IN-BUILDING EMERGENCY COMMUNICATIONS

STUDY GROUP REPORT

May 10th, 2022

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The scope of the study group was to review the existing in-building emergency communications (IBEC) systems provisions and assess their need for improvements.[1]

The study group convened virtually (through Adobe Connect) four times: December 1st, 2021, December 29th, 2022, January 18th, 2022, and February 24th, 2022. At each of these meetings, the study group discussed the issues and shared pertinent information and concerns related to IBEC systems, as well as the efficacy of the current building code requirements and whether changes to the current building code requirements are warranted.

Currently, the responsibility for the installation of IBEC systems is split between the building owner and the locality in which the building is being constructed. Building owners are required to install infrastructure cabling for the systems while the locality is responsible for any additional communication equipment required for the operation of the system.[2] After installation, the locality is responsible for maintenance, testing and any necessary system modifications or upgrades, as well as all associated costs.[3] Some members support maintaining the responsibilities as they currently are in the VCC, while other members support placing the full responsibility on one entity.

Additionally, the Virginia Construction Code (VCC) includes a requirement to install "radiating cable", for IBEC systems, which is a cabling utilized in systems that are uncommon today, and the VCC provides very limited specifications for the design and installation of IBEC systems.

The Study Group considered the following code change proposals related to IBEC systems:

Proposal B918.1-21: The Virginia Fire Chiefs Association representative drafted proposal and shared it with the study group for deliberation. Some significant proposal details include:

- Adds references in the VCC to Section 510.4 and 510.5 of the International Fire Code (IFC) for the design, installation, and testing of IBEC systems.
- Transfers the responsibility for the installation of the entire IBEC system from the locality to the building owner.

The following Study Group members support proposal B918.1-21:

- Department of General Services
- Backhaul Engineering
- Virginia Building and Code Officials Association
- Virginia Fire Prevention Association

[1] For a full list of Study Group members, please see Appendix B, "Study Group Members". For a full list of participants during each Study Group meeting, please see Appendix A, "Meeting Summaries, Agendas, Participants".

[2] The provisions for In-Building Emergency Communications Systems are located in Section 918 of the Virginia Construction Code: https://codes.iccsafe.org/content/VCC2018P3/chapter-9-fire-protection-and-life-safety-systems#VCC2018P3_Ch09_Sec918

[3] The provisions for the maintenance of In-Building Emergency Communications Systems are located in Section 510 of the Virginia Statewide Fire Prevention Code: https://codes.iccsafe.org/content/VFC2018P2/chapter-5-fire-service-features#VFC2018P2_Ch05_Sec510.1

- Virginia Fire Chiefs Association

The following Study Group members do not support proposal B918.1-21:

- International Association of Electrical Inspectors, Virginia Chapter
- Apartment & Office Building Association/Virginia Apartment Management Association
- Virginia Restaurant, Lodging & Travel Association

The primary opposition to this proposal centered on the increased cost-burden to building owners since the portion of the system that is currently required to be provided by the locality would now be required to be provided by the building owner.

Proposal B918.1(2)-21: Technical specifications related to the design and installation of IBEC systems are very limited in the current VCC. At the request of the study group, DHCD staff drafted proposal B918.1(2)-21 to address this issue and shared it with the study group for deliberation. Some significant proposal details include:

- Adds a reference in the VCC to sections 510.4 and 510.5 of the International Fire Code for the design, installation, and testing of IBEC systems.
- Does not change the existing VCC provisions regarding locality and building owner responsibilities (installation, testing, maintenance, upgrades, etc.).
- Deletes section 2702.2.3 in the IBC to reduce confusion since these requirements are covered in sections 510.4 and 510.5 of the International Fire Code

The following Study Group members support proposal B918.1(2)-21:

- Apartment & Office Building Association/Virginia Apartment Management Association
- Backhaul Engineering
- Virginia Restaurant, Lodging & Travel Association
- Virginia Fire Prevention Association
- Virginia Fire Chiefs Association

The following Study Group members do not support proposal B918.1(2)-21:

- International Association of Electrical Inspectors, Virginia Chapter
- Department of General Services
- Virginia Building and Code Officials Association

The primary opposition to this proposal was that it does not make sense to maintain the split-responsibility for the installation of the IBEC system between the building owner and the locality. Further, opponents felt that it would be incongruent to support both the VFCA proposal and this DHCD staff proposal given the competing requirements for whom is responsible for the installation of the IBEC system.

Proposal B918.1.1-21: Current VCC provisions for IBEC systems require installation of radiating cable; however, radiating cable systems are not common today. At the request of

the study group, DHCD staff drafted proposal B918.1.1-21 to address this issue and shared it with the study group for deliberation. Some significant proposal details include:

- Replacing “radiating cable” with “cabling” to allow designers to opt for cabling other than radiating cable.
- Allows for new cabling technologies that would otherwise have been prevented by the existing limiting language.

The following Study Group members support proposal B918.1.1-21:

- Apartment & Office Building Association/Virginia Apartment Management Association
- Virginia Department of Fire Programs
- Virginia Restaurant, Lodging & Travel Association
- Virginia Fire Prevention Association
- Virginia Fire Chiefs Association
- Virginia Building and Code Officials Association

The following Study Group members do not support proposal B918.1.1-21:

- International Association of Electrical Inspectors, Virginia Chapter
- Department of General Services

The members that do not support this proposal did not provide reasoning for their opposition.

The report that follows provides a summary of the discussions, including questions and concerns that were raised. Supporting documents and the summaries from each of the four study group meetings are included as appendices following this report.

Note: the links referenced throughout the report were active as of the writing of this report.

BACKGROUND

During the 2003 Session of the Virginia General Assembly, the Virginia Department of Fire Programs, with the assistance from the Departments of Emergency Management and Housing and Community Development, was requested in House Joint Resolution 588 (HJ 588) to study the feasibility of adopting requirements within the Commonwealth that will ensure buildings are constructed and equipped to permit effective and reliable public safety radio communications for emergency personnel operating within them.[5]

At the same time, the Virginia General Assembly unanimously passed House Bill 2529, which would become state law requiring the Board of Housing and Community Development to promulgate regulations as part of the Building Code requiring such new commercial, industrial, and multifamily buildings be designed and constructed so that emergency public safety personnel may send and receive emergency communications from within those structures or equipped with emergency communications equipment so that emergency public safety personnel may send and receive emergency communications from within those structures.[6] [7]

In December of 2004, as a result of the HJ 588 feasibility study and the new state law, the Virginia Department of Fire Programs and the Board of Housing and Community Development created an Ad-Hoc Committee on In-Building Emergency Communication Systems.[8] Though the code change proposals developed by this Ad-Hoc Committee did not receive consensus, the work of the committee laid the framework for the Ad-Hoc Committee during the following code cycle.

In January of 2007, the Ad-Hoc Committee on In-Building Emergency Communication Systems was reconvened and attempted to address the issues that had been brought up previously:

- Costs of the systems
- The party responsible for paying for additional IBEC equipment when interference is caused by new development
- How to interface the entire public safety spectrum used by all responders –
    - Mixed media/technology
    - Different ages of equipment
    - Different power outputs
- Potential legal issues faced by building owners when the equipment does not operate properly and the equipment failure leads to lost lives or serious injuries
- Technical issues with current systems

In October of 2007, the Stakeholder's Meeting for Further Consideration of Non-Consensus Items was presented with an IBEC code change proposal that was developed with consensus between the Ad-Hoc IBEC Committee, Workgroup 2, and Workgroup 3. This proposal received consensus for approval at this meeting and was approved by the Board of Housing and Community Development for inclusion in the 2006 edition of the Virginia Construction Code. The

[5] House Joint Resolution 588: see Appendix C, "Supporting Documentation"
[6] House Bill 2529: see Appendix C, "Supporting Documentation"
[7] State Law § 36-99.6:2: https://law.lis.virginia.gov/vacode/title36/chapter6/section36-99.6:2/
[8] HJ 588 Feasibility Study: see Appendix C, "Supporting Documentation"

language approved for the 2006 edition remains mostly unchanged in the current Virginia Construction Code.[9]

During the 2018 Code Development Cycle, the Board of Housing and Community Development considered three code change proposals to amend the Virginia Construction Code IBEC requirements.[10]

- **B916.1-18 (Approved)** – Added exception #6 to 918.1 in the Virginia Construction Code, which provides an exception for the installation of IBEC systems in "buildings in localities that do not provide the additional communication equipment required for the operation of the system."
- **B916-18 (Not approved)** – Proposed adding technical requirements (system monitoring, installation per NFPA 1221 and NFPA 72, testing per NFPA 1221 and NFPA 72, critical area designations), and changing the responsibility for the installation of additional equipment for the IBEC system from the locality to the building owner.
- **B918.2-18 (Not approved)** – Proposed referencing the IFC for all requirements, while maintaining the five existing Virginia exceptions as outlined in the 2015 Virginia Construction Code.

The Board of Housing and Community Development approved B916.1-18, but determined that additional discussions were needed and directed DHCD staff to convene a group of interested stakeholders to continue the discussions during the 2021 Code Development Cycle.

The objectives for this study group were to:

- Gather information and data for review and discussion
- Identify issues with current requirements
- Identify areas of agreement and/or disagreement
- Identify areas of support and/or opposition
- Identify possible improvements to current requirements
    - Submit proposal(s) to update existing requirements (if applicable)
- Summarize findings or recommendations
- Review any related proposals submitted during the 2021 cycle (if applicable)

[9] 2006 IBEC Code Change Proposal: see Appendix C, "Supporting Documentation"
[10] B916.1-18, B916-18, and B918.2-18: see Appendix C, "Supporting Documentation"

CURRENT UNIFORM STATEWIDE BUILDING CODE (USBC) REQUIREMENTS

Current code (2018 USBC, effective July 1, 2021) requires the installation of dedicated infrastructure in buildings and structures within localities utilizing public safety wireless communications to accommodate and perpetuate continuous IBEC equipment to allow emergency public safety personnel to send and receive emergency communications.[11] The exceptions to this requirement are:

1. Buildings of Use Groups A-5, I-4, within dwelling units of R-2, R-3, R-4, R-5, and U.

2. Buildings of Types IV and V construction without basements, that are not considered unlimited area buildings in accordance with Section 507 of the USBC.

3. Above grade single story buildings of less than 20,000 square feet (1858 m^2).

4. Buildings or leased spaces occupied by federal, state, or local governments, or the contractors thereof, with security requirements where the building official has approved an alternative method to provide emergency communication equipment for emergency public safety personnel.

5. Where the owner provides technological documentation from a qualified individual that the structure or portion thereof does not impede emergency communication signals.

6. Buildings in localities that do not provide the additional communication equipment required for the operation of the system.

The responsibility for installing the IBEC system is split between the building owner and the locality. The building owner is required to install radiating cable, such as coaxial cable or equivalent. The radiating cable shall be installed in dedicated conduits, raceways, plenums, attics, or roofs, compatible for these specific installations as well as other applicable provisions of this code. The locality is responsible for the installation of any additional communication equipment required for the operation of the system.

The ongoing operation and maintenance of the IBEC system is the responsibility of the locality and the building owner is required to provide sufficient operational space within the building to allow the locality access to and the ability to operate the IBEC equipment.

Upon completion of installation, after providing reasonable notice to the owner or their representative, emergency public safety personnel shall have the right during normal business hours, or other mutually agreed upon time, to enter onto the property to conduct field tests to verify that the required level of radio coverage is present at no cost to the owner. Any noted deficiencies in the installation of the radiating cable or operational space shall be provided in an inspection report to the owner or the owner's representative.

[11] The provisions for In-Building Emergency Communications Systems are located in Section 918 of the Virginia Construction Code: https://codes.iccsafe.org/content/VCC2018P3/chapter-9-fire-protection-and-life-safety-systems#VCC2018P3_Ch09_Sec918

The building owner is also required to provide standby power for the IBEC system with the capability of providing not less than 12 hours at 100-percent system operation capacity.

CURRENT STATEWIDE FIRE PREVENTION CODE (SFPC) REQUIREMENTS

2018 SFPC provisions specific to IBEC systems are located in section 510:[12]

- IBEC equipment shall be maintained in accordance with USBC and the provisions of section 510 of the SFPC.
- If it is determined by the locality that increased amplification of their emergency communication system is needed, the building owner shall allow the locality access as well as provide appropriate space within the building to install and maintain necessary additional communication equipment by the locality. If the building owner denies the locality access or appropriate space, or both, the building owner shall be responsible for the installation and maintenance of these additional systems.
- After providing reasonable notice to the owner or the owner's representative, the fire official, police chief, or their agents shall have the right during normal business hours, or other mutually agreed upon time, to enter onto the property to conduct field tests to verify that the required level of radio coverage is present at no cost to the owner.

[12] SFPC Maintenance of In-Building Emergency Communication Equipment: https://codes.iccsafe.org/content/VFC2018P2/chapter-5-fire-service-features#VFC2018P2_Ch05_Sec510

CONSIDERATIONS AND CONCERNS

Several concerns associated with the requirements for IBEC systems were raised and evaluated by the study group members.

- Responsibilities
    - One of the overarching discussions throughout the study group meetings dealt with split-system responsibility between the building owner and the locality. The current building code requirements place the responsibility for the installation of the infrastructure cabling on the building owner and installation of any other equipment on the locality.
    - At the study group's December 29th meeting, the Department of General Services' representative stated that the current split-responsibility of IBEC systems is not mirrored anywhere else in the code and that it is not a practical, nor efficient way to install a life-safety system in the building. The representative from Backhaul Engineering agreed with this sentiment and stated that putting the responsibility solely on the building owner or solely on the locality would be better, but that most localities do not have the money to fully-fund these systems.[13]
    - At the study group's January 18th meeting, the Virginia Fire Chiefs Association's representative provided national data from the Safer Buildings Coalition that states, according to Alan Perdue, the Executive Director of the Safer Buildings Coalition, that Virginia is the only state in the country with a split-system responsibility and that all other states place the responsibility for the design, installation, and maintenance of the system on the building owner.[14] [15]
    - While the current code requirements detail the responsibilities for the installation of the IBEC system, it is not entirely clear who is responsible for the design of the system. The discussion from the group's February 24th meeting landed on the general understanding from representatives from Backhaul Engineering and the Apartment & Office Building Association that the building owner is responsible for the design of the system. Building owners use software such as ibWave to assist in the system design based on a rough order of magnitude provided prior to the build and then the building owner will pick a vendor, either a manufacturer or independent contractor, to approve the design.[16]
    - While a plurality of the stakeholders supports the responsibility of the design, installation, and maintenance of the system being that of the building owner, representatives of the Apartment & Office Building Association and the Virginia Restaurant, Lodging & Travel Association oppose increasing the building owner's responsibility.[17]
- Technical system requirements
    - Another area of focus for the study group was on the technical requirements of IBEC systems. The general consensus from the group was that the current language in the building code does not address the technical requirements of the system design as it

[13] December 29th, 2021 Meeting Summary: see Appendix A
[14] January 18th, 2022 Meeting Summary: see Appendix A
[15] National ERCES Adoption Information: see Appendix C, "Supporting Documentation"
[16] February 24th, 2022 Meeting Summary: see Appendix A
[17] February 24th, 2022 Meeting Summary: see Appendix A

pertains to minimum signal strengths into the building, minimum signal strengths out of the building, ongoing system performance, amplification systems and components requirements, and signal booster requirements, among others. These technical requirements are outlined in Section 510.4 and 510.5 of the 2021 International Fire Code, but they are not outlined in the current building code.[18]

- The group was asked at their January 18th meeting if they would be in support of DHCD staff drafting a proposal to incorporate references to Sections 510.4 and 510.5 of the 2021 International Fire Code to provide technical guidance on the design and installation of IBEC systems. Representatives from Backhaul Engineering, Virginia Department of Emergency Management, Virginia Municipal League, the Virginia Building and Code Officials Association, the International Association of Electrical Inspectors' Virginia Chapter, the American Institute of Architects' Virginia Chapter, the Apartment & Office Building Association, the Department of General Services, and the Virginia Fire Chiefs Association were all in support. No stakeholders present at the meeting were opposed to this route.[19]

- Costs
  - The costs associated with the installation of IBEC systems were discussed at several meetings.
  - At the group's December 29th meeting, the representative from the Department of General Services stated that one building owner estimated their costs to be between $0.50 and $0.75 per square foot, but did not follow-up with concrete data for the group.[20]
  - The representative from the Apartment & Office Building Association provided the group with IBEC systems costs from an engineer from Siemens based on five different building designs. The costs for these systems ranged from $0.10 to $0.38 per square foot and were provided to the group at their February 24th meeting.[21] These figures represent those costs incurred by the building owner and they include the design and installation of the wiring only and do not include the cost of additional equipment.
  - Other cost components considered by the group were with respect to annual testing and recertification and maintenance and monitoring. The representative from the Department of General Services stated that the system integrator he knows charged between $1,000 and $5,000 for the annual testing and recertification of IBEC systems for small to large systems. He also stated that most building owners typically sign up for maintenance and monitoring of the system, which costs between $1,000 and $2,000 per year.[22]

[18] 2021 IFC IBEC Technical Requirements: https://codes.iccsafe.org/content/IFC2021P1/chapter-5-fire-service-features#IFC2021P1_Pt03_Ch05_Sec510.4

[19] January 18th, 2022 Meeting Summary: see Appendix A

[20] December 29th, 2021 Meeting Summary: see Appendix A

[21] IBEC Costs – Steve Shapiro: see Appendix C, "Supporting Documentation"

[22] January 18th, 2022 Meeting Summary: see Appendix A

CODE CHANGE PROPOSAL DRAFTED BY THE VIRGINIA FIRE CHIEFS ASSOCIATION (VFCA)

The Virginia Fire Chiefs Association representative drafted a code change proposal and shared it with the study group for deliberation.

The proposal intends to provide references to Sections 510.4 and 510.5 of the International Fire Code (IFC) for the design, installation, and testing of IBEC systems.[23]

Section 510.4 of the IFC covers the technical requirements for the systems, components, and equipment used in IBEC systems. These technical requirements outline the required listing of the equipment (UL 2524), the minimum signal strength requirements both into and out of the building, how the system shall be designed, the system's standby power requirements, how the system shall be monitored, and what design documents are required to be provided to the fire code official.

Section 510.5 of the IFC covers the installation requirements for IBEC systems and provides detailed provisions for the mounting of donor antennas, the system approval requirements prior to installation of the system, the minimum qualifications of the personnel responsible for installing the systems, the procedure for acceptance testing of the system, and to which federal regulations the IBEC system is to comply.

Further, this code change proposal places the responsibility for the installation of the entire IBEC system on the building owner. As such, the existing exception for buildings in localities that do not provide additional communication equipment for the operation of the system has been removed since the responsibility for the installation of the system is proposed to no longer be split between the building owner and the locality. Lastly, the Operations and the Acceptance Test provisions from the existing language were removed with the intent that the ongoing operations and maintenance of the IBEC system would shift from the locality to the building owner and the acceptance testing provisions would be covered in the reference to the International Fire Code.

Organizations in Support	**Organizations in Opposition**
Department of General Services	International Association of Electrical Inspectors, Virginia Chapter
Backhaul Engineering	Apartment & Office Building Association/Virginia Apartment Management Association
Virginia Building and Code Officials Association	Virginia Restaurant, Lodging & Travel Association
Virginia Fire Prevention Association	
Virginia Fire Chiefs Association	

[23] Section 510.4 and Section 510.5 of the 2021 International Fire Code

Note: The Apartment & Office Building Association represents the Virginia Apartment Management Association

The primary opposition to this proposal centered on the increased cost-burden to building owners since the portion of the system that is currently required to be provided by the locality would now be required to be provided by the building owner.

CODE CHANGE PROPOSALS DRAFTED BY DHCD STAFF

DHCD staff drafted two proposals to address IBEC systems. The first proposal incorporated a reference to sections 510.4 and 510.5 of the International Fire Code and provided a clarification that the acceptance testing procedure required by 510.5.4 of the International Fire Code should be the responsibility of the locality, as addressed in Section 918.2 of the Virginia Construction Code. This proposal also deleted section 2702.2.3 of the International Building Code, which addresses standby power for IBEC systems. At their January 18th meeting, the group decided it would be best to delete section 2702.2.3 of the International Building Code to reduce confusion since these requirements would be covered by referencing the aforementioned International Fire Code sections.

Organizations in Support	**Organizations in Opposition**
Apartment & Office Building Association/Virginia Apartment Management Association	International Association of Electrical Inspectors, Virginia Chapter
Backhaul Engineering	Department of General Services
Virginia Restaurant, Lodging & Travel Association	Virginia Building and Code Officials Association
Virginia Fire Prevention Association	
Virginia Fire Chiefs Association	

The primary opposition to this proposal was that it does not make sense to maintain the split-responsibility for the installation of the IBEC system between the building owner and the locality. Further, opponents felt that it would be incongruent to support both the VFCA proposal and this DHCD staff proposal given the competing requirements for whom is responsible for the installation of the IBEC system.

The second proposal drafted by DHCD staff dealt with the limitations surrounding the building owner being required to install “radiating cable, such as coaxial cable or equivalent.” Radiating cable was commonly used in IBEC systems when the existing VCC requirements were added to

the 2006 USBC, but a radiating cable system is not common today. The change proposed by DHCD staff, based on conversations and deliberations in the study group, was to strike the existing language quoted above and replace it with “cabling” to allow designers to opt for cabling other than radiating cable. The intent is to provide the space for new cabling technologies that would otherwise have been prevented by the existing limiting language.

Organizations in Support	**Organizations in Opposition**
Apartment & Office Building Association/Virginia Apartment Management Association	International Association of Electrical Inspectors, Virginia Chapter
Virginia Department of Fire Programs	Department of General Services
Virginia Restaurant, Lodging & Travel Association	
Virginia Fire Prevention Association	
Virginia Fire Chiefs Association	
Virginia Building and Code Officials Association	

Opponents to this proposal did not provide reasoning for their opposition.

SUPPORTING DOCUMENTATION AND REFERENCE MATERIALS

Documentation discussed by the study group included the following:

- DHCD staff power point presentation
- House Bill 2529 – 2003 General Assembly
- House Joint Resolution 588 Feasibility Study
- BDA White Paper
- B916.1-18 – 2018 Code Cycle Proposal
- B916-18 – 2018 Code Cycle Proposal
- B918.1-18 – 2018 Code Cycle Proposal
- 47 CFR 90.219
- How to Best Determine When a Building Needs an ERCES or Not
- National ERCES Adoption Information
- North Carolina Fire Code Section 510
- NFPA 1221 vs NFPA 1225
- SAFECOM Guidance on P25 Compliance
- UL2524 Power Point
- IBEC System Costs
- Code Change Proposal - submitted by Virginia Fire Chiefs Association
- Code Change Proposals - drafted by DHCD staff

CONCLUSIONS AND ACKNOWLEDGEMENTS

Study group meetings yielded several fruitful discussions regarding ways in which the current building code requirements for IBEC systems fall short and the current code requirements can be improved by incorporating references to Sections 510.4 and 510.5 of the International Fire Code and possibly delineating the responsibility of the system to one party instead of two. The stakeholders did not reach consensus on these two items. However, this report documents the key issues discussed and it includes supplementary documents provided by stakeholders.

Below is a summary of the key findings, based on the information provided and stakeholder process.

- The current building code requirements for IBEC systems lack technical provisions for how these systems should be designed, installed, operated, and maintained.
    - Discussions indicated that the overwhelming majority of stakeholders support providing references to the technical requirements of IBEC systems in Sections 510.4 and 510.5 of the International Fire Code.
- A majority of stakeholders support putting the responsibility for the entirety of the IBEC system on the building owner.
- The costs incurred by building owners for the installation of the infrastructure cabling for IBEC systems are not much different than in 2003 when the General Assembly began looking into this issue, but the study group did not provide values for the potential incurred costs by the building owner if the responsibility for the system is placed entirely on the building owner.[24]

Finally, the staff of DHCD wishes to thank the study group participants for the time and energy they committed to this process. The stakeholders presented arguments based on their backgrounds in fire services; fire and building codes; emergency management and prevention; law enforcement; public administration, private engineering firms and more. This committed group lent many hours of their time submitting documents, conducting conversations, and reviewing their colleagues' arguments and positions. They shared their knowledge and experience in the form of anecdotes, documented case studies, and current practices. We deeply appreciate their expertise and willingness to engage in the study group discussions.

[24] February 24th, 2022 Meeting Summary: see Appendix A

APPENDIX A: Agendas, Meeting Summaries, Participants

In-Building Communications
December 1, 2021
9:00 a.m.
Virtual Meeting: https://vadhcd.adobeconnect.com/va2021cdc/

AGENDA

1) Welcome

2) Introductions

3) Overview of VA Code Development Process

4) Background

5) Discussion

6) Assignments and Next Steps

7) Next Meeting

In-Building Communications Meeting Summary

December 1, 2021 9:00 a.m. – 10:35 a.m.

Virtual Meeting: https://vadhcd.adobeconnect.com/va2021cdc/

ATTENDEES:

VA Department of Housing and Community Development (DHCD) Staff:
Cindy Davis: Deputy Director, Division of Building and Fire Regulations
Jeanette Campbell: Administrative Assistant, BFR
Jeff Brown: State Building Codes Director, State Building Codes Office
Richard Potts: Code Development and Technical Support Administrator, SBCO
Travis Luter: Code and Regulation Specialist, SBCO
Paul Messplay: Code and Regulation Specialist, SBCO
Florin Moldovan: Code and Regulation Specialist, SBCO
Stephen Reynolds: Training Specialist, Virginia Building Code Academy
Kyle Flanders: Senior Policy Analyst, Policy and Legislative Office

Study Group Members:
Jamie Wilks: Madison County Building Official; VBCOA committee member; prior Building Official in Matthews County; Retired from Norfolk fire department
Robert (Jonah) Margarella: Architect at Baskervill (Studio Director); 24+ years in architecture; member of SBCTRB
Dwayne Tuggle: Amherst, VA Mayor; VA State Police-retired
Steve Shapiro: Retired Building Official City of Hampton - 34 years; LLC Shapiro Associates; AOBA; prior President of ICC
Dana Buchwald: Senior Account Manager (in-building signal for emergency responders) at Backhaul Engineering
Debbie Messmer: Virginia Department of Emergency Management
Troy Knapp: Electric Plan Reviewer with VA DGS, Division of Engineering and Buildings; prior Electric Plan Review Engineer 13 years William & Mary College; 20+ years Electrical Engineer
Robert Melvin: VRLTA-Restaurant, Lodging & Travel Association, Director of Government Affairs
Andrew Milliken: VFCA, VFSB Chairman of Fire Codes and Standards Committee, (also submitted a proposal last cycle on this issue)
Tammy Breski: Broadband Project Manager, VA DHCD Division of Community Development; prior Verizon Construction Manager

Other Interested Parties:
Ron Clements
Ernie Little
Linda Hale
Sean Farrell
Todd Strang

Study Group Members not in attendance:
Patrick Green: Virginia State Police
Jodi Roth: Virginia Retail Federation
Gerry Maiataco: Virginia Fire Prevention Association
Tread Willis: International Association of Electrical Inspectors-VA
Jay Davis: Virginia Department of Fire Programs
Jim Crozier: Virginia Association of Counties

AGENDA AND DISCUSSION ITEMS: *(Power Point Presentation Slides with additional information indicated)*
Presentation is on the DHCD website, with a link on the cdpVA website

1) Welcome

Jeff Brown: General Housekeeping- Directed participants to the Adobe Connect presentation area, the attached files and microphone settings. Attendants were asked to mute microphones until they wish to speak, identify themselves as they speak, be respectful and be concise in their comments. Use the 'Raise Hand' feature in the meeting room to speak. Cameras will not be used in these virtual meetings. All meetings are public, but generally, discussions will be among study group members.

2) Introductions

Jeff Brown: DHCD staff introductions: Cindy, Jeff, Richard, Paul, Florin, Jeanette from BFR.
Study Group members made personal introductions. *(slide)*
Study Group members will be indicated as such in the Adobe Connect meeting participant list with 'SG' after their names. If anyone outside of the group would like to join the email list, they should contact sbco@dhcd.virginia.gov with their request.

Robert Melvin: He is not sure how many meetings his group can participate in, due to the General Assembly legislative process (Jodi as well). Jeff Brown acknowledged this and said he would try to work around those dates and get some meetings in before Session begins, and will wait until after Session ends to start the General Workgroup meetings in March.

3) Overview of VA Code Development Process

Jeff Brown: Showed participants *(3 slides)* indicating tentative meeting dates, Code Development Process flowchart and cdpVA website overview.

The Virginia codes are usually updated every 3 years. The 2018 code cycle was completed last year, and codes became effective in Virginia on 7/1/21.

The 2021 cycle to integrate the newest I-Codes into the Virginia code started with submitting the Notices of Intended Regulatory Action (NOIRA), which was published in the Virginia Register of Regulations. Study Groups will be conducted for special topics, in order to identify issues, review proposals and get recommendations before submitting them to the Board of Housing at the end of the phase. Files for discussion can be found in lower left box of this Adobe meeting site, including a flowchart of the regulatory process, together with this presentation *(all slides)*. These files can also be found on cdpVA.

The BHCD in October approved a policy to limit proposal submission only to the proposed phase. The final phase of the development process is limited only to corrections, technicalities or error revision; it is not intended for new changes, which was previously allowed, but it caused too many complications and delays to the process. If someone wants to propose a change during the final phase, it will instead be pushed to the next code change cycle. The cdpVA website *(slide)* can be used to submit change proposals. It also includes historical data from the 2015 and 2018 cycles, and other important information such as meeting dates, agendas, summaries, development cycle flowchart, base documents, etc…

Study Groups *(slide)* are generally small - about 12-15 group representatives. They meet regarding specific topics until discussions end. Any potential proposals resulting from the Study Group discussions will be included in the General Workgroup Agenda(s) for review and discussions by stakeholders, prior to BHCD consideration. The Study Groups will then disband. This IBEC group is a Study group. Recommendations we may make will be based on how discussions proceed and what proposals are submitted to this group and/or what proposals we submit as a group.

Sub-Workgroups *(slide)* review proposals according to topic, which are generally broader in scope than the Study groups. They will submit recommendations based on proposals received or created within the group to

the General Workgroups, who make recommendations and submit to the BHCD. Currently, the Sub-Workgroups are: Energy, Statewide Fire Prevention Code and Resiliency.

General Workgroups *(slide)* consider proposals submitted by anyone and the meetings are public, open to all. The proposals go to the BHCD in blocks and those that are unanimously approved and disapproved are voted on by the BHCD in blocks. Proposals that did not reach a consensus for approval or disapproval are voted on individually by the BHCD. The General Workgroups for the 2021 cycle will start to meet in March.

4) Background / History

Jeff Brown: In Building Emergency Communications (IBEC) *(slide)* is 2-way emergency responder communication coverage inside of buildings. Starting in 2021, the I-Code term has been changed to Emergency Responder Communications Coverage (ERCC). This is used to indicate the ability to communicate in a building, not necessarily a specific communication system.

This group will also discuss Emergency Responder Communication Enhancement Systems (ERCES). ERCES may be used in buildings where the signal strength does not meet minimum requirements. This is a system made up of a donor antenna in-tower with a bi-directional amplifier to boost the signal. Coaxial cable or fiber medium is used to distribute the signal throughout the building. There are additional information sources online.

House Bill 2529 in 2003 *(slide)* was initiated as a result of problems identified in the 9-11 emergency response. BHCD was directed to develop codes for new building construction to ensure the operation of communications used by emergency personnel, or provide equipment to allow such emergency communications.

HJR 588 in 2003 *(slide)* directed a taskforce in Virginia to study the feasibility of adopting requirements to ensure that buildings were constructed and equipped to permit effective radio communications inside the buildings. The group agreed that local jurisdictions are responsible for delivering adequate radio signals to the exterior of a building before requiring the installation of emergency communications requirements to overcome signal degradation inside the structure.

2004-2007 Virginia ad-hoc committee *(slide)* compromise proposal was approved by the BHCD for the 2006 Virginia Construction Code (VCC), which remains mostly unchanged today.

2018 Code Development Cycle *(slide)* The BHCD considered proposals to amend the VCC emergency communications requirements. One was approved: (B916.1-18) however, two were not approved: (B916-18 and B918.1-18). The Board decided there needed to be a more in-depth study and discussion, which is what this Study Group will be doing.

The objectives of this Study Group *(slide)* are to gather information, identify issues with current code, identify areas of agreement or disagreement, support and opposition, identify possible improvements and submit proposals (if any), summarize findings and review any proposals related to the topic (if any) submitted throughout the 2021 cycle.

VCC codes are available for free online: codes.iccsafe.org/codes/Virginia *(slide)*

2021 IBC requirements *(slide)* of Section 918 (ERCC) states that two-way ERCC shall be provided in all new buildings in accordance with Section 510 of the International Fire Code (IFC). This is the only model we have.

2021 Section 510 IFC *(slide)* also states that two-way ERCC shall be provided in all new buildings (with 3 exceptions). It also includes technical requirements of the systems to be used. These systems also need to be designed in accordance with NFPA 1221, section 926, and they also need to be UL 2524 listed.

2018 requirements in VCC Section 918 *(slide)* has 6 listed exceptions: 1) Use groups, 2) Types IV and V, 3) One-story buildings less than 20k sq. ft., 4) Government owned or leased spaces with other security requirements approved by a Building Official, 5) Owner has a technical documentation form stating that the building does not impede signals 6) Building that doesn't provide the equipment needed to operate the system.

2018 VA requirements 918.1.1, .2, .3… and 918.2 *(slide)* regarding installation, operations, inspection and acceptance test for equipment. The building owner is not responsible for everything – they do need to provide

infrastructure (cable installation) and space for the locality to work with the equipment. The locality should be responsible for the system after installation of cables, including operation, maintenance and inspection.

5) Discussion

Jeff Brown: 2018 cycle proposals *(slide)* B916.1-18 approved (adding exception 6); 916-18 not approved; 918.1-18 not approved.

This Study Group will be re-addressing the proposals not previously approved:

B916-18 proposed adding technical requirements (as per NFPA 1221 and 72). Virginia doesn't have any specifics currently. Proposed changing responsibility for installation from locality to building owner.

B918.1 proposed referencing the IFC, while keeping the existing 2015 VCC exceptions for installation.

Jeff Brown: Opened discussion to the floor for questions or comments about history and current status:

Dana Buchwald: In section 918, exception #3, what is the basis for this exception (+1 story over 20k sqft). Staff responded that this threshold was used to correlate with sprinkler requirements for buildings of similar size.

Troy Knapp: He is a Plan Reviewer. He says that not having technical requirements makes it difficult for planners and builders to follow. He agrees that this needs some clarification.

Jonah Margarella: Why were the 2 proposals open for discussion not approved? Jeff Brown says that one reason was cost and who would be responsible to pay, another may have been just because the group was too large with too many different sides and the BHCD wanted a Study Group to look into it further.

Cindy Davis: She thinks that AOBA had big concerns based on previous issues. Primarily: who is responsible? Especially for existing buildings, to upgrade or maintain older systems. Steve Shapiro agreed with Cindy.

Steve Shapiro: Regarding the reason for exception #5, he's unsure of what the wording entire structure or "portion thereof" would mean specifically. Jeff Brown said there may be only a portion of the building where communication fails.

Jamie Wilks: He thinks the current code section is good starting point, but it's important to identify the standards to adhere to. He also says some smaller localities would have trouble paying for these systems.

Andrew Milliken: As a starting point, it would be important for this group to look at what prior discussions were, especially the financial burden for localities. He is concerned that the existing code requirements did not achieve the original intended goal.

Robert Melvin: He understands Andrew's concerns, but also thinks that businesses would not be able to bear the financial burden at this time (COVID), inflation, etc. While we need to ensure safety protocols, hotels and restaurants, etc., will not be able to handle the financial burden and many didn't get any financial government assistance. Jeff Brown asked for any others to try to provide stats that could help with the financial discussion.

Andrew Milliken: Wants to clarify that most of this discussion is about new buildings. We should note that it will not be retroactively required for existing buildings.

Steve Shapiro: Asked about the financial information Jeff Brown is looking for; will the data need to be in by the 14th, and should we be more specific on what exactly the cost would be comprised of? Jeff Brown says it's not required by 14th, and he knows there have been different ideas about what the #s would include, as well as how it would be presented. He is not expecting that we will come to consensus about financial recommendations during the course of this Study Group.

6) Assignments and Next Steps

Jeff Brown asked for everyone to review and research the information provided, ask questions, raise concerns, gather additional information, and submit for the next meeting. *(slide)*

7) Next Meeting

December 29th 9am-3pm with a one hour lunch break from 12-1. *(slide)* There will be more discussion about the current issues at hand, rather than reviewing prior data. Adobe Connect will continue to be used for virtual meetings. Jeff Brown thanked everyone for their participation.

AGENDA

In-Building Emergency Communications Study Group

December 29, 2021

9:00 a.m.

Virtual Meeting: https://vadhcd.adobeconnect.com/va2021cdc/

I) Welcome

II) Discussion

- A) Background of Virginia Requirements
  - i) Previous IBEC Feasibility Study (HJR588)
  - ii) Development of Initial Virginia Code Requirements
- B) Andrew Milliken Draft Proposal
- C) System Requirements (IFC, NFPA, etc.)
- D) Installation Responsibility
- E) System Costs

III) Other

IV) Assignments and Next Steps

V) Next Meeting

In-Building Emergency Communications Study Group

December 29, 2021 9:00 a.m. to 1:40 p.m.

Virtual Meeting: https://vadhcd.adobeconnect.com/va2021cdc/

ATTENDEES:

VA Department of Housing and Community Development (DHCD) Staff:

Cindy Davis: *Deputy Director, Division of Building and Fire Regulations (BFR)*
Jeanette Campbell: *Administrative Assistant, BFR*
Jeff Brown: *State Building Codes Director, State Building Codes Office (SBCO)*
Paul Messplay: *Code and Regulation Specialist, SBCO*
Florin Moldovan: *Code and Regulation Specialist, SBCO*

Study Group Members:

Jamie Wilks: *Madison County Building Official; VA Building Code Officials Association (VBCOA) committee member; prior Building Official in Matthews County; Retired from Norfolk fire department*
Robert (Jonah) Margarella: *Architect at Baskervill (Studio Director); 24+ years in architecture; member of State Building Code Technical Review Board (SBCTRB)*
Steve Shapiro: *Retired Building Official, City of Hampton-34 years; LLC Shapiro Associates; Apartment & Office Building Association (AOBA); prior President of International Code Council (ICC)*
Dana Buchwald: *Senior Account Manager (in-building signal for emergency responders) at Backhaul Engineering*
Joseph (Tread) Willis: *International Association of Electrical Inspectors-VA (IAEI)*
Debbie Messmer: *Virginia Department of Emergency Management (VDEM)*
Troy Knapp: *Electric Plan Reviewer with VA Department of General Services (DGS), Division of Engineering and Buildings; prior Electric Plan Review Engineer 13 years William & Mary College; 20+ years Electrical Engineer*
Robert Melvin: *Restaurant, Lodging & Travel Association (VRLTA), Director of Government Affairs*
Andrew Milliken: *VA Fire Chiefs Association (VFCA), VA Fire Services Board (VFSB) Chairman of Fire Codes and Standards Committee, (also submitted a proposal on this issue)*
Joshua (Jay) Davis: *Virginia Department of Fire Programs (VDFP)*

Other Interested Parties:

Todd Strang: *Spotsylvania County Fire Official*

Study Group Members not in attendance:

Patrick Green: *Virginia State Police (VSP)*
Jodi Roth: *Virginia Retail Federation*
Gerry Maiataco: *Virginia Fire Prevention Association (VFPA)*
Jim Crozier: *Virginia Association of Counties (VACO)*
Tammy Breski: *Broadband Project Manager, VA DHCD Division of Community Development; prior Verizon Construction Manager*
Dwayne Tuggle: *Amherst, VA Mayor; VA State Police-retired*

AGENDA AND DISCUSSION ITEMS:

1) Welcome

Jeff Brown: Thanked everyone for attending. Asked for members to stay muted unless they are speaking. The meeting is open to anyone, but only Study Group members should join the discussion. He noted that Patrick Green, Jodi Roth, Gerry Maiataco and Jim Crozier were not in attendance last week, and may not be on today. He allowed Tread Willis (IAEI) and Jay Davis (VDFP) to introduce themselves to the group, as they were not in last week's meeting.
The group objectives are to look at the issues surrounding in-building emergency communication systems, define areas of agreement and disagreement, look at the technical requirements in the code, discuss costs and responsibilities related to these systems and clarify this data for the Board of Housing and Community Development. All proposals made will be discussed. We currently have one draft proposal made by Andrew Milliken, which is on the table for discussion.
Notes will be taken in all meetings, including outstanding questions or issues, as well as areas of agreement. Questions will be researched by DHCD or assigned group members to provide answers. At the conclusion of the meetings, the group's findings will be summarized and reported to the Board, including the items of agreement.

2) Discussion:

Background of Virginia Requirements

Previous IBEC Feasibility Study (HJR588)

Jeff: There were some questions at the first meeting about the history of the IBEC requirements in the code. In 2003, there was a feasibility study done. There was legislation that directed DHCD to develop regulations related to IBEC systems and a joint resolution to conduct a feasibility study regarding potential IBEC regulations. The feasibility study (file attached) gives the background from 2003: discussion, issues, questions, findings, etc. Jeff thinks many of the same topics and issues will arise in this study group, so it will be important to see what was discussed in the feasibility study, and what is different since then. They discussed a broad range of the potential costs of system installation, but those have probably changed, so we will need to revisit the topic and gather updated data. He asked if there were any questions or comments about the study.

Dana Buchwald: asked if the group is only addressing new construction, and why? (Besides cost).

Jeff: Anything is open for discussion: what's required, what are options, what are pros & cons about new vs. existing buildings. In the past, the discussions did not include existing buildings. Andrew's proposal also does not addresses existing buildings. It is rare that there is a building code requirement for retrofit of existing buildings, though there are examples. Previous retrofit provisions have been implemented through legislation. Discussions will be noted in the final report, including talk around new vs. existing buildings, and where the group lands on that issue.

Dana: Specifically asked because she speaks with a lot of AHJs and fire marshals, who have said that they are afraid to go into some buildings, because they don't have a proper signal.

Andrew Milliken: Regarding new vs. existing buildings, he thinks it's important for the group to comment on both for the purpose of arriving at consensus. The VA code does speak specifically to new construction, so the group should prioritize that discussion. He still thinks it's beneficial to provide information on existing buildings.

Jay Davis: Regarding old vs. new buildings, in areas with some density, most localities deal with the ability to communicate in the buildings as they are constructed. When construction continues in the area, the systems can overlap and interfere with each other. Boosters may be needed to achieve clear communications. Localities may need to look at signals each time new construction is done. It isn't one and done, there is a need for constant checks and balances as growth continues. He thinks the group does need to discuss what happens after installation.

Jeff: Agrees with Jay. There is a responsibility question – who is responsible for system upgrades when needed? Currently localities are responsible for the systems and any upgrades, but the group will discuss responsibility

not only as it relates to design and installation, but also maintenance and upgrades. Additionally, the FCC may require frequency changes, so the group would want to discuss what that would look like, how often would it happen, and who would be responsible for any upgrades?

Steve Shapiro: The feasibility study mentioned that a retrofit requirement could add 10-25% to the cost of a system, which would have a big impact.

Jonah Margarella: The IFC and VCC reference maintenance, testing and proof of compliance in section 510.6. Is that enough to keep validating the system over time?

Jeff: That is a good question, and it will be important keep it in mind during discussions about inspections and maintenance testing requirements and costs.

Tread Willis: The cost of retrofit requirements can be tremendous and could be infeasible or impractical. However, he thinks the group should consider the occupancy change language in chapter 7 of the existing building code (VEBC), and the increase in square footage qualification in Andrew's proposal to determine if, under certain circumstances, retrofitting could be required. He doesn't actually like the idea of doing that, however, the current existing building code says that a change of occupancy could actually require a new sprinkler system to be installed. Could the same apply for IBEC systems?

Jeff: Agrees that the VEBC would be the right place for any requirements related to existing buildings.

