corona and brush discharges are possible. According to Section 9.5.2 of NFPA-77,, "Recommended Practice on Static Electricity," 2007 edition "No evidence is available, however, that a corona discharge is capable of igniting a dust cloud. Likewise, no evidence is available that a brush discharge can ignite dusts with MIEs greater than 3 mJ, provided that no flammable gas or vapor is present in the dust cloud." Similarly Section 7.2.5.3 of CENELEC TR50404,, "Electrostatics—Code of Practice for the Avoidance of Hazards Due to Static Electricity," 2003 edition, states that "…In the absence of flammable atmospheres with MIE less than 3 mJ, brush and corona discharges may be tolerated." Special consideration must be given to situations in which high surface charging processes are present since these can result in creation of so-called "propagating brush discharges." In such cases only non-conductive components having breakdown voltages <4 kV should be used (ref. Section 10.1.4.6 of NFPA-77 and Section 7.2.5.3 of CENELEC TR50404)
Committee Meeting Action: Accept in Principle
See Committee action on Committee Proposal 654-51 (Log #CP5).
Committee Statement: See Committee Action and the substantiation for Committee Proposal 654-51 (Log #CP5).
Number Eligible to Vote: 28
Ballot Results: Affirmative: 23
Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

654-53 Log #24 **Final Action: Accept in Principle**
(9.3.1.3)

Submitter: Robert L. Gravell, E. I. duPont de Nemours & Company, Inc.
Recommendation: Revise text as follows:
9.3.1.3 Bonding and grounding with a resistance of less than 1.0 x 106 ohms to ground shall be provided for conductive components; however, resistance to ground in metal systems is typically less than 10 ohms and values well in excess of this may be indicative of problems such as loose or corroded grounding components
Substantiation: While a resistance of less than 106 ohms is considered adequate for static charge dissipation the use of such a criterion for evaluating the adequacy of metal-to-ground connections can be misleading since the resistance of such grounds should be orders of magnitude below this value. The suggested rewording is consistent with sections 7.4.1.3 and 7.4.1.3.1 of NFPA-77, "Recommended Practice on Static Electricity," 2007 edition
Committee Meeting Action: Accept in Principle
Instead of adding the proposed language to the existing requirement in 9.3.1.3, add the following annex to this section:
A.9.3.1.3 Where the bonding/grounding system is all metal, resistance in continuous ground paths typically is less than 10 ohms. Such systems include those having multiple components. Greater resistance usually indicates that the metal path is not continuous, usually because of loose connections or corrosion. A grounding system that is acceptable for power circuits or for lightning protection is more than adequate for a static electricity grounding system.
Committee Statement: The recommended change from the submitter proposed non-mandatory language not suitable for the standard. The Committee accomplished the intent of the submitter by adding annex material based upon the submitter's reference to NFPA 77, *Recommended Practice on Static Electricity*.
Number Eligible to Vote: 28
Ballot Results: Affirmative: 23
Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.
Comment on Affirmative:
SCHERPA, T.: Suggest removing the last sentence from the new annex material. As it stands, this appendix implies that lightning protection systems or power circuits could be used as process equipment ground connections.

654-54 Log #26 **Final Action: Accept in Principle**
(9.3.2)

Submitter: Robert L. Gravell, E. I. duPont de Nemours & Company, Inc.
Recommendation: Revise text as follows:
9.3.2 ~~Where belt drives are used, the belts shall be electrically conductive and have a resistance of less than 1.0x106 ohms to ground~~ Significant electrostatic charging can occur during operation of conveyor belts used to transport materials or transmission belts used to drive rotating components. Belts used in Class II locations must meet the following requirements:
9.3.2.1 Conveyor belts operating at less than 5 m/s must have a surface resistivity less than 109 ohm/square on both surfaces or a resistance less than 109 ohms through the belt when measured at 20-25o C and 50% relative humidity; they must also be grounded by conductive pulleys. Guidelines provided in Section 9.3.2.2 must be followed where speed exceeds 5 m/s
9.3.2.2 Power transmission belts and high-speed conveyor belts must meet the following requirements:
1. Velocity not to exceed 30 m/s
2. Belt must meet the criterion that RxB < 105 ohm-m where R is the resistance measured at the inner side of the mounted transmission belt between an electrode halfway between the two pulleys and ground (ohms) and B is the width of a flat belt or twice the depth of the side face of a V belt (meters); alternatively resistance through the belt must be less than 109 ohms when measured at 20-25o C and 50% relative humidity
3. Belt must be grounded by conductive pulleys
Substantiation: The universal requirement for 'conductive belts' in any location where a combustible dust is handled is not justified. Per Section 10.4.1 of NFPA-77, "Recommended Practice on Static Electricity," 2007 edition, potential static charging on belts and conveyors should be addressed "…if a possibility exists that ignitable concentrations of flammable gases or vapors or combustible dusts or fibers might be present;" per NFPA-499 guidelines this means Class II locations. The changes suggested are consistent with guidelines

presented in Section 10.4 of NFPA-77 and Section 4.5 of CENELEC TR50404, "Electrostatics—Code of Practice for the Avoidance of Hazards Due to Static Electricity," 2003 edition.

Committee Meeting Action: Accept in Principle

See Committee action on Committee Proposal 654-51 (Log #CP5).

Committee Statement: See Committee Action and the substantiation for Committee Proposal 654-51 (Log #CP5).

Number Eligible to Vote: 28

Ballot Results: Affirmative: 22 Negative: 1

Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

Explanation of Negative:

SCHERPA, T.: Proposal 654-43 (Log #51) does not delete or modify the existing section 9.3.2, and therefore it does not address the intent of this proposal.