Development of Initial Virginia Code Requirements

Jeff: Drafts and the final code change proposal that was submitted to the BHCD:
Between the years of 2003-2007, there were many discussions and attempts to reach consensus. In 2007, a proposal from Cheri Hainer titled "IBEC proposal 2007.10.10" (attached) finally had an acceptable compromise. That document and the feasibility study together are good background information regarding how the existing IBEC code requirements were developed. He advised the group to look at these and all of the related documents sent out on Dec 17th for more background.

Dana: Was looking at the NFPA 1225 2022 (newest) edition considered (to see where the technology is heading)? For example, in the 2018 version, conduit wouldn't be required in every building and would save a tremendous amount of money. Was this addressed: looking at newer codes?

Jeff: It would be good to look at it and discuss. He asked Dana to captain that. Someone has submitted a draft proposal in cdpVA to incorporate 1225 into the 2021 USBC, but it's not fully processed yet. The group will start to look at the codes and standards more in the "system requirements" section (below).

Andrew Milliken Draft Proposal

Jeff: Andrew Milliken, representing the VFCA, drafted a proposal that is not officially in cdpVA yet. It is a good starting point, to see what a proposal for this cycle might look like (attached).

Andrew: Wanted to get something out to start discussions, and to bring section 918 in the new construction code back in line with the charge in Title 36. The main idea is to remove requirements for building owners to provide conduit, which serves no purpose, and to provide direction to code officials, in section 918.1.1, for what standards would apply to installation, and also meet the IFC standards. The proposal references NFPA 1221, not 1225, but the group can discuss further. He's trying to keep it concise and simple to get back in line with the charge in Title 36 and provide a new starting point for this section by removing excess requirements.

Steve: Who is responsible to provide the system in the building?

Andrew: The proposal keeps the same language that was found prior to 2018, requiring the building owner, where a system is necessary, to provide the system. This is similar to standpipe systems, where the building owner is responsible for installation.

Steve: What exactly would the owner have to provide?

Andrew: If the owner didn't meet the minimum signal requirements, or have attestation to prove that they could provide good communications coverage throughout the building, they would have to provide a 2-way IBEC system (DAS or bi-directional antenna system connected to the fire alarms). This is the same as the requirements in a number of states.

Troy Knapp: The difference he sees is that the Virginia code states 'providing radiating cable or equal' and then the locality would provide other equipment: basically amplifiers battery backup, together with acceptance testing. He thinks it's analogous to providing fire alarm horns and strobes in the building, but not providing the active equipment to make it work. The way it's setup - for the building owner to provide radiating cable or antennas, and for localities to provide amplifiers or other equipment to make it work - nothing else in the code is setup to work that way. It's not practical, not efficient, and it's no way to install a life-saving system in a building. It makes it hard to review plans, enforce the code and give guidance to engineers. It would be like putting emergency lights in and requiring the locality to put in a generator.

Dana: She agrees with Troy. It's nonsensical. To put the responsibility only on the building owner or only on the locality would be better. Most of the people she speaks to in localities do not have the money to do it all. Some other areas in the country provide tax breaks for existing buildings and new construction. Separation doesn't make sense.

Jeff: Yes. It's on our list to discuss what other states and localities are doing, and what their requirements are. Which ones don't require systems and which ones do, and how do they do it (who's responsible, and how do they offset the costs)? He sked for anyone to provide that type of information, and said it may be assigned at the end of this discussion or between now and the next meeting.

Troy: He recently (last year) joined the Safer Buildings Coalition. They are a group of manufacturers, engineers and AHJ's working through these types of issues, and trying to get consistency across the nation. They troubleshoot problems and interference with existing systems. He'll ask for information on what others are doing. One person in that group says VA is only one of a few states that require localities to provide anything. He said the IBEC systems are like fire alarm or sprinkler systems; the owners' cost of doing business and providing safe buildings. He hasn't looked at any cost documentation, but a particular owner said their cost was 50 to 75 cents per square foot. Troy will get more information as he can.

Jeff: Any information would be good. He is looking for a few sources to compare data. Anything on cost and what others are doing would be helpful to the group.

Steve: One question for Andrew regarding his draft proposal: why is the exception #6 (VCC Section 918.1) stricken - wasn't that exception just added in the 2018 edition of the VCC?

Andrew: Localities already aren't providing additional equipment and there is no additional equipment to provide in this proposal. He's proposing an all-in-one owner-provided life-safety system, like fire alarms, standpipes and sprinklers.

Dana: Agreed and asked if anyone is familiar with Fairfax. They have requirements that are well-done and are somehow being enforced. They say it's "highly encouraged and recommended" that all commercial, multi-unit residential, governmental and educational occupancies reliable on building code and safety…' similar to most jurisdictions in Florida. Fairfax put down the requirements in about 8 pages, although Tampa has like 40 pages. She spoke with the AHJ in Fairfax, who says everyone is on board, and it works fine for them. She has a stack of requirements from various jurisdictions. She knows of only 3 jurisdictions in VA that have written down their requirements (Arlington may be one).

Jeff: Some localities do have policies. He said he hasn't looked at them, but if they are not in line with code, it would be problematic. He thinks the best starting point for specific IBEC system design or installation requirements would be the existing model code requirements. Some Virginia localities currently have their own local policies to identify minimum system requirements or point to IFC or NFPA for specific requirements since the current VCC requirements are somewhat vague and do not reference the IFC. He asked that if Dana or anyone else has any information to share, she should get it to DHCD to share with group.

Troy: Has documents from Stafford, Loudoun and Arlington. Stafford's is published by the fire and rescue department, office of the fire marshal. It does have code references. He'll forward. He agrees with Jeff that they don't need to rewrite code if there's already code to reference regarding requirements.

Andrew: Is from Stafford. They have standards for when these systems are provided. They see developers come in and ask for the IBEC requirements, which is evidence that the industry requirement for infrastructure is usually on owner, and that VA is behind on this code issue.

Jeff: It would be helpful to see what other states require and to compare that information.

Jay: He retired from the city of Charlottesville in 2020. He worked on this type of project before he left. There, the construction process was part of the design features of a building. A document was handed to developers stating that the building could achieve communications, with specific language showing what the city uses, and that they expect builders to provide compatible 95% in-building communications without interference. The responsibility was on the developer and designer. They specifically referenced NFPA 72 and the fire code, but the building code didn't require it. When a building has already been built somewhere else, the developer would know how it interacted there/then. It was more complicated when a new building was proposed that had never been constructed before. They would then discuss at least providing space and conduit for equipment, so they could add after the building was constructed. He says they want to do the right thing, but what do they have to provide? He can provide the document from Charlottesville. The big thing is really giving clear guidance no matter what.

Jeff: The code is minimum now. He thinks the challenge is the missing link of design & installation standards. Even if nothing else changes, looking at IFC and NFPA and referencing it or somehow adding a little more guidance in the code regarding system requirements would be helpful. If there are at least design and instillation requirements, it would give more clear guidance to designers, owners and localities to work with.

Steve: He assumes that the VA localities mentioned: Fairfax, Arlington, Stafford, Loudoun and Charlottesville are still in compliance with 2018 IBC section 918.1.1. He's hoping that they don't require more than what the current building code requires.

Dana: Fairfax references 1221 and 72 but it's not specific. Companies like Publix come in with designs they already have. They have a safety plan with towers already scoped out before construction. If builders would incorporate BDA in life safety plans, it would help with cost and time. A 2-hour burn room, for example, is something to put in during construction so it's known upfront and there is no cost or time wasted to put it in later.

Jeff: The question is who are we minimizing cost for? Even if someone comes in with a plan today for a building that already has a pre-designed IBEC system, installation responsibility would still fall on the locality. The building owner is currently not required to install the system.

{BREAK - 9:57am-10:05am}

System Requirements (IFC, NFPA, etc.)

Jeff: Wants to look at system requirements, setting Andrew's proposal aside for the moment. The code says that we need to ensure that the building has continuous IBEC. What are the various types of systems? What else besides amplifiers and antennas, etc. is available? Are there other systems that don't fit the mold of NFPA 1221 or 1225, or are they all encompassed in the existing standards and code requirements? Are there newer technologies to include in discussions?

Dana: She has seen mobile units and portable units. Instead of systems being installed during construction, these units can be dispatched as needed. She doesn't think they are a good solution. Whatever the system is, it needs to be UL 2524 rated.

Jeff: What types of systems does that UL rating cover?

Dana: It seems that the various systems are all similar: they have bi-directional amplifiers (BDAs), annunciator panels, 12- to 24-hour battery backups, alarms that are part of BDA in the fire panel, a remote shutoff if needed, repeater and signal booster. All of the manufacturers have or are working on the UL 2524 rating. They all seem to be the same.

Jeff: There are minimal system requirements in the code – what you mentioned. Primary differences may be in the in-between, wiring, and equipment for signal transmission, which could vary by manufacturer.

Jay: Localities have their own systems operating on 800 MHz or other types. The systems are able to address specific brands, like Motorola. The components that go with it also have to be installed according to code and be UL certified. The locality would be the driving factor to determine which system the building owner would need to use to interact with what the locality is using.

Dana: Agreed. It depends what tower, where and what frequency the AHJ wants. The first thing to consider is what the locality offers, and then the IBEC system requirements would be installed accordingly.

Tread: IFC section 510 says that the system must be designed by an FCC licensed person or otherwise adequately trained person, so designers would have to be responsible for equipment. In his county, (Prince William), the Fire Marshal's office reviews the system designs, and the IBEC system must be integrated into the fire alarm system as well, for notification if there's a failure. The requirements of the locality will drive the system needed. Similar to a building official listing the geographic design criteria for residential applications, the fire official needs to provide local specifications for builders to follow in the system design.

Jeff: Good point. He imagines other localities have language to that effect.

Dana: That is how it's done in most places. In order to install systems, you have to be certified by the manufacturer of the system. The locality would not be that person, it would be the design and install certified person. The installer needs to know the RF specifics for the locality.

Troy: Recently learned that NICET has just initiated a certification program for installation of IBEC systems. It's possible that language should include the NICET certification, which should be up and running by the time the code is put into action.

2021 IFC

Jeff: Reviewed the IBEC provisions of the 2021 IFC. Section 510.1 lays out requirements for where systems are required. This is in conflict with existing requirements in VCC chapter 9. If the VCC is updated to reference the IFC, it should not reference 510 in general, but only certain parts of 510 (i.e. design & installation 510.2, etc.) in order to not interfere with VCC.

Steve: Noted that Andrew's draft proposal only references sections 510.4 and 510.5.

Jeff: IFC section 510.2 covers existing buildings. 510.3 is about permits required, which is already covered by the VCC. Sections 510.4 and 510.5 are the ones that apply to this discussion. IFC 2021 Section 510.4 references the new UL 2524 listing requirement. 510.4.1 addresses the need for 95% adequate signal strength for 95% of the areas in the building. Does anyone have details about 95% signal strength and DAQ of 3? Also, when is this determined – can it be determined before the system is installed or before construction starts?

Dana: Typically, the building should be substantially constructed before testing because the building materials matter a great deal in signal testing. DAQ (delivered audio quality) is done with handheld radios, which is very subjective – how clear the communication is between 2 people. Additionally, the state requirements can be increased, but not decreased.

Jeff: Is the system testing in Andrew's proposal, or even in the existing VCC exception (owner provides technical documentation from a qualified individual that the structure doesn't impede signals) able to be done only after the building is substantially complete?

Dana: This is where a survey would come in. It's a heat map of the building showing what parts of the building have signal and what parts don't. Some say they want 99% in 'critical' areas and then 90-95 in other general areas. Jurisdictions can increase but not decrease these requirements. This testing only works when buildings are substantially built.

Jeff: In the design phase, if the builder doesn't think anything will impede, they would still need to prove it before they move on with construction, (unless they have exception 6 stating that they don't need an IBEC system in the building). Is that accurate?

Dana: Some signal information can be obtained in a green field. If it fails at that point, you will know that a system enhancement is needed. Typically, after substantial construction, a survey is done, which is a grid walk of the building or each floor in 20 sections, showing what the signal is. Sometimes, owners even include extra antennas throughout the building, which is overkill. However, if boosters are needed somewhere, they have to be there. Even in a huge building, it would only cost about $5k or less for boosters everywhere to be super safe.

Troy: There are software packages available to analyze buildings in the planning phase (like the heat maps Dana mentioned). Those would help for cost and time management before ground is even broken. Walk through grid testing is used after buildings are mostly constructed. Some engineers put verbiage into the contract so that builders will include something that will pass the test.

Dana: What's used pre-construction is called a Rough Order of Magnitude (ROM) for building construction costs / budget purposes. It's usually overestimated.

Jeff: What percentage of buildings would require a system when tested? Most or few? Is it by area? Location?

Andrew: As an AHJ, he has seen a lot of times when a ROM is included, or another evaluation tool that is used before construction.

Dana: Yes, a ROM would be used before construction. The designer would get wave specs and tower locations together with a life-saving or electrical plan. This would be the time and place to determine if a system will be needed. It is usually done in coordination with electricians. Tread confirmed.

Tread: System monitoring will be done by a fire alarm contractor. It's not technically difficult, but practically, it would make sense to have fire alarm panel or command center centrally located in physical proximity for monitoring purposes. Distribution of cables is simple. Varied electric materials are acceptable. The problem is when the building has a fire alarm control panel in a dedicated space and the radio equipment is not.

Jay: What percentage of buildings would need an IBEC system? This is a crucial point, because in Virginia, there are lots of different terrain that could encourage or inhibit transmission (beach, mountain, valley, etc.). Locality is also important in this discussion. A Locality may have a good tower grid and good boosting system, whereas other areas may not. At other times, the building itself could be a crucial component. If, for example, a hospital has great coverage, but installs an MRI and has signal interference – what then? The group would want to address the need for enhancement in that case. So, it depends on where (terrain & locality signal strength provisions), building type and modifications.

Jeff: Yes, this was looked at heavily in the feasibility study. Part of the issue is that if you require certain coverage in building, how can that happen if locality doesn't provide the signal at the site to begin with? Per 510.4.1.1, if you need a minimum of 95% and DAQ of 3, what if the signal available at the exterior of the building is inadequate? Is there a baseline for a locality to provide a certain signal strength?

Steve: Wanted to clarify a point. A ROM test would tell you how to design a system, but wouldn't say if you need one or not. Is it correct that the building would still have to be substantially complete to definitively say if a system is needed or not?

Dana: Yes. The ROM would really be used for budget purposes. A building with 5 stories is more likely to need a system than a one-story building (in general, but it could be different based on location). She hasn't seen a large building yet that doesn't need one. RF is cut by concrete, steel, other buildings, water, low E glass, etc…

Andrew: The locality signal is discussed in 510.1, but his proposal doesn't address this. The IBEC 2-way system is based on the existing signal measured at exterior of building.

Jeff: IFC Section 510.4.2 says the system has to comply with sub-sections 2.1-2.8 and with NFPA 1221. In Section 510.4.2.1, structures need enhancement when required as per specifications in 510.4.1-510.4.3. Systems with RF emitting devices have to be approved by the fire official before installation. They also have to be certified by the radio licensing authority and be suitable for public safety use. Can someone explain this approval process?

Jay: Localities have a communication system center and whomever oversees it would know the system and signal strength. He noted that if many others start building around that area, existing buildings might need to adjust their amplification, due to potential signal interference. This should be left to the local communications system personnel to determine.

Jeff: So, a fire official has to review and approve, but also the local system person whom Jay referenced.

Troy: There's a document that also has to be signed by the FCC license-holder to ensure that the system isn't interfering with other signals. Reference section 510.5.2

Jeff: Section 510.5.5 also refers to compliance with FCC regulations.

Dana: agrees. The FCC licensee has to sign off together with the AHJ after the system is installed. Also an annual test and a 5 year test is needed, using a retransmission authorization document.

Jeff: Section 510.4.2.2 technical criteria – a fire official keeps a document giving designers specific (local) technical criteria.

{BREAK - 11:02am-11:07am}

Jeff: Reviewed standby power 510.4.2.3, signal booster 510.4.2.4 and system monitoring requirements 510.4.2.5.

Andrew: Most of these requirements are the same as the UL requirements, so this is good – they match.

Jeff: 501.4.2.6, 7, 8 – read off requirements for additional frequencies and change of frequencies, design documents and other technical design requirements.

Jeff: Section 510.5 says that installation requirements need to be in accordance with NFPA 1221, 510.5.2 and 510.5.5. Jeff asked what exactly does NFPA 1221 say – is it in agreement with everything else in section 510? If anyone can supply, it would be helpful. However, he asked group members to be careful - don't supply copyrighted documents - summaries of the requirements for discussion would be best.

Jeff: went over 510.5.1, .2, .3, .4, .5 installation requirements. 510.5.1 discusses mounting of donor antenna, signage and approval. Sections 510.5.2 and 510.5.3 discusses installation of amplification system, licensing and approval. Section 510.5.1.4 outlines the acceptance testing procedure. Section 510.5.1.5 mentions FCC compliance, and references FCC 47 CFR part 90.219, which the group will need to review further.

Jeff: Another situation to consider is when different jurisdictions (1st responders) come together in a single location; how does that work with an IBEC system?

Jay: In mutual aid agreements, the local jurisdiction is the unified command for all. They will give out their handsets or have other localities adjust their handsets to what the command center dictates. This is accomplished with an 'Incident Management System'.

Jay: Regarding certification and licensing. Will this be added into the proposal, or just referencing IFC?

Jeff: Good point. If Andrew's proposal is used, it specifically references section 510.5, which lists specific minimum qualifications. A question to consider is should section 510.5 be referenced, or should it be deferred to the fire official to determine? Either way, this is separate from licensing requirements – If a contractor's license is required, that would be through DPOR and would be separate from and in addition to any minimum qualification requirements of the code.

Dana: Whomever installs the system has to be certified by the manufacturer (ex: Honeywell), and whomever performs the annual and 5 year inspections has to be certified to cover that manufacturer's system. The certification requirement therefore, kind of handles itself, since it will void the warranty if not adhered to.

Jeff: summarized section 510.6: maintenance. 510.6.1-testing; 510.6.2-additional frequencies (cost on the building owner); 510.6.3-nonpublic; 510.6.4-field testing. All of this is maintenance and could have costs associated. These costs should be addressed by the group, or see if it is already addressed elsewhere.

Andrew: It is already in addressed in (2018 SFPC) section 510.3

Cindy: In Virginia now, when a building is approved as code compliant, you don't have to keep upgrading things to bring them up to current codes. Whose problem is it when another building is built next-door, or something else happens to impede the signal after a system is approved? She asked if anyone in the group is familiar with the NIST research happening now around first responder communications, or if anyone is involved in any other work that may affect future codes in this area, which could be incorporated now?

Jay: On existing buildings, if construction is completed and C.O.s have been issued, then yes – who is responsible, especially if a neighbor builds something that interferes? If localities change signal strength, the localities would have to adjust everyone's system accordingly (not a cost to building owners).

Cindy: If a locality adjusts signal at no cost, it is a non-issue for this group. However, all costs and any kind of retrofit is an important question to discuss. If systems are required, who, how, when, cost, etc…for updating? In the past, retrofit has only been done by legislation.

Installation Responsibility

Jeff: Another thing to consider – what if you're putting the new building in an established area and others have their signals set until you come in? Would the new building owner carry the cost to adjust all the other building signals or systems? Is there any example today that anyone can share on this? Who is responsible?

Dana: In Florida, there are class 'a' and class 'b' systems, depending on area density. If an established building owner has an annual inspection, and changes are needed, the building owner is responsible to adjust. It also depends on tower location, so it's difficult to give a blanket answer to anything. For the most part, it's understood that owners just have to live with what's there, what they have, what happens after… The main

thing is the main system (infrastructure). If that's as it should be, you can always add, remove or adjust antennas / boosters at an unsubstantial cost.

Andrew: If a locality determines a lack of coverage, they should be in the mix of fixing it. In the past, it was like throwing the baby out with the bathwater by saying that there wasn't an easy solution to existing buildings, so drop the whole issue. Now, it's pretty important to discuss primarily new buildings, so that there can be a focus on the system issues across the board, as charged in Title 36. Existing buildings should be a separate issue and discussed separately.

Steve: has the same question as Cindy. AOBA isn't in favor of building owners taking any additional responsibility. It isn't right for existing owners to take on the cost for a neighbor putting up new building and impeding the signal in their building. It doesn't make any sense at all.

Jamie: It goes back to the current code language for installation – the owner will install and the locality is also responsible. It's not like other issues, where there are details about who is responsible for what, and a clear delineation. Installation is also not clearly described – no guidelines or reference to standards.

Jeff: Even if no changes are made to responsibility, should there be more specifics about installation requirements? Localities are handling this now through local policies (as discussed earlier), since there aren't specifics. What is the current consensus in the group? (Is everyone in agreement that the current VCC requirements should be amended to include more specific design and installation information?)

Jay: He doesn't have a problem with leaving the code as it is now regarding installation requirements. Localities are handling that now. For existing buildings, he agrees with Andrew that it's better to not discuss existing structures now, because there won't be any progress on new construction.

Jeff: With other systems, the owner maintains them as approved, and doesn't need to pay to upgrade. The existing building discussion can be had later, but it won't hold up the new construction discussion now.

Steve: As far as agreeing to update the VCC to reference IFC sections 510.4 and 510.5, he wants to consult with his association for additional guidance.

Andrew: Also agreed that it's a valuable discussion, but to keep in mind the Title 36 mandate for IBEC systems in new construction.

Dana: There is discussion happening regarding K-12 schools now, as far as upgrading existing structures, however implementation keeps getting kicked down the road. The Safer Buildings Coalition is lobbying for this presently. Perhaps discussion around IBEC systems in existing buildings could be something that would require implementation in a future date?

Jeff: Summarized things that were discussed in this section, and asked if there were any other things to consider.

{LUNCH BREAK 11:57am – 1:00pm}

System Costs

Jeff: wanted to start identifying what the costs may be for the locality and/or building owner – for the current code, proposal(s) and any other discussion.

Jeff: Permit fees: does anyone know about or have experience with this?

Andrew: Yes. His experience is that permit fees requirements are similar to fees for fire alarm systems.

Troy: Currently updating the DEB permitting policy. Going by the exception in the building code for systems 30v or less. They don't need a permit unless they penetrate fire-rated construction, or are being run in plenums.

Tread: Since the IBEC system will be tied into the fire alarm system, he thinks a permit should be required.

Jeff: ROM study or other pre-construction estimate analysis?

Dana: ROM studies cost a few thousand or less.

Jeff: Is it a cost that is separately paid, or is it integrated in the overall design cost?

Dana: Information is all gathered first, but there still can't get be an exact cost estimate. An iBwave design system is typically used. It can be tied in with the overall design price in contract, or it can be individually priced. It can also be integrated with electricians. BDA instillation can be part of the electrician's or fire alarm installer's responsibility. Later, when actual data comes in after the build, the cost can change.

Jeff: Are there any other pre-installation fees – FCC, local authority?

Dana: She doesn't think so. There's a small permitting fee from the local jurisdiction, but that's it. She will double check to make sure there are no other costs.

Jeff: There is also the cost of annual and periodic (5 yr) tests, and possible system upgrades or modification costs. Is there anything else?

Dana: There's usually a maintenance agreement with an inspector for a fee. They are usually set for 5 years and can cost up to about $5k for larger buildings. Hospitals are typically more complicated. It can also be setup with extra costs for different things, like emergency off-hours contacts, for example.

Jeff: Could these be stand-alone, or also tied in with the fire alarm system?

Dana: They are usually included in one agreement. They can stand alone if there is not a separate fire alarm system.

Steve: How about cost of the system itself?

Jeff: Yes, design and installation is a cost that will be included in the list.

Dana: She looked at NFPA 1225 quickly, which discusses 2 hour rated vs. standard coax (there's a big cost difference). She will look at it further.

Jeff: Is this something new in NFPA 1225 that is not in 1221? Please look and share next time.

Tread: Any metal conduit, (EMT, IMC or RMC) will be a 2 hour rating. It is more expensive than a standard UL 444 coaxial cable, but much less than a 1941 cable, which is cost-prohibitive – about $135 per foot for a 1,000 foot reel. Cost for EMT, IMC or RMC cable costs a few dollars ($8-$10) per foot.

Troy: Did Tread say that putting a coax in conduit would provide a 2 hour rating?

Tread: Yes. EMT, IMC or RMC will give the equivalent of a 2 hour rating. He will get the information to support it.

Troy: The 2 hour rated cable is only required for riser, but not horizontal cabling? He will double check. It could be in the 1221 or 1225. He thinks it is consistent with the building rating.

Cindy: Does conduit keep the radiating cable from working the way it's supposed to?

Andrew: If referring to "leaky cable", that is an older technology. Now, we see systems where the cable goes from an amplifier to a repeater device in the building.

3) Other

Jeff: Jamie asked earlier (in the chat box) if the SFPC covers maintenance. Yes, section 510 of the SFPC does cover maintenance. 510.2 states that the owner must provide space for and access to the system. The locality is responsible for testing and associated upgrades, at no cost to the owner (unless owner doesn't provide access). Jeff: provided a link in the chat box to a NIST program of public safety communications, which may point to new technology that could be emerging; cellular and LTE. These should be discussed, and latest technology should be identified and included if it will be the new industry standard.

Troy: He did read an article recently from the Safer Buildings Coalition that says that the 2022 edition of NFPA 1225 discussed 'standards for emergency service communications', which used to be 'emergency communications enhancement systems'. It says that land mobile radio systems are being used less, and cellular and LTE systems are being used more. It also references the future of PS communications and FirstNet.

Jeff: Yes, any new technologies – bring to the table.

4) Assignments and Next Steps

Jeff: between now and the next meeting, collect data on:

- **Cost:** Steve & Troy
- **NFPA 1221 & 1225, UL 2524 and FCC 47 CFR part 90.219**: Dana
- **Other States/localities:** (requirements, funding, etc.)
    - Jay will find out about NC and MD and what's new.
    - Andrew will look for national data about who does what where.
- **NIST:** DHCD will contact a public service coordinator

5) Next Meeting

Jeff: Asked the group to get all data collected and remitted to DHCD in a timely fashion, so it can get on the agenda and be sent out to the group to review prior to next meeting. A Doodle poll will be sent to the group members to determine when the best date is for the next meeting. Jeff thinks maybe the week of Jan 17th (although the 17th is holiday). He wished a happy and healthy new year to all.

AGENDA

In-Building Emergency Communications Study Group

January 18, 2022

9:00 a.m.

Virtual Meeting: https://vadhcd.adobeconnect.com/va2021cdc/

I) Welcome

II) Discussion

- **A) NFPA 1221 and 1225**
- **B) UL2524**
- **C) FCC 47 CFR part 90.219**
- **D) National Data**
- **E) NIST Public Safety Communications Research**
- **F) Other Fees (FCC, local radio authority,etc.)**
- **G) System Costs**
- **H) FEMA P-25**
- **I) 2021 IBC Section 2702.2.3**
- **J) ERCES Standard Proposal**

III) Other

IV) Assignments and Next Steps

V) Next Meeting

In-Building Emergency Communications Study Group

Meeting Summary: January 18, 2022 9:00 a.m. to 11:09 a.m.

Virtual Meeting: https://vadhcd.adobeconnect.com/va2021cdc/

ATTENDEES:

VA Department of Housing and Community Development (DHCD) Staff:

Cindy Davis: *Deputy Director, Division of Building and Fire Regulations (BFR)*
Jeanette Campbell: *Administrative Assistant, BFR*
Jeff Brown: *State Building Codes Director, State Building Codes Office (SBCO)*
Richard Potts: *Code Development and Technical Support Administrator, SBCO*
Paul Messplay: *Code and Regulation Specialist, SBCO*
Florin Moldovan: *Code and Regulation Specialist, SBCO*
Travis Luter: *Code and Regulation Specialist, SBCO*

Study Group Members:

Jamie Wilks: *Madison County Building Official; VA Building Code Officials Association (VBCOA) committee member; prior Building Official in Matthews County; Retired from Norfolk fire department*
Robert (Jonah) Margarella: *Architect at Baskervill (Studio Director); 24+ years in architecture; member of State Building Code Technical Review Board (SBCTRB)*
Steve Shapiro: *Retired Building Official, City of Hampton-34 years; LLC Shapiro Associates; Apartment & Office Building Association (AOBA); prior President of International Code Council (ICC)*
Dana Buchwald: *Senior Account Manager (in-building signal for emergency responders) at Backhaul Engineering*
Joseph (Tread) Willis: *International Association of Electrical Inspectors-VA (IAEI)*
Debbie Messmer: *Virginia Department of Emergency Management (VDEM)*
Troy Knapp: *Electric Plan Reviewer with VA Department of General Services (DGS), Division of Engineering and Buildings; prior Electric Plan Review Engineer 13 years William & Mary College; 20+ years Electrical Engineer*
Andrew Milliken: *VA Fire Chiefs Association (VFCA), VA Fire Services Board (VFSB) Chairman of Fire Codes and Standards Committee, (also submitted a proposal on this issue)*
Dwayne Tuggle: *Amherst, VA Mayor; VA State Police-retired*
Jim Crozier: *Virginia Association of Counties (VACO)*

Other Interested Parties:

Todd Strang: *Spotsylvania County Fire Official*
Sean Farrell: *Prince William County*

Study Group Members not in attendance:

Patrick Green: *Virginia State Police (VSP)*
Jodi Roth: *Virginia Retail Federation*
Robert Melvin: *Restaurant, Lodging & Travel Association (VRLTA), Director of Government Affairs*
Joshua (Jay) Davis: *Virginia Department of Fire Programs (VDFP)*
Gerry Maiataco: *Virginia Fire Prevention Association (VFPA)*
Tammy Breski: *Broadband Project Manager, VA DHCD Division of Community Development; prior Verizon Construction Manager*

AGENDA AND DISCUSSION ITEMS:

Welcome

Jeff Brown: Welcomed everyone. He gave a reminder that these meetings are being recorded for the purpose of preparing meeting summaries. This meeting is scheduled to run until 3pm, but it may end early. There will be breaks every hour. Study group members are listed in the box on the left of the main meeting screen. Meetings are open to all, but discussion and chat should only be between study group members. Individuals who are not study group members are welcome to reach out to a group member or DHCD staff to ask questions or share opinions outside of the meeting. The summary from the last meeting is posted on the DHCD website, with a link in cdpVA for review. He asked for the group members to check their microphones for correct operation.

Discussion

Jeff: There were good discussions and topics raised in the last meetings. There were some assignments, and group members brought back information for discussion in this meeting. The related documents were sent out to study group members and are also available to view or download in the 'files' pod on bottom left of the Adobe Connect meeting window. The end goal for this group is to provide a summary or report of all the discussions. He asked DHCD staff to begin working on that. He hopes to cover any remaining topics today, and identify all areas of agreement and disagreement. He is hoping that the group may be able to wrap up meetings today and potentially finish up via email. He asked everyone to speak up as needed. He noted that costs are something that the group may want to discuss further.

NFPA 1221 and 1225

Jeff: The 2021 IFC references NFPA 1221. NFPA 1225 is being considered for reference in later editions of the IFC. Dana looked into these further and provided document #6 in the 'files' box to the left on the screen. The document "NFPA 1225 vs NFPA 1221 – Dana" explains how the NFPA standards work with the IFC, the differences between the two standards and what it would look like moving from the 1221 to the 1225 as the newer standard.

Dana Buchwald: In 1225, the information is compiled in one place and is more user friendly than 1221. They changed some verbiage from ERCES to different terminology, opening up the type of communication to other types of technology. Cell technology has come up a lot, but there would still be a need for DAS infrastructure. Also, cell can't run too close to RF; they have to be a certain distance apart. The cost is significantly more (cell) under the guise of a third party, so there's not as much control as in a P25 system. They have lightened up on the cable requirements. Conduit is so expensive and is needed for the donor antenna. However, the requirements have lightened up on horizontal runs. The DAQ up to 3.0 is required, but that is subjective.

Jeff: The 2021 IFC requires a DAQ of 3.0. Is 1225 requiring the same thing?

Dana: It may be 3.4 in 1225. Critical area coverage (like under stairs) has gone to 99% in 1225, as opposed to 95% in 1221.

From Chat Box:

Paul Messplay-DHCD: 18.9.1 in NFPA 1225 requires DAQ of at least 3.0 09:12AM

Paul Messplay-DHCD: 510.4.1.2 in 2021 IFC also requires minimum 3.0 DAQ 09:15AM

Jeff: The 2021 IFC requires 95% in all areas and 99% in critical areas. It sounds like the 1225 has a lot of the same requirements. Any conflicting requirements of referenced standards would have to be handled through the USBC order of precedence. If the IFC matches the 1221 or 1225, there would not be a problem. However, if 1221 or 1225 have a different requirement than the IFC, the IFC requirement would take precedence. The IFC says that the system has to be designed in accordance with section 510 and the NFPA. They do not appear to conflict so far.

Dana: A 2-hour burn cable is not required in 1-hour building. For buildings with sprinklers, they back off on the cabling aspect.

Jeff: Asked if there were any other comments about the subject? He would like to have input from other members about how the standards work together with the IFC. If the group recommends that the 2021 VCC reference the IFC, and the IFC references NFPA 1221, as long as there are no conflicts, that should work.

Steve Shapiro: Should IFC sections 510.4 and 510.5 be directly referenced? They seem to capture all the requirements.

Jeff: If the group agrees on that, we could draft a code change proposal.

Dana: The IFC covers new and existing buildings.

Jeff: The focus of this group is only on new buildings. This is why there should only be a reference to technical requirements in new buildings, such as the requirements in sections 510.4 and 510.5.

Jonah Margarella: As an architect reviewing plans, referencing either the IFC or NFPA would be helpful as guidance to design a system.

Andrew Milliken: Making an amendment to the IFC to reference 1225 would not be preferable. It would be better to let 1225 come in to later IFC editions as planned.

Jeff: Agrees. It is better to not amend the IFC, as it would cause some confusion since it is not usually done.

UL2524

Jeff: The UL listing is required in 2021 IFC section 510.4. DHCD found a training document from UL explaining the requirements of the UL standard. It was sent to the group and is available to download from files box in the meeting room. He asked the group to review and consider the requirements.

FCC 47 CFR part 90.219

Jeff: Systems must comply with FCC 47 CFR part 90.219. Dana provided that document. Jeff asked if there were any questions or comments.

Steve: Heard that the federal regulation stipulates who can license the systems. He thought it had to be the locality as per the CFR.

Dana: The only licensing is the FCC licensee. Permits for in-signal boosters are needed in some jurisdictions, but not others. Licensing the system also varies by jurisdiction, but she doesn't think it's mandated anywhere.

Troy Knapp: System licensing is taken care of under the FCC license holder agreement. The FCC license holder has to approve the installation of the particular system. That's the only licensing he's aware of.

Dana: She agrees with Troy. The only other licensing she has heard of is by jurisdiction for whatever they may want. They may refer to it as a license or a permit. The FCC licensee ensures that the radio signal is owned and that the frequencies are approved so that there's no interference. That's the only actual licensing she's aware of. Whomever is in control of the system in that area is to make sure that there's no interference to the frequencies of other owners.

National Data

Jeff: Andrew and Jay provided information in documents sent to the group, and available in the file box.

Andrew: Provided a document, and since then, he looked at all of the states. 47 of 50 states required new buildings to have in-building communication systems. Indiana and Minnesota allow the localities to decide and dictate what is required. Virginia is the only state now that has a combination of owner and locality requirements. The vast majority of states simply reference the IFC and enforce without amendment.

Jeff: Asked Andrew to send the remainder of that information he just shared, and it will be sent out to the group.

Steve: Just to clarify, 47 of 50 states require system installation and the owner is responsible?

Andrew: Yes, that's correct. The other 2 states (besides VA) allow the localities to make those decisions.

Jeff: Jay Davis provided a document from North Carolina, showing their Fire Code requirements in section 510. Jay was not on the call to discuss. Jeff showed the document to the group, noted that it's available in the files box and asked the group to review it.

NIST Public Safety Communications Research

Jeff: There was some discussion about this in past meetings. What is the future of these systems? Are there changes coming? What is the potential for cellular or LTE? The biggest concern is that whatever is put forward by the group should encompass discussion of the newest technology. Remembering that care must be taken

when mixing cell and RF, that they cannot be located too closely together. If a locality switches to cell or LTE, what would happen with the existing systems? Does every system have to be upgraded? What about wiring infrastructure?

Dana: Separation needs are true for straight cell. Public safety cell has to be separate from regular cell. It also has to be away from RF. Nothing should interfere with public safety. All over the country, P25 has been upgraded for emergency handheld devices. It doesn't seem likely that only cell would work.

Troy: He spoke with a systems integrator at RF Connect, which does both cell and public safety systems. A lot of cell systems are replacing hard-wired phones in buildings. Washington DC was first to go ahead with that with AT&T, but Verizon filed a lawsuit and won. There are problems with vendors and public safety liability. LTE or cell needs lots of data broadband connection. With handheld, there's not a lot needed and it's less expensive.

Jeff: It sounds like the technology is there, but it sounds like there are some challenges with implementation. Cell is being discussed, but not being used yet. He asked for the group to check and see if there's any other published information to say that it's going in that direction.

Troy: Reviewed a plan recently and got news that the City of Richmond fire department may be using cell phones, but he needs to confirm that.

Andrew: Could it be because there's no radio coverage?

Troy: No, it's new construction where there's no system installed yet.

Jeff: It sounds like currently most localities use handheld radios. On a national level, people are looking at new technology, but it doesn't sound like it's coming soon. We can provide commentary that some technology is being explored, but not being implemented in Virginia yet. Everyone is still using handheld with RF.

From Chat Box:

Paul Messplay-DHCD: Just spoke with Jim on the phone. He wanted me to relay that Orange county's P25 system is a combination system that uses cellular and RF. The units on their handhelds automatically switch between the two and dispatch can switch between them. If one of the signals drops, it automatically switches to the other 09:48AM

Other Fees (FCC, local radio authority, etc.)

Jeff: It seems like fees may be administered by local authorities, if there are any at all. This has already been discussed and it seems like there's nothing new to add.

From Chat Box:

Paul Messplay-DHCD: From Dana with regard to "Other fees": "There is nothing much to say in terms of permitting costs, it's across the board from 0 to whatever the locality decides, the joke is 0 to a million. There is no formula or standard and there's no charge from the FCC. Typically the electricians or Fire Alarm folks will be pulling permits." 09:51AM

System Costs

Jeff: This will be a question and concern for some stakeholders, especially if there's consideration for some proposals like the one Andrew submitted, which would switch responsibility to the building owner. He asked the group to look for representative examples of real life applications.

Steve: Spoke with an engineer yesterday, who will get him prices on various actual new projects:

1. High-rise commercial office building with 25 stories, about 560k square feet, courtyard, fitness center, food service restaurants and an underground parking deck
2. Low-rise commercial office building with 4 stories, about 40k square feet
3. High-rise multi-family building with 16 stories, about 178k square feet, 154 units, underground parking and fitness center

He hopes to have the data by the end of the week and he will provide it to the group as soon as he gets it.

Troy: The system integrator he knows says that cost is based on size. About $1k to $5k for small to large systems. Most typically sign up for maintenance and monitoring which costs about $1k to $2k per year. Another individual he spoke with said it would cost about 50–75 cents per square foot for installation.

Jeff: Just to clarify, the $1k to $5k you spoke of was for the annual testing and recertification of the system?

Troy: Yes.

FEMA P25

Jeff: Jamie Wilks submitted a document in the file box.

Jamie Wilks: The FEMA P25 is an initiative at the federal level to ensure that whatever systems are installed work in mutual aid situations. Most states have mutual aid programs. This would ensure systems can talk to each other between localities.

Jeff: Thanked Jamie for providing the document. There have been questions in previous discussions about how to addresses how systems work in mutual aid response situations.

2021 IBC Section 2702.2.3

Jeff: DHCD staff discovered another section in the IBC that discusses emergency responder communication systems. Most of the IBEC requirements are found in chapter 9, but this one is related to providing back up emergency power to these systems. It says that standby power at 100% for 12 hours is required. The group should consider and decide if this should be referenced, and if the owner or locality should be responsible to provide. It should also be compared with chapter 9 to see if there is any conflict.

{BREAK 10:00 to 10:07}

Jeff: Does anyone have thoughts or comments on the section 2702.2.3 requirements?

Tread Willis: The National Electric code is for legally required emergency stand by systems. Their standard is 1.5 hours for battery backups. 12 hours would need a generator and who would provide one? It could be a big cost. Multiple inverter systems could provide the 12 hours, but it could be problematic if owners or localities were forced to supply a generator.

Jeff: It does sound substantial. The biggest question now is if chapter 9 says that the owner provides the infrastructure and the locality provides communication equipment, who would provide the standby power? This will probably come up at some point and have to be addressed.

Troy: VCC 1008 specifies 90 minutes for emergency lighting only. 12 hours is not dictated by the National Electric code.

Jeff: This is a current section in building code, so it needs to be addressed. The NEC is a referenced standard, but the IBC still requires the 12 hour backup.

Steve: He looked at the 2015 IBC, and backup required was 24 hours and in 2018 it changed to 12 hours.

Andrew: The discussion is about standby power, not emergency power. The 90 minutes refers to getting people out of a building in an emergency situation. He recalls that the 24 hours was reduced to 12 hours because it pushed some buildings into tying it into the generator. The intent of the 12 hours in this section (he thinks the listing of the system requires 12 hours of battery backup) is similar to providing batteries for the actual components of the system, which wouldn't necessarily require a generator. Moving from the model code language, it is a point of confusion and conflict.

Jeff: If the 12 hours is typically something that's handled through batteries in the system, the issue would be taken care of. The problem would occur if there were a generator needed.

Dana: Agrees with Andrew. She's looking at a battery backup system now. It is for the system itself. She has never run into a generator issue. The 12 hour backup is for the system, and it is normal.

Jeff: If the 12 hours is specified in UL or in IFC 510, why is this section needed at all? Having this requirement in chapter 27 seems to complicate things. This may have been overlooked or come into effect after the original IBEC state amendments.

Steve: The 2021 IFC section 510.4.2.3 says that dedicated stand by batteries or 2 hour standby batteries connected to the generator in accordance with section 1203 are required. It also says that 12 hours stand by is required. He thinks it would work to reference that section of the IFC, which also agrees with the IBC section 2702.2.3.

From Chat Box:

Paul Messplay-DHCD: IFC section link: https://codes.iccsafe.org/content/IFC2021P1/chapter-5-fire-service-features#IFC2021P1_Pt03_Ch05_Sec510.4.2.3 10:19AM

Paul Messplay-DHCD: In-building, two-way emergency responder communication radio coverage systems shall be provided with dedicated standby batteries or provided with 2-hour standby batteries and connected to the facility generator power system in accordance with Section 1203. The standby power supply shall be capable of operating the in-building, two-way emergency responder communication coverage system at 100-percent system capacity for a duration of not less than 12 hours." 10:19AM

Jeff: If this group puts together a proposal and references 510.4 and 510.5, it should also be clear who is responsible to provide the battery backup. It should also cover the IBC requirements.

Andrew: The UL listing also requires 12 hours of battery backup at 100% capacity (slide 13 in the presentation provided).

Jeff: If we reference the IFC for design of these systems, it would be best to delete this section in Chapter 27 to avoid confusion, since it's covered already in the IFC and NFPA.

From Chat Box:

Paul Messplay-DHCD: FYI: The national data summary provided by Andrew has been updated in the files pod. Please download the most recent version 10:25AM

ERCES Standard Proposal

Jeff: There's one proposal in cdpVA that has already been submitted. We will likely get more. Proposals are due February 1st as a deadline to get to the first Workgroup meetings in March. The proposal is to amend section 918 to reference NFPA 1225 and require UL2524 listing (there are no changes to general, installation, or responsibility sections). He asked the group members to read the proposal. He noted that the group is not required to take any action on this proposal, unless there is unanimous agreement to support or not support the proposal. There will still be opportunity to comment on cdpVA or at the Workgroup meeting in the first week of March. Andrew mentioned that it may be too soon to reference 1225, since 1221 is already in the IFC.

Steve: What does "minimizing noise" mean in the reason statement, item 3, second bullet? In accordance with the CFR standard, the license holder is responsible for retransmission of the frequencies to which the licensee is licensed and is required to review and approve every IBEC enhancement system prior to installation.

Dana: In the exceptions, looking at number 3 - just because a building is one story, it doesn't mean it would qualify for an exception. At first, I thought 20k square feet would be too large, but it is probably ok, depending on what the building is made of. In exception 6 - buildings in localities that do not provide additional communication equipment required to operate the system - is that up for debate?

Jeff: The code change proposal is showing the existing code sections that are being amended, and only the underlined text is new (all other text is existing regulation). The change is proposing to add a new section to the 2021 VCC Section 918 referencing NFPA 1225 and requiring UL2524 listing

Jeff: Whatever this group puts forward, there will be a summary about what is agreed on and what is not agreed on.

Other

Jeff: Explained how to move forward with proposals. This group may provide a proposal, but will definitely provide background information and the group discussions, including areas of agreement and disagreement.

Steve: Comments to proponents of the ERCES standard proposal – what does the bullet about minimizing noise mean, and how would it be implemented?

Jeff: Will send along that question to the proponents.

Dana: Gave her understanding of what the "minimizing noise" bullet means. If someone is putting in a BDA for a building, they provide the antenna and call sign. The licensee has to sign off with their approval and give provisional transmission authorization. It lets the licensee know that whatever is used doesn't interfere with what is existing. It's just an approval from the licensee before installation.

Jeff: He has a question for the proponents similar to Steve's. They make a statement and reference 1225. Are they trying to say that this is something new that 1225 brings, or are they saying that by not referencing the IFC or any NFPA standards, they are missing out on that piece?

Jeff: Does everyone support DHCD or someone in the group drafting a proposal taking section 918 in the VCC, and incorporating references to IFC Sections 510.4 and 510.5 for the design and installation of IBEC systems? This would also incorporate the references to NFPA 1221 and UL2524 requirements. He asked for the group to vote with thumbs up or down. All group members voted thumbs up. Dana, Debbie, Dwayne, Jamie, Tread, Jonah, Steve, Troy and Andrew agreed. DHCD will draft the proposal and anyone else who volunteers can help.

Steve: Is there a consensus to delete IBC standby power, since it's covered by IFC?

Jeff: Asked the group to vote on that – deleting IBC standby power requirement from the VCC (since IFC and 1221 will be referenced)? All in favor. Everyone in the group voted yes. Jeff will include that change in the draft proposal as well.

Andrew: Likes having consensus. He asked for a vote to see where everyone stands on the question of responsibility.

Jeff: Any discussion on who is responsible?

Steve: He's willing to have more discussion and bring back to AOBA for their opinion. Retail Federation and Restaurant, Lodging and Travel may also have concerns.

Jeff: DHCD can help by contacting members that are not present today to ensure that we have input on the outstanding topics, so Andrew can finalize his proposal for submission in cdpVA. We can also determine who supports the proposal and assist in adding them as co-proponents.

Andrew: What is the timeline? Feb 1st?

Jeff: Feb 1st is the cutoff to get proposals in for the first set of Workgroup meetings. For the second set of workgroup meetings in April, the cutoff is March 12th.

Andrew: Will work on it, It may be good to see the first proposal before he completes his to sync up.

Jeff: That sounds good. Getting everything in by Feb 1st sounds tight. If the proposal is in by March 12th, there are still 2 more rounds of meetings in April and June.

Andrew: How about the 6 existing exceptions in the VCC? It would be good to look at them, since they are specific to VA.

Steve: Will go to AOBA to discuss. Exception 6 was just added in the 2018 VCC, but is proposed to be stricken in Andrew's proposal.

Jeff: Anyone else?

Troy: The VCC states something about anyone using communication systems. Some people he speaks with think that systems are only used by fire departments. Others are using them besides the fire department, the systems are used by all first responders.

Jeff: There could be commentary language in the IFC, but the VCC is clear that it's for all emergency responders. A proposal from the group could make it very clear that it's not just for fire officials.

NOTE: Troy contacted DHCD staff after the meeting and provided the following definition from the 2018 VCC that clarifies that IBEC systems are intended to benefit all first responders:

"*EMERGENCY PUBLIC SAFETY PERSONNEL. Emergency public safety personnel includes firefighters, emergency medical personnel, law-enforcement officers, and other emergency public safety personnel routinely called upon to provide emergency assistance to members of the public in a wide variety of emergency situations, including fires, medical emergencies, violent crimes, and terrorist attacks*."

Assignments and Next Steps

Jeff: DHCD will draft a proposal, anyone in the group is welcome to assist. He will not schedule next meeting yet, until more information is gathered. If there's another meeting needed, DHCD will send a Doodle poll for the date.

Jeff: anything else?

Dana: FirstNet doesn't replace a system, it augments it.

Jeff: Does anyone have documentation related to handheld and RF working in conjunction with Cell and LTE? Any documentation on emerging new technologies to summarize and support what technologies are used now, when new technology might be coming, and what upgrades might be required?

Dana: It cost a fortune to upgrade to P25, and this was recently done not just throughout VA, but all over the country. She doesn't think there will be a massive change from that soon since everyone just invested in new P25 systems. They are tried and true.

Jeff: We can summarize this discussion in our report, but so far we really only have statements and no data on this topic. Are there any whitepapers or anything else published about this to support that there is no change expected in the near future?

Dana: Even if newer technology is wanted, there's still infrastructure, providers, maintenance, fees, etc. involved driving the cost up. She doesn't think that will be easy to pass.

Jeff: He knows the question will come up, so the group will include in their summary. He thanked everyone for their time and closed the meeting.

Additional Information needed:

- Jeff asked Andrew to send over documentation to support that 47 of the 50 states required new buildings to have in-building communication systems, with Indiana and Minnesota allowing localities to decide.

- DHCD staff will ask proponents of the ERCES standard proposal:
    - What does the bullet about minimizing noise mean, and how would it be implemented?
    - Also, they make a statement and reference 1225. Are they trying to say that this is something new that 1225 brings, or are they saying that by not referencing the IFC or any NFPA standards, they are missing out on that piece?

- Regarding Andrew's proposal:
    - Steve will bring back to AOBA for their opinion regarding responsibility and striking exception 6. Retail Federation and Restaurant, Lodging and Travel may also have concerns.
    - DHCD will help gather input form members, especially those not in attendance today, to assist Andrew in finalizing his proposal and can also assist with adding co-proponents in cdpVA before March 12.

AGENDA

In-Building Emergency Communications Study Group

February 24th, 2022

9:00 a.m.

Virtual Meeting: https://vadhcd.adobeconnect.com/va2021cdc/

I. Welcome

II. Discussion

   a. Costs
   b. Responsibility
   c. Radiating Cable
   d. Andrew Milliken Proposal
   e. Staff Proposal

III. Other

IV. Next Steps

In-Building Emergency Communications Study Group

Meeting Summary: February 24, 2022 9:00 a.m. to 10:26 a.m.

Virtual Meeting: https://vadhcd.adobeconnect.com/va2021cdc/

ATTENDEES:

VA Department of Housing and Community Development (DHCD) Staff:

Jeff Brown: *State Building Codes Director, State Building Codes Office (SBCO)*
Richard Potts: *Code Development and Technical Support Administrator, SBCO*
Paul Messplay: *Code and Regulation Specialist, SBCO*
Florin Moldovan: *Code and Regulation Specialist, SBCO*
Travis Luter: *Code and Regulation Specialist, SBCO*
Jeanette Campbell: *Administrative Assistant, Division of Building and Fire Regulations (BFR)*

Study Group Members:

Jamie Wilks: *Madison County Building Official; VA Building and Code Officials Association (VBCOA) committee member; prior Building Official in Matthews County; Retired from Norfolk fire department*
Robert (Jonah) Margarella: *Architect at Baskervill (Studio Director); 24+ years in architecture; member of State Building Code Technical Review Board (SBCTRB)*
Steve Shapiro: *Retired Building Official, City of Hampton-34 years; LLC Shapiro Associates; Apartment & Office Building Association (AOBA); prior President of International Code Council (ICC)*
Dana Buchwald: *Senior Account Manager (in-building signal for emergency responders) at Backhaul Engineering*
Debbie Messmer: *Virginia Department of Emergency Management (VDEM)*
Andrew Milliken: *VA Fire Chiefs Association (VFCA), VA Fire Services Board (VFSB) Chairman of Fire Codes and Standards Committee, (also submitted a proposal on this issue)*
Tammy Breski: *Broadband Project Manager, VA DHCD Division of Community Development; prior Verizon Construction Manager*

Other Interested Parties:

Ron Clements: *VFSB Chairman of Fire Codes and Standards Committee*
Sean Farrell: *Prince William County*

Study Group Members not in attendance:

Troy Knapp: *Electric Plan Reviewer with VA Department of General Services (DGS), Division of Engineering and Buildings (DEB), 20+ years Electrical Engineer*
Joseph (Tread) Willis: *International Association of Electrical Inspectors-VA (IAEI)*
Dwayne Tuggle: *Amherst, VA Mayor; VA State Police-retired*
Jim Crozier: *Virginia Association of Counties (VACO)*
Patrick Green: *Virginia State Police (VSP)*
Jodi Roth: *Virginia Retail Federation*
Robert Melvin: *Restaurant, Lodging & Travel Association (VRLTA), Director of Government Affairs*
Joshua (Jay) Davis: *Virginia Department of Fire Programs (VDFP)*
Gerry Maiataco: *Virginia Fire Prevention Association (VFPA)*

DISCUSSION:

Welcome

Jeff Brown: Welcomed everyone to the meeting, reminded the group that the meeting will be recorded. Asked members to stay muted when not speaking, and identify themselves when they do speak. There will be a 5 minute break each hour, and an hour for lunch from 12-1pm, if the meeting runs that long. The meeting is open to the public, but the discussion is limited to the Study Group members. Group members are listed in a pod at the bottom of the Adobe meeting room.

Andrew Milliken Proposal

Jeff: This proposal basically changes responsibility of installation of the in-building emergency system to the building owner. It also references IFC sections 510.4 and 510.5 for the design and installation of the systems. Andrew did get input from some study group members since the last meeting. He would like to complete the draft after today's discussion. If there are any co-proponents to the proposal, they will be added when it's ready to be submitted.

Andrew Milliken: He did get some group feedback and not many changes have been made. He wants to bring system responsibility to building owners, as it is in most parts of the country. There is a sentence added to the end of section 918.1.1, saying that the requirement is no greater than what is already being provided by the jurisdiction. This language from the model code would not be incorporated in 510.4 and 510.5, and would be the basis for the requirements. He's interested in hearing any additional comments or suggestions from the group.

Steve Shapiro: He and Robert Melvin, and those they represent all agree that they do not want the responsibility to be on the business owner.

Jeff: Will send an email after today's discussion to get a vote from all Study Group members to see who supports or does not support the proposal. Co-proponents will be added to the proposal, and all the notes will be included in the final report.

Jamie Wilks: He supports this proposal, and he doesn't think the responsibility should be on the individual localities. The systems are very important for the first responders and for the safety of all.

Steve: Asked for confirmation that the people who do not support the proposal will be noted somewhere, and that the Board will know that there is not full consensus for the proposal.

Jeff: Yes, there will be a summary report prepared by DHCD to the Board indicating the reasons for non-consensus, including names of proponents and non-proponents.

Dana Buchwald: Would like to know what reasons the non-supporters have.

Steve: The cost for the building owner, including equipment installation and upgrades.

Dana: She thinks that the building owner should pay. She thinks that the cost of the system is minimal relative to the entire cost of the building.

Jamie: In all due respect to Steve and his constituents, he thinks building owners should pay for the systems as a matter of public safety, and it should not be the responsibility of the localities.

Jeff: DHCD will work with Andrew to finalize the proposal and will send a poll to the group. Proponent's names will be included on the proposal when it goes forward.

Andrew: He thanked everyone for their participation.

Staff Proposal

Jeff: Based on feedback from the group, the current code requirements do not provide much guidance on the technical requirements of the system. This proposal is intended to provide that guidance, and not to address the question of responsibility. Section 918.1.1 was rearranged and broken down into two sections: installation and responsibility. The installation section references installation in accordance with IFC sections 510.4 and 510.5. Section 918.2 says that the locality shall do the acceptance testing, however IFC 510.5.4 says that the building owner shall do the testing. He asked the group to discuss. Paul provided a link in the chat box to IFC section 510.5.4. There is a certain order of precedence in VCC Chapter 1 in that most administrative things in the reference codes and standards are superseded by the VCC, except for some testing and inspection requirements.

Part of this amendment references the IFC. There may be an opportunity to provide an exception stating that the locality is responsible for the acceptance testing.

Andrew: Asked Jeff to clarify the 'except for…' language suggested for the acceptance testing. He thought the guidance from 510.4 and 510.5 was being followed, but it seems like 918 would override that.

Jeff: He would leave 918.2 as it is, but put an exception after 918.1.1 that exception testing should be the responsibility of the locality.

Andrew: Acceptance testing should be done by the designer, who provided the system and who needs to be properly trained. Localities may not be certified.

Steve: Sees the potential conflict, but in 918.2 now, the localities are responsible for the acceptance testing. He thinks that the solution Jeff offered in the language would work.

Andrew: Is thinking of a situation where the locality doesn't provide equipment and doesn't have the technical expertise to do the acceptance testing. Sections 510.4 and 510.5 outline the steps for the process, but in this case, it would not apply and the locality would have to come up with their own process.

Jeff: Without a change, the locality would be doing it anyway.

Dana: Agrees with Andrew. She doesn't think that localities would be prepared to do the testing, since there's certain expertise required for each system.

Jeff: Says that the localities are doing it now. He asked the group how localities are doing it now, according to 918.2.

Andrew: Section 918.1.1.1 looks like it has a lot of existing language. Is there a way to outline in the proposal where it comes from, because right now it looks like a brand new section? He doesn't want to confer that the group is endorsing responsibility on the building owner, instead of simply revising the section and changing the order of the language.

Jeff: DHCD can put it back into one paragraph, if it makes it cleaner and easier for some group members to support.

Andrew: Thinks it should be left as it was.

Jeff: Does anyone object to the formatting? Leaving 918.1.1 as it was in the 2018 Code? Since there's no objection, it will be left. He still would like to hear from the group about sections 510.4 and 510.5.

Steve: Asked Jeff if he wanted to explain the deletion of the IBC section at the bottom of the page.

Jeff: IBC 2702.2.3 has some requirements for emergency or stand-by power. IFC and NFPA both already have those requirements, so it was stricken, since it is redundant. In section 918.1.1, when localities provide the equipment, they will do the acceptance testing, and building owners will provide space and access for that testing. Once completed, it will be sent out with a poll and if everyone supports it, we'll put it forward as a proposal from the Study Group. If it isn't fully supported, that will be noted.

Andrew: Adopting those particular sections would work without an additional exception.

Steve: In Andrew's proposal, exception # 6 was stricken, but it's still in this proposal. Does Andrew still support this proposal?

Andrew: Responsibility per sections 510.4 and 510.5 are a broader discussion. In this case, he supports for the purpose of consensus. Changing the first sentence to reference the IFC is fine.

Jaimie: We have two proposals, are we discussing moving both proposals forward?

Jeff: Some will support both, but we will explain the intent of both. This proposal focuses on one change in bringing in section 510.4 and 510.5. Most will support it. Andrew's proposal changes the responsibility to the building owner.

Jaimie: Thinks there may be some confusion moving forward with both proposals.

Jeff: If some are not comfortable supporting Andrew's proposal, the other one could still go through with consensus. Both proposals plus a Study Group report and meeting summaries will be provided to the Workgroups.

Jeff: There were questions about the FCC licenses. The IFC seems to reference two different licenses. One that allows the locality to operate on a certain frequency. The other says that there is also a general radio license required. Is this standard or is it something new?

Dana: This is standard everywhere. There needs to be someone on site with a GROL general radio operator's license.

Jeff: How does incorporation of NFPA 1221 correlate with the IFC? He doesn't think there's a conflict and the IFC should take precedence. He asked the group if there is any other discussion about this.

Dana: No significant differences that she noticed.

Costs

Jeff: There was some discussion about costs in general, but there were no specifics. Steve did gather some more specific information for the group to review.

Steve: He reached out to an associate at Siemens, who collected costs based on real life data. This is the current cost for the building owner, not including anything for the locality. Based on the type of project, the costs were anywhere from $0.10 to $0.38 per square foot for the system. (Attachment provided: "IBEC Costs – Steve Shapiro)

Jeff: DHCD will include the information in the final report.

Steve: The costs were not much different in 2003 or 2004, when the General Assembly addressed the issue.

Tammy Breski: Asked if anyone has given thought to wireless, or is that an add-on. In one case, retrofit of wireless on top of a DAS system added a significant cost when both antennas were put together.

Jeff: Building owners are adding wireless more and more. The group focus has been on IBEC, but wireless may come into play.

Dana: Cellular and public safety DAS are frequently done together, but they do need to be a certain distance apart from each other.

Responsibility

Jeff: DHCD noticed that the responsibility for the installation is addressed by the code, but not necessarily the design of the system. Typically the building owner has been responsible for the design and putting the cabling in. However, the VCC is not clear on the other aspects of the system, such as who designs the system and gets it up to a point where the locality installs their additional equipment. He asked the group to discuss what they have seen in the field.

Steve: Doesn't think AOBA has any issue with this being the building owner's responsibility, but he is not sure how this has been handled in the various localities.

Jeff: It does seem like the building owners are responsible for system design. If localities are providing equipment and perform the acceptance testing, do they also have input on the design of the system?

Dana: The owners usually use software called ibWave to assist with the system design. The owners would provide a ROM (Rough Order of Magnitude) prior to the build. The manufacturer, or independent contractor would provide the design.

Jeff: Is it up to the building owner to pick a vendor? Who handles that? Would the locality have a say?

Dana: There can't be too many chiefs. Especially in new construction. The ultimate desire would be for the architect to include the system design in their specs. The industry is heading in that direction, but is not there yet.

Jeff: If Andrew's proposal goes through, it would change the responsibility. If the other proposal goes through, it would not change responsibility.

{BREAK – 10:03 – 10:08}

Radiating Cable

Jeff: This was mentioned by the group during previous meetings, but there was not much discussion. Section 918 says that the building owner shall install radiating cable, which is now outdated. He asked if the group thinks that this should be addressed, since it seems to indicate that radiating cable is the only option.

Dana: She thinks that type of cable is usually used for long tunnels, but not necessary for buildings.

Steve: Thinks that using radiating cable may defeat the purpose because it doesn't work inside of a conduit.

Jamie: Thinks that the language should be corrected if it is outdated, and that it should be more inclusive or open ended so that it doesn't have to continue to be changed with new technology.

Jeff: Asked if anyone could suggest better language for this section.

Steve: Will ask the Siemens engineer that provided the cost estimates and send Jeff an email response.

Jeff: Asked if anyone is familiar with Backbone cable mentioned in NFPA 1225.

Tammy: Not necessarily answering the question about backbone cable. However, most cabling on DAS systems are a plenum-rated cable, and some are using a Cat 5 cable. Perhaps generic language should be used, not identifying the type of cable.

Jeff: He asked Tammy to clarify if she was saying that since there are different types of cabling that could be utilized, did she mean to say that generic language should be used in the proposal, such as "the owner should provide cabling"?

Tammy: Yes.

Dana: Usually ½" plenum cable is used. There has been pushback about how much conduit is needed and if it needs backbone or horizontal runs. The language in the proposal could encompass everything under just the word "cabling".

Jeff: It sounds like it should just say "the building owner shall install cabling". He asked for thumbs up or down poll now, and he will follow up with a poll to the entire group. Three thumbs up and none down. Should this be included in the DHCD-drafted proposal? Or should there be a stand-alone proposal for this language?

Steve: The safest thing would be to make this a separate change.

Jeff: That sounds good. DHCD will send a poll, and if the full group supports, it will be a separate SG proposal to change the language to read "cabling". If the full group is not in support, it will be a proposal with proponents named.

Next Steps

Jeff: DHCD will get proposals drafted and put out on cdpVA, noting who supports them. DHCD will get the SG report drafted and out to the group, then to the public before the report and proposals go to the Workgroup.

Steve: What are the dates for the Workgroup?

Jeff: There's a 30 day cutoff for proposals before Workgroup meets, so any from this group will need to be submitted by March 12 for the April meetings. Otherwise, they will be done before May 1, for consideration in the June Workgroup meetings.

Jaimie: Thanked the SG members. He considers both proposals to be an improvement over what is there now.

Jeff: Yes. Thanks to all.

APPENDIX B: Study Group Members

IN-BUILDING EMERGENCY COMMUNICATIONS

Study Group Members

Jamie Wilks – Virginia Building and Code Officials Association

Jonah Margarella – American Institute of Architects, VA Chapter

Gerry Maiataco – Virginia Fire Prevention Association

Tread Willis – International Association of Electrical Inspectors, Virginia Chapter

Andrew Milliken – Virginia Fire Chiefs Association

Jay Davis – Virginia Department of Fire Programs

Jim Crozier – Virginia Association of Counties

Dwayne Tuggle – Virginia Municipal League

Steve Shapiro – Virginia Apartment & Office Building Association / Virginia Apartment Management Association

Dana Buchwald – Backhaul Engineering

Debbie Messmer – Virginia Department of Emergency Management

Patrick Green – Virginia State Police

Troy Knapp – Virginia Department of General Services

Tammy Breski – DHCD Broadband Office

Robert Melvin – Virginia Restaurant, Lodging & Travel Association

Jodi Roth – Virginia Retail Federation

APPENDIX C: Supporting Documentation


VIRGINIA
DHCD
VIRGINIA DEPARTMENT OF HOUSING
AND COMMUNITY DEVELOPMENT
Partners for Better Communities

In-Building Emergency Communications Study Group

December 1, 2021 Meeting

2021 Code Development Cycle

DHCD staff

Cindy Davis, Deputy Director of Building and Fire Regulations

Jeff Brown, State Building Codes Office Director

Richard Potts, Code Development and Technical Support Administrator

Paul Messplay, Code & Regulation Specialist

Florin Moldovan, Code & Regulation Specialist

Study Group members

- Jamie Wilks, VBCOA
- Jonah Margarella, AIA-VA
- Gerry Maiataco, VFPA
- Tread Willis, IAEI-VA
- VFCA
- Jay Davis, VDFP
- Jim Crozier, VACO
- Dwayne Tuggle, VML
- Steve Shapiro, AOBA
- Dana Buchwald, Backhaul Engineering
- Debbie Messmer, VDEM
- Patrick Green, VSP
- Troy Knapp, DGS
- Tammy Breski, DHCD
- Robert Melvin, VRLTA
- Jodi Roth, VRF

2021 code development cycle (tentative dates)

October 1st cdpVA was opened for submission on code change proposals for the 2021 Code Development Cycle

November 2021: Notices of Intended Regulatory Action (NOIRAs) Published

December 2021: Study Groups begin meeting

February 2022: Sub-Workgroups begin meeting

March-June 2022: Stakeholder Workgroup meetings

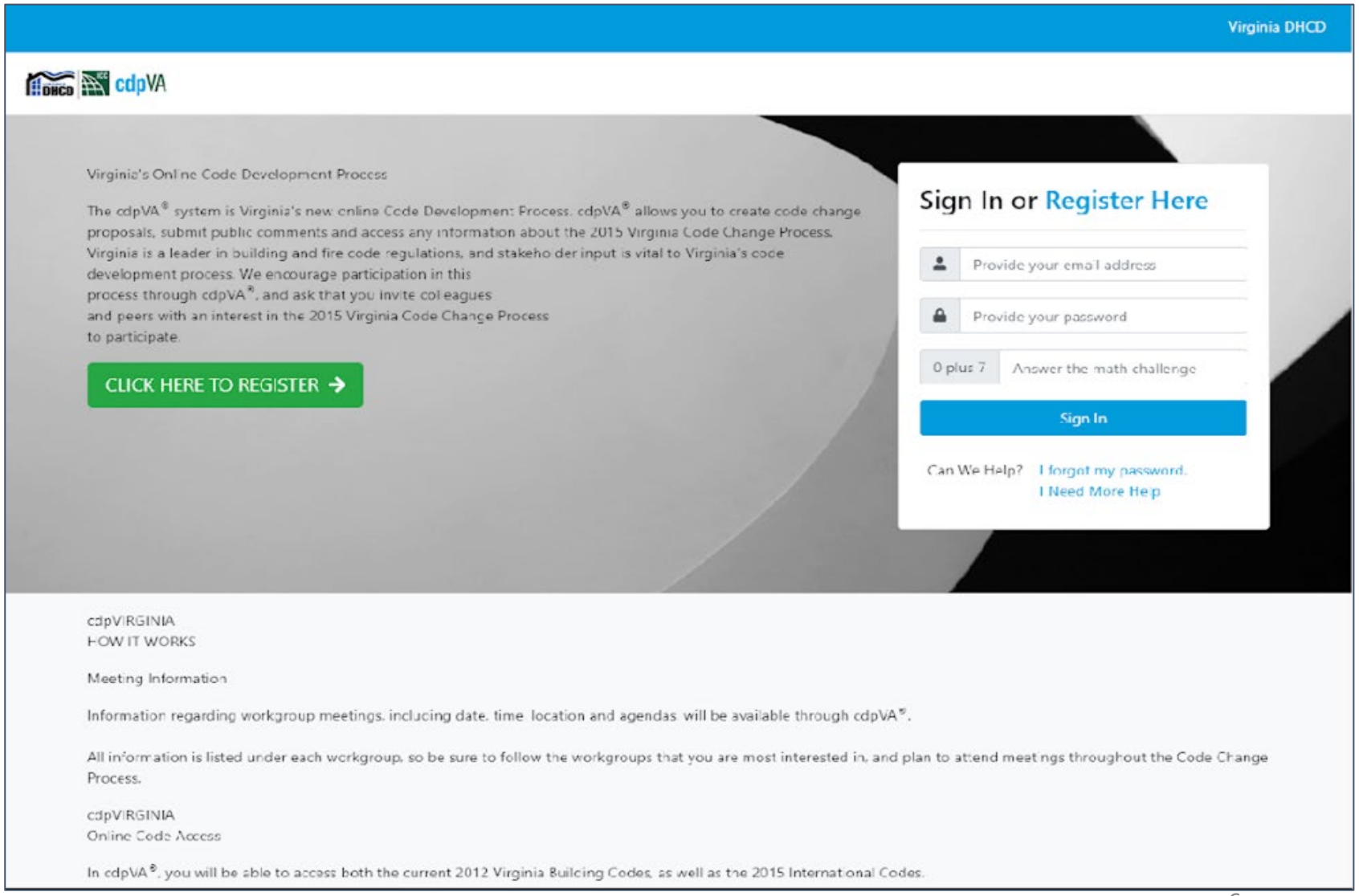
September 2022: BHCD meets to consider proposals

December 2022: BHCD considers proposed regulations

Fall/Winter 2023 = 2021 Virginia Codes Effective (Tentative)

va.cdpaccess.com

Virginia's online code development System (cdpVA)



Study Groups

- Study specific topics that require additional review and discussion
- Identify areas of consensus and disagreement
- Determine if code change proposals or other solutions are appropriate
- May review proposals, provide analysis, make recommendations, and/or develop code change proposals
- Proposals and recommendations of Study Groups are reviewed by the General Workgroups prior to BHCD consideration

Sub-workgroups

- Review all code change proposals within their subject topics, prior to the proposals being considered by the General Workgroups
- Make recommendations on each proposal, including negotiating compromises where appropriate
- May also develop new code change proposals, or support proposals submitted by others by joining the proposal as a proponent

General Stakeholder Workgroups

- All meetings are open to attendance and participation by anyone
- Review and discuss all submitted code change proposals, including all proposals and recommendations from Study Groups and Sub-Workgroups
- A workgroup recommendation is determined for each proposal and the recommendation is provided to the Board of Housing and Community Development
- Workgroup recommendations are classified as follows:

  Consensus for Approval: No workgroup participant expressed opposition to the proposal

  Consensus for Disapproval: Any workgroup participant expressed opposition to the proposal and no workgroup participant, other than the proponent, expressed support for the proposal.

  Non-Consensus: Any workgroup participant expressed opposition to the proposal

In-Building Emergency Communications

Q: What is In-Building Emergency Communications?

A: Two-way emergency responder communication coverage inside of buildings.

- Earlier editions of the IBC/IFC (and the current VCC) refer to it as “In-Building Emergency Communications”
- The 2021 IBC refers to it as “Emergency Responder Communication Coverage”

Emergency Responder Communications Enhancement Systems

Q: What is an ERCES?

A: A system installed to ensure “Emergency Responder Communication Coverage” is commonly referred to as an “Emergency Responder Communications Enhancement Systems, or “ERCES”.

ERCES are typically made up of:

- A donor antenna that receives external radio signals from the local emergency responder tower
- A bi-directional amplifier/repeater that boost the radio signal
- A coaxial cable or fiber medium that distributes the radio signal throughout the building
- Coverage antennas that transmit and receive radio signals within the building for reception by handheld radios used by emergency responders.

House Bill 2529 (2003)

January 2003: House Bill 2529 resulted in § 36-99.6:2. Installation of in-building emergency communication equipment for emergency public safety personnel.

“The Board of Housing and Community Development shall promulgate regulations as part of the Building Code requiring such new commercial, industrial, and multifamily buildings as determined by the Board be (i) designed and constructed so that emergency public safety personnel may send and receive emergency communications from within those structures or (ii) equipped with emergency communications equipment so that emergency public safety personnel may send and receive emergency communications from within those structures.”

HJR 588 (2003)

“HJR588 Task Force”

January 2003: Virginia Department of Fire Programs, with the assistance of VDEM and DHCD, was requested to study the feasibility of adopting requirements within the commonwealth that will ensure buildings are constructed and equipped to permit effective and reliable public safety radio communications for emergency personnel operating within them.

BHCD Ad-Hoc Committee on IBEC

2004 - 2007: “Ad-Hoc Committee on In-Building Emergency Communication Systems”

- Ultimately a compromise proposal was approved by the Board of Housing and Community Development in 2007, for inclusion in the 2006 edition of the Virginia Construction Code (VCC)
- The language approved for the 2006 edition remains (mostly unchanged) in the current VCC

2018 code development cycle

During the 2018 Code Development Cycle, the Board of Housing and Community Development (BHCD) considered the following proposals to amend the VCC in-building emergency communications requirements:

- B916.1-18 (Approved)
- B916-18 (Not approved)
- B918.1-18 (Not approved)

The BHCD also determined that additional discussions were needed and directed DHCD staff to convene a group of interested stakeholders to continue the discussions during the 2021 Code Development Cycle.

Objectives

- Gather information and data for review and discussion
- Identify issues with current requirements
- Identify areas of agreement and/or disagreement
- Identify areas of support and/or opposition
- Identify possible improvements to current requirements
    - Submit proposal(s) to update existing requirements (if applicable)
- Summarize findings or recommendations
- Review any related proposals submitted during the 2021 cycle (if applicable)

Access to codes

codes.iccsafe.org/codes/virginia

Free Online Access to
Virginia and ICC Code books!

2021 IBC requirements

SECTION 918

EMERGENCY RESPONDER COMMUNICATION COVERAGE

[F]918.1General. In-building two-way emergency responder communication coverage shall be provided in all new buildings in accordance with Section 510 of the International Fire Code.

2021 IFC requirements

510.1Emergency responder communication coverage in new buildings.

Approved in-building, two-way emergency responder communication coverage for emergency responders shall be provided in all new buildings. In-building, two-way emergency responder communication coverage within the building shall be based on the existing coverage levels of the public safety communication systems utilized by the jurisdiction, measured at the exterior of the building. This section shall not require improvement of the existing public safety communication systems.

Exceptions:

1.Where approved by the building official and the fire code official, a wired communication system in accordance with Section 907.2.13.2 shall be permitted to be installed or maintained instead of an approved radio coverage system.

2.Where it is determined by the fire code official that the radio coverage system is not needed.

3.In facilities where emergency responder radio coverage is required and such systems, components or equipment required could have a negative impact on the normal operations of that facility, the fire code official shall have the authority to accept an automatically activated emergency responder radio coverage system.

2018 Virginia requirements

SECTION 918

IN-BUILDING EMERGENCY COMMUNICATIONS COVERAGE

918.1 General.

For localities utilizing public safety wireless communications, dedicated infrastructure to accommodate and perpetuate continuous in-building emergency communication *equipment* to allow *emergency public safety personnel* to send and receive emergency communications shall be provided in new *buildings* and *structures* in accordance with this section.

Exceptions:

1. *Buildings* of Use Groups A-5, I-4, within *dwelling units* of R-2, R-3, R-4, R-5, and U.
2. Buildings of Types IV and V *construction* without basements, that are not considered unlimited area *buildings* in accordance with Section 507.
3. Above grade single story buildings of less than 20,000 square feet (1858 m^2).
4. *Buildings* or leased spaces occupied by federal, state, or local governments, or the contractors thereof, with security requirements where the *building official* has *approved* an alternative method to provide emergency communication equipment for *emergency public safety personnel*.
5. Where the *owner* provides technological documentation from a qualified individual that the *structure* or portion thereof does not impede emergency communication signals.
6. *Buildings* in *localities* that do not provide the additional communication *equipment* required for the operation of the system.

2018 Virginia requirements

918.1.1 Installation.

The *building owner* shall install radiating cable, such as coaxial cable or equivalent. The radiating cable shall be installed in dedicated conduits, raceways, plenums, attics, or roofs, compatible for these specific installations as well as other applicable provisions of this code. The *locality* shall be responsible for the installation of any additional communication *equipment* required for the operation of the system.

918.1.2 Operations.

The *locality* will assume all responsibilities for the operation and maintenance of the emergency communication *equipment*. The *building owner* shall provide sufficient operational space within the *building* to allow the *locality* access to and the ability to operate in-building emergency communication *equipment*

918.1.3 Inspection.

In accordance with Section 113.3, all installations shall be inspected prior to concealment.

918.2 Acceptance test.

Upon completion of installation, after providing reasonable notice to the *owner* or their representative, *emergency public safety personnel* shall have the right during normal business hours, or other mutually agreed upon time, to enter onto the property to conduct field tests to verify that the required level of radio coverage is present at no cost to the *owner*. Any noted deficiencies in the installation of the radiating cable or operational space shall be provided in an inspection report to the *owner* or the *owner's* representative.

2018 cycle proposals

- **B916.1-18 (Approved)** - Added exception “6. Buildings in localities that do not provide the additional communication equipment required for the operation of the system.”
- **B916-18 (Not approved) -** Proposed adding technical requirements (system monitoring, installation per NFPA 1221 and NFPA 72, testing per NFPA 1221 and NFPA 72,critical areas), and changing responsibility for installation of all minimum system installation from the locality, to the building owner.
- **B918.1-18 (Not approved) -** Proposed referencing the IFC for all requirements, while maintaining the five existing (2015 VCC) Virginia exceptions.


ANY
QUESTIONS
?

Assignments/homework

Prior to the next meeting, please:

- **Research information provided today**
  - Reach out to other members and/or DHCD staff with any questions
- **Identify areas of interest or concern that you would like to discuss at the next meeting**
  - Provide to DHCD by December 14th
- **Identify and provide helpful/relevant information (reports, data, etc.) for the group to review**
  - Provide to DHCD by December 14th

Note: If any member wants to share information with the group between meetings, please send it to DHCD staff and we will distribute it to our email list to make sure we do not miss any interested parties that might be added to our list as we go along.

Next meeting

Next Meeting (Virtual)

December 29, 2021

9:00 am - 3:00 pm

(lunch break 12:00 pm -1:00 pm)

Link: https://vadhcd.adobeconnect.com/va2021cdc/

Division of Building and Fire Regulations

State Building Codes Office

sbco@dhcd.virginia.gov

804-371-7150

VIRGINIA ACTS OF ASSEMBLY -- 2003 SESSION

CHAPTER 611

An Act to amend the Code of Virginia by adding a section numbered 36-99.6:2, relating to the Uniform Statewide Building Code; installation of communication equipment for emergency public safety personnel.

[H 2529]

Approved March 18, 2003

Be it enacted by the General Assembly of Virginia:

1. That the Code of Virginia is amended by adding a section numbered 36-99.6:2 as follows:

§ 36-99.6:2. Installation of in-building emergency communication equipment for emergency public safety personnel.

The Board of Housing and Community Development shall promulgate regulations as part of the Building Code requiring such new commercial, industrial, and multifamily buildings as determined by the Board be (i) designed and constructed so that emergency public safety personnel may send and receive emergency communications from within those structures or (ii) equipped with emergency communications equipment so that emergency public safety personnel may send and receive emergency communications from within those structures.

For the purposes of this section:

"Emergency communications equipment" includes, but is not limited to, two-way radio communications, signal boosters, bi-directional amplifiers, radiating cable systems or internal multiple antenna, or any combination of the foregoing.

"Emergency public safety personnel" includes firefighters, emergency medical services personnel, law-enforcement officers, and other emergency public safety personnel routinely called upon to provide emergency assistance to members of the public in a wide variety of emergency situations, including, but not limited to, fires, medical emergencies, violent crimes, and terrorist attacks.

House Document No. 2
2004

HOUSE JOINT RESOLUTION 588

Studying the feasibility of adopting requirements within the Commonwealth of Virginia that will ensure buildings are constructed and equipped to permit effective and reliable public safety radio communications for emergency personnel operating within them.

PREFACE

During the 2003 Session of the Virginia General Assembly, the Virginia Department of Fire Programs—with assistance from the Departments of Emergency Management and Housing and Community Development—was requested in House Joint Resolution 588 (HJ 588) to study the feasibility of adopting requirements within the Commonwealth that will ensure buildings are constructed and equipped to permit effective and reliable public safety radio communications for emergency personnel operating within them.

The goals of the study included: broad stakeholder participation and input using an open process; use of a multi-agency project team; timely completion without sacrificing quality; identifying partnership opportunities for providing the Commonwealth with substantive guidance on technology/policy alternatives; and results useable for, but not constrained by, House Bill 2529 (HB 2529) directing the:

> "Board of Housing and Community Development to promulgate regulations as part of the Building Code requiring the installation in new commercial, industrial and multi-family buildings of emergency communications equipment for emergency service personnel to facilitate effective communications between emergency public safety personnel involved in emergency situations."

The *HJ 588 Task Force* created for this study includes participants from the Department of Housing and Community Development (DHCD); the State Fire Marshal's Office (within DHCD); the Virginia Department of Emergency Management; the Department of General Services; the Virginia Department of Fire Programs; the Virginia Association of Counties; telecommunications consultants and industry representatives; local fire, rescue and law enforcement personnel; local building officials; and stakeholder organizations representing builders/owners of retail and commercial office buildings, apartments, and condominiums.

Task Force staff from DHCD and the State Fire Marshal's Office includes Emory Rodgers, Charles "Ed" Altizer, and Rick Farthing. Participants from the Virginia Department of Emergency Management include Greg Britt, Tanya Brown, Parker Winborne, and Vic Buisset. Staff assigned from the Virginia Department of Fire Programs includes Adam Thiel, Aubrey W. "Buddy" Hyde, Jr., Ron Collins, Jennifer Cole, and Christy King.

The HJ 588 Task Force gratefully acknowledges the dedication and input of all study participants who volunteered their time. Many traveled great distances to participate in multiple meetings. This acknowledgement includes those organizations that volunteered staff members to participate in this endeavor. We also acknowledge the hospitality of Chesterfield Fire & EMS, the Henrico Division of Fire, and Hanover Fire & EMS for providing meeting accommodations.

TABLE OF CONTENTS

EXECUTIVE SUMMARY

During the 2003 Session of the Virginia General Assembly, the Virginia Department of Fire Programs (VDFP)—with assistance from the Department of Emergency Management and the Department of Housing and Community Development—was requested in House Joint Resolution 588 (HJ 588) to study the feasibility of adopting requirements within the Commonwealth that will ensure buildings are constructed and equipped to permit effective and reliable public safety radio communications for emergency personnel operating within them. (The full text of HJ 588 is included in this report as Appendix I.)

Resulting from this legislation, the VDFP formed the *HJ 588 Task Force* including participants from the Department of Housing and Community Development (DHCD); the State Fire Marshal's Office (within DHCD); the Virginia Department of Emergency Management; the Department of General Services; the Virginia Department of Fire Programs; the Virginia Association of Counties;[1] stakeholder organizations representing builders/owners of retail and commercial office buildings, apartments, and condominiums; telecommunications consultants and industry representatives; local fire, rescue and law enforcement personnel; and local building officials. (A complete list of participants is found in Appendix II.)

Goals for the study included: broad stakeholder participation and input using an open process; use of a multi-agency project team; timely completion without sacrificing quality; identifying partnership opportunities for providing the Commonwealth with substantive guidance on technology/policy alternatives; and results useable for, but not constrained by, House Bill 2529 (HB 2529) directing the:

> "Board of Housing and Community Development to promulgate regulations as part of the Building Code requiring the installation in new commercial, industrial and multi-family buildings of emergency communications equipment for emergency service personnel to facilitate effective communications between emergency public safety personnel involved in emergency situations." (The full text of HB 2529 is included as Appendix III of this report.)

The HJ 588 Task Force identified three principal areas affecting the feasibility of adopting requirements within the Commonwealth to ensure buildings are constructed and equipped to permit emergency public safety personnel to utilize effective and reliable radio communications while they are within buildings.

These three focus areas include: 1) policy, 2) implementation, and 3) technology.

1. **Policy** – The public policy issues associated with requiring in-building public safety radio communications solutions are complex and multi-faceted, but not insurmountable. Local governments across the United States have adopted ordinances requiring the installation of in-building public safety radio

[1] Participation was also invited from the Virginia Municipal League.

communications solutions since 1991.[2] However, Virginia would be the first state to implement such a requirement statewide.

2. **Implementation** – In Virginia, the implementation instrument for adopting such a requirement is the Uniform Statewide Building Code (USBC) development and change process. Given the relationship between the 2003 General Assembly's direction in HJ 588 and HB 2529, the Task Force spent substantial time discussing implementation issues that will be further explored in the USBC development process. In addition, DHCD and the State Fire Marshal's Office held meetings (outside the HJ 588 study) with Task Force participants to draft sample code language for emergency communications equipment in *new* buildings—this draft language is included in this report as Appendix IV.[3]

3. **Technology** – The technology behind public safety radio communications in the built environment is inherently complex and a comprehensive treatment is beyond the scope of this study. Therefore, the Task Force focused on studying the feasibility of potential technological solutions for addressing the challenge of providing effective and reliable public safety radio communications in buildings. A variety of alternatives was explored with the conclusion that no *single* technology will apply to every jurisdiction in the Commonwealth. However, a range of technology solutions is available with applicability to almost any situation in Virginia.

[2] The Jack Daniel Company (2003) http://www.rfsolutions.com/sbwp.htm

[3] It is critical to note that this *draft* language *has not* been through the prescribed USBC development/change process and is provided in this report as an exhibit only, with no warranty of Task Force, board, or agency consensus on any of its specific provisions.

SUMMARY OF KEY ISSUES	
POLICY	***New construction***—Applying in-building technology solutions to ensure effective and reliable public safety radio communications is generally less costly in new construction (or during renovations) than in existing buildings. Typically, owners and developers have more financing options for installing emergency communications equipment in new buildings or those undergoing extensive renovation. Computerized radio system models and measurement tools are available to forecast system performance with enough accuracy to effectively design in-building solutions for new construction projects.
POLICY	***Retrofitting existing buildings***—While many of the local in-building public safety radio communications ordinances adopted outside Virginia since 1991 have retrofit provisions, requiring the installation of emergency communications equipment in existing buildings could cost between 10 and 25 percent more than the cost of installing the same technology in new construction. For building owners, securing capital for retrofitting an existing building can be difficult, unless incentives are provided by public or private entities. In the event of a fire or other emergency, however, such a system could prove economically beneficial for helping reduce property damage and life loss.
POLICY	***Target hazards***—Requiring the installation/retrofit of emergency communications equipment in buildings (new and existing) with occupancies having a high potential for life loss or property damage could prove beneficial in the event of a fire or other emergency exposing the property and its occupants to harm. Retrofit provisions for specific "high-hazard" occupancy types have been previously incorporated in the USBC.
POLICY	***Funding***—The exact cost to install emergency communications equipment in buildings across Virginia is hard to define as several variables affect installation and maintenance costs. Research for this study suggests costs can range anywhere from $0.15 to $1.25 per square foot in new construction; with an additional 10 to 25 percent for retrofitting existing buildings. If required by the USBC for new construction, these costs would likely be added to initial financing arrangements and amortized over the life of the building. Securing funds to retrofit an existing building from operational cash flows could be difficult unless financial incentives are provided by public or private entities.