654-55 Log #9 **Final Action: Reject**
(9.3.3)

Submitter: Bill Stevenson, CV Technology, Inc.

Recommendation: Add new text as follows:

9.3.3 Intermediate Bulk Containers. Re-write in committee will be required. N.B. we will also need to add similar information in the air-material separator section of the new document.

Substantiation: It is now known (published findings of Martin Glor) that a brush discharge is not capable of igniting pure dust (he tried and failed using sulfur dust). Since a brush discharge is the only credible discharge from an FIBC, for pure dusts Type A and Type B containers are suitable and even preferred. This whole section needs to be revamped. Also, the composition of the bag is not the only issue, we also need to address bag liners.

Note: A brush discharge is also the only credible discharge from a filter in an air-separator. Groundable filters have been known to fail due to repeated air pulsation and once continuity to ground is lost between the filter element and the housing an isolated conductor is created. If the potential difference gets great enough, a spark would jump the gap from the filter to the housing. This usually occurs at a sharp point and has been identified as the source of ignition in filter air-separators. Using groundable filters for pure dusts is not a good idea.

Committee Meeting Action: Reject

Committee Statement: The submitter has provided no specific technical recommendation on which the Committee can act. The submitter is encouraged to review the ROP and consider submitting specific recommendations for the Committee to review during the Public Comment period.

Number Eligible to Vote: 28

Ballot Results: Affirmative: 23

Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

654-56 Log #27 **Final Action: Accept in Principle in Part**
(9.3.3.1(3))

Submitter: Robert L. Gravell, E. I. duPont de Nemours & Company, Inc.

Recommendation: Revise text as follows:

9.3.3.1(3) A Type C FIBC shall be permitted to be used for dispensing into any flammable vapor, gas, dust, or hybrid atmosphere for which the FIBC has been tested and found suitable, provided the FIBC is electrically grounded with a resistance of less than ~~1~~ 100 megaohms to ground.

Substantiation: A resistance of <100 megaohms to ground from any point on the surface of a Type C FIBC is considered sufficient for static charge dissipation per IEC 61340-4-4, "Electrostatics Part 4-4: Standard Test Methods for Specific Applications—Electrostatic Classification of Flexible Intermediate Bulk Containers (FIBC)". This higher resistance is also consistent with requirements for personnel grounding via static dissipative footwear per ASTM F2413-05. It is also recommended that a reference to IEC 61340-4-4 be added to both Section A.9.3.3.1 of Annex A and to the references listed in Annex G.

Committee Meeting Action: Accept in Principle in Part

Revise text as follows:

9.3.3.1(3) A Type C FIBC shall be permitted to be used for dispensing into any flammable vapor, gas, dust, or hybrid atmosphere for which the FIBC has been tested and found suitable, provided the FIBC is electrically grounded with a resistance of less than 1 megohm to ground as measured at the ground tab.

Committee Statement: The 100 megohm requirement that is proposed by the submitter is for the bag itself, while the current 1 megohm requirement is the measured resistance to ground from the tab and not to any other part of the IBC. The editorial correction retains the 1 megohm requirement but clarifies the point of reference for that measurement. Since the change to 100 megohm was not accepted, the inclusion of the IEC reference has not been made as suggested in the submitter's substantiation.

Number Eligible to Vote: 28

Ballot Results: Affirmative: 23

Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

654-57 Log #55 **Final Action: Accept in Principle in Part**
(9.3.5 (New))

Submitter: Albert I. Ness, Rohm and Haas Company

Recommendation: Add new text to read as follows:

9.3.5 Manual additions of solids through an open port or a manway into a vessel containing flammable vapors shall be permitted to be done in 50 lb (25 kg) batches or smaller.

9.3.5.1 The bags shall be constructed of paper, plies of paper and plastic in which the nonconductive plastic film is covered by paper on both sides, or antistatic plastic.

9.3.5.1.1 Direct emptying of powders from nonconductive plastic bags into a vessel that contains a flammable atmosphere shall be strictly prohibited.

9.3.5.1.2 Powder shall not be emptied from a nonconductive container in the presence of a flammable atmosphere.

9.3.5.1.3 Fiber drums or packages shall not have a loose plastic liner that can leave the package and behave like a plastic bag.

9.3.5.1.4 Metal chimes shall be grounded.

9.3.5.2 Personnel in the vicinity of openings of vessels that contain flammable liquids should be grounded, and special attention shall be paid to housekeeping, because accumulation of nonconductive residues (e.g., resins) on the floor or on items such as grounding clips can impair electrical continuity.

9.3.5.3 Bulk quantities shall be permitted to be charged in 50 lb (25 kg) batches with a ½ minute interval between charges.

Substantiation: The current requirements in NFPA 654 for manual addition of solids into a vessel containing flammable vapors is insufficient. This is a hazardous operation and the requirements are not sufficiently protective. They are less than the guidance in NFPA 77 Recommended Practice on Static Electricity. This proposal adds the advice from NFPA 77 as requirements as well as an open literature source, referenced below.

Committee Meeting Action: Accept in Principle in Part

Revise as shown:

9.3.5 Manual additions of solids through an open port or a manway into a vessel containing flammable atmospheres ~~vapors~~ shall be permitted to be done in 50 lb (25 kg) batches or smaller.

9.3.5.1* A documented risk assessment acceptable to the authority having jurisdiction shall address the potential for charge accumulation during dumping of the contents to produce a discharge that exceeds the MIE of the flammable atmosphere within the vessel.

A.9.3.5.1 The risk assessment should address considerations such as, container construction, solids properties, properties of the liquid, addition rate, material construction of the receiving vessel, agitating devices and intensity of agitation. Fiber drums or packages should not have a loose plastic liner that can leave the package and produce an incendive discharge.

9.3.5.1.2* Conductive components of the container shall be grounded.

A.9.3.5.1.2 For example, metal chimes on fiber drums should be grounded. For uncoated fiber drums, grounding one chime might be sufficient.

9.3.5.2* Personnel in the vicinity of openings of vessels that contain flammable atmospheres shall be grounded.

A.9.3.5.2 See NFPA 77 for recommended practices on the grounding of personnel.

9.3.5.3 Operators shall wear flame-resistant garments as specified in NFPA 2112 and personnel protective equipment during charging operations.

Committee Statement: The Committee corrected recommended text in several places to use mandatory statements as required per Manual of Style. The Committee added the risk assessment provision consistent with other application of the risk assessment approach found throughout the document. No substantiation was provided by the submitter in support of the proposed addition of 9.3.5.3 pertaining to bulk quantities of material and the 1/2 minute interval between batches. Without any specific basis for the time interval, the Committee did not accept this recommended addition to the standard at this time.

Number Eligible to Vote: 28

Ballot Results: Affirmative: 23

Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

Comment on Affirmative:

FEBO, JR., H.: The correct conversion for 50 lbs is 22.5 kg not 25 kg.

654-58 Log #23 **Final Action: Accept**
(9.7)

Submitter: Robert L. Gravell, E. I. duPont de Nemours & Company, Inc.

Recommendation: Revise text as follows:

9.7 The temperature of external surfaces, such as compressors; steam, water, or process piping; ducts; and process equipment in an area containing a combustible dust shall be maintained below ~~80 percent of~~ the minimum ignition temperature of the dust layer as determined by recognized test methods acceptable to the authority having jurisdiction ~~or 329°F (165°C), whichever is lower.~~ For organic dusts which may dehydrate or carbonize the temperature shall not exceed the lower of the ignition temperature or 165°C.

Substantiation: The suggested rewording is consistent with Section 500.8 (D)(2) of NFPA-70, "National Electrical Code," 2008 edition, which states that when establishing maximum surface temperature for electrical equipment "The

temperature marking specified in 500.8 (C) shall be less than the ignition temperature of the specific dust to be encountered. For organic dusts that may dehydrate or carbonize the temperature marking shall not exceed the lower of either the ignition temperature or 165ºC." The use of 165o C as an upper temperature limit is not justified in situations where carbonization is not an issue. It is suggested that the explanatory note for this section found in Annex A also be modified to be consistent with Section A.4.3.1.2 of NFPA-499, 2008 edition.
Committee Meeting Action: Accept
Committee Statement: Committee did not add the annex as suggested by the submitter in the substantiation as no specific wording was provided.
Number Eligible to Vote: 28
Ballot Results: Affirmative: 23
Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

654-59 Log #31 **Final Action: Accept in Principle**
(9.8)

Submitter: Brice Chastain, Georgia-Pacific
Recommendation: Revise text to read as follows:
9.8 Industrial Trucks. In areas ~~containing a combustible dust~~ where a deflagration hazard exists, only industrial trucks listed or approved for the electrical classification of the area, as determined by Section 6.6, where commercially available, shall be used in accordance with NFPA 505, *Fire Safety Standard for Powered Industrial Trucks Including Type Designations, Areas of Use, Conversions, Maintenance, and Operations*.
Substantiation: Diesel-powered front-end loaders suitable for use in hazardous locations have not been commercially available. See exact text contained in NFPA 664, paragraph A.7.5 addressing provisions to reduce the fire hazard from diesel-powered front-end loaders used in Class II hazardous areas as defined in Article 500 of NFPA 70. Recommend Annex material associated with paragraph 9.8 include these provisions.
Committee Meeting Action: Accept in Principle
Revise text to read as follows:
9.8 Industrial Trucks.
9.8.1 In areas ~~containing a combustible dust~~ where a dust explosion hazard or dust fire hazard exists, only industrial trucks listed or approved for the electrical classification of the area, as determined by Section 6.6, shall be used in accordance with NFPA 505, *Fire Safety Standard for Powered Industrial Trucks Including Type Designations, Areas of Use, Conversions, Maintenance, and Operations*.
9.8.2* Where industrial trucks, in accordance with NFPA 505, are not commercially available a documented risk assessment acceptable to the authority having jurisdiction shall be permitted to be used to specify the fire and explosion prevention features for the equipment used.
Add Annex to 9.8.2 as shown below:
A.9.8.2 Diesel-powered front-end loaders suitable for use in hazardous locations have not been commercially available. The following provisions can be used to reduce the fire hazard from diesel-powered front-end loaders used in Class II hazardous areas as defined in Article 500 of NFPA 70, National Electrical Code.
(1) Only essential electrical equipment should be used, and wiring should be in metal conduit. Air-operated starting is preferred, but batteries are permitted to be used if they are mounted in enclosures rated for Type EX hazardous areas.
(2) Where practical, a water-cooled manifold and muffler should be used.
(3) Loaders that are certified to meet the Mine Safety and Health Administration (MSHA) criteria (formerly Schedule 31) found in 30 CFR 36, "Approved Requirements for Permissible Mobile Diesel-Powered Transportation Equipment," are also acceptable in lieu of A.9.8.2 (1) and A.9.8.2 (2).
(4) The engine and hydraulic oil compartments should be protected with fixed, automatic dry chemical extinguishing systems.
(5) Loaders should have a high degree of maintenance and cleaning. Frequent cleaning (daily in some cases) of the engine compartment with compressed air could be necessary. Periodic steam cleaning should also be done.
(6) Loaders should never be parked or left unattended in the dust explosion hazard or dust fire hazard area.
Committee Statement: The Committee modified the submitter's wording to reflect that used in the standard for consistency (rather than deflagration hazard, the document addresses both a dust explosion hazard and a dust fire hazard). The words "where commercially available" were not added as recommended as the Committee believes that language weakens the requirement.
Number Eligible to Vote: 28
Ballot Results: Affirmative: 23
Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