POLICY	***Responsibility***—The Task Force limited their scope of work, in accordance with HJ 588, by agreeing that local jurisdictions (as the federally licensed operators of public safety radio systems) are responsible for delivering adequate radio signal to the exterior of a (proposed or existing) building *before* requiring the installation of emergency communications equipment to overcome signal degradation inside the structure. The Task Force also agreed that changes to the local public safety radio system (environmental or technological) occurring after an in-building solution is accepted by authorities should not place an undue compliance burden on building owners.
POLICY	***Local government option***—The USBC can include provisions allowing local governments to "opt-in" or "opt-out" of specific code sections. An "opt-in" code section only applies to a jurisdiction if the local governing body adopts it; an "opt-out" code provision applies to a jurisdiction *unless* the local governing body chooses *not* to accept it. Given regional and local differences across Virginia, the Task Force recommended the local government option for inclusion in any USBC action on in-building public safety radio communications, but could not reach consensus for "opt-in" versus "opt-out."
IMPLEMENTATION	***Statewide code applicability***—As with any potential change to the Uniform Statewide Building Code, the principal implementation challenge facing the Board of Housing and Community Development (which promulgates the USBC) is crafting code language applicable across the entire Commonwealth.
TECHNOLOGY	***Radio spectrum availability***—A finite amount of radio spectrum is available for all uses, public and private. Public safety radio communication systems are currently restricted to certain "bands" of the spectrum as regulated by the Federal Communications Commission (FCC). While an additional band in the spectrum has recently been allocated for public safety use (700MHz), the burgeoning need for "space" on the airwaves makes fundamental change to public safety radio communications appear limited for the foreseeable future.

TECHNOLOGY	***Radio system trends***—Public safety agencies nationwide, including those in Virginia, are progressively replacing older (VHF/UHF) public safety radio systems designed in the 1970s with newer, 800MHz "trunked" systems. These systems have features allowing more efficient utilization of limited radio frequencies (assigned by the FCC) and include safety features for emergency response personnel. Most of Virginia's more populous jurisdictions have recently replaced their older (first or second generation) systems, while others are in the planning or deployment stages. While these 800MHz systems have many advantages over their predecessors, overall system performance depends on the ability of mobile and portable radios to reach fixed antenna sites over distances, through building and terrain features, and from within buildings.
TECHNOLOGY	***Radio system lifecycles***—Limited spectrum availability, coupled with the high cost and complexity of deploying a public safety radio system in a jurisdiction, markedly reduces the ability of public safety agencies to fundamentally change their basic communications technology over time. This leads to long system lifecycles as demonstrated by the fact that many of today's frontline public safety radio systems were designed and built up to 30 years ago; while newer systems (and therefore any in-building solutions designed to work with them) are projected to last many years into the future.
TECHNOLOGY	***External solutions***—A variety of devices designed for use by emergency response personnel from outside the building are currently available with promise for reducing the difficulty of providing effective and reliable public safety radio communications within buildings during emergency incidents. Since radio signals are ultimately subject only to the laws of physics, however, it seems unlikely that a completely external "solution" is on the horizon. Nonetheless, existing buildings with marginal coverage can be positively affected by externally deployed technologies and Task Force members agreed that addressing the in-building communications challenge should include the continued research, development, and testing of external radio communications adjuncts.
TECHNOLOGY	***Internal solutions***—Given the laws of physics governing radio energy, installing emergency communications equipment inside certain buildings will probably always be part of any comprehensive solution for providing effective and reliable public safety radio communications across Virginia. With the diversity of public safety radio systems around the Commonwealth, however, no *single* internal solution currently exists to guarantee effective and reliable public safety radio communications within *all* buildings. The selection, design, and installation of in-building solutions depends on a variety of factors such as construction type, architectural features, building materials, and existing public safety radio system characteristics.

TECHNOLOGY	
	The future—The continued advancement of technology will undoubtedly affect the future of public safety radio communications in buildings. Whether or not these changes improve or degrade the current situation faced by emergency response personnel in many jurisdictions remains to be seen. The basic principles governing public safety radio systems are stable enough, however, that the installation of emergency communications equipment in certain buildings to provide effective and reliable communications for emergency response personnel need not be postponed.

CHAPTER 1. INTRODUCTION

Effective and reliable radio communication is important for both public safety personnel and building occupants during emergencies. The types of incidents to which first responders are called range from domestic disputes to hostage situations; fractured limbs to cardiac arrests; and smoke alarm activations to major fires involving a hundred or more firefighters. The efficiency and effectiveness of all these operations—whether law enforcement, emergency medical, or fire department mitigated (and frequently a combination of agencies and disciplines is involved)—depend on coordinated strategy and tactics that can only be achieved with effective and reliable radio communications, both inside and outside buildings. Furthermore, when situations become extreme and threaten responders' lives, the radio serves as their lifeline to "outside" help and back-up assistance. As resolved by the Virginia General Assembly in 2003:

> "The lives of those emergency public safety personnel who respond to such emergencies, as well as the lives of those persons who may be within a building in which an emergency occurs, frequently depend solely upon the ability of those public safety personnel to communicate by radio transmissions with others who are within such buildings and others who are outside such buildings."[4]

Property owners and managers have a related interest in the efficiency and effectiveness of public safety operations conducted in their buildings. Simply stated, the sooner the suspects are apprehended, the patients are transported, and the fire is out...the sooner business returns to normal. Particularly in a fire or hazardous materials incident, the degree of property damage and life loss can depend greatly on the effectiveness of communications among emergency responders. Building owners and operators also have a vested interest in the safety of their tenants and are often willing to go the "extra mile" to provide safety features for preventing emergencies.

Emergency public safety personnel use handheld/portable radios ("walkie-talkies") as the primary form of tactical communications on incident scenes; using them for communications with both other responders and their public safety communications ("dispatch") center. First-arriving units use portable radios to describe conditions found at the scene and also to request additional assistance/back-up. As incidents increase in size and complexity, communications systems must be able to "scale-up" to handle increased message traffic. Typical, day-to-day "routine" incidents can often be managed on a single channel, but larger incidents may require several channels to allow for clear and timely exchanges of information. Separate channels may also be needed for command, tactical, and support functions.

Public safety radio systems are designed to cover a specific service area. Transmit/receive sites in a radio system are capable of putting certain amounts of radio "signal" on the ground (measured in decibels or "dBs"), where it is possible to receive and transmit signals between mobile radios, portable radios, and fixed sites. In most

[4] Source: Text – House Joint Resolution 588

modern portable radio-based public safety radio systems, the areas covered by a site for transmitting and receiving are about the same; this is known as a "balanced path" approach to system design. This essentially means that if a portable radio can "hear" the system from a given location, the system should also be able to "hear" the portable radio when it transmits; the converse of this situation is also true.

The overall amount of radio coverage provided by a system is expressed in terms of the area covered, signal strength in that area, and the reliability of the coverage.

Area covered is the geographic area where the signal strength of radio signals from a system exceeds a certain value. This value is based on two parameters – the sensitivity of the receiver in the portable radio (how well the radio can "hear"), and the amount of additional margin required in the system to overcome natural and man-made obstructions. Margins are also included which take into account how a user carries and operates a portable radio. For example, consider one radio site with an antenna on a tower, and a radio user with a portable (hand-held) radio at a location near the tower. If the user is outside the building, the system design must include enough margin to overcome any man-made or natural obstructions (e.g., terrain, foliage, buildings) that may interfere with the ability of the signal to reach the portable radio user once it has left the tower. If the portable radio user needs to operate from inside the building, the system design must also include sufficient margin to penetrate the structure.

Reliability is the statistical probability that signal strength will exceed a minimum acceptable value and is expressed in percentages. Public safety radio systems are typically designed for 95 percent signal reliability. The usual goal of a public safety radio system design is to provide signal strengths exceeding minimum acceptable values 95 percent of the time, in 95 percent of locations within the defined service area.

System designers use computer modeling to predict the radio coverage that a specific system design will provide. These sophisticated systems use digitized terrain data, digitized land use data, and radio wave propagation models.

Problem Statement

As identified in House Joint Resolution 588 (HJ 588), "reliable emergency public radio transmissions between those who are within a building and to others outside of buildings have been a significant and continuing problem for emergency public safety personnel."[5] HJ 588 also identified modern construction techniques and materials as a contributor to this life safety issue, "modern construction materials and techniques often make it more difficult for emergency public safety personnel to communicate with other persons within buildings and with other persons outside of buildings because those materials and techniques sometimes block or impede the transmission of radio signals."[6]

[5] Source: Text – House Joint Resolution 588
[6] Source: Text – House Joint Resolution 588

All radio systems have inherent limitations caused by the physics of radio waves and their propagation characteristics. These limitations are particularly salient in buildings, where modern construction materials can impede the radio signal from sender to receiver and vice versa. While a complete discussion of radio physics, signal propagation and attenuation is beyond the scope of this study, many people are familiar with wireless communications through their mobile phones, pagers, and personal digital assistants (PDAs). A "dropped call" or signal interference during a mobile telephone conversation is an inconvenience to most people. Public safety personnel can experience the same difficulties in buildings during emergency response activities—with negative impacts on their operational efficiency and effectiveness. Communications difficulties are often implicated in firefighter line-of-duty death investigations such as those listed in Appendix V of this report. (It is important to note that not all these difficulties can be attributed to radio signal attenuation in buildings; however, the recurrent theme underscores the importance of effective and reliable communications for emergency public safety personnel.) Recognizing the causal link between inadequate public safety radio communications and fatal incidents, the National Institute for Occupational Safety and Health (NIOSH) contracted for an extensive study of firefighter radio communications; the final results of which are still forthcoming.

Appendix VI provides data presented to the HJ 588 Task Force from Fairfax County highlighting several buildings with reported and tested in-building public safety radio communications problems[7]. These data suggest the difficulty of providing effective and reliable public safety radio communications in buildings is not confined to any particular construction or occupancy type.

Appendix VII and Appendix VIII provide anecdotal descriptions of in-building public safety radio communications difficulties from the Tidewater area and Fairfax County, respectively.

Study Methodology

The HJ 588 Task Force convened its first official meeting on March 26, 2003. (Many of the participants were previously involved in a Statewide Fire-Rescue Radio Communication Task Force meeting on November 7, 2002, which aimed to address fire-rescue department concerns related to the planning and deployment of new two-way radio communications systems.)

During the March 26, 2003 meeting the Task Force identified three principal areas of consideration and outlined some general goals for the study.

The three broad areas for study included: 1) policy, 2) implementation, and 3) technology. General goals included broad stakeholder participation and input using an

[7] These data are not all-inclusive and represent only a sample of these buildings within Fairfax County where problems with effective and reliable public safety radio communications have been identified.

open process; use of a multi-agency project team; timely completion without sacrificing quality; identifying partnership opportunities for providing the Commonwealth with substantive guidance on technology/policy alternatives; and results useable for, but not constrained by, House Bill 2529 (HB 2529) directing the:

> "Board of Housing and Community Development to promulgate regulations as part of the Building Code requiring the installation in new commercial, industrial and multi-family buildings of emergency communications equipment for emergency service personnel to facilitate effective communications between emergency public safety personnel involved in emergency situations."

The HJ 588 Task Force met five times to discuss and policy, implementation, and technology considerations affecting the feasibility of adopting requirements to ensure buildings are constructed and equipped to permit effective and reliable in-building radio communications for emergency public safety personnel. Several members of the task force additionally participated in code discussions relating to House Bill 2529.

It is essential to note that every HJ 588 Task Force meeting was an open meeting, participants were continually encouraged to bring other interested parties to the meetings, and to contribute any information they felt important for inclusion in the study.[8] Staff working on HJ 588 also conducted an extensive literature review and repeatedly asked participants to provide any essential, relevant literature.

Table 1. Study Chronology

Chronology	
August 15, 2002	The Virginia Fire Services Board Committee on Fire Prevention and Control was approached regarding the issue of 800MHz radio system difficulties in buildings. At the request of the Virginia Fire Services Board, the Virginia Department of Fire Programs began coordinating (in cooperation with the Virginia State Fire Marshal's Office) a statewide task force to address fire-rescue department concerns related to the planning and deployment of new two-way radio communications systems.
November 7, 2002	After 2 months of collecting information on coverage concerns and potential solutions from departments with radio systems (800 MHz and otherwise) deployed within the last five years, the Virginia Department of Fire Programs and the Virginia State Fire Marshal's Office host an Statewide Fire-Rescue Radio Communication Task Force.

[8] Participation was also invited from the Virginia Municipal League.

January 8, 2003	Delegate Vincent F. Callahan, Jr. introduced House Joint Resolution 588 – *Reliable radio communications for emergency public safety personnel. Requesting the Virginia Department of Fire Programs to study the feasibility of adopting requirements within the Commonwealth that will ensure that buildings are constructed and equipped in such a way that will permit emergency public safety personnel to utilize effective and reliable radio communications while they are within buildings. The Department of Fire Programs shall complete its work by December 1, 2003, and shall submit an executive summary and report of its written findings and recommendations to the Governor and the 2004 Session of the General Assembly.*
January 8, 2003	Delegate James F. Almand introduced House Bill 2529 - *Uniform Statewide Building Code; installation of communication equipment for emergency public safety personnel. Requires the Board of Housing and Community Development to promulgate regulations as part of the Building Code requiring the installation in new commercial, industrial and multi-family buildings of emergency communications equipment for emergency service personnel to facilitate effective communication between emergency public safety personnel involved in emergency situations. The bill defines emergency communications equipment and emergency public safety personnel.*
January 30, 2003	The Virginia House of Delegates passed HJ 588 (97-Y 0-N).
February 4, 2003	The Virginia House of Delegates passed HB 2529 (100-Y 0-N).
February 13, 2003	The Senate of Virginia passed HJ 588 (40-Y 0-N).
February 17, 2003	The Senate of Virginia passed HB 2529 (37-Y 0-N).
February 21, 2003	HB 2529 bill text as passed by House and Senate.
February 22, 2003	HJ 588 bill text as passed by House and Senate.
March 26, 2003	HJ 588 Task Force held its initial meeting to begin exploring issues and reliable radio communications for emergency public safety personnel and identified three general topic areas: policy, implementation, and technology.

April 21, 2003	HJ 588 Task Force met to further define issues within the three broad topic areas.
July 28, 2003	HJ 588 Task Force met to detail and discuss issues relating to any potential code change relating to in-building radio coverage in new construction and to discuss issues relating to the three broad themes of HJ 588 – policy, implementation, and technology.
September 8, 2003	HJ 588 Task Force met to discuss further issues around any proposed code change and to identify steps to move forward.
October 16, 2003	HJ 588 Task Force held its final meeting to discuss potential costs associated with implementing types of in-building solutions and to discuss the retrofit policy issue.

What Others Have Done

Since 1991, local ordinances in communities across the United States have addressed in-building public safety radio communications. Many cities and counties are supplying a remedy to reliable in-building radio coverage issues by passing ordinances requiring certain structures to have provisions to provide internal radio communications for the purpose of public safety communications. Examples include:

Table 2. What Others Have Done[9]

What Others Have Done	
Burbank, California	No person shall maintain, own, erect, or construct any building or structure or any part thereof or cause the same to be done which fails to support adequate radio coverage for City emergency service workers, including but not limited to firefighters and police officers. **NOTE**: This is the earliest known example of such a local ordinance. effective 9/21/91.
Fort Lauderdale, Florida	Requirements of a Radio Signal Booster System which will correct for a reduction in the radio signal to a level below that required amount to assure the 95% coverage reliability needed for public safety communications caused by a new building development.

[9] The Jack Daniel Company (2003) www.rfsolutions.com/sbwp

Broomfield, Colorado	To provide minimum standards to insure a reasonable degree of reliability for emergency services communication from within certain buildings and structures within the city to and from emergency communication centers. It is the responsibility of the emergency service provider to receive the signal to and from the building structure.
Sparks, Nevada	No person shall maintain, own, erect, or construct any building or structure or any part thereof or cause the same to be done which fails to support adequate radio coverage for City emergency service workers, including but not limited to firefighters and police officers.
Grapevine, Texas	No person shall maintain, own, erect, or construct any building or structure or any part thereof or cause the same to be done which fails to support adequate radio coverage for City emergency service workers, including but not limited to firefighters and police officers.
Hampshire, Illinois	Fire Protection District – Establishing requirements for fire communications enhancement systems.
Tempe, Arizona	To provide minimum standards to insure a reasonable degree of reliability for emergency services communications from within certain buildings and structures within the city to and from emergency communications centers. It is the responsibility of the emergency service provider to get the signal to and from the building site.
Scottsdale, Arizona	No person shall maintain, own, erect, or construct any building or structure or any part thereof or cause the same to be done which fails to support adequate radio coverage for City emergency service workers, including but not limited to firefighters and police officers. A certificate of occupancy may not be issued for any building or structure which fails to comply with this requirement.
Ontario, California	No existing or future wireless communications facilities shall interfere with any public safety radio communications systems including, but not limited to, the 800 MHZ radio system operated by the West End Communication Authority which provides public safety communications during emergencies and natural disasters.
Ontario, California	No person shall maintain, own, erect, or construct any building or structure or any part thereof or cause the same to be done which fails to support adequate radio coverage for City emergency service workers, including but not limited to firefighters and police officers.
Roseville, California	No person shall, erect, construct, change the use of or provide an addition of more than 20% to, any building or structure or any part thereof, or cause the same to be done which fails to support adequate

	radio coverage for the City of Roseville Radio Communications System, including but not limited to firefighters and police officers.
Folsom, California	No person shall erect, construct, change the use of or provide an addition of more than 20% to, any building or structure or any part thereof, or cause the same to be done which fails to support adequate radio coverage for Sacramento Regional Radio Communications System, including but not limited to firefighters and police officers. **NOTE:** This goes beyond the coverage requirement by defining a performance confirmation procedure; scheduled periodic verification of performance; a forward looking technical requirement that anticipates potential interaction with cellular services.
Broward County, Florida	To ensure uninterrupted operation of Broward County's public safety, law enforcement, other emergency-related and county operational telecommunications networks by making it a violation of Broward County Code of Ordinances for a property owner, lessee, licensee, contractor, or government entity not otherwise exempt by law, to erect a building or other structure, or portion thereof, or cause a building or other structure, or portion thereof, to be erected or constructed in a manner that creates interference with Broward County's public safety, law enforcement, other emergency-related and county operational telecommunications networks.
West Hartford, Connecticut	(Code change) No person shall erect, construct, change the use of, or construct an addition of more than 50% in gross floor area to any building or structure of Type I or Type II construction which exceeds 10,000 square feet in gross floor area, including any portions thereof which may be located below grade, which fails to support adequate radio coverage.
Sarpy County, Nebraska	No person shall erect, construct, remodel, renovate, or provide an addition of more than 20% to, any building or structure or any part thereof, or cause the same to be done which fails to support adequate radio coverage for the Sarpy County Communications Systems (SCRCS), including but not limited to emergency service workers, firefighters and police officers.
Schaumburg, Illinois	No person shall erect, construct, maintain or modify any building or structure or any part thereof, or cause the same to be done which fails to support adequate radio coverage for village public safety services, including but not limited to police, fire, and public works departments. A certificate of occupancy may not be issued for any building or structure which fails to comply with this requirement. The frequency range which must be supported shall be 806 to 816 MHz and 856 to 866 MHz, or as otherwise established and required in writing by the

	village as being necessary for public safety purposes.
Bayside, Milwaukee County, & Ozaukee County Wisconsin	No person or organization shall maintain, own, erect, or construct any building or structure which is used for commercial, multi-family, or institutional use or any part thereof or cause the same to be done which fails to support adequate radio coverage to public safety service workers, including, but not limited to firefighters and police officers.

CHAPTER 2. POLICY

The Task Force explored several policy issues affecting the feasibility of requiring the installation of emergency communications equipment in buildings. This chapter summarizes their findings.

New Construction

Applying in-building technology solutions to ensure effective and reliable public safety radio communications is generally less costly in new construction (or during renovations) than in existing buildings. Typically, owners and developers have more financing options for installing emergency communications equipment in new buildings or those undergoing extensive renovation. Computerized radio system models and measurement tools are available to forecast system performance with enough accuracy to effectively design in-building solutions for new construction projects.

Retrofitting Existing Buildings

Retrofitting involves the addition of new equipment, which was not available at the time of initial construction, to a building to bring it up to current code requirements. Retrofit measures to address specific requirements are typically mandated by the legislature.

Table 3 is a summary of retrofit measures previously applied in the Uniform Statewide Building Code (USBC) governing:

Table 3. USBC Retrofit Applications[10]

	Retrofit Applications
Colleges and Universities	Battery-powered or AC-powered smoke detector devices installed in college and university buildings containing dormitories for sleeping purposes.
Juvenile Care Facilities	Battery-powered or AC-powered smoke detectors shall be installed and maintained in all local and regional detention homes, group homes, and other residential care facilities for children and juveniles which are operated by or under the auspices of the Virginia Department of Juvenile Justice.

[10] Uniform Statewide Building Code 2000 Edition

Deaf and Hearing Impaired	Smoke detectors providing an effective intensity of not less than 100 candela to warn deaf or hearing impaired individual shall be provided, upon request by the occupant to the landlord or proprietor, to any deaf or hearing-impaired occupant of any of the following occupancies: dormitory buildings, multiple-family dwellings, or one-family or two-family dwelling units.
Assisted Living Facilities	A fire protective signaling system and an automatic fire detection system meeting the requirements of the USBC, Volume I, 1987 Edition, Third Amendment, shall be installed in assisted living facilities.
Assisted Living Facilities	Battery or AC-powered single and multiple station smoke detectors meeting the requirements of the USBC, Volume I, 1987 Edition, Third Amendment, shall be installed in assisted living facilities.
Dwelling Units	AC-powered smoke detectors with battery backup or an equivalent device shall be required to be installed to replace a defective or inoperative battery-powered smoke detector located in dwelling units or rooming houses offering to rent overnight sleeping accommodations.
Nursing Homes and Facilities	Fire suppression systems as required by the edition of this code in effect on October 1, 1990, shall be installed in all nursing facilities licensed by the Virginia Department of Health.
Nursing Homes and Facilities	Fire alarm or fire detector systems, or both, as required by the edition of this code in effect on October 1, 1990, shall be installed in all nursing homes and nursing facilities licensed by the Virginia Department of Health.
Hospitals	Fire suppression systems shall be installed in all hospitals licensed by the Virginia Department of Health as required by the edition of this code in effect on October 1, 1995.
Hotels and Motels	Smoke detectors shall be installed in hotels and motels as required by edition VR 394-01-22, USBC, Volume II, in effect on March 1, 1990.
Hotels and Motels	An automatic sprinkler system shall be installed in hotels and motels as required by the edition of VR 394-01-22, USBC, Volume II, in effect on March 1, 1990.
Dormitories	An automatic fire suppression system shall be provided throughout all buildings having a Group R-2 fire area which are more than 75 feet or six stories above the lowest level of exit discharge and which are used, in whole or in part, as a dormitory to house students by any public or private institution of higher education.

Care Facilities	In each kitchen there shall be installed and maintained at least one approved type ABC portable fire extinguisher with a minimum rating of 2A10BC. The facility shall provide and maintain at least one battery operated, properly installed smoke detector as a minimum (i) outside each sleeping area in the vicinity of bedrooms and bedroom hallways, and (iii) on each additional floor.
Adult day care centers	Battery-powered or AC-powered smoke detector devices shall be installed in all adult day care centers licensed by the Virginia Department of Social Services.

A great deal of discussion occurred concerning retrofit and its potential impacts such as the fiscal impact to building owners, who would absorb retrofit costs, and whether incentives could be offered to ease the way for retrofit. The estimated cost to retrofit a building with an in-building solution is 10 to 25 percent over that of new construction. Therefore if in new construction the cost to provide an in-building solution is $1.00 per square foot, the cost to retrofit the same building can be estimated to range anywhere from $1.10 - $1.25 a square foot. This estimate does not take into account historic structures and instances of unique construction (e.g., cinderblock building with a plaster roof), where the retrofit cost could range even higher than 25 percent over the cost of installing a like system in a like structure.

Retrofit financing is a major concern. It was noted that once a building is constructed, retrofit costs must be funded from operational cash flows and substantial amounts of money are often difficult to absorb. As the costs associated with retrofit were of paramount concern, the Task Force entertained a great deal of discussion regarding the potential of offering tax credits or other incentives to building owners who retrofit to help absorb costs incurred.

It was also noted that the timeframe to implement and enforce a retrofit provision for installing emergency communication equipment in buildings would need to be lengthy.

Retrofit is logistically complex as many buildings, commercial office buildings, in particular, have multiple tenants. Each of these tenants has a unique set-up and diverse needs. In order to retrofit, a building owner must gain permission and coordinate with each building occupant as well as taking into account each of their security needs. Many buildings also lease their roof space to private telecommunications firms; before adding an in-building solution radio interference concerns would need to be reconciled.

Target Hazards

Requiring the installation/retrofit of emergency communications equipment in buildings (new and existing) with occupancies having a high potential for life loss or property damage could prove beneficial in the event of a fire or other emergency exposing the property and its occupants to harm. Retrofit provisions for specific "high-hazard" occupancy types have been previously incorporated in the USBC, as listed in Table 3.

Over time, various retrofit measures have been applied to structures including assisted living facilities, nursing homes, colleges and universities, juvenile care facilities, hospitals, hotels and motels, dormitories, state-regulated care facilities, and adult day care centers. The Task Force agreed that government-owned buildings, including schools, should not be exempt from any retrofit measures. There was also discussion as to whether or not buildings such as historic structures should be included in any retrofit action.

Funding

The HJ 588 Task Force spent a great deal of time discussing funding issues around the installation of emergency communications equipment in new construction, as well as for retrofitting existing buildings.

The exact cost to install emergency communications equipment in buildings across Virginia is hard to define as several variables affect installation and maintenance costs, such as labor rates, competition among qualified firms, complexity of installation for a specific building, and existing public safety radio system characteristics. Research for this study suggests costs can range anywhere from $0.15 to $1.25 per square foot in new construction;[11] with an additional 10 to 25 percent for retrofitting existing buildings (retrofitting costs for some buildings could be even higher.[12] If required by the USBC for new construction, these costs would likely be added to initial financing arrangements and amortized over the life of the building. Securing funds to retrofit an existing building from operational cash flows could be difficult unless financial incentives are provided by public or private entities. More detail on the costs of installing in-building solutions can be found in Chapter 5 of this report.

The possibility of alternate funding strategies for system installation in new or existing structures in the form of neutral host systems may exist. This potential strategy is not specific to any particular vendor or technology, but basically runs broadband services anywhere from 400 to 2.4 GHz, which essentially covers the entire spectrum of wireless applications, including public safety. The notion is that a public safety solution could "piggy-back" on the neutral host system, offering a "win-win" situation for the building owner. Currently, the market for this strategy is limited to large stadiums, shopping malls, convention centers, and coliseum type venues.

---

[11] Source: rfsolutions.com and HJ 588 Task Force Meeting on October 16, 2003
[12] Source: HJ 588 Task Force Meeting on October 16, 2003

It was noted that the cost to implement a neutral host system could add approximately 25 – 50 percent to the initial costs[13] of a public safety in-building solution.

Responsibility

When looking at the potential policy implications associated with requiring in-building solutions some questions regarding responsibility were presented.

The Task Force limited their scope of work, in accordance with HJ 588, by agreeing that local jurisdictions (as the federally licensed operators of public safety radio systems) are responsible for delivering adequate radio signal to the exterior of a (proposed or existing) building *before* requiring the installation of emergency communications equipment to overcome signal degradation inside the structure.

The Task Force also agreed that changes to the local public safety radio system (environmental or technological) occurring after an in-building solution is accepted by authorities should not place an undue compliance burden on building owners.

Local Government Option - Opt-In/Opt-Out

The USBC can include provisions allowing local governments to "opt-in" or "opt-out" of specific code sections. An "opt-in" code section only applies to a jurisdiction if the local governing body adopts it; an "opt-out" code provision applies to a jurisdiction *unless* the local governing body chooses *not* to accept it. Given regional and local differences across Virginia, the Task Force recommended the local government option for inclusion in any USBC action on in-building public safety radio communications, but could not reach consensus for "opt-in" versus "opt-out."

[13] Source: HJ 588 Task Force Meeting on October 16, 2003

CHAPTER 3. IMPLEMENTATION

The implementation instrument for adopting requirements within the Commonwealth to ensure that buildings are constructed and equipped in such a way to permit emergency public safety personnel to utilize effective reliable radio communications while they are within buildings is the Virginia Uniform Statewide Building Code (USBC).

The USBC prescribes mandatory regulations for the construction of buildings and structures and their internal equipment. Buildings constructed before the 1973 adoption of the USBC must comply with the Virginia Public Building and Safety Regulations (VPBSR). However, since the adoption of the USBC, local building inspection departments have been responsible for enforcing compliance with building code requirements during construction.

During the 2003 Virginia General Assembly, Session House Bill 2529 (HB2529) was passed, which specifically requires the:

> "Board of Housing and Community Development to promulgate regulations as part of the Building Code requiring the installation in new commercial, industrial and multi-family buildings of emergency communications equipment for emergency service personnel to facilitate effective communication between emergency public safety personnel involved in emergency situations."

While this is a separate and ongoing effort from HJ 588, given the similarity between the two tasks the Virginia Department of Fire Programs, the Department of Housing and Community Development, and the State Fire Marshal's office incorporated discussions of potential code language in the work of the Task Force. In order to facilitate this process members of the HJ 588 Task Force participated in formulating this proposed code change.

Given the extensive and required process for implementing changes to the USBC, this study was limited to discussions of "potential" (draft) code language – as described in Appendix III.[14]

The following is a brief summary of the USBC code change process.

The 2003 USBC and Statewide Fire Prevention Code (SFPC) update cycles will follow the requirements established by the Administrative Processes Act (APA), which requires the Department of Housing and Community Development to publish a baseline/proposed 2003 USBC/SFPC that is reviewed and approved by the Department of Planning and Budget, the Office of the Attorney General, the Board of Housing and Community Development (BHCD) and is published in the Virginia Register. Several

[14] It is critical to note that this *draft* language *has not* been through the prescribed USBC development/change process and is provided in this report as an exhibit only, with no warranty of Task Force, board, or agency consensus on any of its specific provisions.

comment periods will be provided to allow for submission of both administrative and technical code changes. The Codes and Standards Committee of the BHCD will review all code changes and make recommendations to the full Board as to what should be included in the 2003 regulations. Once the BHCD recommends approval the final regulations go through another set of reviews by applicable state agencies, another public hearing, and an open comment period. The BHCD then approves the final recommendations, which are subject to an appeals process of 30 days. It is estimated this process would encompass the majority of 2004 and resultant changes could possibly become effective in the Spring of 2005.

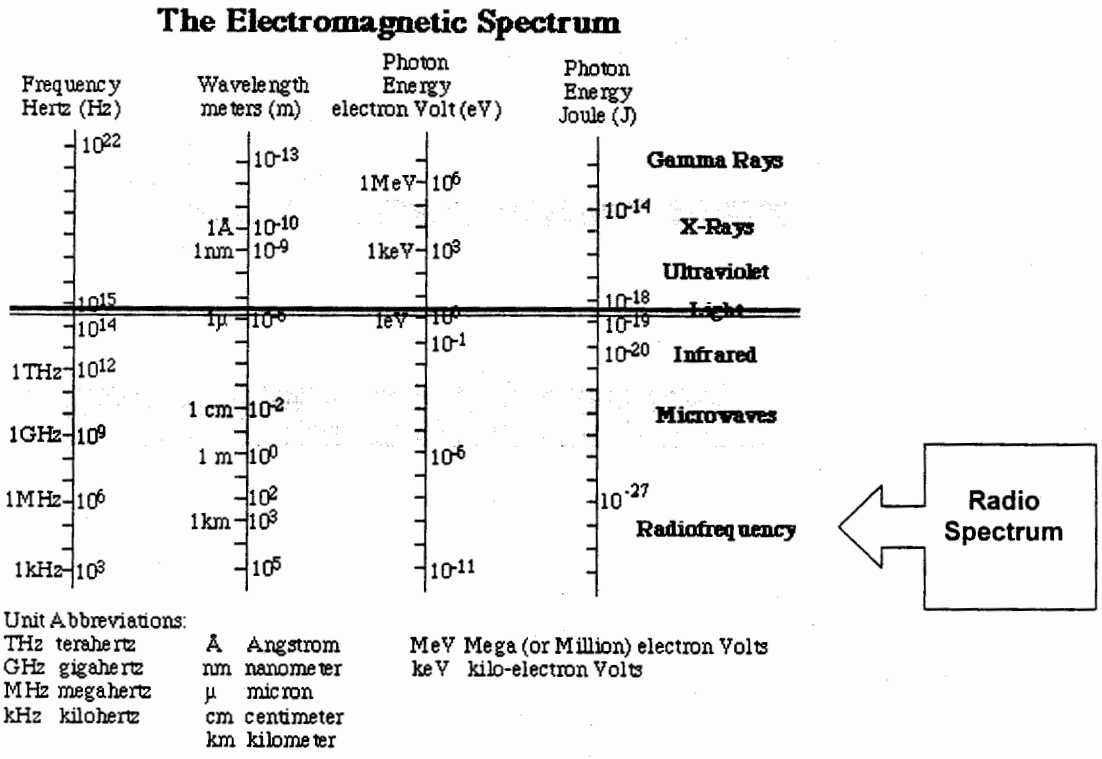
CHAPTER 4. TECHNOLOGY

A complete discussion of the underlying principles governing the design, installation, use, and benefits/limitations of public safety radio systems is beyond the scope of this report. (Several basic references are provided in the reference list at the end of the report). Therefore, this chapter relates primarily to issues identified by the HJ 588 Task Force as salient for studying the feasibility of requiring the installation of emergency communications equipment in buildings to provide effective and reliable communications for emergency public safety personnel.

Radio Spectrum Availability

A finite amount of radio spectrum (part of the overall electromagnetic spectrum that also includes visible light, infrared, x-rays, etc.) is available for all uses, public and private. Figure 1 illustrates the complete electromagnetic spectrum with the radio spectrum occupying approximately the bottom one-third of the diagram.

Figure 1. The Electromagnetic Spectrum[15]

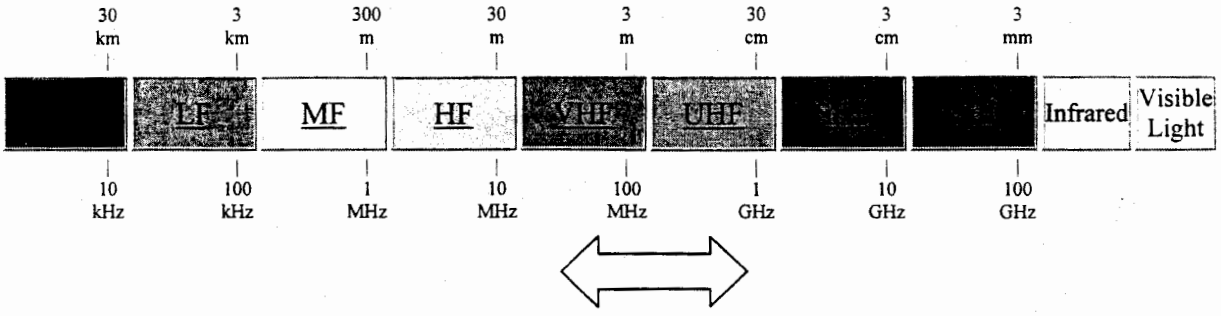


[15] National Aeronautics and Space Administration (1996) http://science.nasa.gov/newhome/help/glossfig1.htm

Within the radio spectrum, public safety radio communication systems are restricted to certain "bands" and are regulated by the Federal Communications Commission (FCC) in Title 47 of the Code of Federal Regulations (47CFR90.20). While additional spectrum has recently been allocated for public safety use (700MHz), the burgeoning need for "space" on the airwaves makes fundamental change to public safety radio communications appear limited for the foreseeable future.

Figure 2 illustrates just the radio spectrum with infrared and visible light for context at the extreme right; the arrow along the bottom approximates the range of frequencies allocated for public safety.

Figure 2. The Radio Spectrum[16]



Each band of the radio spectrum allocated for public safety use has different characteristics, as described in Table 4.

[16] Adapted from Neuhaus, John (2002) "Allocation of Radio Spectrum in the United States," http://www.jneuhaus.com/fccindex/spectrum.html#table_of_contents

Table 4. Public Safety Radio Characteristics[17]

	FREQUENCY RANGE	PROPAGATION CHARACTERISTICS	TYPICAL USAGE
VHF "Low Band"	30 MHz - 50 MHz	Low path loss, good refraction over terrain features, poor building penetration. Requires approximately 84" mobile or portable antenna for efficient transmission/reception. Compact (50") mobile antennas can be used with reduced efficiency.	Older technology that is still very effective for providing mobile coverage to large geographic areas. Vehicular repeaters operating on higher frequencies must be used if effective portable coverage is desired. Still used in Virginia by VDOT and some rural public safety agencies.
VHF "High Band"	148 MHz to 174 MHz	Somewhat higher path loss and reduced refraction over terrain features than VHF "Low Band." Requires approximately 19" mobile or portable antenna for efficient transmission/reception. Larger antennas can be used if higher gain is desired. Smaller portable antennas consist of approximately 8" of coiled spring coated with plastic to provide 19" electrical length, but are very inefficient.	Popular land mobile radio band, was used in a wide variety of public safety communications applications. Still used in many areas of the Commonwealth. Jurisdictions have left this band mostly due to congestion, lack of available frequencies, and difficulty implementing trunked radio systems here. Still used by many agencies in Virginia, including Virginia State Police.
UHF Band	450 MHz to 470 MHz	Again, higher path loss associated with higher frequencies. Poor refraction over terrain features. Requires 6" antenna for efficient transmission/reception. Larger antennas can be used if higher gain is desired.	Popular land mobile radio band, was used in a wide variety of public safety communications applications. Came into wide use in the 1970s for city and suburban county systems. Ideal for portable radio coverage in buildings. Still used in many areas of the Commonwealth. Jurisdictions have left this band mostly due to lack of new frequencies and difficulty implementing trunking systems.
UHF "T" Band	470 MHz to 512 MHz	Similar to UHF band above.	Expansion band created in major metropolitan areas. Uses spectrum shared with UHF TV channels 14-20. Usage similar to UHF band above. In Virginia, only used in metropolitan Washington, DC and Northern Virginia.
700 MHz band	764 MHz - 776 MHz 794 MHz - 806 MHz	Similar to 800 MHz band below.	New public safety spectrum taken from reallocated UHF TV channels 64-69, not available yet in most areas of the United States.
800 MHZ Band	806 MHz - 824 MHz 851 MHz - 869 MHz	Considerably higher path loss than lower frequency bands, but improved building penetration and portable radio coverage. Poor refraction over terrain features. Requires 3" mobile or portable antenna for efficient transmission/reception. Larger mobile and portable antennas are frequently used to obtain higher gain.	Very popular land mobile band in urban, suburban and suburban/rural jurisdictions. Use of trunking is mandatory, provides excellent system capacity and advanced features. Most urban, semi-urban and suburban jurisdictions use or plan to use systems in the 800 MHz band. Availability of new frequencies is limited, future use of 700 MHz will help.

Radio System Trends

Public safety agencies nationwide, including those in Virginia, are progressively replacing older (VHF/UHF) public safety radio systems designed in the 1970s with newer, 800MHz "trunked" systems. These systems have features allowing more efficient utilization of limited radio frequencies (assigned by the FCC) and include safety features for emergency response personnel. Most of Virginia's more populous jurisdictions have recently replaced their older (first or second generation) systems, while others are in the planning or deployment stages. While these 800MHz systems have many advantages over their predecessors, system performance ultimately

[17] Anderson, Jack (2003) RCC Consultants, prepared for HJ 588 Task Force.

depends on the ability of mobile and portable radios to reach fixed antenna sites over distances, through building and terrain features, and from within buildings.

Table 5 displays selected results from a statewide interoperability survey in which respondents were asked to identify the public safety radio communications frequencies currently used by systems within their jurisdiction.[18]

Table 5. Selected Public Safety Radio Bands Used in Virginia—2003

Jurisdiction	*Population*	*Low Band VHF (25 - 50 MHz)*	*High Band VHF (150 - 174 MHz)*	*UHF (406 - 512 MHz)*	*800 MHz*	*Notes*
Accomack County	38,305	EMS, Fire, Law	EMS, Fire, Law			
Albemarle County	79,236	EMS, Fire	EMS, Fire, Law	Law		800 MHz in planning stages
Amherst County	31,894				EMS, Fire, Law	
Arlington County	189,453				EMS, Fire, Law	
Botetourt County	30,496			EMS, Fire, Law		
Charlottesville, City of	45,049	Fire		Fire		800 MHz in planning stages
Chesapeake, City of	199,184				Fire	
Chesterfield County	259,903				EMS, Fire, Law	
Colonial Heights, City of	16,897				EMS, Fire	
Covington City	6,303				EMS, Fire, Law	
Danville, City of	48,411		Law			
Fairfax City	21,498				EMS, Fire, Law	
Fairfax County	969,749				EMS, Fire, Law	
Franklin County	47,286	EMS, Fire, Law				
Frederick County	59,209	EMS, Fire	EMS, Fire			
Goochland County	16,863	EMS, Fire, Law	Fire			
Hampton, City of	146,437				Law	
Hanover County	86,320				EMS, Fire, Law	
Harrisonburg, City of	40,468	Law	Law	Law		800 MHz in planning stages
Henrico County	262,300				EMS, Fire, Law	
Henry County	57,930	EMS, Fire, Law	EMS, Fire, Law	EMS, Fire, Law		
Hopewell, City of	22,354				Fire	
Madison County	12,520	EMS, Fire, Law	EMS, Fire, Law			
Norfolk, City of	234,403				Law	
Petersburg, City of	33,740		Law	Law		
Portsmouth, City of	100,565				EMS, Fire, Law	
Prince William County	280,813			Law		
Richmond County	8,809	Fire				
Roanoke, City of	94,911				Fire	
Rockbridge County	20,808			EMS, Fire, Law		
Rockingham County	67,725	EMS, Fire		EMS, Fire		800 MHz in planning stages
Smyth County	33,081	EMS, Fire, Law	EMS, Fire, Law	EMS, Fire, Law		
Spotsylvania County	90,395				EMS, Fire, Law	
Stafford County	92,446	EMS, Fire, Law	EMS, Fire, Law	EMS, Fire, Law		
Staunton, City of	23,853			EMS, Fire		
Suffolk, City of	63,677				EMS, Fire, Law	
Surry County	6,829	Law	Law			
Virginia Beach, City of	425,257				Fire	
Waynesboro City	19,520			EMS, Fire, Law		
Westmoreland County	16,718	EMS, Fire, Law		EMS, Fire, Law		
Wise County	40,123	Law	Fire, Law			
Wythe County	27,599	EMS, Fire, Law	EMS, Fire, Law			

[18] The statewide radio interoperability survey—an effort unrelated to HJ 588—from which these samples are drawn is still ongoing. To prevent duplication of effort, these preliminary and unverified results are included here to give a general impression of the current state of affairs with respect to public safety radio communications in Virginia.

Table 5 shows the trend toward combining public safety radio systems for different agencies into a single system (to promote interoperability), with 800MHz "trunked" systems the current local favorite based on frequency characteristics and availability (from the FCC). In fact, many of the above listed jurisdictions enjoy regional interoperability where portable radios from one system are programmed to operate on an adjacent system; in these cases, in-building solutions designed for one system can actually serve (without modification or additional cost) emergency public safety personnel from adjacent localities.

In jurisdictions where public safety agencies have separate systems in disparate bands, without plans to combine them, determining the system for which an in-building solution must be designed is a salient and early consideration. The Task Force agreed that, instead of requiring building owners to install emergency communications equipment to serve multiple systems at potentially 2 or 3 times the expense, any USBC action should include provisions requiring the locality to designate a single (primary) public safety radio system.