654-60 Log #38 **Final Action: Accept**
(10.2)

Submitter: Thomas C. Scherpa, E. I. DuPont de Nemours & Company
Recommendation: Revise text to read as follows:
10.2 System Requirements.
Fire protection systems required by this standard shall comply with 10.2.1 through~~and~~ 10.2.9.
10.2.1* Fire-extinguishing agents shall be compatible with the conveyed materials.
10.2.2 Where fire detection systems are incorporated into pneumatic conveying systems, an analysis shall be conducted to identify safe interlocking requirements for air-moving devices and process operations.
10.2.3 Where firefighting water or wet product can accumulate in the system, vessel and pipe supports shall be designed to support the additional water weight.
Substantiation: Large amounts of firefighting water can be used in extinguishing activities, both from fixed suppression systems and from manual application of hose streams. Wet product can plug vessel outlets, allowing the water to accumulate in the system. Vessel and pipe supports should be designed to withstand the additional gravity load to prevent structural collapse. Collapsing equipment could endanger emergency response crews.
Committee Meeting Action: Accept
Number Eligible to Vote: 28
Ballot Results: Affirmative: 23
Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

654-61 Log #52 **Final Action: Reject**
(10.2.9.3)

Submitter: Tony L. Thomas, Flamex, Inc.
Recommendation: Add new text to read as follows:
The requirements of 10.2.9.1 shall not apply when the abort damper circuit and releasing device are fail-safe and the damper automatically diverts airflow upon a failure of the releasing device or circuit.
Substantiation: A typical abort gate has an electromagnet as the releasing device. When the releasing circuit opens, the electromagnet loses power and the damper falls into the divert position. One or more 110 VDC magnets are used because there would be additional power supply considerations if low voltage devices were used.
Committee Meeting Action: Reject
Committee Statement: Series wired circuits can be supervised to allow additional signaling as required for safe shutdown.
Number Eligible to Vote: 28
Ballot Results: Affirmative: 23
Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

654-62 Log #CP9 **Final Action: Accept**
(10.4.2.3 and A.10.4.2.1 (new))

Submitter: Technical Committee on Handling and Conveying of Dusts, Vapors, and Gases,
Recommendation: Add the following new text:
10.4.2.1* Portable spray hose nozzles that are listed or approved for use on Class C fires shall be provided in areas that contain dust, to limit the potential for generating unnecessary airborne dust during fire-fighting operations.
A.10.4.2.1 A nozzle listed or approved for use on Class C fires produces a fog discharge pattern that is less likely, than a straight stream nozzle, to suspend combustible dust, which could otherwise produce a dust explosion potential.
10.4.2.3 It shall be permitted to use straight stream nozzles or combination nozzles to reach fires in locations that are otherwise inaccessible with the nozzles specified in 10.4.2.1.
Substantiation: Annex material is required to explain the basis for the requirement that portable spray nozzles be limited to nozzles listed or approved for use in Class C fires. The additional requirement specifies conditions when it is permissible to use straight stream nozzles.
Committee Meeting Action: Accept
Number Eligible to Vote: 28
Ballot Results: Affirmative: 23
Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

654-63 Log #5 **Final Action: Reject**
(10.5)

Submitter: Bill Stevenson, CV Technology, Inc.
Recommendation: New wording needs to be crafted in committee to require automatic sprinklers for areas handling combustible dust to be compatible with the IBC and IFC.
Substantiation: This explanation was developed by a client and is presented here as the basis for consideration of a proposal to require automatic sprinklers for facilities handling combustible dust under paragraph 10.5.
You remember correctly that we did an exhaustive study this year of both the IBC and IFC, as they relate to Combustible Dust Manufacturing. In both cases we employed the 2006 editions. Based upon this analysis, our view is that

facilities employed for Combustible Dust Manufacturing that are in excess of 12,000 sq ft (pretty much all our plants) are required to have Automatic Sprinkler Systems. Our logic is as follows:

(1) Both the IBC and the IFC rely heavily on "Control Tables", which list the maximum allowable quantities of hazardous materials allowed per control area. In the case of the IFC, Article 2703.1.1 states as follows:

"The maximum allowable quantity of hazardous materials per control area shall be as specified in Tables 2703.1.1(1) through 2703.1.1(4)". The companion table in the IBC is Table 307.1(1).

(2) In both cases (the IBC and the IFC), the tables do not list combustible dust at all. In other words, this class of materials literally does not exist in the table. Our Senior Code Specialist has confirmed that this means there is no requirement for combustible dusts at all, at least as the requirement is related to any and all Articles in the IBC and the IFC that refer specifically to the respective tables.

(3) Anecdotally, there are multiple cases in both the IBC and the IFC where Combustible Dust is suggested to be a hazardous material that may be required (by implication) to reside in an H-2 area. That said, the firm requirement does not exist.

(4) In Chapter 2 of the IFC (Definitions), it indicates the following:

High-hazard Group H. High-hazard Group H occupancy includes, among others, the use of a building or structure, or a portion thereof, that involves the manufacturing, processing, generation or storage of materials that constitute a physical or health hazard in quantities in excess of quantities allowed in control areas constructed and located as required in Section 2703.8.3. Hazardous uses are classified in Groups H-1, H-2, H-3, H-4 and H-5 and shall be in accordance with this code and the requirements of Section 415 of the International Building Code.

Exceptions: The following shall not be classified in Group H, but shall be classified in the occupancy that they most nearly resemble:

1. Buildings and structures that contain not more than the maximum allowable quantities per control area of hazardous materials as shown in Tables 2703.1.1(1) and 2703.1.1(2), provided that such buildings are maintained in accordance with this code.

(5) Logically, since the exception applies (Combustible Dust doesn't exceed the amount in the table since it is not listed in the table), so the bottom line is this: Combustible Dust Manufacturing, Processing and Handling should be classified in the occupancy that it most nearly resembles.

(6) A quick read of the Occupancy Classes in Chapter 2 of the IFC (Definitions) confirms that the only choice is Factory Industrial Group F, the "Factory Industrial Group". The description reads as follows:

F occupancy includes, among others, the use of a building or structure, or a portion thereof, for assembling, disassembling, fabricating, finishing, manufacturing, packaging, repair or processing operations that are not classified as a Group H high-hazard or group S storage occupancy.

(7) Factory Industrial Group F is further sub-divided into F-1 (Moderate Hazard) and F-2 (Low Hazard). It is reasonable to classify Combustible dust Manufacturing, Processing and Handling as F-1.

(8) All of the logic thus far was necessary to construct a frame work for determining the requirement for Automatic Sprinkler Systems (a sub-set of Fire Protection systems, found in the IFC Chapter 9).

(9) Chapter 9, Section 903, Article 903.2.3 states the following:

903.2.3 Group F-1. An automatic sprinkler system shall be provided throughout all buildings containing a Group F-1 occupancy where one of the following conditions exists:

1. Where a Group F-1 fire area exceeds 12,000 sq ft (1115 m^2);

2. Where a Group F-1 fire area is located more than three stories above grade plane; or

3. Where the combined area of all Group F-1 fire areas on all floors, including any mezzanines, exceeds 24,000 sq ft (2230 m^2).

Committee Meeting Action: Reject

Committee Statement: No specific recommendation was provided with the submitter's proposal.

Number Eligible to Vote: 28

Ballot Results: Affirmative: 23

Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

654-64 Log #CP12 **Final Action: Accept**
(10.9 (New))

Submitter: Technical Committee on Handling and Conveying of Dusts, Vapors, and Gases,

Recommendation: Add a new Section on Impairment:

10.9 Impairments of Fire Protection and Explosion Prevention Systems.

10.9.1* Impairments shall include anything that interrupts the normal intended operation of the fire protection or explosion prevention system.

10.9.2* A written impairment procedure shall be followed for every impairment to the fire protection or explosion prevention system.

10.9.3* Impairments shall be limited in size and scope to the system or portion thereof being repaired, maintained, or modified.

10.9.4* Impairment notification procedures shall be implemented by management to notify plant personnel and the authority having jurisdiction of existing impairments and their restoration.

Add accompanying annex also:

A.10.9.1 Impairments can include isolating of fire pump controllers, closing of sprinkler system control valves, and isolating and disabling or disconnecting of detection and suppression systems.

A.10.9.2 The impairment procedure consists of identifying the impaired system and alerting plant personnel that the protection system is out of service.

A.10.9.3 The facility manager is responsible for ensuring that the condition causing the impairment is promptly corrected.

A.10.9.4 When the impairment notification procedure is used, it triggers followup by the relevant authorities having jurisdiction. This followup helps to ensure that impaired fire and explosion protection systems are not forgotten. When the system is closed and reopened, most companies notify their insurance company, broker, or authority having jurisdiction by telephone or other predetermined method.

Substantiation: The standard permits certain practices with regard to location and protection of equipment within dust hazard process facilities based upon the installation and use of specific fire protection and explosion prevention systems. This new section on impairment establishes procedures to be followed any time those systems are taken out of service or any time there is an interruption in the operation of performance of the system. The introduction of this new section on impairment is consistent with the Management of Change requirements currently in the standard as the impairment represents a change in status of some aspect of the process or equipment.

Committee Meeting Action: Accept

Number Eligible to Vote: 28

Ballot Results: Affirmative: 23

Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

654-65 Log #CP13 **Final Action: Accept**
(11.2.1)

Submitter: Technical Committee on Handling and Conveying of Dusts, Vapors, and Gases,

Recommendation: Revise existing 11.2.1 as follows:

11.2.1 Operating and maintenance procedures ~~and emergency plans~~ shall be developed.

Add a new 11.2.2:

11.2.2 A written emergency response plan shall be developed for preventing, preparing for, and responding to work-related emergencies including but not limited to fire and explosion.

renumber existing 11.2.2 to 11.2.3

Substantiation: This change by the Committee clarifies that there are operating and maintenance procedures required as part of plans within the facility that are in addition to the emergency plan that is also required. The Committee separated the emergency plan requirement to emphasize that it is a separate element that must also be prepared.

Committee Meeting Action: Accept

Number Eligible to Vote: 28

Ballot Results: Affirmative: 23

Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

654-66 Log #CP10 **Final Action: Accept**
(11.5 (New))

Submitter: Technical Committee on Handling and Conveying of Dusts, Vapors, and Gases,

Recommendation: Revise Chapter 11 to include a new section on Contractors and Subcontractors:

11.5 Contractors and Subcontractors.

11.5.1* Contractors performing work involving the installation, repair, or modification of buildings (interior and exterior), machinery, fire protection equipment, and so forth, shall be trained, and only qualified contractors shall be employed.

11.5.2 Companies that hire contractors to operate their equipment shall ensure that those contractors are properly trained and qualified to operate the equipment and perform the work. Written documentation shall be maintained detailing the training that was provided and who received it.