Radio System Lifecycles

Limited spectrum availability, coupled with the high cost and complexity of deploying a public safety radio system in a jurisdiction, markedly reduces the ability of public safety agencies to fundamentally change their basic communications technology over time. This leads to long system lifecycles as demonstrated by the fact that many of today's frontline public safety radio systems were designed and built up to 30 years ago; while newer systems (and therefore any in-building solutions designed to work with them) are projected to last many years into the future.

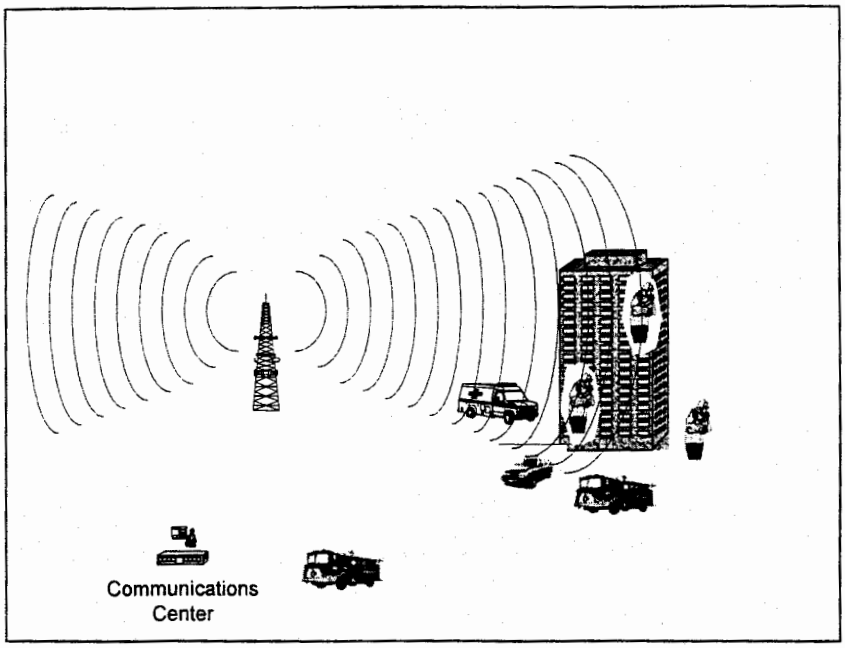
Basic Radio System Performance

Under ideal circumstances, public safety radio systems (conventional or trunked, in all bands) could penetrate all buildings using only their basic infrastructure, without assistance from internal or external adjuncts. In these cases, radio signal strength is sufficient to overcome attenuation from building materials (e.g., steel, concrete, window coatings, etc.) with enough margin to provide acceptable coverage and reliability, specifically, to allow portable radio use throughout 95 percent of the building, 95 percent of the time. (Even the most expensive radio system could not assure 100 percent coverage to all areas, at all times.) No specialized equipment or user training is required to operate within buildings, since the system functions the same inside and outside the structure.

In many buildings throughout Virginia, the local jurisdiction's basic radio system infrastructure provides adequate coverage and reliability for emergency public safety personnel to operate within while retaining the radio's safety features, the ability to communicate with other users, and the communications center ("dispatch").

The diagram in figure 3 illustrates radio system performance using only basic infrastructure.

Figure 3. Basic Radio System Performance[19]



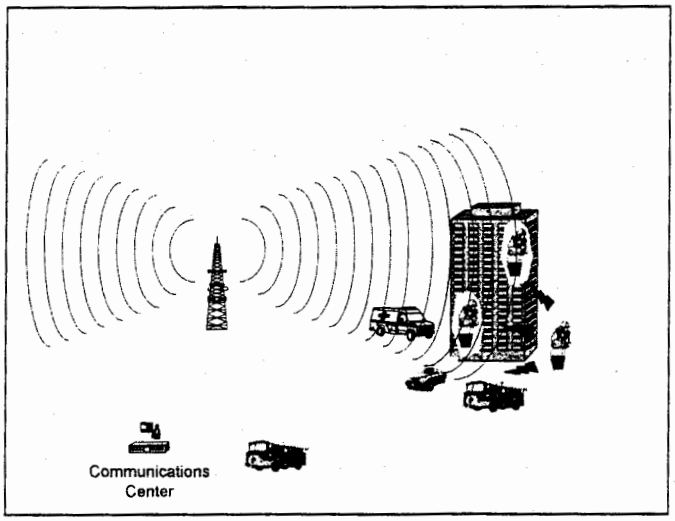
Direct/Talkaround Mode

Most public safety radio systems include a "direct" or "talkaround" mode allowing the radio user to communicate directly with other users when the basic system infrastructure cannot provide enough signal strength to "hear" the user's portable radio (and vice versa) in a given location, at a given time. (The "talkaround" term refers to talking "around" the system...which is usually designed to have all transmissions pass through an antenna/repeater site, thus ensuring message receipt by all users.) Radio functionality is markedly diminished in this mode since users lose safety features, can no longer talk with or hear their communications center, and may not be able to talk with or hear the incident commander and other units operating on the scene. Direct/talkaround mode provides only limited ability to penetrate all areas of large, dense structures and floor-to-floor communications are difficult over multiple floors.

Figure 4 illustrates the direct/talkaround mode.

[19] Anderson, Jack (2003) RCC Consultants, presented to HJ 588 Task Force.

Figure 4. Radio System Performance in Direct/Talkaround Mode[20]



External Solutions

Several devices designed for use by emergency response personnel from outside the building are currently available with promise for reducing the difficulty of providing effective and reliable public safety radio communications within buildings during emergency incidents. It is important here to note the difference between inter-operability and operability. Many of the external public safety radio communications adjuncts currently being marketed are primarily for enhancing *inter*-operability between agencies; before these can work, operability inside/outside the building must still be achieved.

Since radio signals are ultimately subject only to the laws of physics, it seems unlikely that a completely external "solution" is on the horizon. Nonetheless, existing buildings with marginal coverage can be positively affected by externally deployed technologies. Task Force members agreed that addressing the in-building communications challenge should include the continued research, development, and testing of external radio communications adjuncts.

Vehicular Repeaters

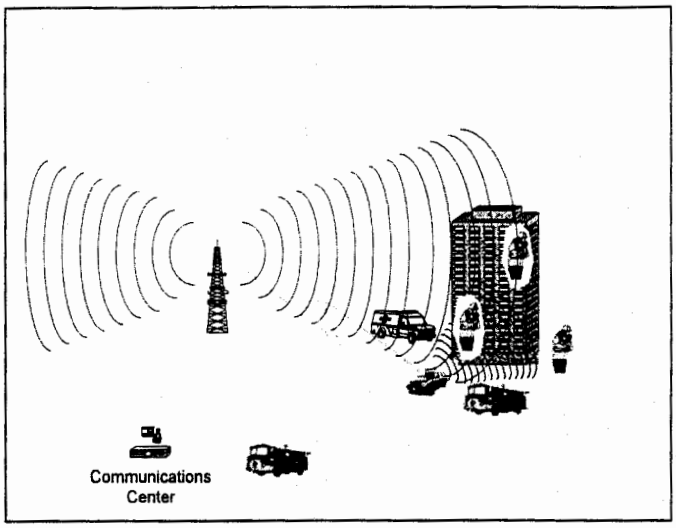
Vehicular repeaters are devices located on public safety vehicles with the ability to "boost" the signal received from either a fixed antenna site on the radio system or a portable radio located on the incident scene, thus enhancing basic system performance. The use of a vehicular repeater is more effective than direct/talkaround mode, but still provides limited ability to penetrate all areas of a structure since the active signal they produce is also subject to attenuation by

[20] Anderson, Jack (2003) RCC Consultants, presented to HJ 588 Task Force.

building materials and terrain. The relative cost and complexity of these devices limits their deployment potential within a public safety vehicle fleet, meaning initial emergency response operations would need to either await the arrival of a vehicle so equipped or begin without effective and reliable communications.

Figure 5 provides an illustration of vehicular repeater performance.

Figure 5. Vehicular Repeater Performance[21]



Internal Solutions

Given the laws of physics governing radio energy, installing emergency communications equipment inside certain buildings will probably always be part of any comprehensive solution for providing effective and reliable public safety radio communications across Virginia.

With the diversity of public safety radio systems around the Commonwealth, no *single* internal solution currently exists to guarantee effective and reliable public safety radio communications within *all* buildings. A viable alternative in densely populated urban areas may not be an option for sparsely populated rural areas. Simply put, "one size does not fit all."

The selection, design, and installation of in-building solutions depends on a variety of factors such as construction type, architectural features, building materials, and existing public safety radio system characteristics. The need to proactively address these variables suggests the need for an open, interactive, and continued dialogue between local emergency response personnel, building officials, property owners and managers, architects, plan reviewers, and radio system engineers. This dialogue is critical for

[21] Anderson, Jack (2003) RCC Consultants, presented to HJ 588 Task Force.

ensuring the design of any in-building solution meets the needs of the community in a cost-effective manner.

This section describes several current alternatives for providing effective and reliable public safety radio communication within buildings—without advocating for any particular vendor or system type.

Signal Boosters (BDAs)

Signal boosters, more commonly known as Bi-Directional Amplifiers (BDAs), appear the predominant in-building technology solution currently used to help remedy in-building radio coverage issues in areas served by trunked 800MHz public safety radio systems. A BDA system consists of one or more amplifiers located inside the building, an external antenna, and an internal antenna network. The external antenna, usually located on the roof of the building, receives the signal coming from the radio system antenna/tower site and brings it into the amplifier while radiating a signal back to the radio site. The internal antenna network then passes signal from the amplifier into the building, throughout all needed locations, and receives messages from portable radios being used in the building, passing them back to the amplifier, out through the external antenna, and into the public safety radio system.

Proper BDA system design is technically straightforward, but essential. Both the internal and external antenna systems are critical. Coverage requirements, interference with other equipment, interference with other radio sites, and general cost of materials needed are important design factors. It is possible for a BDA to amplify signals other than the signals desired by the application. BDAs are also capable of multi-band usage with the same antenna, but different amplifiers are needed. In the event of a fundamental change in the local public safety radio system, BDA systems would probably not require complete replacement to remain functional.

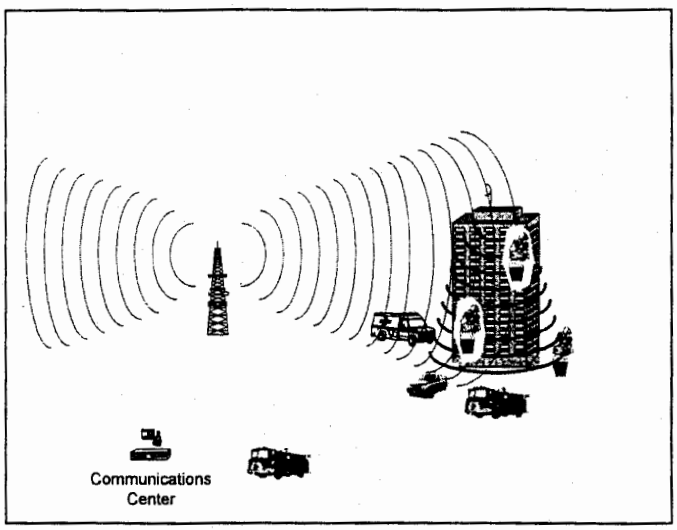
System cost factors include: design, the cost of the amplifier (usually a fixed cost), antennas, coaxial cable, fiber optic cable, splitters, labor to install the system, and annual preventive maintenance. BDA systems can be tailored to provide coverage throughout a building, or only in areas where radio coverage is marginal/non-existent.

BDAs provide a seamless link between the public safety radio system infrastructure and the distributed antenna/cable system in a building. BDAs are fully linked with system infrastructure and provide complete control over coverage reliability (signal is propagated throughout the structure by design). It is also important to note that with a BDA system if "dead spots" are discovered after installation (or caused by renovations) complete retooling is not always necessary as the addition of more cable (an possibly an additional amplifier) can usually provide remedy.

There are no additional training considerations for emergency public safety personnel with BDA systems and all system features are available to all users.

Figure 6 illustrates the performance of an in-building system using a signal booster (BDA).

Figure 6. Signal Booster (BDA) Performance[22]



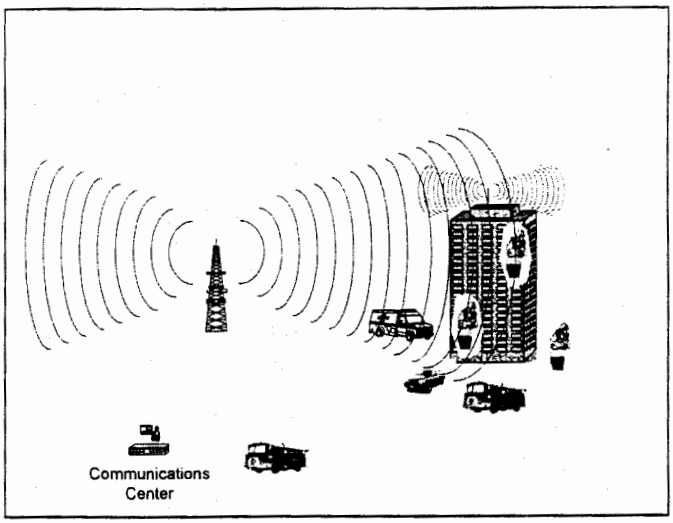
Special Repeater at Building/In-Building Portable Radios

Special repeaters at buildings, coupled with "unique" building radios passed out to emergency services personnel during an incident, can be an effective solution in rural areas with limited responses to an affected building. This requires the installation of an individual/special repeater (essentially a stand-alone radio system) with a cache of hand-held portable radios distributed on-site to emergency services personnel when they arrive at an incident. The number of portable radios required for a major incident is a limiting factor and this option also causes substantial training issues for the emergency services personnel in the locality and in surrounding localities delivering mutual-aid. Some solutions of this nature can provide a link to the public safety radio system infrastructure, but in general they provide only a limited communications capability.

Figure 7 provides an illustration of special repeater performance at a building so equipped.

[22] Anderson, Jack (2003) RCC Consultants, presented to HJ 588 Task Force.

Figure 7. Special Repeater Performance[23]



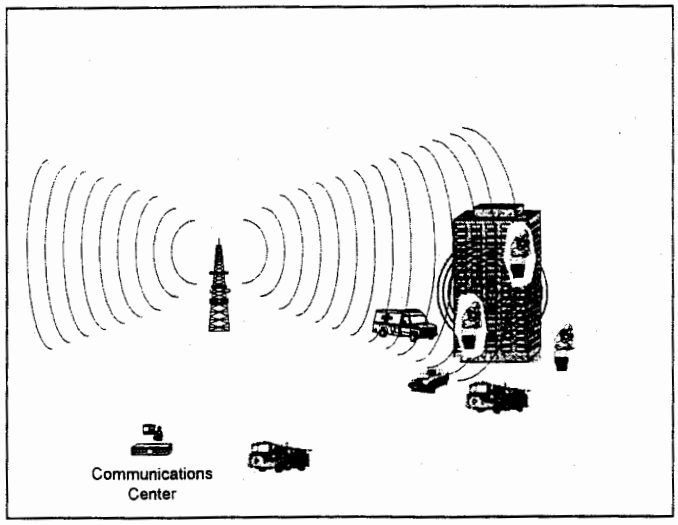
Voting Receivers Installed at Building

Voting receivers are essentially a series of repeaters feeding repeaters. Voting receivers are typically used for conventional VHF and UHF systems and require a very strong outside signal to blanket the structure; they are not a viable option for trunked radio systems in any radio band. Each individual radio channel requires a receiver and therefore multiple receivers may be necessary to cover all areas of the structure. Each individual receiver requires a dedicated leased telephone circuit back to the voting comparator. Voting receivers can enhance emergency communications, but require a great deal of maintenance.

Figure 8 depicts the performance of a voting receiver-based system.

[23] Anderson, Jack (2003) RCC Consultants, presented to HJ 588 Task Force.

Figure 8. Voting Receiver Performance[24]



The Future

The continued advancement of technology will undoubtedly affect the future of public safety radio communications in buildings. Whether or not these changes improve or degrade the current situation faced by emergency response personnel in many jurisdictions remains to be seen. The basic principles governing public safety radio systems are stable enough, however, that the installation of emergency communications equipment in certain buildings to provide effective and reliable communications for emergency response personnel need not be postponed.

[24] Anderson, Jack (2003) RCC Consultants, presented to HJ 588 Task Force.

CHAPTER 5. COST / BENEFIT ANALYSIS

The exact cost to install emergency communications equipment in buildings across Virginia is hard to define as several variables affect installation and maintenance costs. Research for this study suggests installation costs can range anywhere from $0.15 to $1.25 per square foot in new construction;[25] with an additional 10 to 25 percent for retrofitting existing buildings.[26] (In some buildings, particularly those with historical value or housing other complex systems, retrofit costs could significantly exceed 25 percent.)[27]

This extremely wide range ($1.10) for new construction (and by extension, for retrofitting existing buildings) is attributable to several factors including variable labor costs, different installation complexities, variable building sizes, the competitive environment in a given region, and the use of building materials with a high degree of radio signal attenuation in certain structures. Over time, as more installations are completed in Virginia, it seems likely the cost range will narrow.

Table 6 on the following pages contains cost *estimates* for installing emergency communications equipment in new and existing buildings based on notional scenarios suggested by the HJ 588 Task Force. While these estimates are based on the signal booster/BDA solution described in the previous chapter, given the wide range between the "low" and "high" estimates derived in the table it seems likely that most other in-building solutions would fall somewhere within this range.

The notional building parameters (including the estimated square footage) and the average cost per square foot estimates are from the website of Saylor Publications, Inc.[28] Saylor has provided construction cost data and consulting services for over 40 years.

Table 6. Cost Estimates for Installing Emergency Communications Equipment

[25] The Jack Daniel Company (2003) www.rfsolutions.com/sbwp AND presentation by Tim Dennis, et al. to the HJ 588 Task Force on 10/16/03.
[26] Presentation by Tim Dennis, et al. to the HJ 588 Task Force on 10/16/03.
[27] Presentation by Tim Dennis, et al. to the HJ 588 Task Force on 10/16/03.
[28] Saylor Publications, Inc. (2003) www.saylor.com/lacosts/csfpage1.htm

Property Type Building Parameters	Estimated Square Footage	Average Building Cost Per Square Foot (New)	Total Building Cost (New)	Low-Range Cost for In-Building Solution (New)	Mid-Range Cost For In-Building Solution (New)	High-Range Cost for In-Building Solution (New)	Mid-Range In-Building Solution Cost as % of Total Building Cost (New)	Mid-Range Cost for In-Building Solution (Retrofit)
Apartment, 2-3 Story 2 Story, 10 Ft. Story Height	15,000	$60.21	$903,142.50	$2,250.00	$10,500.00	$18,750.00	1.2%	$12,390.00
Apartment, 4-7 Story 6 Story, 11 Ft. Story Height	65,000	$67.29	$4,373,863.00	$9,750.00	$45,500.00	$81,250.00	1.0%	$53,690.00
Apartment, 8-30 Story 15 Story, 11 Ft. Story Height	175,000	$76.29	$13,350,102.50	$26,250.00	$122,500.00	$218,750.00	0.9%	$144,550.00
Auditorium 1 Story, 35 Ft. Story Height	25,000	$119.35	$2,983,785.00	$3,750.00	$17,500.00	$31,250.00	0.6%	$20,650.00
Bank 1 Story, 14 Ft. Story Height	4,000	$114.80	$459,193.60	$600.00	$2,800.00	$5,000.00	0.6%	$3,304.00
Convenience Market 1 Story, 12 Ft. Story Height	5,000	$64.78	$323,891.00	$750.00	$3,500.00	$6,250.00	1.1%	$4,130.00
Courthouse 2 Story, 12 Ft. Story Height	40,000	$105.93	$4,237,116.00	$6,000.00	$28,000.00	$50,000.00	0.7%	$33,040.00
Day Care Center 1 Story, 10 Ft. Story Height	6,000	$70.52	$423,146.40	$900.00	$4,200.00	$7,500.00	1.0%	$4,956.00
Dormitory 3 Story, 10 Ft. Story Height	30,000	$68.42	$2,052,618.00	$4,500.00	$21,000.00	$37,500.00	1.0%	$24,780.00
Fire Station 2 Story, 14 Ft. Story Height	9,000	$90.29	$812,616.30	$1,350.00	$6,300.00	$11,250.00	0.8%	$7,434.00
Garage Parking, Above Ground 4 Story, 10 Ft. Story Height	185,000	$28.67	$5,303,617.00	$27,750.00	$129,500.00	$231,250.00	2.4%	$152,810.00
Garage Parking, Underground 10 Ft. Story Height	90,000	$37.05	$3,334,680.00	$13,500.00	$63,000.00	$112,500.00	1.9%	$74,340.00
Government Building 2 Story, 12 Ft. Story Height	25,000	$90.57	$2,264,332.50	$3,750.00	$17,500.00	$31,250.00	0.8%	$20,650.00
Hospital, General 4 Story, 15 Ft. Story Height	140,000	$182.56	$25,558,344.00	$21,000.00	$98,000.00	$175,000.00	0.4%	$115,640.00
Hotel 4-7 Story 5 Story, 10 Ft. Story Height	100,000	$99.19	$9,919,260.00	$15,000.00	$70,000.00	$125,000.00	0.7%	$82,600.00
Hotel 8-30 Story 15 Story, 10 Ft. Story Height	470,000	$107.06	$50,317,401.00	$70,500.00	$329,000.00	$587,500.00	0.7%	$388,220.00
Jail 2 Story, 12 Ft. Story Height	20,000	$140.99	$2,819,720.00	$3,000.00	$14,000.00	$25,000.00	0.5%	$16,520.00
Manufacturing, Heavy 1 Story, 20 Ft. Story Height	40,000	$74.15	$2,966,044.00	$6,000.00	$28,000.00	$50,000.00	0.9%	$33,040.00
Manufacturing, Light 1 Story, 12 Ft. Story Height	35,000	$51.68	$1,808,954.00	$5,250.00	$24,500.00	$43,750.00	1.4%	$28,910.00
Medical Office 2 Story, 10 Ft. Story Height	8,000	$133.23	$1,065,841.60	$1,200.00	$5,600.00	$10,000.00	0.5%	$6,608.00
Motel 3 Story, 9 Ft. Story Height	46,000	$75.14	$3,456,449.20	$6,900.00	$32,200.00	$57,500.00	0.9%	$37,996.00
Multiple Residence 2 Story, 9 Ft. Story Height	7,000	$75.17	$526,201.20	$1,050.00	$4,900.00	$8,750.00	0.9%	$5,782.00
Office 2-3 Story 3 Story, 12 Ft. Story Height	23,000	$79.38	$1,825,721.60	$3,450.00	$16,100.00	$28,750.00	0.9%	$18,998.00

Property Type Building Parameters	Estimated Square Footage	Average Building Cost Per Square Foot (New)	Total Building Cost (New)	Low-Range Cost for In-Building Solution (New)	Mid-Range Cost For In-Building Solution (New)	High-Range Cost for In-Building Solution (New)	Mid-Range In-Building Solution Cost as % of Total Building Cost (New)	Mid-Range Cost for In-Building Solution (Retrofit)
Office 4-7 Story 6 Story, 12 Ft. Story Height	64,000	$95.85	$6,134,304.00	$9,600.00	$44,800.00	$80,000.00	0.7%	$52,864.00
Office 8-30 Story 20 Story, 12 Ft. Story Height	135,000	$111.75	$15,086,601.00	$20,250.00	$94,500.00	$168,750.00	0.6%	$111,510.00
Restaurant 1 Story, 12 Ft. Story Height	5,000	$102.54	$512,683.50	$750.00	$3,500.00	$6,250.00	0.7%	$4,130.00
Restaurant, Fast Food 1 Story, 10 Ft. Story Height	3,000	$113.26	$339,779.40	$450.00	$2,100.00	$3,750.00	0.6%	$2,478.00
School, Elementary 1 Story, 14 Ft. Story Height	43,000	$111.42	$4,791,184.70	$6,450.00	$30,100.00	$53,750.00	0.6%	$35,518.00
School, Secondary 2 Story, 14 Ft. Story Height	100,000	$108.97	$10,897,370.00	$15,000.00	$70,000.00	$125,000.00	0.6%	$82,600.00
Shopping Center, Strip 1 Story, 10 Ft. Story Height	6,000	$82.17	$493,042.80	$900.00	$4,200.00	$7,500.00	0.9%	$4,956.00
Social Club 1 Story, 12Ft. Story Height	20,000	$72.83	$1,456,646.00	$3,000.00	$14,000.00	$25,000.00	1.0%	$16,520.00
Store, Department 2 Story, 16 Ft. Story Height	150,000	$75.16	$11,273,385.00	$22,500.00	$105,000.00	$187,500.00	0.9%	$123,900.00
Store, Discount 1 Story, 18 Ft. Story Height	80,000	$83.33	$6,666,704.00	$12,000.00	$56,000.00	$100,000.00	1.1%	$66,080.00
Store, Retail 1 Story, 14 Ft. Story Height	35,000	$65.00	$2,274,930.00	$5,250.00	$24,500.00	$43,750.00	1.1%	$28,910.00
Supermarket 1 Story, 12 Ft. Story Height	20,000	$62.03	$1,240,614.00	$3,000.00	$14,000.00	$25,000.00	1.1%	$16,520.00
Surgical Center 2 Story, 14 Ft. Story Height	10,000	$177.88	$1,778,810.00	$1,500.00	$7,000.00	$12,500.00	0.4%	$8,260.00
Theater, Movie 1 Story, 20 Ft. Story Height	16,000	$93.98	$1,503,683.20	$2,400.00	$11,200.00	$20,000.00	0.7%	$13,216.00
Warehouse 1 Story, 24 Ft. Story Height	45,000	$44.57	$2,005,753.50	$6,750.00	$31,500.00	$56,250.00	1.6%	$37,170.00

On the benefit side of the equation, installing emergency communications equipment in buildings has potential to meaningfully reduce life loss and property damage. The average fire dollar loss in a commercial building fire can reach hundreds of thousands of dollars. While the installation of in-building solutions alone will not *prevent* a fire, ensuring effective and reliable radio communications among emergency public safety personnel can increase the effectiveness of fire suppression and rescue efforts, thus reducing the risk exposure of building occupants and contents.

Further economic benefits could be realized if the investment in such a system helps prevent deaths and injuries to emergency public safety personnel while handling incidents in buildings so equipped.

GLOSSARY/DEFINITIONS

- First Responder: Fire, emergency medical personnel, law enforcement, and other identified entities who, by specialty or profession normally arrive first on the scene of an emergency incident to assess or take action to save lives, protect property, and/or mitigate the situation.[29]
- Interoperability vs. Operability – Simply stated, operability allows public safety personnel to reach other responders on the same radio system; while interoperability allows emergency responders on different radio systems to seamlessly communicate. (Interoperability solutions will not work without basic communications operability.)
- Emergency Communication Equipment: Emergency communication equipment, includes, but is not limited to, two-way radio communications, signal booster, bi-directional amplifiers, radiating cable systems or internal multiple antenna, or a combination of the foregoing.
- Emergency Public Safety Personnel: Emergency public safety personnel includes firefighters, emergency medical personnel, law-enforcement officers and other emergency public safety personnel routinely called upon to provide emergency assistance to members of the public in a wide variety of emergency situations, including, but not limited to, fires, medical emergencies, violent crimes and terrorist attacks.
- Trunking: Trunking a radio system helps with capacity issues. Trunking is used whenever a large number of mobile/hand-held radios need to share radio frequencies. In a trunked radio network, a large number of workgroups/talk groups can share fewer channels because the trunking equipment dynamically allocates an available channel when users key their radio.[30]
- Ultra High Frequency (UHF): A band of radio frequencies from 300 – 3000 MHz.
- Very High Frequency (VHF): Contains low and high band. A band of radio frequencies ranging from 30 -300. Low band is characterized as 39 -150 MHz and high band is characterized from 151 - 300 MHz.
- Voting receiver system: Is basically repeaters feeding repeaters with the strongest signal being the one transmitted. The advantage of a voting receiver system is that it is much more likely that at least one of the receivers will be able to receive the input signal[31].
- Vehicular repeater: A vehicular repeater is a mobile network repeater that provides extended network coverage and on-scene incident capability.[32]

[29] Source: Secure Virginia Panel – Radio Interoperability Working Group
[30] Source: http://www.zetron.com/pages/trunk/
[31] Source: http://www.ussc.com/~uarc/rptr.synfaq1.html
[32] Source: http://www.opensky.com/../network/vrepeater.asp

REFERENCES

Blankenship, K., T. Rappaport and H. Xu. "Propagation and Radio Design Issues in Mobile Radio Systems for the GloMo Project." Bradley Department of Electrical and Computer Engineering, Virginia Polytechnic Institute and State University. January 31, 1997. http://www.sss-mag.com/pdf/prop.pdf

Campbell, T. "Communication Systems and Emergency Response Centers." *Managing Fire and Rescue Services*. Washington, DC: International City/County Management Association, 2002. p. 447-483.

"Fire Department Communications Manual: A Basic Guide to System Concepts and Equipment." United States Fire Administration, Federal Emergency Management Agency. http://www.usfa.fema.gov/downloads/pdf/publications/fa-160.pdf.

"In-Building/In-Tunnel User Considerations." Public Safety Wireless Network Program. August 2002. http://www.pswn.gov/admin/librarydocs11/In-Building_In-Tunnel_User_Considerations_8-19-02.pdf.

"Part 90 Private Land Mobile Radio Services, Subpart 90.20." *Title 47, Volume 5 47CFR90.20* Code of Federal Regulations. October 1, 2002. http://frwebgate.access.gpo.gov/cgi-bin/get-cfr.cgi?TITLE=47&PART=90&SECTION=20&TYPE=TEXT

"Public Safety In-Building/In-Tunnel Ordinances and Their Benefits to Interoperability Report." Public Safety Wireless Network Program. November 2002. http://www.pswn.gov/admin/librarydocs11/In_Building_In_Tunnel_Ordinances_Report.pdf.

"Radio Systems – UHF, VHF, 800 MHz, simplex, repeaters, conventional, trunking: Just what do these terms mean...," *Radio News* February 1999. http://www.timemci.com/downloads/99feb.pdf.

"Radio Terminology, Part 2: Simplex Systems," *Radio News* March 1999 http://www.timemci.com/downloads/99mar.pdf.

"Radio Terminology: Part 3 Conventional Repeaters," *Radio News* April 1999 http://www.timemci.com/downloads/99apr.pdf

"Radio Terminology: Part 4 – Trunked Radio," *Radio News* May 1999 http://www.timemci.com/downloads/99may.pdf

"Radio Terminology: Part 5 Wide Area Trunked *Radio Network*," Radio News June 1999 http://www.timemci.com/downloads/99june.pdf

"Signal Booster Ordinance and Codes: White Paper," *www.RFSolutions.com* The Jack Daniel Company 2003 http://www.rfsolutions.com/sbwp.htm.

Stauffer, E. "Fire Department Communication Systems." *Fire Protection Handbook Eighteenth Edition*. Quincy, MA, 2002. p. 10-191-200.

"The FCC's On-Line Table of Frequency Allocations" *47 C.F.R. § 2.106* Federal Communications Commission Office of Engineering and Technology Policy and Rules Division November 24, 2003 http://www.fcc.gov/oet/spectrum/table/fcctable.pdf.

Thiel, Adam K. "Improving Firefighter Communications." *Technical Report Series: Major Fires Investigation Project Special Report 099.* United States Fire Administration, Federal Emergency Management Agency. http://www.usfa.fema.gov/downloads/pdf/publications/tr-099.pdf.

"Washington, DC, Area Sniper Investigation – Communication After-Action Report." Public Safety Wireless Network Program. September 2003. http://www.pswn.gov/admin/librarydocs13/Sniper_report.pdf

APPENDIX I- House Joint Resolution 588

Requesting the Department of Fire Programs, with the assistance of the Department of Emergency Management and the Department of Housing and Community Development, to study the feasibility of adopting requirements within the Commonwealth to ensure that buildings are constructed and equipped in such a way that will permit emergency public safety personnel to utilize effective and reliable radio communications while they are within buildings. Report.

Agreed to by the House of Delegates, January 30, 2003
Agreed to by the Senate, February 13, 2003

WHEREAS, firefighters, emergency medical services personnel, law-enforcement officers, and other emergency public safety personnel routinely are called upon to provide emergency assistance to members of the public in a wide variety of emergency situations, including, but not limited to, fires, medical emergencies, violent crimes, and terrorist attacks; and

WHEREAS, responding to these emergencies frequently requires those emergency public safety personnel to enter offices, commercial facilities, apartments, condominiums, and other buildings under the most exigent and dangerous circumstances; and

WHEREAS, the lives of those emergency public safety personnel who respond to such emergencies, as well as the lives of those persons who may be within a building in which an emergency occurs, frequently depend solely upon the ability of those public safety personnel to communicate by radio transmissions with others who are within such buildings and others who are outside such buildings; and

WHEREAS, reliable emergency public radio transmissions between those who are within buildings and to others outside of buildings have been a significant and continuing problem for emergency public safety personnel; and

WHEREAS, modern construction materials and techniques often make it more difficult for emergency public safety personnel to communicate with other persons within buildings and with other persons outside of buildings because those materials and techniques sometimes block or impede the transmission of radio signals; and

WHEREAS, technology is available in the form of antennas and signal booster devices, which can be used to provide improved and reliable radio communications in buildings for emergency public safety personnel; and

WHEREAS, a number of jurisdictions elsewhere in the United States have enacted laws requiring developers and building owners to install and use antennas and signal booster devices to facilitate reliable radio communication by emergency public service personnel; and

WHEREAS, it is essential for the members of the public and for those emergency public service personnel who are required to enter into buildings during emergencies that the Commonwealth provide a means to ensure effective and reliable in-building radio communications; now, therefore, be it

RESOLVED by the House of Delegates, the Senate concurring, That the Department of Fire Programs, with the assistance of the Department of Emergency Management and the Department of Housing and Community Development, be requested to study the feasibility of adopting requirements within the Commonwealth to ensure that buildings are constructed and equipped in such a way that will permit emergency public safety personnel to utilize effective and reliable radio communications while they are within buildings.

In conducting this study, the Department of Fire Programs shall consult with and consider the views and comments from representatives of the Virginia Association of Counties, the Virginia Municipal League, and organizations representing builders and owners of apartments, condominiums, factories, and retail and commercial office buildings.

All agencies of the Commonwealth shall provide assistance to the Department of Fire Programs upon request.

The Department of Fire Programs shall complete its work by November 30, 2003, and shall submit an executive summary and report of its written findings and recommendations for publication as a document to the Governor and the 2004 Session of the General Assembly. The executive summary and report shall be submitted as provided in the procedures of the Division of Legislative Automated Systems for the processing of legislative documents and reports no later than the first day of the 2004 Regular Session of the General Assembly and shall be posted on the General Assembly's website.

APPENDIX II – HJ 588 Participants

Name	Representing
Duncan Abernathy	Virginia Society of the American Institute of Architects
Ed Altizer	Virginia State Fire Marshal
Jack Anderson	RCC Consultants
Matt Benedetti	Capital Strategies
Lt. R.W. Blystone	Prince George Police Department
Vic Buisset	Virginia Department of Emergency Management
Gregory Britt	Virginia Department of Emergency Management
Tanya Brown	Virginia Department of Emergency Management
Jeffrey Coffman	Fairfax County Fire & Rescue Department
Jennifer Cole	Virginia Department of Fire Programs
Ron Collins	Virginia Department of Fire Programs
Christy Cooper	Apartment and Office Building Association / Building Owners and Managers Association
Dave Dailey	Fairfax County Fire & Rescue Department
James Dawson	Chesterfield Fire & EMS
Glen Dean	State Fire Marshal's Office
Mike Deli	Fairfax County Fire & Rescue
Tim Dennis	CRE Partners
Rick Farthing	State Fire Marshal's Office
Rodney Gohn	Fairfax County Police Department
Cheri Hainer	Virginia Beach - VBCOA
Steve Hall	Chesterfield Fire & EMS
Aubrey W. "Buddy" Hyde, Jr.	Virginia Department of Fire Programs
Mark Ingrao	Apartment and Office Building Association
Norman Johnson	City of Richmond
Christy King	Virginia Department of Fire Programs
Patrick McCloud	Virginia Apartment Management Association / Richmond Apartment Management Association
Curtis McIver	Department of Housing and Community Development
Nelson Migdal	Apartment and Office Building Association
Jim Milby	Building Owners and Managers Association
Dennis Mitchell	Virginia Fire Services Board
Phillip Paquette	Virginia Fire Services Board
Darlene Pope	Apartment and Office Building Association/Building Owners and Managers Association
Todd Pugh	Henrico County General Services
Jack Proctor	Department of Housing and Community Development
Ed Rhodes	Virginia Fire Chiefs Association
Emory Rodgers	Department of Housing and Community Development
Bobby Schenk	Department of General Services – Division of Engineering and Buildings

Bill Shelton	Department of Housing and Community Development
Edwin Smith	Virginia Association of Counties / Henrico County Division of Fire
Jim Spradlin	SPRINT
Adam Thiel	Virginia Department of Fire Programs
Julie Cheyalier Walton	County of Prince George
Charles Werner	Charlottesville Fire Department
Chris Whyte	Virginia Association for Commercial Real Estate
Parker Winborne	Virginia Department of Emergency Management

APPENDIX III – House Bill 2529

VIRGINIA ACTS OF ASSEMBLY – CHAPTER

An Act to amend the Code of Virginia by adding a section numbered 36-99.6:2, relating to the Uniform Statewide Building Code; installation of communication equipment for emergency public safety personnel.

[H 2529]
Approved

Be it enacted by the General Assembly of Virginia:

1. That the Code of Virginia is amended by adding a section numbered 36-99.6:2 as follows:

§ 36-99.6:2. Installation of in-building emergency communication equipment for emergency public safety personnel.

The Board of Housing and Community Development shall promulgate regulations as part of the Building Code requiring such new commercial, industrial, and multifamily buildings as determined by the Board be (i) designed and constructed so that emergency public safety personnel may send and receive emergency communications from within those structures or (ii) equipped with emergency communications equipment so that emergency public safety personnel may send and receive emergency communications from within those structures.

For the purposes of this section:

"Emergency communications equipment" includes, but is not limited to, two-way radio communications, signal boosters, bi-directional amplifiers, radiating cable systems or internal multiple antenna, or any combination of the foregoing.

"Emergency public safety personnel" includes firefighters, emergency medical services personnel, law-enforcement officers, and other emergency public safety personnel routinely called upon to provide emergency assistance to members of the public in a wide variety of emergency situations, including, but not limited to, fires, medical emergencies, violent crimes, and terrorist attacks.

Legislative Information System
http://leg1.state.va.us/cgi-bin/legp504.exe?031+ful+HB2529ER 03/26/2003

APPENDIX IV – Draft Proposed USBC Code Change

HOUSING AND COMMUNITY DEVELOPMENT REGULATORY CHANGE FORM
(Use this form to submit changes to building and fire codes)

Address to submit to: DHCD, the Jackson Center 501 North Second Street Richmond, VA 23219-1321 Tel. No. (804) 371 – 7150 Fax No. (804) 371 – 7092 Email: bhcd@dhcd.state.va.us	Document No. _____ Committee Action: _____ BHCD Action: _____
Submitted by: DHCD	Representing: DHCD for VDFP/Client Work Group
Address: 501 2nd Street, Richmond, VA	Phone No.: 804-371-7140
Regulation Title:2003 USBC/SFPC	Section No(s): 2003 USBC/IBC 902, 912 & SFPC 511

Proposed Change: USBC IBC 902.0 Definitions

Add 902.1 Definitions.

Emergency Communication Equipment. Emergency communication equipment, includes, but is not limited to, two-way radio communications, signal booster, bi-directional amplifiers, radiating cable systems or internal multiple antenna, or a combination of the foregoing.

Emergency Public Safety Personnel. Emergency public safety personnel includes firefighters, emergency medical personnel, law-enforcement officers and other emergency public safety personnel routinely called upon to provide emergency assistance to members of the public in a wide variety of emergency situations, including, but not limited to, fires, medical emergencies, violent crimes and terrorist attacks.

Add new section into the USBC IBC Section 912.0 In-building Emergency Communication Radio Coverage

912.1. General. The locality shall determine by a written policy that it is necessary to require an in-building emergency communication radio system to be designed and constructed so that emergency public safety personnel may send and receive emergency communications from within those structures or be equipped with emergency communication equipment so that emergency public safety personnel may send and receive emergency communications from within those structures within the locality or designated geographical areas of the locality. An in-building emergency communication equipment for emergency public safety personnel shall be provided in unlimited area buildings and buildings of Construction Types I, II, III, IV and V as regulated by the International Building Code.

Exceptions:

1. Local and state governments, federal space within private buildings and private buildings/spaces with top security clearance requirements where the building official has approved an alternate method to provide emergency communication equipment for emergency public safety personnel.
2. Where the owner provides documentation from a qualified individual approved by the building official where emergency communication equipment would not be required for two-way radio communication.
3. Above-grade single story buildings of 12,000s.f. or less.
4. USBC Group R-5 of the International Residential Code and Groups R-3 and R-4 of the International Building Code.
5. Construction Type IV and V buildings of combustible construction without basements.
6. Where the building official approves alternate technology to provide in-building emergency

communications for emergency public safety personnel.
912.1.1. Applicability. The provisions of this section shall apply to building applications filed on and after the set forth effective date of this code.
912.2. General. Where required, in-building radio coverage shall be designed, installed, inspected and tested in accordance with provisions of this section.
912.2.1. A minimum signal strength of –95dBm, as measured at the antenna terminal of the public safety portable transceiver, shall be available to receive and transmit in 95% of the area on each floor of the building from or to the designated public safety radio system. A minimum received signal strength of –95dBm, as measured at the designated radio system fixed end receiver terminal, shall result for portable radio transmissions made in 95% of the area on each floor of the building. The building official shall be permitted to accept lower minimum signal strength specifications where required for the radio system technology used in a jurisdiction.
912.2.1.1. Where bi-directional amplifier systems are installed, the proof of performance signal strength measurement for the downlink path shall be based on a control channel or traffic channel signal from the designated public safety radio system. Signal strength measurements for the uplink path shall be based on one input signal generated using a portable radio operated at the worst-case extremity of the distributed antenna system. Bi-directional amplifiers shall be maintained an out of band noise, intermodulation, and spurious emissions to desired carrier ratio of at least 35 dBc when measured against public safety system carrier signal levels.
912.2.2. The in-building emergency communication radio system shall be designed for a 95% reliability factor.
912.2.3. Where the installed in-building emergency communication radio system contains electrically powered components there shall be an independent power source to provide power for a period of twelve ours without external power input. Where a battery system is installed there shall be automatic charging in the presence of an external power input.
912.2.4. The in-building emergency communication radio system shall have the capability for self-monitoring of the emergency communication equipment. Where there is a requirement for a supervised fire alarm system the emergency communications equipment self-monitoring can be tied into the building fire alarm system. Where there is no required supervised fire alarm system, there shall be a visual/audible alarm for self-monitoring in the vicinity of the emergency communication equipment.
912.3. Acceptance test procedures. Upon completion of the installation, the performance of the in-building emergency communication radio system shall be tested to ensure that the 95% area and 95% reliability requirements are satisfied.
912.3.1. The text shall be conducted using a public safety portable radio with speaker microphone or equivalent portable radios approved by the building official.
912.3.2. Where bi-directional amplifier systems are installed, the gain value and output levels of all uplink and
downlink amplifiers shall be measured and documented, and the acceptance test results shall be kept on file with the building owner for verification each year during the annual inspection and tests.
912.3.3. A copy of the acceptance test records shall be kept on the premises and a copy shall be submitted to the fire official.
912.3.4. The acceptance tests shall be conducted and certified by a qualified individual approved by the building official.

Add new section to the SFPC 511.0. Maintenance of in-building emergency communication radio systems
511.1 General. In-building emergency communication radio systems shall be maintained in accordance with the USBC and the provisions of this section.
511.2. Annual inspection. The annual inspection shall test all components of the system, including but not limited to, amplifiers, independent power sources, antennas and wiring a minimum of once every twelve months.