11.5.3 Contractors working on or near a given process shall be made aware of the potential hazards from and exposures to fire, explosion, or toxic releases.

11.5.4* Contractors shall be trained and required to comply with the facility's safe work practices and policies, including but not limited to equipment lockout/tagout permitting, hot work permitting, fire system impairment handling, smoking, housekeeping, use of personal protective equipment, and so forth.

11.5.5 Contractors shall be made aware of the facility's emergency response and evacuation plan.

11.5.6 Contractors shall be informed of whom to report emergencies to and be advised of safe egress points and evacuation areas in the event of an emergency such as fire, explosion, or toxic release.

The following annex items are also to be added:

A.11.5.1 Qualified contractors should have proper credentials, which include applicable American Society of Mechanical Engineers (ASME) stamps, professional licenses, and so forth.

A.11.5.4 It is suggested that annual meetings be conducted with regular contractors to review the facility's safe work practices and policies. Some points to cover include to whom the contractors would report at the facility, who at the facility can authorize hot work or fire protection impairments,

smoking and nonsmoking areas, and so forth.
Substantiation: The Committee recognizes that it is important to establish requirements applicable to contractors and subcontractors. Industry statistics demonstrate that contractors and subcontractors contribute to incidents involving dust fires and explosions and must be aware of practices and safeguards in place to prevent such incidents.
Committee Meeting Action: Accept
Number Eligible to Vote: 28
Ballot Results: Affirmative: 23
Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.
Comment on Affirmative:
JENNETT, J.: A.11.5.1 Not all jobs performed by contractors require ASME stamps.
This section should be eliminated and allow state and local codes to dictate when a ASME stamp is required.

654-67 Log #21 **Final Action: Reject**
(A.1.1)

Submitter: Peter Levitt, Sternvent Company, Inc.
Recommendation: Revise text as follows:
A.1.1 Examples of industries and materials, covered by this standard, that handle combustible particulate solids, either as a process material or as a fugitive or nuisance dust, include but are not limited to the following:
(1) ~~Agricultural~~, Chemicals ~~and food commodities~~, fibers and textile materials.
~~(2) Forest and furniture products industries~~
~~(3) Metals processing~~
(2) Paper products
(3) Pharmaceuticals
(4) Resource recovery operations (tires, municipal solid waste, metal, paper or plastic recycling operations)
(5) ~~Wood, metal or~~ Plastic fabricators
Substantiation: I have excluded materials that are covered by other NFPA standards, called out in 1.4.1.
The emphasis in A.1.1 should be on the materials, products or industries covered by 654.
Possibly the list can be improved by including other examples.
Committee Meeting Action: Reject
Committee Statement: The documents that cover the recommended deleted items presently refer to NFPA 654 for some provisions. Those proposed topics for deletion by the submitter are still covered in part by NFPA 654 as the other NFPA documents covering those specific dust types direct the user to NFPA 654 for requirements on pneumatic conveying. For that reason the Committee does not believe it is appropriate to delete the items as proposed.
Number Eligible to Vote: 28
Ballot Results: Affirmative: 23
Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

654-68 Log #CP14 **Final Action: Accept**
(A.3.3.3 Air Moving Device)

Submitter: Technical Committee on Handling and Conveying of Dusts, Vapors, and Gases,
Recommendation: Revise text to read as follows:
A.3.3.3 Air-Moving Device (AMD). An air-moving device is a fan or blower. ~~, centrifugal fan, or mixed flow fan. These devices have previously been called blowers or exhausters.~~ A general description of each follows:
a. Fans:
(1) A wide range of devices that utilize an impeller, contained within a housing, that when rotated create air/gas flow by negative (vacuum) or positive differential pressure.
(2) These devices are commonly used to create comparatively high air/gas volume flows at relatively low differential pressures.
(3) These devices are typically used with ventilation and/or dust collection systems.
(4) Examples are centrifugal fans, industrial fans, mixed or axial flow fans, inline fans, etc.
b. Blowers:
(1) A wide range of devices that utilize various shaped rotating configurations, contained within a housing, that when rotated create air/gas flow by negative (vacuum) or positive differential pressure.
(2) These devices are commonly used to create comparatively high differential pressures at comparatively low air/gas flows.
(3) The most common use of these devices are with pneumatic transfer, HVLV (High-Velocity, Low Volume) dust collection, and vacuum cleaning systems.
(4) Examples are PD (Positive Displacement) blowers, screw compressors, multi-stage centrifugal compressors/blowers and regenerative blowers.
Substantiation: Existing appendix information is incomplete and inaccurate. The proposed text provides additional information based on the terminology used routinely by those in the air handling industry.
Committee Meeting Action: Accept
Number Eligible to Vote: 28
Ballot Results: Affirmative: 23
Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

654-69 Log #7 **Final Action: Accept in Principle**
(A.4.2.1 Various)

Submitter: Bill Stevenson, CV Technology, Inc.
Recommendation: Add new text as follows:
This is not suggested wording, rather it is a suggested approach. Could we add annex material to help users determine where an explosion hazard exists?
Substantiation: The phrase "where an explosion hazard exists..." is found in several places in the document. Nowhere in the document can be found information on how to determine where an explosion hazard exists.
Committee Meeting Action: Accept in Principle
Add the following text to the end of the existing A.4.2.1:
To determine if a dust explosion hazard exists, consider the following:
1. Is the dust explosible? Determine using either ASTM E 1226 or equivalent.
2. Determine where in the process a dust cloud sufficient to support a deflagration could occur. Use loss records and knowledge of process conditions to make this assessment.
3. Identify likely ignition sources. Recognize that ignition sources are complex and not always predictable. It is best to assume ignition is possible in all cases.
4. Assess the likelihood of an event. For example, a material with a low MIE has a greater likelihood of ignition, all else being equal. Determine MIE, if appropriate, using ASTM E 2019.
5. In terms of a worst case scenario, consider what are the predictable consequences? Start with predictable primary events and then secondary events.
6. If the consequences are intolerable to either the owner/operator or the AHJ ask:
a. Can the risk be eliminated?
b. Can controls be applied to minimize the likelihood?
c. Can the risk be tolerated utilizing mitigation techniques to reduce or control the consequences?
Committee Statement: The Committee worked with the submitter to develop language for inclusion in the annex that addresses the concern identified by the submitter. Determining that a dust explosion hazard exists is a critical element in the application of the standard; this annex commentary offers an approach that can be followed to make that determination.
Number Eligible to Vote: 28
Ballot Results: Affirmative: 23
Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

654-70 Log #37 **Final Action: Reject**
(A.6.6.2)

Submitter: Erdem A. Ural, Loss Prevention Science & Technologies, Inc.
Recommendation: Revise Table A.6.6.2 to account for the MIE, LAYER AIT, CLOUD AIT, AND DUST RESISTIVITY.
Substantiation: Subject table is too conservative for some dusts and not nearly conservative enough for others.
Committee Meeting Action: Reject
Committee Statement: The submitter has not provided specific data to be included in the revision to the table.
Number Eligible to Vote: 28
Ballot Results: Affirmative: 23
Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

654-71 Log #53 **Final Action: Accept in Principle**
(Figure C.2.1)

Submitter: Tony L. Thomas, Flamex, Inc.
Recommendation: Revise Figure C.2.1 as follows:
Move location of spark detectors from outlet of air-material separator to inlet of air-material separator.
Substantiation: C.2.2 states that "the detectors are usually situated on the inlet to the collector as shown in Figure C.2.1". However, the detectors are shown on the outlet of the collector.
Committee Meeting Action: Accept in Principle
Revise 2nd sentence of C.2.2 as shown:
C.2.2 Dual Detectors. Because spark detectors have limited fields of view, most systems require two detectors to cover a round duct. ~~The detectors are usually situated on the inlet to the collector, as shown in Figure C.2.1.~~ Both detectors are usually situated at the same duct diameter located on the discharge side of the collector, as shown in Figure C.2.1. This system is the only type of spark detection system required by this standard. However, because it is a minimum compliance standard, additional measures are allowed.
Revise Figure C.2.1 to show detectors on either side of duct at the outlet only, opposite each other (like in Figure C.2.4).

(See Figure C.2.4 on Page 28.)

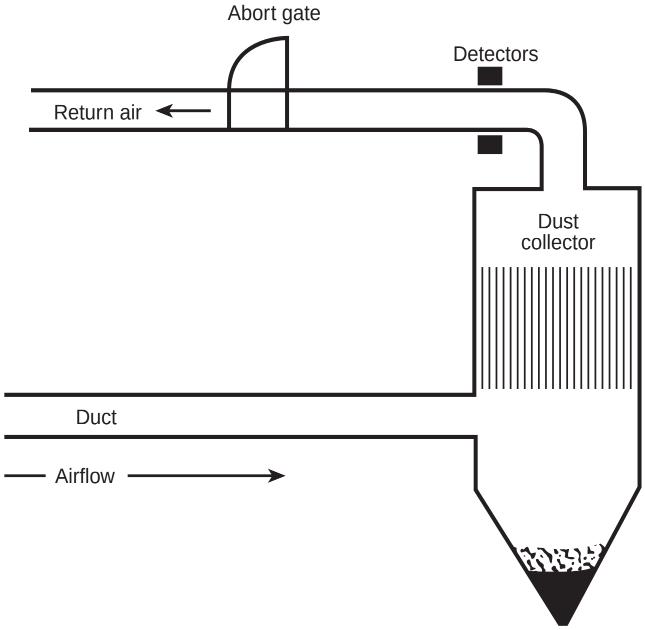

Figure C.2.1

Committee Statement: As noted by the submitter, the current Figure C.2.1 and the written description in the existing paragraph didn't match; the Committee's action to revise the text and the figure make it so they now match.
Number Eligible to Vote: 28
Ballot Results: Affirmative: 23
Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

654-72 Log #54 **Final Action: Reject**
(Figure C.2.1 and C.2.2)

Submitter: Tony L. Thomas, Flamex, Inc.
Recommendation: Revise text to read as follows:
The detectors are usually located on the inlet and outlet of the collector.
Substantiation: We believe that the highest level of protection would be achieved with an additional detection location on the outlet of the air-material separator. We have seen dust collector fires and deflagrations in the past that were not caused by a spark entering the dust collector through the inlet duct.
Committee Meeting Action: Reject
Committee Statement: See Committee Action and Statement on Proposal 654-71 (Log #53).
The detectors are not shown on inlet in Figure C.2.1, since it describes the minimal system where the detector must be on the outlet; Figure C.2.4 shows detectors on both inlet and outlet.
Number Eligible to Vote: 28
Ballot Results: Affirmative: 23
Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.

654-73 Log #14 **Final Action: Reject**
(Annex D)

Submitter: Robert G. Zalosh, Firexplo
Recommendation: Revise text as follows:
This Appendix is intended to explain and quantify how the potential ignition of a localized dust cloud can lead to significant pressure and flame injury hazards. It also provides a derivation of the maximum allowable accumulated dust as specified in the body of NFPA 654.