511.2.1. The annual and five-year inspection tests shall be performed by the locality or by qualified individuals or agencies approved by the fire official.
.511.2.2. Amplifiers shall be tested to ensure that the gain and output levels are the same as designated on the approved acceptance test. The independent power source shall be tested under load for a period of one hour.
511.2.3. All components shall function in accordance with the manufacturer's specifications and intended purpose.
511.3. Five-year tests. No less than every five years, a radio coverage test shall be performed to ensure that the in-building emergency communication radio system meets the requirement of the original acceptance coverage test in accordance with the USBC under which the building was built. Note: The USBC requires on each floor 95% coverage and minimum signal strength of 95dBm for receiving and transmission.
511.4. Field tests. After providing reasonable notice to the owner or their representative the fire official, fire or police chief or their agents shall have the right during normal business hours to enter onto the property to conduct field tests to verify that the required level of radio coverage is present at no cost to the owner. Any noted deficiencies shall be provided in an inspection report to the owner or the owner's representative.
511.5. A copy of the annual and five-year inspection tests shall be kept on the premises and the fire official shall retain a copy.

Supporting Statement:
IBC 902 add definitions from the Code of Virginia
IBC 912 add new section
IBC 912.1 Scope Requires localities to have systems installed in Construction Types I, II, III, IV and V unless they fall into the 6 exceptions. Offers the opportunity for the locality to opt in. Another option that will be considered concurrently is to seek legislative action amending 36-99.6.2 to allow local optional enforcement. The exceptions provide for alternate means and new technology; allows the owner to provide data to contest the requirement; and, allows for most all smaller commercial and residential buildings to be exempted. Some commenters believe the 12,000 s.f. is too low and should be raised, but a substitute number has not been proposed. The VSAIA recommends that the Scope to be limited to Construction Types I which are the larger multi-story buildings. or very large one story unlimited area buildings such as retail box stores Multi-family mid-rise buildings of 3 to 5 story buildings of Construction Types IV and V without basements would be exempted and most of the ones with basements would probably not be designated for wiring/conduits. Some want Groups E and I exempted as they are generally not considered "commercial buildings" as referenced in the law.
IBC 912.1.1 Only applicable to buildings built after the effective date of this code.
IBC 912.2 Set forth the technical, inspection and testing requirements. These are industry standards used by multiple vendors and different type systems. Localities can use lower signal strengths per 912.2.1.
912.2.3 Provides separate power source to ensure operation with loss of building power.
912.2.4 Provides self-monitoring so maintenance personnel or public safety personnel can tell system is operable.
912.3 Provides the acceptance test criteria for new installations.
SFPC 511.0 to 511.5. Provides for an annual inspection and five-year tests of the entire system to be based on the standards and USBC built under.

This code change will increase the cost of construction for those building designated to have these systems installed. Cost estimates run from a few thousand dollars to several hundreds of thousands of dollars. Based on meeting discussions not every new building designated within 912.1 would need to be wired or provide amplification equipment. To date there isn't a consensus on this code change proposal.

APPENDIX V – Line-of-Duty Death Investigations

Incident	Citation and Communications Key Issue
Wood Truss Roof Collapse Claims Two Firefighters Memphis, Tennessee Incident Date: Dec. 26, 1992	*Source: United States Fire Administration, Technical Report Series, Report 069.* *Investigated by J. Gordon Routley.* **Communications Issue:** Incident Commander was unable to communicate with companies over tactical radio.
Four Firefighters Killed, Trapped by Floor Collapse Brackenridge, Pennsylvania Incident Date: Dec. 20, 1991	*Source: United States Fire Administration, Technical Report Series, Report 061.* *Investigated by J. Gordon Routley.* **Communications Issue:** Radio system was inadequate for current needs.
Indianapolis Athletic Club Fire Indianapolis, Indiana Incident Date: Feb. 5, 1992	*Source: United States Fire Administration, Technical Report Series, Report 063.* *Investigated by Mark Chubb.* **Communications Issues:** Communications Equipment – One firefighter was seriously burned attempting to activate the emergency notification button on his portable radio. Communications Systems – Problems in communication between the Incident Commander and the Communications Center may be related to the activation of a new radio system shortly before the incident. Additional training should have been conducted.
The East Bay Hills Fire Oakland-Berkeley, California Incident Date: Oct. 19-22, 1991	*Source: United States Fire Administration, Technical Report Series, Report 060.* *Investigated by J. Gordon Routley.*

	Communications Issue: Radio channels and Communications Center overwhelmed by situation.
Floor Collapse Claims Two Firefighters Pittston, Pennsylvania Incident Date: March 15, 1993	*Source: United States Fire Administration, Technical Report Series, Report 073.* *Investigated by J. Gordon Routley.* **Communications Issue:** Radio System is inadequate for the needs of the fire department. Entry crews did not have portable radios to communicate with Incident Commander.
Structural Collapse at Residential Fire Claims Lives of Two Volunteer Fire Chiefs and Once Career Fire Fighter New Jersey Incident Date: July 4, 2002 Report Date: Aug. 19, 2003	*Source: The National Institute for Occupational Safety and Health (NIOSH)* *http://www.cdc.gov/niosh/face200232.html* **Communications Recommendation:** Establish and maintain regional mutual-aid radio channels to coordinate and communicate activities involving units from multiple jurisdictions.
Volunteer Fire Fighter Killed and Career Chief Injured During Residential House Fire Tennessee Incident Date: March 1, 2002 Report Date: Sept. 3, 2002	*Source: The National Institute for Occupational Safety and Health (NIOSH)* *http://www.cdc.gov/niosh/face200232.html* **Communications Recommendation:** Ensure that fire fighters are equipped with a radio that does not bleed over, cause interference, or lose communication under field conditions.
Career Fire Fighter Dies After Becoming Trapped by Fire In Apartment Building New Jersey Incident Date: May 9, 2002 Report Date: March 21, 2002	*Source: The National Institute for Occupational Safety and Health (NIOSH)* *http://www.cdc.gov/niosh/face200118.html* **Communications Recommendation:** Establish and maintain multiple operating frequencies for emergency services, allowing portable radios at incidents to be equipped with two frequencies, one channel for tactical messages and one channel for command.

Career Fire Fighter Dies After Falling Through the Floor Fighting a Structure Fire at a Local Residence Ohio Incident Date: March 8, 2001 Report Date: Feb. 28, 2002	*Source: The National Institute for Occupational Safety and Health (NIOSH)* *http://www.cdc.gov/niosh/face200116.html* **Communications Recommendation:** Ensure that personnel equipped with a radio, position the radio to receive and respond to radio transmissions.
Residential Fire Claims the Lives of Two Volunteer Fire Fighters and Seriously Injures an Assistant Chief Missouri Incident Date: March 18, 2001 Report Date: Nov. 20, 2001	*Source: The National Institute for Occupational Safety and Health (NIOSH)* *http://www.cdc.gov/niosh/face200115.html* **Communications Recommendation:** Provide adequate on-scene communications including fireground tactical channels.
Volunteer Fire Fighter (Lieutenant) Killed and One Fire Fighter Injured During Mobile Home Fire Pennsylvania Incident Date: Jan. 11, 2001 Report Date: Aug. 8, 2001	*Source: The National Institute for Occupational Safety and Health (NIOSH)* *http://www.cdc.gov/niosh/face200104.html* **Communications Recommendation:** Ensure that personnel equipped with a radio, position the radio to receive and respond to radio transmissions.
Roof Collapse Injures Four Career Fire Fighters at a Church Fire Arkansas Incident Date: Dec. 28, 2000 Report Date: Oct. 30, 2001	*Source: The National Institute for Occupational Safety and Health (NIOSH)* *http://www.cdc.gov/niosh/face200103.html* **Communications Recommendation:** Ensure that fire fighters are equipped with a radio that does not bleed over, cause interference, or lose communication under field conditions.
Residential House Fire Claims the Life of One Career Fire Fighter Florida Incident Date: Nov. 25, 2003	*Source: The National Institute for Occupational Safety and Health (NIOSH)* *http://www.cdc.gov/niosh/face200044.html* **Communications Recommendation:**

Report Date: Aug. 2, 2001	Consider providing all fire fighters with portable radios or integrated into their face pieces.
A Volunteer Assistant Chief Was Seriously Injured and Two Volunteer Fire Fighters Were Injured While Fighting a Townhouse Fire Delaware Incident Date: Oct. 29, 2000 Report Date: March 7, 2001	*Source: The National Institute for Occupational Safety and Health (NIOSH)* *http://www.cdc.gov/niosh/face200043.html* **Communications Recommendation:** Ensure that the assignment of a tactical channel is established by Central Dispatch prior to personnel entering a hazardous environment.
Residential Structure Fire Claims the Life of One Career Fire Fighter Alabama Incident Date: April 20, 2000 Report Date: Aug. 3, 2001	*Source: The National Institute for Occupational Safety and Health (NIOSH)* *http://www.cdc.gov/niosh/face200026.html* **Communications Recommendation:** Ensure that fireground communication is present through both the use of portable radio and face-to-face communications.
Structure Fire Claims the Lives of Three Career Fire Fighters and Three Children Iowa Incident Date: Dec. 22, 1999 Report Date: April 11, 2001	*Source: The National Institute for Occupational Safety and Health (NIOSH)* *http://www.cdc.gov/niosh/face200004.html* **Communications Recommendation:** Ensure that fireground communication is present through both the use of portable radios and face-to-face communications.
Warehouse Fire Claims the Life of a Battalion Chief Missouri Incident Date: Dec. 18, 1999 Report Date: Nov. 6, 2002	*Source: The National Institute for Occupational Safety and Health (NIOSH)* *http://www.cdc.gov/niosh/face9948.html* **Communications Recommendation:** Ensure that fire fighters are equipped with a radio that does not bleedover, cause interference, or lose communication under field conditions.
Six Career Fire Fighters Killed in Cold-Storage and Warehouse Building Fire	*Source: The National Institute for Occupational Safety and Health (NIOSH)* *http://www.cdc.gov/niosh/face9947.html*

Massachusetts Incident Date: Dec. 3, 1999 Report Date: Sept. 27, 2000	**Communications Recommendation:** Ensure that standard operating procedures (SOPs) and equipment are adequate and sufficient to support the volume of radio traffic at multiple-alarm fires.
Two Firefighters Dies and Two are Injured in Townhouse Fire District of Columbia Incident Date: May 30, 1999 Report Date: Nov. 23, 1999	*Source: The National Institute for Occupational Safety and Health (NIOSH)* *http://www.cdc.gov/niosh/face9921.html* **Communications Recommendation:** Ensure that personnel equipped with a radio position the radio to receive and respond to radio transmissions.
Eight-Alarm Fire in a 27-Story High-Rise Apartment Building for the Elderly Nearly Claims the Life of One Fire Fighter Missouri Incident Date: Oct. 12, 1998 Report Date: Feb. 23, 199	*Source: The National Institute for Occupational Safety and Health (NIOSH)* *http://www.cdc.gov/niosh/face9826.html* **Communications Recommendation:** Ensure that procedures are established to record fireground radio communications.
Sudden Floor Collapse Claims the Lives of Two Fire Fighters and Four Are Hospitalized with Serious Burns in a Five-Alarm Fire New York Incident Date: June 5, 1998 Report Date: Nov. 30, 1998	*Source: The National Institute for Occupational Safety and Health (NIOSH)* *http://www.cdc.gov/niosh/face9817.html* **Communications Recommendation:** Ensure that communication equipment used on the fireground, e.g., handie-talkies, will remain operational in the event that one until malfunctions.
Commercial Structure Claims the Life of One Fire Fighter California Incident Date: March 8, 1998 Report Date: July 24, 1998	*Source: The National Institute for Occupational Safety and Health (NIOSH)* *http://www.cdc.gov/niosh/face9807.html* **Communications Recommendation:** Ensure sufficient personnel are available and properly functioning communications equipment are available to use to adequately support the volume of

	radio traffic at multiple-responder fire scenes.
Single-Family Dwelling Fire Claims the Lives of Two Volunteer Fire Fighters Ohio Incident Date: Feb. 5, 1998 Report Date: June 16, 1998	*Source: The National Institute for Occupational Safety and Health (NIOSH)* *http://www.cdc.gov/niosh/face9806.html* **Communications Recommendation:** Provide adequate on-scene communications including fireground tactical channels.
Floor Collapse in a Single Family Dwelling Fire Claims the Life of One Fire Fighter and Injures Another Kentucky Incident Date: Feb. 17, 1997 Report Date: April 27, 1998	*Source: The National Institute for Occupational Safety and Health (NIOSH)* *http://www.cdc.gov/niosh/face9704.html* **Communications Recommendation:** Ensure that fire fighters who enter hazardous areas, e.g., burning or suspected unsafe structures, be equipped with two-way communications with incident command.
Sudden Roof Collapse of a Burning Auto Parts Store Claims the Lives of Two Fire Fighters Virginia Incident Date: March 18, 1996 Report Date: April 27, 1998	*Source: The National Institute for Occupational Safety and Health (NIOSH)* *http://www.cdc.gov/niosh/face9617.html* **Communications Recommendation:** Fire departments should ensure that standard operating procedures and equipment are adequate and sufficient to support the volume of radio traffic at multiple-responder fire scenes.

APPENDIX VI – Fairfax County Data Sample

"Margin needed to cover 95%" indicates the amount of building penetration design margin needed to provide usable signal to 95% of the indoor test points, when ordered from lowest penetration loss to highest penetration loss.

Positive numbers in the "Min Loss" column indicate that indoor signal strength at one or more indoor test points exceed the outside average. These locations can be considered as having 0 dB penetration loss.

-34	average
-55	max
-14	min
-32	median
9	stdev

								Averages		
								91	71	48
Building / Location	**Description**	**Margin needed to cover 95%**	**Mean loss**	**Median loss**	**Min loss**	**Max loss**	**# of samples**	**Est. % covered w/ head portable**	**Est. % covered w/ SMA portable**	**Est. % covered w/ hip portable**
Tysons I Mall, Tysons	2 - 3 story large shopping mall	-39	-19	-18	9	-41	2434	86	69	48
Giant, Vienna	1 story grocery store on end of strip mall	-26	-19	-19	4	-31	404	88	29	3
Famous Dave's BBQ, Oakton	1 story restaurant on end of strip mall	-14	-6	-7	7	-21	92	100	100	91
Books A Million, Oakton	1 story strip mall storefront in middle of strip mall	-28	-19	-19	1	-34	143	97	71	20
Giant, Oakton	1 story grocery store on end of strip mall	-28	-19	-20	1	-35	621	98	69	20
Hallmark, Oakton	1 story strip mall storefront in middle of strip mall	-26	-18	-19	-4	-28	111	100	75	23
Toy Corner, Oakton	1 story strip mall storefront in middle of strip mall	-24	-14	-13	2	-27	95	100	87	53
Teacher's Store, Oakton	1 story strip mall storefront in middle of strip mall	-24	-16	-16	-4	-27	116	100	90	37
Oakmarr Rec Center, Oakton	2 story county recreation center, partial below grade	-33	-14	-12	13	-41	480	98	91	76
Oakton High School, Oakton	2 story large high school	-43	-24	-23	-1	-52	1289	98	90	76
Costco, Fair Oaks	1 story warehouse store	-26	-15	-15	8	-34	1507	100	100	100
County Radio Shop, Fairfax	1 story block/Butler service shop with offices	-36	-20	-21	5	-43	478	100	89	59
South Run Recreation Center, Pohick	2 story county recreation center, partial below grade	-32	-16	-13	3	-34	392	82	64	44
Fairfax PSCC, Annandale	First floor of 2-story 911 center, former elem. school	-33	-18	-17	3	-37	520	91	71	39
3701 S George Mason, Bailey's Crossroads	First floor of 26 story high rise apartment	-30	-23	-23	-7	-32	105	94	35	3
3701 S George Mason, Bailey's Crossroads	23rd floor of 26 story high rise apartment	*	*	*	*	*	143	100	100	99
Herndon Police HQ, Herndon	1 story brick police station and offices	-26	-15	-16	6	-35	510	100	92	49
Worldgate Garage, Herndon	Basement parking garage, at and below grade	-40	-36	-38	-5	-40	396	30	10	3
Herndon Museum, Herndon	1 story wood frame old train station	-20	-9	-8	5	-29	125	100	100	98
Herndon Municipal Center, Herndon	2 story brick and concrete office building	-23	-11	-11	4	-32	134	100	96	81
WalMart, Hybla Valley	1 story department store	-31	-21	-21	-4	-40	724	100	100	97
Mt. Vernon Hospital, Hybla Valley	First floor of six story hospital	-48	-26	-26	3	-55	516	98	91	71
Mt. Vernon Hospital, Hybla Valley	Below grade tunnel in six story hospital	-55	-45	-50	-9	-57	93	59	33	17
Mt. Vernon Hospital, Hybla Valley	Below grade tunnel and first floor, six story hospital	-53	-29	-29	3	-57	620	92	82	63
Fairfax Hospital, Merrifield	Emergency department treatment and waiting areas	-49	-38	-40	-12	-51	296	79	43	19
Fairfax Hospital, Merrifield	Radiology	-49	-37	-37	-18	-51	227	87	53	12
Fairfax Hospital, Merrifield	Women's center, neonatal 2nd floor	-46	-33	-34	-2	-51	370	95	58	27
Fairfax Hospital, Merrifield	Labor and delivery, 3rd floor	-43	-29	-29	6	-47	171	98	80	46
Fairfax Hospital, Merrifield	Original building, 2nd floor	-37	-23	-22	-8	-39	75	100	93	71
Fairfax Hospital, Merrifield	Original building, ground floor and cafeteria	-40	-23	-23	1	-47	192	99	85	67
Fairfax Hospital, Merrifield	Conference center	-25	-16	-16	1	-35	76	100	100	96
Fairfax Hospital, Merrifield	Warehouse	-45	-23	-23	7	-51	227	95	80	67
Fairfax Hospital, Merrifield	Cafeteria kitchen	-51	-44	-44	-30	-51	145	60	8	0
Fairfax Hospital, Merrifield	Linens	-51	-49	-51	-42	-51	87	8	0	0
Fairfax Hospital, Merrifield	Blood bank, oncology lower level	-51	-48	-49	-15	-51	226	27	3	1
Fairfax Hospital, Merrifield	Morgue	-37	-24	-24	-2	-51	96	99	92	65
Fairfax Hospital, Merrifield	Fire control room	-31	-20	-19	-13	-35	43	100	100	91
Fairfax Hospital, Merrifield	Critical Care Trauma	-49	-42	-43	-23	-51	180	75	15	6
Fairfax Hospital, Merrifield	CCU3	-44	-35	-35	-18	-48	62	97	56	23
Fairfax Hospital, Merrifield	Pharmacy, surgery	-46	-33	-35	-12	-51	191	93	55	34
Fairfax Hospital, Merrifield	Tower building, first floor	-37	-21	-23	2	-39	73	100	92	68

								Averages		
								91	71	48
Building / Location	Description	Margin needed to cover 95%	Mean loss	Median loss	Min loss	Max loss	# of samples	Est. % covered w/ head portable	Est. % covered w/ SMA portable	Est. % covered w/ hip portable
Fairfax Hospital, Merrifield	Pulmonary	-39	-28	-27	-5	-44	148	100	89	55
Fairfax Hospital, Merrifield	Entire visit	-51	-33	-35	7	-51	2886	83	55	34
8000 Towers Crescent Dr., Tysons	1st floor of 18 story large office building	-32	-13	-13	9	-36	235	100	93	77
Herndon Target, Herndon	1 story large department store	-33	-23	-23	3	-45	553	100	100	99
Belle Haven Marina, Belle Haven	Concrete block Natnl. Park Service Bathroom at Marina	-18	-9	-8	1	-20	43	100	72	28
Vienna PD 1st Floor, Vienna	1 story block/brick police station	-22	-14	-14	4	-24	137	100	65	20
Vienna PD Basement, Vienna	1 story block/brick police station, lower level	>=-31	-28	-31	-5	-31	120	21	8	3
Vienna PD Entire Building, Vienna	1story block/brick police station, entire visit	>=-31	-20	-19	4	-31	257	63	39	12
PJ Skidoos, Fairfax	Main floor bar/restaurant	-35	-23	-23	-3	-40	203	100	80	40
PJ Skidoos, Fairfax	Main floor bar/restaurant	>=-44	-38	-39	-3	-44	198	41	9	3
Fire Station 414, Burke	1 story block fire station w/ metal roof	-35	-25	-25	-5	-38	780	89	41	10
Centreville High School	3 story block high school - main office area	-37	-29	-31	-5	-41	122	97	38	14
Centreville High School	3 story block high school - main front corridor	-29	-20	-20	-5	-33	74	100	92	54
Centreville High School	3 story block high school - 1st fl. corridor 1A	-27	-15	-14	1	-34	39	100	97	82
Centreville High School	3 story block high school - 1st fl. corridor 1B	-30	-16	-17	1	-36	99	100	94	71
Centreville High School	3 story block high school - 1st fl. corridor 1C	-32	-17	-16	3	-38	64	98	89	66
Centreville High School	3 story block high school - 1st fl. corridor 1D	-21	-11	-10	2	-28	68	100	100	94
Centreville High School	3 story block high school - 1st fl. dining area	-23	-11	-10	4	-30	141	100	99	91
Centreville High School	3 story block high school - 1st fl. athletics area	-34	-21	-20	-1	-39	341	99	80	51
Centreville High School	3 story block high school - 1st fl. theatre/music area	-33	-22	-24	-6	-39	118	99	79	41
Centreville High School	3 story block high school - entire visit	-34	-19	-18	5	-41	1067	99	82	58
McNair Farms Elementary School	2 story new block elementary school 1st floor	-30	-16	-16	3	-34	753	97	69	42
McNair Farms Elementary School	2 story new block elementary school 2nd floor	-27	-13	-14	5	-31	229	100	84	48
McNair Farms Elementary School	2 story new block elementary school entire visit	-29	-15	-15	5	-34	982	97	73	43
Inova Urgent Care, Centreville	1 story medical facility	>=-28	-23	-24	-15	-28	189	55	2	0
Robinson High School	3 level, "super school", entire visit	-37	-24	-25	-1	-41	1727	92	57	25
Robinson High School	3 level, "super school", main hall and assoc. areas	-37	-25	-26	-1	-41	842	93	52	22
Robinson High School	3 level, "super school", north side, upper level	-32	-21	-21	-2	-37	430	100	76	38
Robinson High School	3 level, "super school", north side, lower level	-39	-28	-29	-8	-41	356	80	39	13
Robinson High School	3 level, "super school", gym and areas on south side	-32	-22	-21	-11	-34	99	100	77	32
Carson Middle School, Chantilly	2 level middle school, second floor	-19	-7	-7	13	-28	351	100	100	97
Carson Middle School, Chantilly	2 level middle school, first floor	-30	-16	-17	10	-36	670	100	96	76
Carson Middle School, Chantilly	2 level middle school, entire visit	-28	-13	-13	13	-36	1021	100	97	84
Westfields High School, Chantilly	2 level high school, first floor	-33	-22	-23	9	-35	1169	78	40	13
Westfields High School, Chantilly	2 level high school, second floor	-29	-20	-21	-1	-33	485	98	48	18
Westfields High School, Chantilly	2 level high school, entire visit	-33	-21	-22	9	-35	1654	84	42	14
Paul Springs Retirement Home, Ft. Hunt Rd.	1 - 3 story retirement home	-24	-17	-18	1	-27	428	93	23	2
5840 Cameron Run Terrace	5th floor of high rise apartment building	*	*	*	*	*	*	100	96	70
5840 Cameron Run Terrace	1st floor of high rise apartment building	-30	-24	-24	-8	-35	176	98	40	7
Chantilly Public Library	1 story public library, library (public) section	-31	-13	-12	14	-37	201	100	93	84
Chantilly Public Library	1 story public library, operations (private) section	-36	-27	-28	1	-40	275	99	61	18
Chantilly Public Library	Entire visit	-35	-21	-23	14	-40	476	99	75	46
Hayfield Secondary School	1st floor of large 2 story middle/high school complex	-43	-24	-25	12	-47	2287	94	71	53
Hayfield Secondary School	Basement of large 2 story middle/high school complex	-35	-23	-24	3	-44	250	100	89	59
Hayfield Secondary School	Entire visit of large 2 story middle/high school complex	-43	-24	-25	12	-47	2537	95	73	53
5366 Summit Drive (Pat's House)	3 level single family home, includes walkout basement	-17	-7	-7	6	-31	138	100	99	97

Building / Location	Description	Margin needed to cover 95%	Mean loss	Median loss	Min loss	Max loss	# of samples	Est. % covered w/ best portable	Est. % covered w/ SMA portable	Est. % covered w/ hip portable
							Averages	91	71	44
South County Government Center	5 story County office building, brand new construction	-39	-25	-25	-5	-47	820	96	88	55
GMU Field House	Concrete block/steel athletic house, main area	-35	-18	-18	-6	-29	253	100	79	17
GMU Field House	Concrete block/steel athletic house, weight room	-22	-15	-14	-5	-27	68	100	94	46
GMU Field House	Concrete block/steel athletic house, stairwell, rooms	-39	-28	-28	-4	-33	558	98	57	20
GMU Johnson Center	Concrete student union building, first floor	-35	-13	-13	4	-32	253	100	100	91
GMU Johnson Center	Concrete student union building, lower level	-42	-34	-39	-1	-43	287	61	23	13
JDR Courtroom C	1st floor of two story brick courthouse/jail	-31	-24	-24	-14	-35	56	100	88	39
JDR Courtroom D	1st floor of two story brick courthouse/jail	-32	-23	-22	-13	-34	62	100	85	39
JDR Security Corridor	1st floor of two story brick courthouse/jail	-28	-19	-18	-5	-32	103	100	95	76
JDR vending machine area	Basement level of 2 story brick courthouse/jail	-39	-35	-37	-1	-48	137	77	15	7
JDR Courtroom B/C lobby	1st floor of two story brick courthouse/jail	-37	-18	-18	-5	-38	44	100	98	77
JDR Security Corridor	1st floor of two story brick courthouse/jail	-25	-16	-15	-7	-30	64	100	98	86
JDR entire visit	Entire visit	-38	-24	-22	-1	-48	485	93	70	45
JDR first floor only	1st floor of 2 story brick courthouse/jail	-34	-20	-19	-5	-35	325	100	93	61
FCWA Admin Building	Lower level of office building, below grade areas	-46	-30	-31	-9	-53	119	96	88	59
FCWA Admin Building	Main floor of office building, at grade	-31	-20	-22	-7	-35	35	100	100	100
FCWA Engineering Building	Lower level of office building, below grade areas	-38	-18	-18	-2	-36	140	100	100	95
FCWA Engineering Building	Main floor of office building, at grade	-17	-9	-7	-1	-22	74	100	100	100

APPENDIX VII – Operational Anecdotes From Tidewater, Virginia Area

Fire departments in the Tidewater area were polled for information regarding in-building radio communication problems experienced with emergency/non-emergency communications.

The following are the responses received.

James City County, Virginia

Has your department experienced radio communications failures in buildings in your city over the past 12 months? **Yes**

What type of construction was present when the problem was identified?

Type I, Fire – Resistive Construction **Yes**
Type II, Non-Combustible Construction **Yes**
Type III, Ordinary Construction **No**
Type IV, Heavy Timber Construction **Yes**
Type V, Woodframe **No**

What is the size of the building and number of floors? **1,000 square feet, 1 floor**

What type of occupancy is located in the building where the problem was encountered? **M – I Industrial**

Did you know that the Virginia Department of Fire Programs was conducting a feasibility study related to "Reliable In-Building Radio Communications for Public Safety" prior to receiving this survey questionnaire? **Yes**

Virginia Beach, Virginia

Has your department experienced radio communications failures in buildings in your city over the past 12 months? **Yes**

What type of construction was present when the problem was identified?

Type I, Fire – Resistive Construction **Yes**
Type II, Non-Combustible Construction **Yes**
Type III, Ordinary Construction **No**
Type IV, Heavy Timber Construction **No**
Type V, Woodframe **No**

What is the size of the building and number of floors? **24 story office and warehouse**

What type of occupancy is located in the building where the problem was encountered? **Mixed use office**

Did you know that the Virginia Department of Fire Programs was conducting a feasibility study related to "Reliable In-Building Radio Communications for Public Safety" prior to receiving this survey questionnaire? **Yes**

Newport News, Virginia

Has your department experienced radio communications failures in buildings in your city over the past 12 months? **Yes**

What type of construction was present when the problem was identified?

Type I, Fire – Resistive Construction **Yes**
Type II, Non-Combustible Construction **Yes**
Type III, Ordinary Construction **No**
Type IV, Heavy Timber Construction **No**
Type V, Woodframe **No**

What is the size of the building and number of floors? **Large commercial with multiple floors**

What type of occupancy is located in the building where the problem was encountered? **Hospital, research facilities, warehouse, and office complex**

Did you know that the Virginia Department of Fire Programs was conducting a feasibility study related to "Reliable In-Building Radio Communications for Public Safety" prior to receiving this survey questionnaire? **No**

NOTE: Additional problems exist in bridge tunnels and on large ships

Portsmouth, Virginia

Has your department experienced radio communications failures in buildings in your city over the past 12 months? **Yes**

What type of construction was present when the problem was identified?

Type I, Fire – Resistive Construction **Yes**
Type II, Non-Combustible Construction **Yes**
Type III, Ordinary Construction **Yes**
Type IV, Heavy Timber Construction **No**
Type V, Woodframe **No**

What is the size of the building and number of floors? **Large buildings and multiple floor buildings**

What type of occupancy is located in the building where the problem was encountered? **Shopping centers, tunnels, and apartment buildings**

Did you know that the Virginia Department of Fire Programs was conducting a feasibility study related to "Reliable In-Building Radio Communications for Public Safety" prior to receiving this survey questionnaire? **Yes**

<u>Hampton, Virginia</u>

Has your department experienced radio communications failures in buildings in your city over the past 12 months? **Yes – the City of Hampton and the Hampton Division of Fire & Rescue operate a GE/Ericsson 800 MHz Trunked radio system. This system operates via two transmitter/repeater sites. Once is located on Buckroe Avenue and the other on Pine Chapel Road. Most of our radio difficulties are concentrated in the northwest section of Hampton. It has been determined that these difficulties are not necessarily due to distance from the transmitter, but a combination of distance from the transmitter, building construction, and location within the building.**

What type of construction was present when the problem was identified?

Type I, Fire – Resistive Construction **Yes**
Type II, Non-Combustible Construction **No**
Type III, Ordinary Construction **No**
Type IV, Heavy Timber Construction **No**
Type V, Woodframe **No**

What is the size of the building and number of floors? **All occupancies are over 50,000 square feet**

What type of occupancy is located in the building where the problem was encountered?

- **Verizon Building, 5200 West Mercury Boulevard, two floors**
- **New Market Mall, 5200 West Mercury Boulevard, two floors**
- **AMC 24 - Theater Complex, Towne Centre Way, three floors**
- **Farm Fresh, Town Centre Way, one floor**
- **West Telemarketing, 247 Foxhill Road, one floor**
- **Farm Fresh, 247 Foxhill Road, one floor**
- **Food Lion, 3855 Kecoughtan Road, one floor**
- **Old Sentara Hampton General Building, 3120 Victoria Boulevard, six floors (anywhere below the ground floor)**
- **Hampton General District Court, 36 South King Street, three floors**

Did you know that the Virginia Department of Fire Programs was conducting a feasibility study related to "Reliable In-Building Radio Communications for Public Safety" prior to receiving this survey questionnaire? **Yes**

APPENDIX VIII – Operational Anecdotes From Fairfax County, Virginia

The following are anecdotes collected from firefighters in the Fairfax County area. These are displayed by individual and are unedited.

*****

One was a fire in 8's area at Ravenworth Towers. I was OIC of T410 when the IC called me to give me an assignment. I was in the stairwell making my way to the floor above the fire and could not get out to acknowledge his call. I made my way to the next floor and down the hall about 20 to 30 feet at which point I was able to acknowledge his transmission and get the assignment.

I had a similar situation at a 79 box on four mile run with the same basic situation. The radio would receive in the stairwell but not able to transmit.

I believe you were there when we were working on the preplan for Skyline Mall and parking garage. The radios would not receive or transmit. The truck left to go to Giant to get dinner. While we were in the store we (engine and truck) got a call for a fire in 8's area. Since I knew the radios didn't work in the garage and I knew the engine crew was still there working on the preplan, we paused at S. Jefferson/Leesburg Pike and made as much noise as possible so they would hear us and check their CAD.

*****

We learned quickly in the FM's office that we could not transmit from basements such as Commonwealth Care. During fire alarms testing, we would look to the contractor using a Nextel direct connect to communicate with a FM at the main fire alarm panel. Our 800 radio would hum at us when we tried to transmit from the basement.

In another case, we used the direct channel on our 800 radios to test the fire alarm at Daniel's Run Elementary School. This channel gave us instant connection on a limited basis. If one of us went to the end of a hallway or changed floors, we lost direct contact. If we are to depend on channel 0 to communicate with a fire fighter during an emergency, we better have several people staged around a building to listen for trouble.

Now, we use the Nextel direct connect during all of our fire alarm tests. This has limited our radio use, and our problems encountered, in city buildings

As our troops continue to test the regular 4-Adam and channel 0 in our city buildings, they will learn where the problem areas are.

*****

There are several buildings where I had to use 4-0 to get out on incidents. None of the incidents were noteworthy fire wise. The buildings are:

10701 Main Street, Floor 1
4315 Chain Bridge Road, Basement
10570 Main Street, Floor 1, 2 & 3
10306 Eaton Place, Basement 3300 Willow Crescent Drive, Terrace Level
3300 Willow Crescent Drive, Terrace Level

*****

No particular "war stories", but our Retesting teams (4 2-person teams) have purchased two-way radios from Costco to communicate in high-rise buildings. The radios had such a "hit or miss" problem with reception, that the $50.00 Cobra walkie talkies are outstanding. They have been using them for months now, and are very pleased. They still carry our radio in hopes they hear an inadvertent dispatch of an engine company for a fire alarm test, but use the 2-ways for communication inside buildings.

*****

One "story" that comes to mind is when we were doing a walk-through at Huntington Metro. There is an 800' service tunnel at the end of the station. Walk more than 15-20 feet into it, and you have no radio capability at all. Needless to say, if we had to operate in there, communications would become a major issue.

*****

Although I do not have the particular dates or incident numbers, I can relate two stories of this very nature. E409 was assisting our Medic unit with an ALS event at the Oak Meadows Nursing Home. As you know, we were on channel B. While we were involved in this ALS incident, unknowing to us, a house fire was dispatched in company 11's area. The fire was on Memorial Street and was a mutual box using the L/M channel for communications. As we went AOR-09/11 the house fire was sent to our CAD and we responded. The L/M patch was extremely poor, if not non-existent. Somewhere between switching from B to A then to L and then to M at the top of the hill, we did not receive the radio transmission that E411 had a working fire. We also did not know that E411 was having trouble finding the fire in the thick smoke and had requested exterior ventilation. We were able to tell the lay-out by seeing the hose lying unattended in the street next to a hydrant. Apparently, several transmissions had been broadcast but missed by incoming units. Fortunately, nobody was injured and the blaze extinguished.

Again months later while at the Paul Springs retirement home, we missed another incident. Our radios default to the no signal tone throughout much of this building. Another ALS event had been dispatched near our location without our knowledge. Having packaged the patient and returning to quarters, we noticed flashing lights and a siren coming towards us. E424 soon passed us headed to an ALS event only blocks away. It was not serious but could have been.

I think you are familiar with Wakefield Towers in company 11's area. These are older non-sprinkled high-rise buildings with little or no radio communication abilities. When you go inside you must switch to -0- and operate in the walkie-talkie mode. That whole notion of switching to a command channel, a separate channel for the RIT team, press the red button for emergencies. For-get-about-it, you got 1 one channel and that's -0-Oscar.

*****

I use to like the fact that when I was assigned to work at Fire Station 23 and we would use the Jewish Community Center next door, that we would lose the ability to talk to PSCC. Considering that, we were less than a mile from PSCC and in a fairly small building. We still lost communications with PSCC.

Also, another quickie would have to be our training evolutions at Huntington Towers. We were doing an evolution and I was assigned to the fire floor ac the fire attack officer. As I was entering the building, still in visual touch with the IC, I would lose radio contact with him. I realize that we were going through the repeater but the fact of the matter is that I had only just crossed the threshold into the structure and had not gone more than 10 feet and was out of radio communication. This is more than a little disconcerting and even though we are attempting to address the situation, I just don't get that warm and comfy feeling anytime I have to enter a large building.

We ran a FVEHF in the parking garage at 5573 Seminary Road (Savory Park Condos) recently. It was a US Postal Service minivan about 300' inside the garage with the occupant compartment well involved. Once I was less than 50' inside the garage (which, as you know, is not truly below grade) I lost all ability to communicate on the operations channel with my driver, PSCC, and incoming units. I had to walk over near side A of the garage and get near an exterior wall before the radio came back in range. As a result, I had to resort to yelling to relay instructions and ultimately using the "0" channel, which of course was only of value once the BC got on the scene. In the interim, I was trying to transmit on the operations channel to have PSCC reduce the response of anything other than the truck and the second-due engine to priority 2. No one heard those transmissions, as I ultimately learned.

*****

On July 28, 2003, we were at a fire alarm sounding in a 16 story high-rise office building. When we reached the 12th floor we found smoke in the hallways. We could not contact PSCC via the radio. We tried several different channels with no success. Access to the surrounding offices was hampered because they were all high security defense department units, so we couldn't readily reach a window. We had to call the driver outside on the talk around channel and they had to relay all the information to incoming units and PSCC. There also have been many instances where personal cell phones have been used to either contact personnel outside or to contact PSCC directly.

*****

This past winter, assisted on a call for excessive amounts of CO on the 8th floor and above in a high-rise. Had units on multiple floors. I'm in the lobby talking with Hazmat. Units and my talk-group could not hear me unless I physically held the radio above my head. Being 6'5", you would think that would be good enough. Good thing I wasn't on a fire floor with heavy heat conditions.

*****

Two stories from the greater 2nd battalion:

Box alarm in a parking garage at Tyson's Corner Mall for a fully involved vehicle, extending to adjoining cars. I was transmitting my reports and requests to the battalion chief, sitting in his buggy that I could see less than 200' away, but he said he was unable to copy any of my radio traffic.

Second, event was reported fire in a high-rise. After gaining access to the reported apartment and determining it was only food on the stove, I attempted to contact Command with my report from the 13th floor apartment. Command said I was breaking up. I went to the balcony to retransmit my report and Command indicated they still had trouble understanding what units I wanted to hold.

*****

Parliament House a 9 story high-rise. As soon as you get 10 feet inside the front door all radio communication stops except for Channel "0" until one gets upper floors close to a window in an apartment. So, if you are in an elevator and get trapped and no one is listening to Channel 0, you are out of luck because no one will hear you. Ravenworth Towers is the same way. Rear of the K-Mart on John Marr is the same way.

Sleep Hollow Nursing Home..."Nursing Home". We had a fire in the laundry room. We entered the building on side C at ground level, by the time we made it back to the laundry room; we were under ground, which means the fire was in the center of the building underneath the majority of the patients. We were unable to talk to the outside units on the repeated channels. I had to position myself halfway down the hallway and carry 2 radios one on "0" and the other on the Fire Ground Channel.

While carrying a portable radio inside Station 8..."Inside Station 8" the radios will start to fade out, the voices sound like Charlie Brown's teacher...if the station radios are down and we are working off of a portable we might not hear the call if we are in the middle of the building.

*****

We make frequent runs to Greenspring Village, 2-3 times a day. This complex is still under construction. As a routine, I have to leave the engine driver outside communicating with him/her on: 4-Ocean" if I need to request anything from PSCC. For those calls involving the entire crew, I have to depend upon using the occupant's telephone.

*****

Dispatched to an ALS emergency for a severe asthma patient in the Bailey Cross Road area of the county. After accessing the patient, we were riding the elevator down from the 6th floor when the elevator car stalled. The radio would not transmit out, leaving us stuck in the elevator with a potentially critical patient. We were rescued when the engine crew that walked down came looking for the missing engine medic, most probably because they wanted to get back before dinner got cold.

*****

For what it's worth, I concur regarding the "0" radios. We ran a vehicle fire deep in the garage under 5573 Seminary our last day, and 30 feet into the garage I lost all ability to talk on the repeated channel. I had to walk to within 20 feet or so of one of the exterior walls to get back in range. We had to shout back and forth and ultimately resorted to the 0 channel so that I could talk to my engine driver. Of course, this took me off the repeated channel.

*****

On July 28, 2003 at 2257 hours Engine 10 and Truck 10 were dispatched to a fire alarm located at 5203 Leesburg Pike. As we were approaching the scene a supplemental MCT message indicated that a called had now seen fire from the 11th floor and that he could hear the fire alarm sounding as well. I called PSCC and asked them about the supplement; they seemed unaware of it.

PSCC then called T-10 and told them that the supplement was in fact accurate and they then asked the truck if they wanted the box filled out. It was at this time that I interjected on the radio and informed PSCC to fill out the assignment and that I would get back to them when I had determined what was going on.

After several minutes of investigation, I confirmed that an alarm was sounding, and I was still trying to determine the status of any fire. I again called PSCC; I asked them if they had filled out the box, if they had checked back with the caller for more information and what channel the incident had been moved to. They informed me that, no they had not completed the assignment, that they were still checking with the caller and that the incident had not been moved to another channel.

I again asked for the assignment to be completed and was informed that they had checked back with the caller and he no longer saw anything, and that the fire officer

"recommended" not filling out the assignment. It was, at this point due in part, to my heightened level of frustration that I told them to do whatever they felt like doing. While this exchange was taking place E-10 Alpha was ascending, as ordered, to the #12 floor. Upon their arrival they encountered a moderate smoke condition with an unknown source. They repeatedly attempted to call both PSCC and myself on both the dispatch and fire ground frequencies, but their attempt went unheard. Eventually, one of their calls was heard and at 2311 hours PSCC finally realized that the assignment should be upgraded. They assigned us to fire ground channel 4-C for the remainder of the event.

10/10/2007
STAKEHOLDER MTG FOR CONSIDERATION OF NC PROPOSALS

VIRGINIA DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT
DIVISION OF BUILDING AND FIRE REGULATION

2006 Code Change Cycle – Code Change Evaluation Form

USBC – Virginia Construction Code
Code Change No. C-912.1

Nature of Change: (text is on code change form)

To provide the basic infrastructure capable of supporting emergency communication equipment in the construction of certain new buildings.

Proponent: City of Virginia Beach (and In-Building Emergency Communications Task Group)

Staff Comments:

This proposal was developed cooperatively through the In-Building Communications Task Group and Workgroups 2 and 3. While the current proposal is not as extensive as former proposals, the groups determined that it would provide a good first step in enhancing the ability of firefighters and emergency responders to effectively communicate where building feature impediments are present. It was recognized that the technology utilized in emergency communications is still in a state of change, which plays a factor in developing a more comprehensive proposal. All groups recommend this change to move forward as consensus.

Codes and Standards Committee Action:

_____ Approve as presented. _____ Disapprove.

_____ Approve as modified (specify):

_____ Carry over to next cycle. _____ Other (specify):

VIRGINIA DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT
CODE CHANGE FORM

Address to submit to: DHCD, The Jackson Center 501 North Second Street Richmond, VA 23219-1321 Tel. No. (804) 371 – 7150 Fax No. (804) 371 – 7092 Email: bhcd@dhcd.virginia.gov		Document No. C-912.1 Committee Action: _____ BHCD Action: _____

Submitted by: Cheri Hainer Representing: City of Virginia Beach

Address: 2405 Courthouse Drive, Bldg. 2, Room 100, Virginia Beach, VA 23456

Phone No. (757) 385-4211

Regulation Title: 2003 USBC and SFPC Section No(s): USBC 902, 912 and SFPC 511

Proposed Change:

(1) In the USBC, add new definitions to Section 902 of the IBC as follows:

Emergency Communication Equipment. Emergency communication equipment, includes, but is not limited to, two-way radio communications, signal booster, bi-directional amplifiers, radiating cable systems or internal multiple antenna, or a combination of the foregoing.