D.1 If a fraction of the accumulated combustible dust in an enclosure of volume V is dispersed so as to form a local dust cloud of optimum concentration, c_{opt}, in a part of the enclosure, the mass of dust in the cloud is equal to $c_{opt} f_{pv} V$, where fpv denotes the fraction of the volume occupied by the dust cloud. If the dispersed fraction of the accumulated dust is designated as disp, the accumulated mass corresponding to the mass in the dust cloud is given by $c_{opt} f_{pv} V/_{disp}$. The value of copt can be obtained from ASTM E1226 tests with the value corresponding to concentration at which the maximum-rate-of-pressure occurs. If there is a plateau rather than a well defined maximum in the plot of rate-of-pressure-rise versus dust concentration, the value of c_{opt} would be the concentration at the beginning of the plateau. Typical values are in the range 500 to 1000 g/m^3.

D.2 According to Paragraph 8.3.4 of NFPA 68-2007, no deflagration venting is needed if f_{pv} is less than or equal to P_{red}/P_{max} because the deflagration pressure will not exceed P_{red}, the maximum allowable deflagration pressure in the enclosure to preclude damage. The value of P_{red} per NFPA 68 is usually taken as 2/3rd of the enclosure yield strength for low strength enclosures. If we set $f_{pv} = P_{red}/P_{max}$ for unoccupied enclosures, then the maximum allowable accumulated dust in the enclosure, m_{Dmax}, is given by

$$m_{D\max} = \frac{c_{opt} V P_{red}}{\chi_{disp} P_{\max}}$$

The volume of enclosures with a uniform height, H, and floor area, A_{floor}, is equal to HA_{floor}. If we assume that χ_{disp} = ¼, then

$$m_{D\max} = \frac{4 c_{opt} H A_{floor} P_{red}}{P_{\max}}$$

D.3 If the dusty enclosure is normally occupied, then the primary personnel hazard is burn injury due to contact or proximity with the burning dust in the dust cloud. The burned dust cloud will be larger than the unburned original dust cloud because of the gas expansion associated with the flame temperature. In the absence of any compression or pressure development, the gas expansion ratio is roughly equal to the temperature ratio, which is approximately equal to $(P_{max} + P_a)/P_a$, assuming the cloud was ignited at atmospheric pressure, P_a. Therefore, the volume of burned gas due to ignition of a cloud of volume $f_{pv}V$, is equal to $(P_{max} + P_a)f_{pv}V/P_a$. In order to have at most a 5% chance of the being immersed in the dust cloud, the burned gas volume should be at most 0.05V.

The corresponding maximum mass of dust in the enclosure in this case is

$$m_{D\max} = \frac{c_{opt} V (0.05 P_a)}{\chi_{disp} (P_{\max} + P_a)}$$

If we make the same assumption as in D.2, i.e. that χ_{disp} = ¼, and express V in terms of height multiplied by floor area, then

$$m_{D\max} = \frac{c_{opt} 4 H A_{floor} (0.05 P_a)}{(P_{\max} + P_a)}$$

D.4 The maximum allowable dust accumulation can also be expressed as the product of dust surface area, Adust, and the dust maximum allowable surface mass density, m''_{Dmax}. The value of m''_{Dmax} corresponding to the equation for mDmax in D.2 is

$$m''_{D\max} = \frac{4 c_{opt} H A_{floor} P_{red}}{(A_{dust} P_{\max})}$$

and the associated maximum allowable average dust layer thickness, t_{Dmax}, is

$$t_{D\max} = \frac{4 c_{opt} H A_{floor} P_{red}}{\rho_{bulk} A_{dust} P_{\max}}$$

where t_{Dmax} is in the same units as H, copt is in the same units as the accumulated dust bulk density, ρ_{bulk}, and the areas and pressures are in consistent units.

D.5 The maximum allowable surface mass density and layer thickness corresponding to the occupied enclosure as described in D.3 are

$$m''_{D\max} = \frac{4 c_{opt} H A_{floor} (0.05 P_a)}{A_{dust} (P_{\max} + P_a)}$$

$$t_{D\max} = \frac{4 c_{opt} H A_{floor} (0.05 P_a)}{\rho_{bulk} A_{dust} (P_{\max} + P_a)}$$

D.6 As an example, consider an enclosure with dust accumulated on equipment, structures, and the floor, such that the dust area is equal to 10% of the floor area, i.e. A_{floor}/A_{dust} = 10. Let us assume that the value of c_{opt} is equal to 500 g/m^3 and the bulk density is 1200 x 103 g/m^3. If we take P_a to be 1 bar abs, and P_{max} = 9 barg, then the equation in D.5 produces m''_{Dmax} = 0.2(500 g/m^3)H. If H = 4 m, m''_{Dmax} = 400 g/m^2. The corresponding value of t_{Dmax} is 400/1200 mm = 0.33 mm. Alternatively, if the dusty area is only equal to 5% of the floor area and the bulk density is 600 kg/m^3, the allowable layer thickness is 1.32 mm.

Continue with current C.2 (5), (6), and (7).
Substantiation: The current Annex D does not account for explosibility properties of the dust material in question. The proposed revision accounts for pertinent explosibility properties and provides an explanation and derivation of the equations being proposed to replaced the current specified maximum allowable dust layer thickness in the body of NFPA 654.
Committee Meeting Action: Reject
Committee Statement: The recommended revision to Annex D does not match the revision to 6.1 that has been approved by the Committee as Committee Proposal 654-15 (Log #CP4). The Committee intends to rework the example based upon the new method contained in 654-15 (Log #CP4) and to submit as a Public Comment for inclusion in the ROC.
Number Eligible to Vote: 28
Ballot Results: Affirmative: 23
Ballot Not Returned: 5 Barton, J., Gillis, J., Hunter, R., Hurst, G., Ness, A.