Emergency Public Safety Personnel. Emergency public safety personnel includes firefighters, emergency medical personnel, law-enforcement officers and other emergency public safety personnel routinely called upon to provide emergency assistance to members of the public in a wide variety of emergency situations, including, but not limited to, fires, medical emergencies, violent crimes and terrorist attacks.

(2) In the USBC, add Section 912 to the IBC as follows:

Section 912. In-Building Emergency Communications Coverage.

912.1 General. In-building emergency communication equipment to allow emergency public safety personnel to send and receive emergency communications shall be provided in new buildings and structures in accordance with this section.

Exceptions:

1. Buildings of Use Groups A-5, I-4, within dwelling units of R-2, R-3, R-4, R-5, and U.

2. Buildings of Type IV and V construction without basements.

3. Above grade single story buildings of less than 20,000 square feet.

4. Buildings or leased spaces occupied by federal, state, or local governments, or the contractors thereof, with security requirements where the building official has approved an alternative method to provide emergency communication equipment for emergency public safety personnel.

5. Where the owner provides technological documentation from a qualified individual that the structure or portion thereof does not impede emergency communication signals.

912.2 Where required. For localities utilizing public safety wireless communications, new buildings and structures shall be equipped throughout with dedicated infrastructure to accommodate and perpetuate continuous emergency communication.

912.2.1 Installation. Radiating cable systems, such as coaxial cable or equivalent shall be installed in dedicated conduits, raceways, plenums, attics, or roofs, compatible for these specific installations as well as other applicable provisions of this code.

912.2.2 Operations. The locality will assume all responsibilities for the installation and maintenance of additional emergency communication equipment. To allow the locality access to and the ability to operate such equipment, sufficient space within the building shall be provided.

912.2.3 Inspection. In accordance with Section 113.3, all installations shall be inspected prior to concealment.

912.3 Acceptance test. Upon completion of installation, after providing reasonable notice to the owner or their representative, emergency public safety personnel shall have the right during normal business hours, or other mutually agreed upon time, to enter onto the property to conduct field tests to verify that the required level of radio coverage is present at no cost to the owner. Any noted deficiencies shall be provided in an inspection report to the owner to the owner or the owner's representative.

(3) In the SFPC, add Section 511 to the IFC as follows:

Section 511. Maintenance of In-Building Emergency Communication Equipment.

511.1 General. In-building emergency communication equipment shall be maintained in accordance with the USBC and the provisions of this section.

511.2 Additional in-building emergency communications installations. If it is determined by the locality that increased amplification of their emergency communication system is needed, the building owner shall allow the locality access as well as provide appropriate space within the building to install and maintain necessary additional communication equipment by the locality. If the building owner denies the locality access or appropriate space, or both, the building owner shall be responsible for the installation and maintenance of these additional systems.

511.3 Field tests. After providing reasonable notice to the owner or their representative, the fire official, police chief, or their agents, shall have the right during normal business hours, or other mutually agreed upon time, to enter onto the property to conduct field tests to verify that the required level of radio coverage is present at no cost to the owner.

Supporting Statement:

In 2002, on behalf of my locality, I made a proposal to require the pre-wiring of buildings to supplement and enhance the locality's emergency communication system. Other localities were experiencing similar issues and several joined in the effort to codify the issue. In 2003, General Assembly Joint Bill 588 required the State Fire Marshall's office (Fire Programs) to study the necessity for appropriate code provisions. A task group representing all affected parties, such as Building and Fire Officials, Building Owners, Contractors, and Radio Systems Technical Advisors meet to discuss this issue and determined there was a need for this to be referenced in the Uniform Statewide Building Code. Based on the outcome of that study as well as the language in House Bill 2529 2003, several versions of this code provision were developed and presented to the Board of Housing. However, there were numerous undetermined construction and cost factors involved and nc

consensus could be reached among the code, construction and building owners communities and consequently no codes were adopted. But the concern for and by the emergency public safety personnel is still prevalent, prompting the introduction of House Bill 2554 2007. Accordingly, the interested parties have come back to the table and as the In-Building Communications Work Group, have arrived at this compromise as a first step to addressing this issue. The installation and maintenance costs and responsibilities of the building owner have been greatly reduced as they now need only provide basic and generic infrastructure capable of enhancing any supplemental emergency communication equipment, which will be provided and maintained by the locality.

Why Emergency Radio Communications Enhancement Systems (ERCES)?

NOTIFIER® by Honeywell

The Issue

Two-Way Radio Dead Spots for First Responders

In an emergency, we depend on First Responders to mitigate the problem and help survivors. These firefighters, EMTs and law enforcement officers rely on two-way radios for communications, especially in multi-story buildings when responders can be located on different floors while trying to save lives. For that reason, radio signals within buildings need to be strong to support two-way communications in an emergency situation.

Buildings can weaken the radio signals that First Responders rely on to orchestrate emergency responses, evacuations, and other life-saving protocols. Concrete, glass windows, metal structures, below-grade build outs, among others impacting radio propagation can cause emergency radio communications to become unreliable or drop altogether.

This is unfortunately a common problem. A 2017 International Association of Fire Chiefs Survey shows:

- 98.5% of Fire Departments reported dead spots in buildings due to poor radio frequency coverage
- 56% of First Responders have experienced a communications failure within a building during an emergency incident within the past 24 months

Codes require an approved level of radio coverage in a building which can be achieved by enhancing the in-building public radio frequency signal coverage with an ERCES (Emergency Radio Communications Enhancement Systems) which comprises of a BDA (Bi-Directional Amplifier) / Signal Booster and Distributed Antenna System (DAS). **But not all key stakeholders know about the code requirements and are putting First Responders at risk when buildings are not outfitted with proper radio frequency signal coverage.**

The Regulatory Response

ERCES and Code Review

This challenge was most famously evident during September of 2001 when the World Trade Center buildings were brought down in terrorist attacks. Because of this the National Institute of Standards and Technology (NIST) studied the disaster and developed recommendations to improve public safety.

The NIST WTC investigation was conducted under the authority of the National Construction Safety Act. The final 2011 NIST WTC report (http://wtc.nist.gov) published a summary of findings, including recommended revisions to current codes, standards, and practices to improve public safety.

In a key conclusion (Recommendation #22), NIST:

> *"…recommends the installation, inspection, and testing of emergency communications systems, radio communications, and associated operating protocols to ensure that the systems and protocols: (1) are effective for large- scale emergencies in buildings with challenging radio frequency propagation environments; and (2) can be used to identify, locate, and track emergency responders within indoor building environments and in the field."*

This resulted in a new section being added to the 2009 edition of the International Fire Code (IFC) that requires all buildings to have approved radio coverage for emergency responders within buildings. Approved is a defined term in the IFC which means acceptable to the *fire code official*. The 2010 edition of NFPA 72, National Fire Alarm and Signaling Code, further defined Two-Way Radio Communications Enhancement Systems requirements for technical coverage and signal strengths under Section 24.5.2*

*These requirements were then relocated from the 2016 Edition of NFPA 72 to NFPA 1221, Section 9.6.

The Result

ERCES and Code Updates

Enhancing in-building radio frequency signal coverage with an Emergency Radio Communication Enhancement System (ERCES) comprised of a BDA (Bi-Directional Amplifier) / Signal Booster and Distributed Antenna System (DAS) is now a key requirement for buildings. Most current adopted Fire and Building Codes require Emergency Responder Radio Signal strength and coverage to be measured in all new and some existing construction. ERCES are required by IBC (International Building Code), IFC and NFPA 1. These codes require ERCES to be installed, serviced and maintained in accordance with NFPA 1221 and NFPA 72. A snapshot of the current IFC and NFPA Codes include:

Conditions	NFPA 1221 Section 9.6 - 2016 Edition	IFC 510 - 2015 Edition (2018 Ed. Avail. Oct. 2017)
Antenna Malfunction	Applicable - System and BDA	Not specifically - AHJ may require
Signal Booster Failure	Yes	Yes
Low Battery 70%	Yes	Not specifically - AHJ may require
Loss of Normal A.C.	Yes	Yes
Failure of Battery Charger	Yes	Not specifically - AHJ may require
Backup Duration	12 Hours	24 Hours* (12 hours 2018 IFC)
Signal Coverage	>=95 dBm (DAQ3.0 2016 Edition) / 90% / 99%	>=95 dBm (DAQ3.0) / 95%
Monitoring / Maintenance	Yes	Yes
Battery Backup Cabinets	NEMA4	NEMA4 (NEMA3R 2018 IFC)

1. IFC Section 510 – Emergency Responder Radio Coverage

The 2018, 2015, 2012, 2009 editions dictate that all new and existing buildings shall have approved radio coverage for emergency responders. Approval is based upon the existing coverage levels of the public safety communication systems utilized by the jurisdiction and measured at the exterior of the building.

> *The 2018 edition (IFC 510.4.1)* ***requires 95% coverage of all areas on each floor of the building*** *and the same signal strength as outlined in NFPA.*

In addition, Bi-Directional Amplifier (BDA) components must be contained in a NEMA-4 type enclosure. Correlating battery backups must be contained in a NEMA 3R or higher-rated cabinet (per 2018 edition), or a NEMA 4-type cabinet. The system requires a battery backup of either 12 hours (2018 edition) or 24 hours. Under all system operating conditions, isolation must be maintained between the donor antenna and all inside antennae and be no less than 20dB greater than the system gain under all operating conditions (2018 edition). It also requires oscillation prevention circuitry for the BDA.

FCC certification is required for the BDA, whose status must be monitored by the fire alarm system with a supervised communications link.

IFC requires system designers and lead installation personnel to have both a valid FCC-issued General Radio Operators License (GROL) and to be certified in-building system training by either the equipment manufacturer or an approved organization/school. IFC also requires inspection and annual testing of ERCES, or whenever structural changes occur that could materially change the original field performance tests.

2. NFPA 1221 & 72 – National Fire Alarm and Signaling Code

NFPA 1221 Section 9.6 (2016 edition) and NFPA 72 Section 24.5.2 (2013, 2010 edition) dictates that **radio coverage shall be provided with 90% floor area in general building areas, and 99% floor area in critical areas**. Critical areas include command centers, fire pump rooms, exit stairs and passageways, elevator lobbies, standpipe cabinets, sprinkler sectionals, valve locations, and other areas specifically identified by an Authority Having Jurisdiction (AHJ).

For signal strength or quality of audio delivered, NFPA 1221 2016 Edition requires the system to provide a Minimum Delivered Audio Quality (DAQ 3.0) and NFPA 72 requires minimum inbound and outbound signal strength of -95 dBm. NFPA requires the system must be capable of all radio system frequencies assigned by AHJ.

NFPA includes system component requirements stating that signal boosters/BDA units must have FCC certification prior to installation and be compatible with both analog and digital communications simultaneously at time of installation. BDA components should be contained in NEMA-4 or 4X type enclosure(s). The system requires a battery backup of 12 hours. Isolation must be maintained between the donor antenna and all internal antennae to ensure non-interference and non-degradation of Public Safety Systems.

A dedicated annunciator panel must be housed within the emergency command center to annunciate status of any signal booster(s). The monitoring panel must provide visual and labeled indications of the following for each signal booster: (1) Normal AC power, (2) Signal booster trouble, (3) Loss of normal AC power, (4) Failure of battery charger, (5) Low-battery capacity and (6) Antenna failure. The BDA status must be monitored by the fire alarm system via a supervised communications link.

3. IBC

IBC Section 916 (2015 edition) and IBC Section 915 (2012 edition) dictate that radio coverage shall be provided in all new buildings in accordance with IFC Section 510.

4. NFPA

NFPA 1 Section 11.10 dictates in all new and existing buildings, minimum radio signal strength for fire department communications shall be maintained at a level determined by the AHJ. Where required by the AHJ, two-way radio communication enhancement systems shall comply with NFPA 1221.

5. Other

Local Ordinances - Many cities and counties have additional ordinances requiring BDA systems. These ordinances are defined by the Authority Having Jurisdiction (AHJ). Specifications set by the AHJ are required and must be met.

FCC - FCC rules apply to all radio frequency (RF) emitters including BDAs. All BDAs must be FCC certified to be legally sold in the USA. Furthermore, all systems must be installed in accordance with applicable FCC rules and regulations. Similarly, in Canada Industry Canada (IC) certification is required.

The Newest Requirements

Performance Compliance – UL 2524

Product performance listings and standards were only recently introduced for ERCES. Prior to the new standards, AHJs, architects, engineers, and building owners could not be 100% certain that systems were code compliant and whether they would perform as claimed by manufacturers. Today, code regulates performance standards and listings provide all necessary parties the certainty that installed BDA systems will provide reliable communications for emergency responders.

UL 2524 for In-building 2-Way Emergency Radio Communication Enhancement systems was introduced as an Outline of Investigation (OOI) on December 21, 2017. An OOI is essentially a draft version of a product standard.

UL 2524 Timeline

- December 2017: UL 2524 published as an Outline of Investigation
- December 2017: Product testing begins
- Spring 2018: Standards Technical Panel (STP) formed for US/CAN
- June – July 2018: UL 2524 proposal balloted
- August 2018: STP meets to review negative ballots and public comments
- August – October 8: Recirculation of revisions to proposal
- October 2018: Published 1st edition on October 18th
- January 2019: 2nd edition published - Bi-National Standard

UL 2524 covers the products (e.g., repeater, transmitter, receiver, signal booster components, external filters, and battery charging components) used for ERCES/ BDA systems installed in a location to improve wireless communication at that location. It does not cover passive RF components which includes antennas, splitters, couplers, coaxial cable and connectors.

UL 2524 addresses the following areas:

- Safety (risk of fire and risk of shock) requirements – construction and testing
- Compliance with specific performance requirements in accordance with the IFC-2018 and NFPA 1221-2016 (2019)
- Reliability performance requirements applicable for life safety systems – construction and testing
- Product marking and installation documentation

Product assessment is done by an OSHA accredited, independent third-party organization and successful investigation results in product listing for the purpose.

NOTE: UL 2524 listed products and their certification information can be accessed with UL Product iQ™ https://iq.ulprospector.com/info/ by using the UL Category Control Number UTMH in the search filter.

The Impact

ERCES for AHJs, Architects, Engineers, Contractors, Building Owners

What does this mean for AHJs?

- An AHJ's fundamental requirement is to ensure the safety of the population within its jurisdiction. With national consensus model codes and installation standards that govern the installation, testing and maintenance of ERCES and UL 2524 listing for product performance in place, it is in the AHJ's best interest to implement these requirements at their local level. Not only will this serve their community and safety personnel at a higher level, it will also mitigate risk and cost of retrofits down the road for the building owners once the code and listing has been mandated locally.

What does this mean for Architects & Engineers?

- With inevitable changes to jurisdictional requirements forthcoming from AHJ's, Architects and Engineers are in a prime position to include forward thinking life-safety specifications in their design proposals. Addressing code compliant and UL 2524 listed ERCES during the design portion of a new build drives inclusion during contract and construction phases.
- Recommending ERCES during the design phase will save clients retrofit costs once the standard has been recorded
- With specific knowledge of new code and listing requirements, Architects and Engineers can position themselves as industry leaders and trusted potential partners

What does this mean for Fire Safety Engineers?

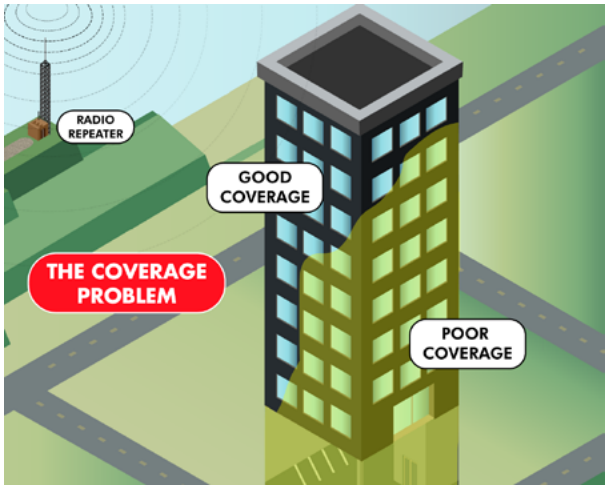
- As experts in fire safety and standards, Fire Safety Engineers are leaned upon by the design team to provide best-practice recommendations. By being aware of code changes, performance listings and their future implications, Fire Safety Engineers help mitigate risk and stay ahead of current safety standards.

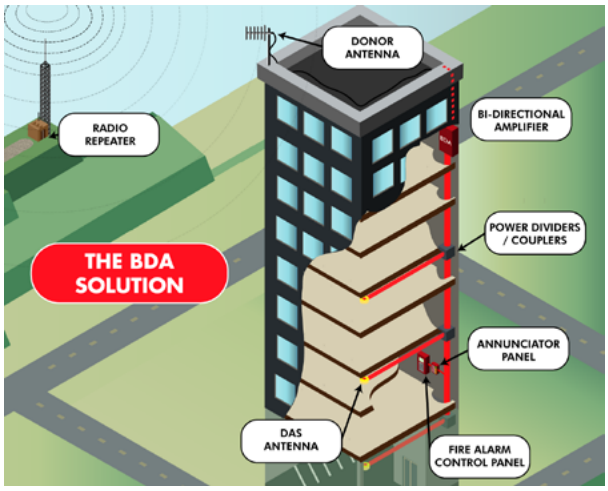
What does this mean for General and Electrical Contractors?

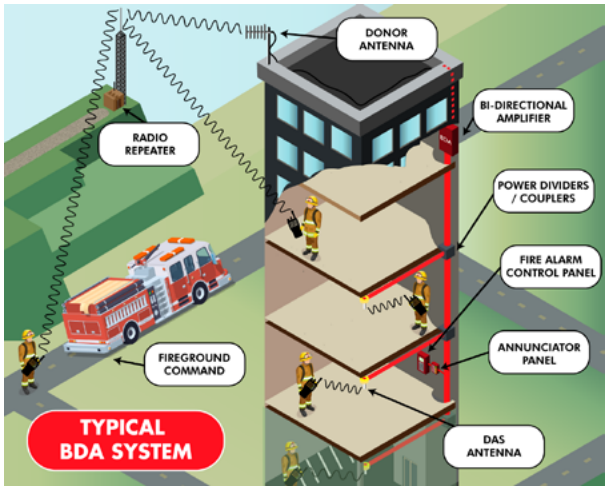
- Both General and Electrical Contractors are expected to be familiar with current code and understand how future code and product standards affect the life span of a building. Including a code compliant and UL 2524 listed ERCES system ahead of time will save construction costs, when compared to making changes in the field, or retroactively.
- By being aware of national consensus model codes and installation standards, and recent product performance listing standards and their eventual trickle down to the local level, contractors can make sure to partner with the right fire safety experts during installation.

What does this mean for Building Owners or Developers?

- Building Owners/Developers are required to build structures that are capable of meeting the mandated radio performance criteria in order to receive their certificate of occupancy (CO). By including a code-compliant and UL 2524 listed system from the earliest stages of a project, Builders/Owners can forgo unnecessary delays in tenant occupancy and fire safety upgrade costs.
- External and environmental changes can also impact the emergency radio performance throughout a building's lifetime, which would need to be amended after each year's inspection. This can be mitigated by adding a code-compliant and UL 2524 listed ERCES system during the design process.
- Safety is a significant selling point to future tenants or owners. A more sophisticated life safety system will provide not only peace-of-mind, but also minimize tenant build-out retrofit costs.







NOTIFIER
12 Clintonville Road
Northford CT 06472
203.484.7161
www.notifier.com

NF_WP_BDA | Rev 01 | 2019-03-28

NOTIFIER® by Honeywell

B916-18

VCC: SECTION 916, 916.1, 916.1.1, 916.1.2, 916.1.3, 916.2, 916.2.1 (New); IBC®: NFPA Chapter 35 (New)

Proponents: Andrew Milliken (amilliken@staffordcountyva.gov)

2015 Virginia Construction Code

SECTION 916
IN-BUILDING EMERGENCY
COMMUNICATIONS COVERAGE

916.1 General.. For localities utilizing public safety wireless communications, dedicated infrastructure to accommodate and perpetuate continuous in-building *emergency communication equipment* to allow *emergency public safety personnel* to send and receive emergency communications shall be provided in new buildings and structures in accordance with this section.

Exceptions:

1. Buildings of Use Groups A-5, I-4, within dwelling units of R-2, R-3, R-4, R-5, and U.
2. Buildings of Types IV and V *construction* without basements, that are not considered unlimited area buildings in accordance with Section 507.
3. Above grade single story buildings of less than 20,000 square feet (1858 m^2).
4. Buildings or leased spaces occupied by federal, state, or local governments, or the contractors thereof, with security requirements where the building official has approved an alternative method to provide *emergency communication equipment* for *emergency public safety personnel*.
5. Where the *owner* provides technological documentation from a qualified individual that the *structure* or portion thereof does not impede emergency communication signals.

916.1.1 Installation.. ~~The building *owner* shall install radiating cable, such as coaxial cable or equivalent. The radiating cable shall be installed in dedicated conduits, raceways, plenums, attics, or roofs, compatible for these specific installations as well as other applicable provisions of this code. The~~ Buildings shall have approved radio coverage for emergency responders within the building based on the existing coverage levels of the public safety communication systems utilized by the jurisdiction, measured at the exterior of the building. This section shall not require improvement of the existing public safety communication systems. Where an emergency responder radio communication enhancement system is provided, installation shall be in accordance with NFPA 1221, NFPA 72 and this section.The *locality* shall be responsible for the installation of any additional communication *equipment* ~~required for the operation of the system.~~ beyond these minimum requirements.

916.1.2 ~~Operations.~~ System Monitoring.. ~~The *locality* will assume all responsibilities for the operation and maintenance of the *emergency communication equipment*. The building *owner* shall provide sufficient operational space within the building to allow the *locality* access to and the ability to operate in-building *emergency communication equipment.*~~
Where provided, the emergency responder radio enhancement system shall be monitored by a listed fire alarm control unit and supervisory signals shall include the following:

1. Loss of normal AC power supply.

2. System battery charger(s) failure.

3. Malfunction of the donor antenna(s).

4. Failure of active RF-emitting device(s).

5. Low-battery capacity at 70-percent reduction of operating capacity.

6. Failure of critical system components.

7. The communications link between the fire alarm system and the emergency responder radio enhancement system.

916.1.3 Inspection.. In accordance with Section 113.3, all installations shall be inspected prior to concealment.

916.2 Acceptance test.. ~~Upon completion of installation, after providing reasonable notice to the *owner* or their representative, *emergency public safety personnel* shall have the right during normal business hours, or other mutually agreed upon time, to enter onto the property to conduct field tests to verify that the required level of radio coverage is present at no cost to the *owner*. Any noted deficiencies in the installation of the radiating~~

~~cable or operational space shall be provided in an inspection report to the *owner* or the *owner's* representative.~~
Where an emergency responder radio coverage system is provided, the system shall be tested and approved in accordance with NFPA 1221 and NFPA 72.

Revise as follows:

916.2.1 Critical Areas. Critical areas, including fire command centers, fire pump rooms, exit stairs, exit passageways, elevator lobbies, standpipe cabinets, sprinkler sectional valve locations, and other areas deemed critical by the AHJ, shall be provided with 99 percent floor area radio coverage prior to occupancy approval.

2018 International Building Code

Revise as follows:

NFPA

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

1 NFPA 1221: Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems, 2019 Edition

Reason Statement: The effectiveness and reliability of emergency responder communication is one of if not the most important aspect of successful emergency response and protection of public safety. In fact, as wireless technologies advance and community hazards expand, these public safety communication tools quickly become the backbone of incident response for not only fire and rescue personnel but also law enforcement and other first responders. Just as the water provided in building standpipes is critical to firefighting operations in large buildings, clear and dependable communications is vital to the safety of first responders in these buildings. This is in keeping with the philosophy inherent in the model codes that, when a facility grows too large or complex for effective fire response, fire protection features must be provided within the building. Building construction features and materials can absorb or block the radio frequency energy used to carry the signals inside or outside the building. Blockage or absorption of the radio frequency signal can prevent a critical message from an emergency responder from being received and acknowledged. Depending on the incident, this loss of information can place other emergency responders in greater danger or may prevent an injured or disoriented emergency responder from communicating for assistance.
The current VCC language requires the use of out-dated technology and in some cases the installation of equipment that may never be used. Unless meeting one of the exemption requirements, building owners are required to route hundreds of feet of likely disconnected cabling throughout the building including in areas where existing coverage may already be adequate. This proposal does NOT remove or modify any of the many exemptions currently indicated by the current code (VCC 916.1) so as to maintain consistency throughout Virginia. In addition, the current VCC language provides no recognition as to the current level of public safety communication strength currently on site. Without additional guidance, this could suggest that a building owner is responsible for providing a higher level of radio coverage than what currently is present in reality - a cost that is not fair to be burdened by the building owner or developer. The proposed language (ICC and NFPA model code language) ensures that the building is only required to maintain the existing level of public safety radio communication coverage available at the exterior of the building. Furthermore, just as building standpipe systems, fire hydrant systems, fire alarm systems and other fire protection systems are required to be provided as part of the building infrastructure for emergency responder use, the reliability and dependability of emergency radio enhancement systems demand that they be similarly connected to and monitored by the building fire alarm system. Finally, the current VCC language does not provide any reference standard for the installation or testing of such systems. This proposal includes a reference to NFPA 1221 for these details to ensure that they are capable, compatible and interoperable for emergency response at any time or location.

Resiliency Impact Statement: This proposal will increase Resiliency
As compared to the ineffective and in some cases unnecessarily burdensome code language currently present in the VCC, this proposal represents a tremendous increase in building and public safety resiliency. Ensuring that first responders are able to effectively communicate is invaluable to the successful outcome of emergency response incidents and the protection of lives and property. The assurance for emergency responder radio coverage that this proposal provides does so not only for the major, or once-in-a-lifetime catastrophes but also many times over in the daily smaller "routine" emergencies that occur throughout buildings.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
Since this proposal does not remove or modify any of the current exemptions from providing in-building communication infrastructure, this proposal only applies to the same buildings where infrastructure is already required to be provided. In fact, this proposal provides the ability of building owners and developers to utilize cost-effective technology to accomplish the requirement with less labor and materials. Moreover, it also works to ensure that such technology is only provided where it is found to be needed and only to the level at which the public safety system currently provides at the exterior of the building. These cost-saving efforts are expected to equal or exceed any added cost to monitor such system by the building fire alarm system. Also, since the proposal is based on national and international standards that have been in place for years, most large construction projects already anticipate these costs for construction around the country.

B916.1-18

VCC: 916.1

Proponents: Ronald Clements Jr (clementsro@chesterfield.gov)

2015 Virginia Construction Code

916.1 General.. For localities utilizing public safety wireless communications, dedicated infrastructure to accommodate and perpetuate continuous in-building *emergency communication equipment* to allow *emergency public safety personnel* to send and receive emergency communications shall be provided in new buildings and structures in accordance with this section.

Exceptions:

1. Buildings of Use Groups A-5, I-4, within dwelling units of R-2, R-3, R-4, R-5, and U.
2. Buildings of Types IV and V *construction* without basements, that are not considered unlimited area buildings in accordance with Section 507.
3. Above grade single story buildings of less than 20,000 square feet (1858 m^2).
4. Buildings or leased spaces occupied by federal, state, or local governments, or the contractors thereof, with security requirements where the building official has approved an alternative method to provide *emergency communication equipment* for *emergency public safety personnel*.
5. Where the *owner* provides technological documentation from a qualified individual that the *structure* or portion thereof does not impede emergency communication signals.
6. Buildings in localities that do not provide the additional communication equipment required for the operation of the system.

Reason Statement: Many localities do not have the funding to provide the communication equipment required to operate in building communication systems. In such localities installation of radiating cable that will not be used makes little sense. Additionally, even if equipment will be provide some time in the future it is not possible to design the system to operate properly without knowing the equipment specifications at the time of building design. Furthermore, the requirement for the locality to provide the equipment puts localities in a position of violating the code when funding is not allocated to purchase the equipment.

Resiliency Impact Statement: This proposal will neither increase nor decrease Resiliency
This code provision is not related to resiliency.

Cost Impact: The code change proposal will decrease the cost of construction
This will decrease the cost of construction by not requiring building infrastructure to be installed that will never be used.

B918.1-18

IBC®: CHAPTER 9, SECTION 918, [F] 918.1; VCC: 916.1, 916.1.1, 916.1.2, 916.1.3, 916.2

Proponents: Linda Hale (Linda.Hale@Loudoun.gov); Andrew Milliken (amilliken@staffordcountyva.gov)

2018 International Building Code

CHAPTER 9
FIRE PROTECTION AND LIFE SAFETY SYSTEMS

SECTION 918
EMERGENCY RESPONDER RADIO COVERAGE

Revise as follows:

[F] 918.1 General.. Emergency responder radio coverage shall be provided in all new buildings in accordance with Section 510 of the International Fire Code ~~Code.~~ .

2015 Virginia Construction Code

Revise as follows:

~~**916.1 General..** For localities utilizing public safety wireless communications, dedicated infrastructure to accommodate and perpetuate continuous in-building *emergency communication equipment* to allow *emergency public safety personnel* to send and receive emergency communications shall be provided in new buildings and structures in accordance with this section.~~

Exceptions:

1. Buildings of Use Groups A-5, I-4, within dwelling units of R-2, R-3, R-4, R-5, and U.
2. Buildings of Types IV and V *construction* without basements, that are not considered unlimited area buildings in accordance with Section 507.
3. Above grade single story buildings of less than 20,000 square feet (1858 m^2).
4. Buildings or leased spaces occupied by federal, state, or local governments, or the contractors thereof, with security requirements where the building official has approved an alternative method to provide *emergency communication equipment* for *emergency public safety personnel*.
5. Where the *owner* provides technological documentation from a qualified individual that the *structure* or portion thereof does not impede emergency communication signals.

~~**916.1.1 Installation..** The building *owner* shall install radiating cable, such as coaxial cable or equivalent. The radiating cable shall be installed in dedicated conduits, raceways, plenums, attics, or roofs, compatible for these specific installations as well as other applicable provisions of this code. The *locality* shall be responsible for the installation of any additional communication *equipment* required for the operation of the system.~~

~~**916.1.2 Operations..** The *locality* will assume all responsibilities for the operation and maintenance of the *emergency communication equipment.* The building *owner* shall provide sufficient operational space within the building to allow the *locality* access to and the ability to operate in-building *emergency communication equipment.*~~

916.1.3 Inspection.. In accordance with Section 113.3, all installations shall be inspected prior to concealment.

Revise as follows:

~~**916.2 Acceptance test..** Upon completion of installation, after providing reasonable notice to the *owner* or their representative, *emergency public safety personnel* shall have the right during normal business hours, or other mutually agreed upon time, to enter onto the property to conduct field tests to verify that the required level of radio coverage is present at no cost to the *owner.* Any noted deficiencies in the installation of the radiating cable or operational space shall be provided in an inspection report to the *owner* or the *owner's* representative.~~

Reason Statement: The provisions of Section 510 are concerned with the reliability of portable radios used by emergency responders inside buildings. This is in keeping with the philosophy inherent in the I-Codes that, when a facility grows too large or complex for effective fire response, fire protection features must be provided within the building.
Emergency responders use portable radios to communicate with other emergency responders, the incident commander and the public safety communications center. Building construction features and materials can absorb or block the radio frequency energy used to carry the signals inside or outside the building. Blockage or absorption of the radio frequency signal can prevent a critical message from an emergency responder from being received and acknowledged. Depending on the incident, this loss of information can place other emergency responders in greater

danger, or may prevent an injured or disoriented emergency responder from communicating for assistance. The requirements apply to analog or digital radio systems and are applicable to all buildings. This section requires that all buildings have approved radio coverage for emergency responders within the building. Approved radio coverage is based on the ability of the existing public safety communications system to transmit a signal inside and outside the building.

The existing radiating or “leaky cable” that is currently required in the code is approximately 15% more expensive than a non-radiating cable. A radiating cable that is then placed in a conduit or raceway that shields the cable eliminates the sole purpose of a radiating cable. A radiating cable (that is not shielded) does have a very specific application, but it is a limited application.

Passing off the costs of this critical communication system to a jurisdiction equates to passing off the expense to the citizens of that jurisdiction, as most fire departments are funded predominantly by local tax dollars and or donations. This is unconscionable that the citizens of a jurisdiction should bear the financial burden of a private building that is being built in a locality. And is tantamount to placing career and volunteer firefighters, who are willing risk their lives to save another, in harm’s way without the most basic of abilities to call a MayDay (e.g. help) or for an incident commander to call for an evacuation prior to firefighters becoming trapped. How many firefighters must perish before we appreciate their un-waiver dedication and provide the rudimentary tools in which to save lives?

Resiliency Impact Statement: This proposal will increase Resiliency

Cost Impact:
The cost will not increase in all buildings, as not all buildings will have impaired emergency radio communications. The impairment degree of those that are compromised will not be the same as it is based on building construction features, existing buildings, and the signal strengths in a jurisdiction. The off set of price from a radiating cable to a metal shielded coaxial cable will also assist with some of the price difference. The cost increased to compromised structures will vary from 40 cents/sq ft to $1.00/sq ft., and is hardly worth a life.

§ 90.219 Use of signal boosters.

This section contains technical and operational rules allowing the use of signal boosters in the Private Land Mobile Radio Services (PLMRS). Rules for signal booster operation in the Commercial Mobile Radio Services under part 90 are found in § 20.21 of this chapter.

(a) ***Definitions.*** The definitions in this paragraph apply only to the rules in this section.

Class A signal booster. A signal booster designed to retransmit signals on one or more specific channels. A signal booster is deemed to be a Class A signal booster if none of its passbands exceed 75 kHz.

Class B signal booster. A signal booster designed to retransmit any signals within a wide frequency band. A signal booster is deemed to be a Class B signal booster if it has a passband that exceeds 75 kHz.

Coverage area of a PLMRS station. All locations within the normal reliable operating range (service contour) of a PLMRS station.

Deploy a signal booster. Install and/or initially adjust a signal booster.

Distributed Antenna System (DAS). A network of spatially separated antenna nodes connected to a common source via a transport medium that provides wireless service within a geographic area or structure.

Operate a signal booster. Maintain operational control over, and responsibility for the proper functioning of, a signal booster.

Signal booster. A device or system that automatically receives, amplifies, and retransmits signals from wireless stations into and out of building interiors, tunnels, shielded outdoor areas and other locations where these signals would otherwise be too weak for reliable communications. Signal booster systems may contain both Class A and Class B signal boosters as components.

(b) ***Authority to operate.*** PLMRS licensees for stations operating on assigned channels higher than 150 MHz may operate signal boosters, limited to the service band for which they are authorized, as needed anywhere within the PLMRS stations' service contour, but may not extend the stations' service contour.

(1) PLMRS licensees may also consent to operation of signal boosters by non-licensees (such as a building owner or a signal booster installation contractor) within their service contour and across their applicable frequencies, but must maintain a reasonable level of control over these operations in order to resolve interference problems.

(i) Non-licensees seeking to operate signal boosters must obtain the express consent of the licensee(s) of the frequencies for which the device or system is intended to amplify. The consent must be maintained in a recordable format that can be presented to an FCC representative or other relevant licensee investigating interference.

(ii) Consent is not required from third party (unintended) licensees whose signals are incidentally retransmitted. However, signal booster operation is on a non-interference basis and operations may be required to cease or alter the operating parameters due to a request from an FCC representative or a licensee's request to resolve interference.

(2) [Reserved]

(c) ***Licensee responsibility; interference.*** PLMRS licensees that operate signal boosters are responsible for their proper operation, and are responsible for correcting any harmful interference that signal booster operation may cause to other licensed communications services. Normal co-channel transmissions are not considered to be harmful interference. Licensees are required to resolve interference problems pursuant to § 90.173(b). Licensees shall act in good faith regarding the operation of signal boosters and in the resolution of interference due to signal booster operation. Licensees who are unable to determine the location or cause of signal booster interference may seek assistance from the FCC to resolve such problems.

(d) ***Deployment rules.*** Deployment of signal boosters must be carried out in accordance with the rules in this paragraph.

(1) Signal boosters may be used to improve coverage in weak signal areas only.

(2) Signal boosters must not be used to extend PLMRS stations' normal operating range.

(3)

(i) Except as set forth in paragraph (d)(3)(ii) of this section, signal boosters must be deployed such that the radiated power of each retransmitted channel, on the forward link and on the reverse link, does not exceed 5 Watts effective radiated power (ERP).

(ii) Railroad licensees may operate Class A signal boosters transmitting on a single channel with up to 30 Watts ERP on frequencies 452/457.9000 to 452/457.96875 MHz in areas where communication between the front and rear of trains is unsatisfactory due to distance or intervening terrain barriers.

(4) Class B signal boosters may be deployed only at fixed locations; mobile operation of Class B signal boosters is prohibited after November 1, 2014.

(5) Class B signal booster installations must be registered in the FCC signal booster database that can be accessed at the following URL: *www.fcc.gov/signal-boosters/registration.*

(6) Good engineering practice must be used in regard to the radiation of intermodulation products and noise, such that interference to licensed communications systems is avoided. In the event of harmful interference caused by any given deployment, the FCC may require additional attenuation or filtering of the emissions and/or noise from signal boosters or signal booster systems, as necessary to eliminate the interference.

(i) In general, the ERP of intermodulation products should not exceed −30 dBm in 10 kHz measurement bandwidth.

(ii) In general, the ERP of noise within the passband should not exceed −43 dBm in 10 kHz measurement bandwidth.

(iii) In general, the ERP of noise on spectrum more than 1 MHz outside of the passband should not exceed −70 dBm in a 10 kHz measurement bandwidth.

(7) Signal booster passbands are limited to the service band or bands for which the operator is authorized. In general, signal boosters should utilize the minimum passband that is sufficient to accomplish the purpose. Except for distributed antenna systems (DAS) installed in buildings, the passband of a Class B booster should not encompass both commercial services (such as ESMR and Cellular Radiotelephone) and part 90 Land Mobile and Public Safety Services.

(e) ***Device Specifications.*** In addition to the general rules for equipment certification in § 90.203(a)(2) and part 2, subpart J of this chapter, a signal booster must also meet the rules in this paragraph.

(1) The output power capability of a signal booster must be designed for deployments providing a radiated power not exceeding 5 Watts ERP for each retransmitted channel.

(2) The noise figure of a signal booster must not exceed 9 dB in either direction.

(3) Spurious emissions from a signal booster must not exceed −13 dBm within any 100 kHz measurement bandwidth.

(4) A signal booster must be designed such that all signals that it retransmits meet the following requirements:

(i) The signals are retransmitted on the same channels as received. Minor departures from the exact provider or reference frequencies of the input signals are allowed, ***provided that*** the retransmitted signals meet the requirements of § 90.213.

(ii) There is no change in the occupied bandwidth of the retransmitted signals.

(iii) The retransmitted signals continue to meet the unwanted emissions limits of § 90.210 applicable to the corresponding received signals (assuming that these received signals meet the applicable unwanted emissions limits by a reasonable margin).

(5) On or after March 1, 2014, a signal booster must be labeled to indicate whether it is a Class A or Class B device, and the label must include the following advisory

(1) In on-line point-of-sale marketing materials,

(2) In any print or on-line owner's manual and installation instructions,

(3) On the outside packaging of the device, and

(4) On a label affixed to the device:

"WARNING. This is NOT a CONSUMER device. It is designed for installation by FCC LICENSEES and QUALIFIED INSTALLERS. You MUST have an FCC LICENSE or express consent of an FCC Licensee to operate this device. You MUST register Class B signal boosters (as defined in 47 CFR 90.219) online at *www.fcc.gov/signal-boosters/registration.* Unauthorized use may result in significant forfeiture penalties, including penalties in excess of $100,000 for each continuing violation."

[78 FR 21564, Apr. 12, 2013, as amended at 83 FR 61097, Nov. 27, 2018]

HOW TO BEST DETERMINE WHETHER A BUILDING NEEDS AN ERCES ~~BDA~~ OR NOT

An In-Building Radio Signal Strength Survey/Signal Survey is a process of measuring the signal strength by taking the signal readings within a specific area and documenting the readings in the form of a signal survey report. This process measures and quantifies the strength of an RF signal of a specific frequency within a specific area of the building. If the project is in a pre-construction phase (Greenfield), an accurate survey may be accomplished by using a radio receiver, i.e. a hand-held portable radio, that has a calibrated RSSI (Radio Signal Strength Indication) readout in dBm (Decibel Milliwatts). Lower signal levels will go into negative numbers, therefore, a higher negative number is really a lower signal level. A signal survey will tell us if a building has acceptable signal coverage or not, both before and after an ERCES system is installed.

An empty lot survey can be extremely useful to pre-construction engineering. ~~I~~iBwave is a design software that uses the design of the building, as well as the materials of the building, e.g. concrete, steel, low E-glass etc. to help anticipate the final signal prior to construction. It helps define the walls in the building and calculates the ~~ambient~~ radio signal strength and DAQ (Delivered Audio Quality) before the building is built. (Most jurisdiction require a minimum of 3.0 ~~dBm~~DAQ.) By taking your signal measurements and, through the software, incorporating the material (type of wall and exterior build e.g.), you can calculate how much of the signal will be degraded or attenuated by the Low-E glass, cinder block walls, concrete, and sheetrock.

In a nutshell, ~~T~~to perform an accurate site testing, pre-construction, have an FCC-GROL licensed technician take RSSI readings and measure DAQ N, S, E, W, of the property. The Project Managers and Engineers that are iBwave experts can predict the signal strength after the building is "dried in" (windows & walls are installed). If the predicted signal strength / Delivered Audio Quality for the critical areas of the building do not meet minimum code-required thresholds, then an ERCES will most likely be required. This is oftentimes too late in the construction process—and sometimes results in costly retrofits pulling cable & hanging antennas in areas that were previously finished. That is why a preliminary RSSI / DAQ test, accompanied with an iBwave design of the building, can accurately predict whether an ERCES will be needed before construction has begun—for a nominal fee.

The final "official" test to determine whether an ERCES is required would be after the building is dried-in, testing RSSI / DAQ in 20 equal size grids / floor. If any of the critical areas fail, then this will be reported to the building owner & the AHJ.

From the Safer Buildings Coalition (January 2022):

"The SBC (Safer Buildings Coalition) does not maintain a specific list of jurisdictions that have adopted in-building emergency responder communication enhancement system (ERCES) requirements. We travel to numerous jurisdictions annually conducting seminars on the ERCES and our audiences are made up of AHJ's, industry stakeholders and building owner representatives. As such, I am aware of numerous states and jurisdictions such as Florida, South Carolina, DC, North Carolina, California, Texas, Georgia, Las Vegas, Oregon, Washington State, New Jersey, Maryland, New York, and many others that have adopted the requirements of the IFC/NFPA. In all these locations, the requirement to provide these systems when needed is located within the fire and/or building codes and they are the responsibility of the owner typically prior to a final certificate of occupancy being issued. **Virginia is the only state/jurisdiction I am aware of that has something different**."

- Alan Perdue, Executive Director for the Safer Buildings Coalition

Honeywell – BDA/ERCES Systems Presentation (June 2021):

"At present 35 states, including Washington D.C., are requiring BDA systems. There are 34 states that have adopted the IFC; 4 more the IBC; and 9 more NFPA 1/101."
https://www.myccfs.org/assets/CoffeeBreakLit/Campus%20Coffee%20Break%202021%20.pdf

Personal Research (January 2022):

At present, 47 states have requirements for ERCES in new buildings as well as Washington, DC and Puerto Rico. Other than Virginia, the two remaining states allow optional local adoption of ERCES requirements. The vast majority of these statues simply adopt Section 510 of the International Fire Code without amendment. None, other than Virginia, share the responsibility of the system with the locality.

International Code Council (August 2021):

https://www.iccsafe.org/wp-content/uploads/Master-I-Code-Adoption-Chart-AUG-2021.pdf

2018 NC Fire Code
510 Emergency Responder communications Coverage and Chapter 80 Referenced Standards. (201208 Item B-5)

SECTION 510 EMERGENCY RESPONDER COMMUNICATION COVERAGE

510.1 Emergency responder radio communication coverage in new buildings. *Approved* in-building 2- way emergency responder communication coverage shall be provided in all new buildings. In-building 2- way emergency responder communication coverage shall be based on the existing coverage levels of the public safety communication systems utilized by the jurisdiction, measured at the exterior of the building. This section shall not require improvement of the existing public safety communication systems.

Exceptions:

1. Where *approved* by the building official and the *fire code official*, a wired communication system in accordance with Section 907.2.13.2 shall be permitted to be installed or maintained instead of an *approved* communications coverage system.

2. Where it is determined by the *fire code official* that the communications coverage system is not needed.

3. In facilities where emergency responder communication coverage is required and such systems, components or equipment required could have a negative impact on the normal operations of that facility, the *fire code official* shall have the authority to accept an automatically activated emergency responder communication coverage system.

4. New buildings 7,500 square feet or less and not more than 1 story above *grade plane*.

4.1. This exception does not apply to windowless buildings, underground buildings or buildings with a *basement*.

510.2 Emergency Responder Communications Coverage in Existing Buildings. Deleted

510.3 Permit required. A construction permit for the installation of or modification to in-building 2- way emergency responder communication coverage systems and related equipment is required as specified in Section 105.7.6. Maintenance performed in accordance with this code is not considered a modification and does not require a permit.

510.4 Technical requirements. Equipment required to provide emergency responder communication coverage shall be listed in accordance with UL 2524. Systems, components and equipment required to provide the in-building 2-way emergency responder communication coverage system shall comply with Sections 510.4.1 through 510.4.2.8.

510.4.1 Emergency communication coverage system signal strength. The building shall be considered to have acceptable in-building 2- way emergency responder communication system coverage when signal strength measurements in 95 percent of all areas on each floor of the building and critical areas shall be provided with 99 percent floor area radio coverage. Critical areas are fire command centers, fire pump rooms, exit stairs, exit passageways, elevator lobbies, sprinkler rooms, riser rooms, standpipe cabinets, sprinkler sectional valve locations, and other areas deemed critical by the AHJ. The signal strength shall meet requirements in Sections 510.4.1.1 through 510.4.1.3.

510.4.1.1 Minimum signal strength into the building. The minimum inbound signal strength shall be sufficient to provide usable voice communications throughout the coverage area as specified by the *fire code official*. The inbound signal level shall be a minimum of -95dBm throughout the coverage area and sufficient to provide not less than a Delivered Audio Quality (DAQ) of 3.0 or an equivalent Signal-to-Interference-Plus-Noise Ratio (SINR) applicable to the technology for either analog or digital signals.

510.4.1.2 Minimum signal strength out of the building. The minimum outbound signal strength shall be sufficient to provide usable voice communications throughout the coverage area as specified by the *fire code official*. The

outbound signal level shall be sufficient to provide not less than a DAQ of 3.0 or an equivalent SINR applicable to the technology for either analog or digital signals.

510.4.1.3 System performance. Signal strength shall be sufficient to meet the requirements of the applications being utilized by public safety for emergency operations through the coverage area as specified by the *fire code official* in Section 510.4.2.2.

510.4.2 System design. The in-building 2- way emergency responder communication coverage system shall be designed in accordance with Sections 510.4.2.1 through 510.4.2.8 and NFPA 1221.

510.4.2.1 Amplification systems and components. Buildings and structures that cannot support the required level of in-building 2- way emergency responder communication coverage shall be equipped with systems and components to enhance the radio signals and achieve the required level of emergency communication coverage specified in Sections 510.4.1 through 510.4.1.3. Emergency communication systems utilizing radio-frequency-emitting devices and cabling shall be approved by the *fire code official*. Prior to installation, all RF-emitting devices shall have the certification of the radio licensing authority and be suitable for public safety use.

510.4.2.2 Technical criteria. The *fire code official* shall maintain a document providing the specific technical information and requirements for the in-building 2- way emergency responder communication coverage system. This document shall contain, but not be limited to, the various frequencies required, the location of radio sites, the effective radiated power of radio sites, the maximum propagation delay in microseconds, the applications being used and other supporting technical information necessary for system design.

510.4.2.3 Standby power. In-building 2- way emergency responder communication coverage systems shall be provided with dedicated standby power or provided with 2-hour standby batteries and connected to the facility generator power system in accordance with Section 604. The standby power supply shall be capable of operating the in-building 2- way emergency responder communication coverage system at 100-percent system capacity for a duration of not less than 12 hours.

510.4.2.4 Signal booster requirements. If used, signal boosters shall meet the following requirements:

1. All signal booster components shall be contained in a National Electrical Manufacturer's Association (NEMA) 4-type waterproof cabinet.

2. Battery systems used for the emergency power source shall be contained in a NEMA 3R or higher-rated cabinet.

3. Equipment shall have FCC or other radio licensing authority certification and be suitable for public safety use prior to installation.

4. Where a donor antenna exists, isolation shall be maintained between the donor antenna and all inside antennas to not less than 20dB greater than the system gain under all operating conditions.

5. Active RF emitting devices used in in-building 2- way emergency responder communication coverage systems shall have built-in oscillation detection and control circuitry.

6. The installation of amplification systems or systems that operate on or provide the means to cause interference on any in-building 2- way emergency responder communication coverage network shall be coordinated and approved by the *fire code official*.

510.4.2.5 System monitoring. The in-building 2-way emergency responder communication coverage system shall be monitored by a listed *fire alarm control unit*, or where approved by the *fire code official*, shall sound an audible signal at a constantly attended on-site location. Automatic supervisory signal shall include the following:

1. Loss of normal AC power supply.

2. System battery charger(s) failure.

3. Malfunction of the donor antenna(s).

4. Failure of active RF-emitting device(s).

5. Low-battery capacity at 70-percent reduction of operating capacity.

6. Failure of critical system components.

7. The communications link between the *fire alarm system* and the in-building 2- way emergency responder communication coverage system.

8. Oscillation of active RF-emitting device(s)

510.4.2.6 Additional frequencies and change of frequencies. The in-building 2- way emergency responder communication coverage system shall be capable of modification or expansion in the event frequency changes are required by the FCC or other radio licensing authority, or additional frequencies are made available by the FCC or other radio licensing authority.

510.4.2.7 Design documents. The *fire code official* shall have the authority to require "as-built" design documents and specifications for in-building 2- way emergency responder communication coverage systems. The documents shall be in a format acceptable to the *fire code official*.

510.4.2.8 Radio communication antenna density. Systems shall be engineered to minimize the near-far effect. In-building 2- way emergency responder communication coverage system designs shall include sufficient antenna density to address reduced gain conditions.

Exception:

1. Systems where all portable devices within the same band use active power control features.

510.5 Installation requirements. The installation of the in-building 2- way emergency responder communication coverage system shall be in accordance with NFPA 1221 and Sections 510.5.1 through 510.5.5.

510.5.1 Mounting of the donor antenna(s). To maintain proper alignment with the system designed donor site, donor antennas shall be permanently affixed on the building or where approved, mounted on a movable sled with a clearly visible sign stating "Movement or repositioning of this antenna is prohibited without approval from the fire code official". The antenna installation shall be in accordance with the applicable requirements in the *International Building Code* for weather protection of the building envelope.

510.5.2 Approval prior to installation.
Amplification systems capable of operating on frequencies licensed to any public safety agency by the FCC or other radio licensing authority shall not be installed without prior coordination and approval of the *fire code official* and the frequency license holder(s).

510.5.3 Minimum qualifications of personnel. The minimum qualifications of the system designer and lead installation personnel shall include both of the following:

1. A valid FCC-issued general radio operator's license.

2. Certification of in-building system training issued by an approved organization or approved school, or a certificate issued by the manufacturer of the equipment being installed.

These qualifications shall not be required where demonstration of adequate skills and experience satisfactory to the *fire code official* is provided.

510.5.4 Acceptance test procedure. Where an in-building 2- way emergency responder communication coverage system is required, and upon completion of installation, the building *owner* shall have the radio system tested to verify that two-way coverage on each floor of the building is not less than 95 percent. The test procedure shall be conducted as follows:

1. Each floor of the building shall be divided into a grid of 20 approximately equal test areas. Where a floor exceeds 128,000 ft2 (11,900 m2), which is the floor area that can be covered by the maximum grid dimension of 80 ft. (24.4m), the floor shall be subdivided into sectors each having an area less than or equal to 128,000 ft2 (11,900 m2), and each sector be tested individually with 20 grid cells in each sector. Signal strength measurements should be taken at the center of each grid and should be performed using standardized parameters as specified by NFPA 1221.

2. The test shall be conducted using a calibrated portable radio of the latest brand and model used by the agency talking through the agency's radio communications system or equipment approved by the *fire code official.*

3. Failure of more than one test area shall result in failure of the test.

4. In the event that two of the test areas fail the test, in order to be more statistically accurate, the floor shall be permitted to be divided into 40 equal test areas. Failure of not more than two nonadjacent test areas shall not result in failure of the test. If the system fails the 40-area test, the system shall be altered to meet the 95-percent coverage requirement.

5. A test location approximately in the center of each test area shall be selected for the test, with the radio enabled to verify two-way communications to and from the outside of the building through the public agency's radio communications system. Once the test location has been selected, that location shall represent the entire test area. Failure in the selected test location shall be considered to be a failure of that test area. Additional test locations shall not be permitted.

6. The gain values of all amplifiers shall be measured and the test measurement results shall be kept on file with the building *owner* so that the measurements can be verified during annual tests. In the event that the measurement results become lost, the building *owner* shall be required to rerun the acceptance test to reestablish the gain values.

7. As part of the installation, a spectrum analyzer or other suitable test equipment shall be utilized to ensure spurious oscillations are not being generated by the subject signal booster. This test shall be conducted at the time of installation and at subsequent annual inspections.

8. Systems shall be tested using two portable radios simultaneously conducting subjective voice quality checks. One portable radio shall be positioned not greater than 10 feet (3048 mm) from the indoor antenna. The second portable radio shall be positioned at a distance that represents the farthest distance from any indoor antenna. With both portable radios simultaneously keyed up on different frequencies within the same band, subjective audio testing shall be conducted and comply with DAQ levels as specified in Sections 510.4.1.1 and 510.4.1.2.

510.5.5 FCC compliance. The in-building 2- way emergency responder communication coverage system installation and components shall comply with all applicable federal regulations including, but not limited to, FCC 47 CFR Part 90.219.

510.6 Maintenance. The in-building 2- way emergency responder communication coverage system shall be maintained operational at all times in accordance with Sections 510.6.1 through 510.6.4.

510.6.1 Testing and proof of compliance. The *owner* of the building or owner's authorized agent shall have the in-building 2- way emergency responder communication coverage system inspected and tested annually or where structural changes occur including additions or remodels that could materially change the original field performance tests. Testing shall consist of the following:

1. In-building coverage test as described in Section 510.5.3.

2. Signal boosters shall be tested to verify that the gain is the same as it was upon initial installation and acceptance. or set to optimize the performance of the system.

3. Backup batteries and power supplies shall be tested under load of a period of 1 hour to verify that they will properly operate during an actual power outage. If within the 1-hour test period the battery exhibits symptoms of failure, the test shall be extended for additional 1-hour periods until the integrity of the battery can be determined.

4. All active components shall be checked to verify operation within the manufacturer's specifications.

5. At the conclusion of the testing, a report, which shall verify compliance with Section 510.5.3, shall be submitted to the *fire code official*.

510.6.2 Additional frequencies. The building *owner* shall modify or expand the in-building 2- way emergency responder communication coverage system at his or her expense in the event frequency changes are required by the FCC or other radio licensing authority, or additional frequencies are made available by the FCC. or other radio licensing authority. Prior approval of an in-building 2- way emergency responder communication coverage system on previous frequencies does not exempt this section.

510.6.3 Nonpublic safety system. Where other nonpublic safety amplification systems installed in buildings reduce the performance or cause interference with the in-building 2- way emergency responder communication coverage system, the nonpublic safety amplification system shall be corrected or removed.

510.6.4 Field testing. Agency personnel shall have the right to enter onto the property at any reasonable time to conduct field testing to verify the required level of radio coverage.

Chapter 80 Referenced Standards

NFPA
NFPA 1221-19 Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems…….510.4.2, 510.5, 510.5.4.
UL
UL2524 -19 Standard for In-building 2- Way Emergency Radio Communication Enhancement Systems ……510.4.
FCC
47 CFR Part 90.219-2007 ……510.5.4, 510.5.5

NFPA 1225 (2022 Edition) vs. NFPA 1221 (2019 Edition)

The most significant changes:

NFPA 1225 (2022 Edition) expands the definition of emergency communications, a movement from Emergency Responder Radio Communications Systems (ERRCS) to Emergency Responder Communication Enhancement Systems (ERCES)

- The Government Affairs Work Group is recommending the adoption of the 2022 edition of NFPA 1225 because there are new requirements that will improve the performance as well as reducing interference issues caused from improperly deployed signal boosters.

NFPA 1225 (2022 Edition) requires the "system" and "components" be listed and labeled in accordance with the UL2524 Standard

- 18.12.1.3: All repeaters, transmitters, receivers, signal-booster components, remote annunciators and operational consoles, power supplies, and battery charging system components shall be listed and labeled in accordance with UL2524, Standard for In-Building 2-Way Emergency Radio Communication Enhancement Systems.
- 1221 (2019): All repeater, transmitter, receiver, signal booster components, optical-to-RF and RF-to-optical converters, external filters, batteries, and battery system components shall be contained in a NEMA4 or NEMA4X type enclosure(s).

NFPA 1225 (2022 Edition) has consolidated the standards for easier access.

NFPA 1225 (2022 Edition) requires under 18.8.4 that "General building areas shall be provided with 95% floor area radio coverage. This differs from NFPA 1221 9.6.7.4 which only requires 90% coverage.

NFPA 1225 (2022 Edition) adds LTE into the code:

- 18.9.1 Downlink
    - A minimum downlink signal shall be sufficient to provide a minimum of DAQ 3.0 for voice communications using either narrowband analog or digital P25 signals or wideband LTE digital signals throughout the coverage area.
- 18.9.2 Uplink
    - The uplink signal shall be sufficient to provide a minimum of DAQ for voice communications using either narrowband, analog or digital P25 signals or widespread LTE digital signals.

NFPA 1225 (2022) 18.11.2.1 requires "Systems shall be upgradeable to allow for instances where the jurisdiction changes or adds system frequencies to maintain communication system coverage as it was originally designed.".

NFPA 1225 (2022) has added a 3rd prong to "Secondary Power Source" 18.13.2

- (3) A 2-hour standby battery and connection to the facility generator power system, providing the facility generator power system can support the complete system load for 12 hours.

Other Changes

- Lightning protection to comply with NFPA 780
- Plan submittal requirements have changed to include a link budget.
- Renewable permit or written authorization by licensee shall be issued for the system
- Coverage in critical areas shall be at 99% including elevators.
- Building and structures that cannot support the required level of radio coverage shall be equipped with an RF-Emitting device certified by the licensee.
- Systems shall be designed to support two different talk paths or channels –
- Minimum inbound signal to support usable voice communications of DAQ 3
- Minimum outbound signal to support usable voice communications of DAQ 3
- AHJ shall maintain a list of all inbound/outbound frequency pairs for distribution to designers
- RF emitting devices shall be compatible with both analog and digital communications
- All cables shall be installed in accordance with chapters 7 and 8 of NFPA 70
- AHJ may approve a single supervisory signal to the fire panel
- Back cables and components installed in buildings that are fully protected by an automatic sprinkler system shall be installed in metal raceways
- Backbone cables and components installed in non-sprinklered buildings or buildings that are only partially protected by a sprinkler system shall meet the following: 1) Listed with a fire rating, and 2) protected by an assembly having a fire resistance rating in accordance with the following: Where primary structural frame of a building is required to have a fire rating of 2 hours or more, the minimum fire resistance rating shall be 2 hours; where the primary structure frame of a building is less than 2 hours, minimum shall be 1 hour; where primary structural frame has no rating, no fire resistance is required.

SAFECOM Guidance Frequently Asked Questions: Understanding P25 Standards and Compliance

This document summarizes the compliance requirements for Project 25 (P25) compliance standards outlined in the *SAFECOM Guidance on Emergency Communications Grants (SAFECOM Guidance)*. Grantees and applicants funding emergency communications projects using federal funds should reference this frequently asked questions document to understand P25 compliance and find resources when needed. For the purpose of this document, the terms "I" and "my" refer to the grantee or applicant of an agency seeking federal funds for emergency communications projects.

Project 25

Q1. What are P25 standards?

P25 is a suite of standards and specifications which enable interoperability among digital two-way land mobile radio (LMR) communications products provided by multiple manufacturers to support the mission critical public safety requirements. These standards provide a number of technical specifications for emergency communications equipment designed to ensure that equipment is interoperable, regardless of manufacturer. The P25 suite of standards, referenced as TIA-102 standards, is published by the Telecommunications Industry Association (TIA),[1] a recognized American National Standards Institute standards development organization. The P25 Steering Committee periodically publishes a list of "Approved Project 25 Suite of Standards" that includes the most recent documents, including revisions.

Q2. What is the P25 Compliance Assessment Program (CAP)?

The P25 CAP is a formal, independent process administered by the Department of Homeland Security (DHS) Office for Interoperability and Compatibility (OIC), to ensure communications equipment offered by the supplier is compliant with the applicable published standards and the test results are reflected in publicly published documents. Through this third party testing process by independent labs, the P25 CAP provides public safety agencies with evidence that the communications equipment they purchase is tested against and complies with the P25 standards for performance, conformance, and interoperability. Compliance test results are provided with official summary test reports and suppliers' declaration of compliance, which are available at https://www.dhs.gov/science-and-technology/p25-cap.

Q3. What does P25 compliance mean?

Compliance with the P25 suite of standards may differ by each federal agency. To maximize opportunities to improve interoperability across investments, grantees are highly encouraged to ensure that digital voice systems and equipment purchased with federal grant funds comply with the P25 suite of standards, unless otherwise noted in a program's grant guidance.[2] P25 compliance

[1] The published standards approved by the P25 Steering Committee are available to employees of government agencies at no cost by completing the TIA online request form for government agencies at: http://www.tiaonline.org/all-standards/p25-downloads-application.

[2] Grantees should read a program's grant guidance carefully to ensure compliance with standards, allowable cost, documentation, reporting, and audit requirements.

helps to ensure federal grant funds are used to purchase interoperable solutions for state, local, tribal, and territorial first responders.

Q4. Why is purchasing P25 compliant equipment and systems so important to the public safety community?

Following the tragic events from 9/11, legislation was passed to improve the interoperability of public safety communications systems and equipment. Congress mandated that new or upgraded equipment must be interoperable and meet certain interoperability standards. As a result, the Federal Government supported the purchase of P25 compliant LMR equipment through grants and policy, to ensure public safety systems can interoperate, regardless of manufacturer.

Purchasing P25 equipment ensures that digital LMR systems will be compatible with other, most importantly contiguous, P25 systems. Additionally, standards-based systems enable interoperable communications between emergency responders from various agencies, jurisdictions, and levels of government in the event they need to communicate during day-to-day incidents, large-scale emergencies, and disaster responses. Additionally, P25 standards provide a broader resource of competitive vendors providing more flexibility in purchasing equipment.

P25 Compliance for DHS Grantees

Q5. DHS/FEMA requires its grantees to comply with the SAFECOM Guidance. As a DHS grantee, am I also required to comply with P25 standards?

Yes, DHS/FEMA grantees are required to comply with P25 standards when purchasing LMR equipment. This requirement and other conditions specific to DHS/FEMA grantees are outlined in Appendix D of the *SAFECOM Guidance*. For additional information, reference the *DHS Authorized Equipment List* to determine allowable equipment types for individual grant programs. If the proposal includes any non-compliant P25 LMR equipment, DHS/FEMA grantees must apply for prior approval.

P25 Purchases Using Federally-Funded Grants

Q6. When applying for a federally-funded emergency communications project, how do I demonstrate that purchases are P25 compliant?

To ensure equipment and systems are compliant with the P25 suite of standards, grantees are strongly encouraged to:

- Review the technical specifications detailed in the P25 Technology Interest Group's (PTIG) *Capabilities Guide*[3] to determine which standards are applicable to the proposed purchase and project.
- Include all applicable P25 standards and expectations for interoperability in any Statement of Work or bid for communications procurements funded through federal grants.
- Ensure all P25 eligible equipment, features, and capabilities selected are P25 compliant, to include new equipment and upgrades. When federal grant funds are used to purchase P25 LMR equipment and systems that contain non-standard features or capabilities[4], when a comparable

[3] The PTIG *Capabilities Guide* can be found on the PTIG website. To register, visit: http://www.project25.org/.

[4] Within the P25 standards, services and features are categorized as mandatory or standard option (see Appendix A for list of mandatory and standard option features). To be P25 compliant, a product *must* support mandatory features, in accordance with

P25 feature or capability is available, grantees must ensure the standards-based feature or capability is included as well.

- Obtain documented evidence of P25 compliance from the manufacturer that the equipment has been tested and passed all the applicable, published, normative P25 compliance assessment test procedures for performance, conformance, and interoperability as defined in the latest P25 CAP Compliance Assessment Bulletins for testing requirements. If documentation for applicable equipment is not available through the P25 CAP, grantees are encouraged to obtain documented evidence from the manufacturer, as part of the proposal, stating that the applicable tests (identified in the procurement package) were conducted in accordance with the published test procedures in the P25 suite of standards.

Q7. What will the federal agency issuing grant funding use to confirm if purchases in my grant application are P25 compliant?

When reviewing grant applications, the federal agency will verify that proposed equipment purchases are P25 compliant by:

- Reviewing the *P25 Compliant Approved (Grant-Eligible) Equipment List* to confirm if the equipment to be purchased has been tested and is reflected on the list. If the item is included, it is P25 compliant.
- Referring to the *DHS Authorized Equipment List* (applicable to DHS/Federal Emergency Management Agency [FEMA] grants only).
  - Note: Some items on this list may not be applicable to the P25 standards.
- Reviewing the application package to confirm if the applicant provided a letter from the manufacturer verifying the purchase is P25 compliant.

If the purchase cannot be verified as P25 compliant using these methods, then the federal agency has the authority to request additional information, grant a waiver, or deny the purchase. As a reminder, the federal agency awarding the grant has the right to deny a waiver and one should only be considered for unique circumstances that will not impact interoperability.

Q8. What will happen if I try to purchase non-compliant P25 equipment?

While not encouraged, in the event a grantee is using federal funds to purchase equipment that does not align with P25 standards, the grantee must consult with the federal agency to determine if non-compliant P25 equipment is allowable. In some cases, written justification must be provided to the grantor.

Many agencies will not approve non-standards-based equipment unless there are compelling reasons for using other solutions. Authorizing language for most emergency communications grants strongly encourages investment in standards-based equipment. Funding requests by agencies to replace or add radio equipment to an existing non-compliant P25 system will be

the P25 definition in the standards. Standard option features are not essential but must conform to the P25 definitions if offered by the manufacturer. All other features offered by a manufacturer are considered proprietary options. A manufacturer's proprietary option is a feature that is not a requirement but may provide an added value to the customer (e.g., status messaging). However, this feature may not be interoperable with other manufacturers' equipment.

considered if there is a clear rationale why such equipment should be purchased and written justification of how the equipment will advance interoperability and support eventual migration to interoperable systems. The written justification should also explain how that purchase will serve the needs of the applicant better than equipment or systems that meet or exceed such standards. Absent compelling reasons for using other solutions, agencies are strongly encouraged to invest in standards-based equipment.

P25 Compliance Resources

Q9. What resources should be considered when applying for emergency communications grant funding?

Grant applicants applying for emergency communications funding are strongly encouraged to work with their Statewide Interoperability Coordinator (SWIC). The SWIC should review the application prior to submission to ensure projects support the state or territory's strategy to improve interoperable emergency communications. The SWIC can also confirm the funding request aligns to the latest versions of their *Statewide Communication Interoperability Plan* and the *National Emergency Communications Plan*, as these are vital plans to improving interoperability.

Q10. Where can I find more information about P25 standards and/or compliance?

Grantees should be aware that a wide range of information is available from government and industry resources, including:

- SAFECOM and the National Council of Statewide Interoperability Coordinators' Land Mobile Radio Trio - LMR 101, LMR for Decision Makers, and LMR for Project Managers: https://www.dhs.gov/safecom/funding
- PTIG: http://www.project25.org/ (Free registration required)
- P25 Suite of Standards: http://www.project25.org/images/stories/ptig/20160128_Approved_P25_TIA_Standards_Q1-2016.pdf
- P25 CAP Information: https://www.dhs.gov/science-and-technology/p25-cap; http://www.firstresponder.gov/Pages/P25CAP.aspx?s=Saver
- P25 CAP Approved (Grant-Eligible) Equipment List: https://www.dhs.gov/science-and-technology/approved-grant-eligible-equipment
- P25 CAP Compliance Assessment Bulletins: https://www.dhs.gov/science-and-technology/p25-cap
- Best Practices for Encryption in P25 Public Safety Land Mobile Radio Systems: https://www.dhs.gov/sites/default/files/publications/20160830%20Best%20Practices%20for%20Encryption_Final%20Draft508.pdf

Update on UL 2524, Standard for In-Building 2-Way Emergency Radio Communications Enhancement Systems

September 17, 2019 SUPDET

Larry Shudak, P.E.
Principal Engineer - Life Safety Systems

Empowering Trust™

Background on ERECS

- Portable Land Mobile Radios (LMRs) are an essential life-safety tool for firefighters
- Many buildings prevent the receipt or transmission of LMR messages based on construction elements and/or building configuration
- ERCES provide assurance that emergency messages can be transmitted and received into and out of every building
- ERCES do not rely on alternate communication equipment or fixed locations from which to transmit

Background on ERECS

Code Requirements – ICC and NFPA

NFPA 72 and NFPA 1221

The 2016 edition of NFPA 1221 includes Section 9.6 (Two-Way Radio Communication Enhancement Systems) with technical requirements for design, installation and performance generally consistent with the 2018 IFC Section 510.

Background on ERECS

Code Requirements – ICC and NFPA

NFPA 1 Fire Code

- First introduced in 2012 edition
- All buildings to have *approved* radio coverage for emergency responders available throughout the interior of building at a level determined by the AHJ.
- References NFPA 72 and NFPA 1221

Background on ERECS

Code Requirements – ICC and NFPA

International Fire Code (IFC) Section 510

- First introduced in 2009 edition
- All new buildings to have *approved* radio coverage for emergency responders available throughout the interior of building at the same coverage levels that existed outside the building
- References NFPA 72 and NFPA 1221

UL 2524

December 2017: UL 2524 published as an Outline of Investigation

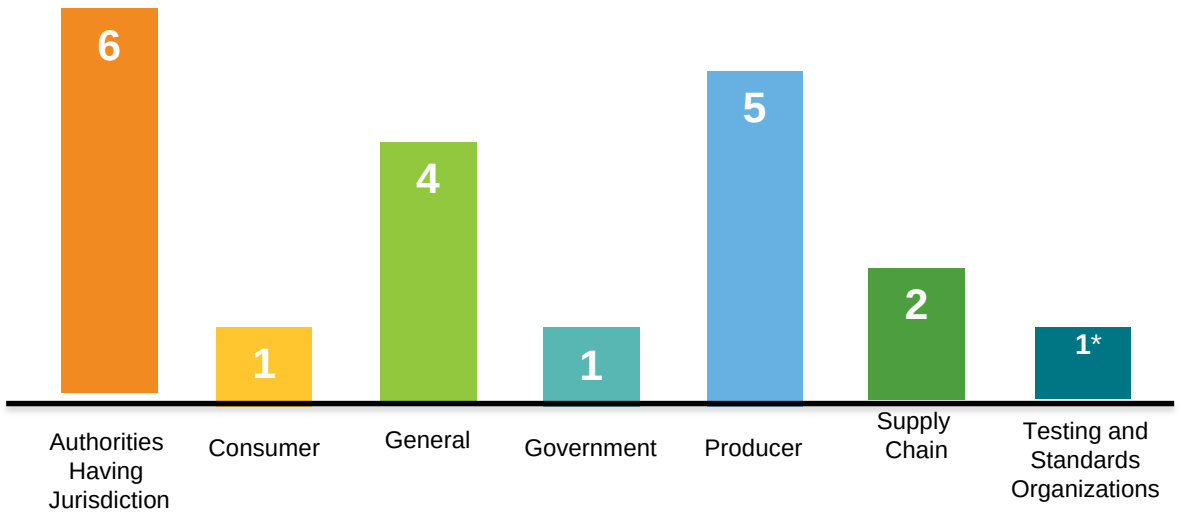
Spring 2018: Standards Technical Panel (STP) formed for US/CAN

October 2018: ANSI accredited First Edition standard published

January 2019: ANSI and SCC accredited Second Edition standard published

UL 2524 Standards Technical Panel (STP)

NUMBER OF VOTING SEATS HELD – 20 TOTAL

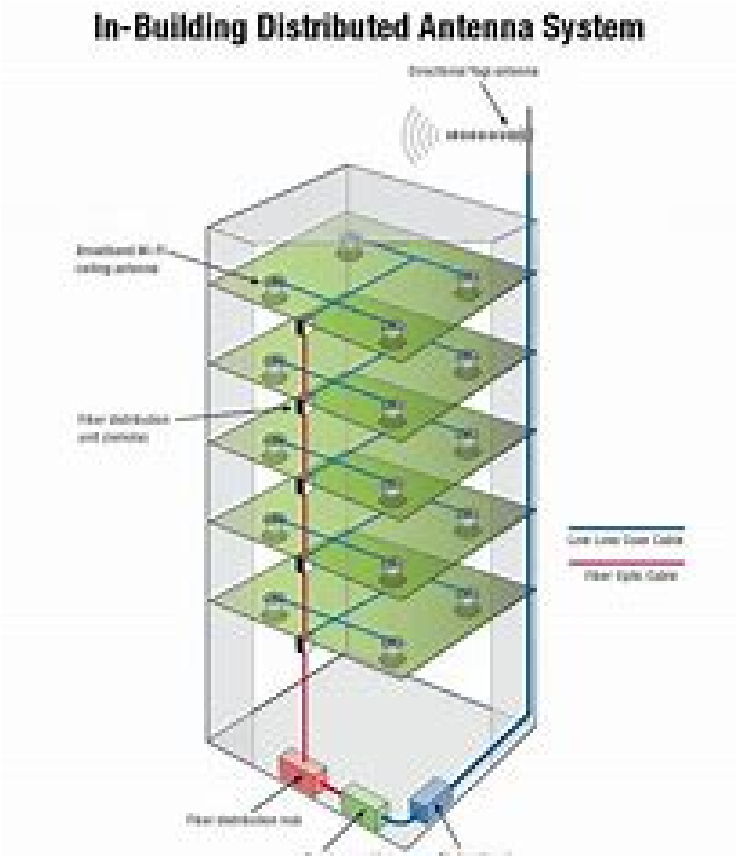


GROUPS REPRESENTED

* UL holds the one voting seat in this category

UL 2524

Distributed Antenna System (DAS)



UL 2524

This standard addresses the following areas:

- Safety (risk of fire and risk of shock) requirements – construction and testing
- Compliance with specific performance requirements in accordance with the IFC-2018 & NFPA 1221-2019
- Reliability performance requirements applicable for life safety systems – construction and testing
- Product marking and installation documentation

UL 2524

Construction:

- Type 4 or 4X for all repeater, transmitter, receiver, signal booster components, external filters, and battery system components
  - ❖ *Rechargeable standby batteries are permitted to be contained in enclosures that comply with the requirements for a Type 3R*
- The system shall be sufficiently modular to have the capability to support revised and/or additional system frequencies within the same frequency band of the bi-directional amplifier supplied to maintain radio system coverage as it was originally intended without the need to replace the system.

UL 2524

Performance - Operation:

a) Loss of normal AC power *

b) Battery charger failure *

c) Loss of battery capacity (to 70 percent depletion) *

d) Donor antenna disconnection *

e) Active RF emitting device malfunction *

f) System component malfunction, other than passive RF components, which affects system performance *

g) Donor antenna malfunction **

* = Visual and Audible annunciation within 200 sec of fault

** = Visual and Audible annunciation within 24 hrs. of fault

UL 2524

Reliability:

a) Variable Voltage Operation Test

b) Variable Ambient Temperature and Humidity Tests

c) Component Temperatures Test

d) Charging Current Test – 12 hours full transmitting load

e) Supply line and input/output ckt Transient Testing

UL 2524

Equipment Survivability

- Type 4 and 4X enclosures
- Backbone pathway survivability
- Standby power – 12 hours at 100% capacity

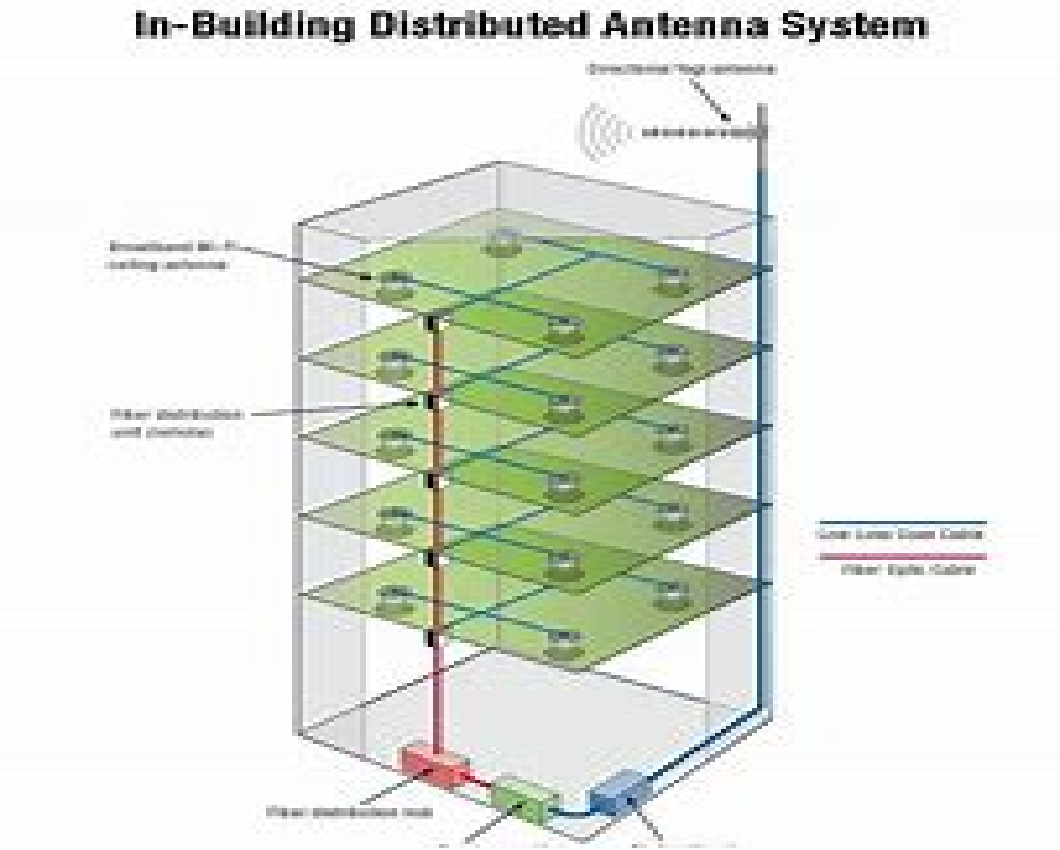
- Does the equipment need to maintain performance to a minimum ambient temperature to extend system operation?
    - Note that equipment includes: repeater, transmitter, receiver, signal booster components, power supply, and battery charging system components

UL 2524

PASSIVE RF COMPONENT – Any device that RF passes through that does not have an active electronic component that requires external power. This includes antennas, splitters, couplers, coaxial cable and connectors. Passive components cannot amplify RF signals.

ACTIVE RADIO FREQUENCY EMITTING DEVICE – A powered device that emits a radio frequency signal as part of an in-building 2-way emergency radio communication enhancement system

Should passive RF components be monitored for integrity?



UL 2524A Outline of Investigation Outline for In-Building Auxiliary Radio Communication Systems

- ARCS for FDNY
- Equipment such as base station, repeaters, transmitters, receivers, signal boosters, power supplies, battery charging system components, and dedicated radio console
- New York City Fire Department Rule 1–RCNY and Rule 3-RCNY 511-01, In-Building Auxiliary Radio Communication Systems.

UL 2524A Outline of Investigation Outline for In-Building Auxiliary Radio Communication Systems

- Unique requirements for FDNY
  - No donor antenna
  - Only manual activation
  - For use with specific channels and radios
  - Passive RF antenna malfunction monitored for integrity

Thank You

Larry Shudak
UL LLC
847-664-2791
lawrence.j.shduak@ul.com

Empowering Trust™

IBEC Costs – Steve Shapiro

- Commercial building in D.C.
  - 12 floors
  - 396,000 sq. ft.
  - system price = $56,560
  - cost per sq. ft. = $0.14
- Commercial building in Winchester
  - 2 floors 59,800 sq. ft.
  - system price = $22,680
  - cost per sq. ft. = $0.38
- Mixed Use in D.C
  - 17 floors
  - 296,650 sq. ft.
  - system price = $36,190
  - cost per sq. ft. = $0.12
- Mixed Use in Alexandria
  - 9 floors 396,000 sq. ft.
  - system price = $38,150
  - cost per sq. ft. = $0.10
- Residential in Reston
  - 16 floors
  - 268,800 sq. ft.
  - system price = $26,460
  - cost per sq. ft. = $0.10

APPENDIX D: Code Change Proposals

B918.1-21

VCC: 918.1, 918.1.1, 918.1.3, 918.1.2, 918.2

Proponents: Andrew Milliken (amilliken@staffordcountyva.gov)

2018 Virginia Construction Code

Revise as follows:

918.1 General. For localities utilizing public safety wireless communications, dedicated infrastructure to accommodate and perpetuate continuous in-building emergency communication to allow *emergency public safety personnel* to send and receive emergency communications shall be provided in new *buildings* and *structures* in accordance with this section.

Exceptions:

1. *Buildings* of Use Groups A-5, I-4, within *dwelling units* of R-2, R-3, R-4, R-5, and U.
2. Buildings of Types IV and V *construction* without basements, that are not considered unlimited area *buildings* in accordance with Section 507.
3. Above grade single story buildings of less than 20,000 square feet (1858 m^2).
4. *Buildings* or leased spaces occupied by federal, state, or local governments, or the contractors thereof, with security requirements where the *building official* has *approved* an alternative method to provide emergency communication equipment for *emergency public safety personne*l.
5. Where the *owner* provides technological documentation from a qualified individual that the *structure* or portion thereof does not impede emergency communication signals.
6. ~~*Buildings* in *localities* that do not provide the additional communication *equipment* required for the operation of the system.~~

918.1.1 Installation. ~~The *building owner* shall install radiating cable, such as coaxial cable or equivalent. The radiating cable shall be installed in dedicated conduits, raceways, plenums, attics, or roofs, compatible for these specific installations as well as other applicable provisions of this code. The *locality* shall be responsible for the installation of any additional communication *equipment* required for the operation of the system.~~ Where provided, an in-building two-way emergency responder communication coverage system shall be designed, installed and tested in accordance with section 510.4 and 510.5 of the International Fire Code. In-building, two-way emergency responder communication coverage within the building shall be based on the existing coverage levels of the public safety communication systems utilized by the jurisdiction, measured at the exterior of the building. This section shall not require improvement of the existing public safety communication systems.

918.1.3 Inspection. In accordance with Section 113.3, all installations shall be inspected prior to concealment.

Delete without substitution:

~~**918.1.2 Operations.** The *locality* will assume all responsibilities for the operation and maintenance of the emergency communication *equipment*. The *building owner* shall provide sufficient operational space within the *building* to allow the *locality* access to and the ability to operate in-building emergency communication *equipment*.~~

~~**918.2 Acceptance test.** Upon completion of installation, after providing reasonable notice to the *owner* or their representative, *emergency public safety personnel* shall have the right during normal business hours, or other mutually agreed upon time, to enter onto the property to conduct field tests to verify that the required level of radio coverage is present at no cost to the *owner*. Any noted deficiencies in the installation of the radiating cable or operational space shall be provided in an inspection report to the *owner* or the *owner's* representative.~~

Reason Statement: At present, 47 states as well as Washington, DC and Puerto Rico have mandatory requirements for emergency responder communication systems in new buildings. None, other than Virginia, share the responsibility of the system with the locality. This proposal revises outdated technology, language and responsibilities for providing in-building emergency responder communication systems. **This proposal was supported by a majority of members of the Study Group convened to look into this topic.**

The effectiveness and reliability of emergency responder communication is one of if not the most important aspects of successful emergency response and protection of public safety. In fact, as wireless technologies advance and community hazards expand, these public safety communication tools quickly become the backbone of incident response for not only fire and rescue personnel but also law enforcement and other first responders. Just as the water provided in building standpipes is critical to firefighting operations in large buildings, clear and dependable communications is vital to the safety of first responders in these buildings. This is in keeping with the philosophy inherent in the model codes that, when a facility grows too large or complex for effective fire response, fire protection features must be provided within the building. Building construction features and materials can absorb or block the radio frequency energy used to carry the signals inside or outside the building. Blockage or absorption of the radio frequency signal can prevent a critical message from an emergency responder from being received and acknowledged. Depending on the incident, this loss of information can place other emergency responders in greater danger or may prevent an injured or disoriented emergency responder from communicating for assistance.

The current VCC language requires the use of out-dated technology and in some cases the installation of equipment that may never be used.

Unless meeting one of the exemption requirements, building owners are required to route hundreds of feet of likely disconnected cabling throughout the building including in areas where existing coverage may already be adequate. This proposal does NOT remove or modify any of the five building exemptions currently indicated by the current code (VCC 916.1) so as to maintain consistency throughout Virginia. In addition, the current VCC language provides no recognition as to the current level of public safety communication strength currently on site. Without additional guidance, this could suggest that a building owner is responsible for providing a higher level of radio coverage than what currently is present in reality - a cost that is not fair to be burdened by the building owner or developer. The proposed language ensures that the building is only required to maintain the existing level of public safety radio communication coverage available at the exterior of the building.

Furthermore, just as building standpipe systems, fire hydrant systems, fire alarm systems and other fire protection systems are required to be provided as part of the building infrastructure for emergency responder use, the reliability and dependability of emergency radio enhancement systems demand that they be similarly connected to and monitored by the building fire alarm system. Finally, the current VCC language does not provide any reference standard for the installation or testing of such systems. This proposal includes a reference to the IFC for these details to ensure that they are capable, compatible and interoperable for emergency response at any time or location.

Resiliency Impact Statement: This proposal will increase Resiliency
As compared to the ineffective and in some cases unnecessarily burdensome code language currently present in the VCC, this proposal represents a tremendous increase in building and public safety resiliency. Ensuring that first responders are able to effectively communicate is invaluable to the successful outcome of emergency response incidents and the protection of lives and property. The assurance for emergency responder radio coverage that this proposal provides does so not only for the major, or once-in-a-lifetime catastrophes but also many times over in the daily smaller "routine" emergencies that occur throughout buildings.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
Since this proposal does not remove or modify any of the five building exemptions from providing in-building communication infrastructure, this proposal only applies to the same buildings where infrastructure is already required to be provided. Althought the responsibility for the system installation moves to the building owner, the costs have not increased. In fact, this proposal provides the ability of building owners and developers to utilize cost-effective technology to accomplish the requirement with less labor and materials. Moreover, it also works to ensure that such technology is only provided where it is found to be needed and only to the level at which the public safety system currently provides at the exterior of the building. These cost-saving efforts are expected to equal or exceed any added cost to monitor such system by the building fire alarm system. Also, since the proposal is based on national and international standards that have been in place for years, most large construction projects already anticipate these costs for construction around the country.

Attached Files

- **BDA_White_Paper_-_Final.pdf**
  https://va.cdpaccess.com/proposal/985/1552/files/download/663/

B918.1(2)-21

VCC: SECTION 918, 918.1, 918.1.1, 918.1.2, 918.1.3, 918.2; IBC®: [F] 2702.2.3

Proponents: DHCD Staff on behalf of the following stakeholders represented at the In-Building Emergency Communications Study Group: The Apartment & Office Building Association/Virginia Apartment Management Association, Backhaul Engineering, Virginia Restaurant, Lodging & Travel Association, Virginia Fire Prevention Association, and the Virginia Fire Chiefs Association

2018 Virginia Construction Code

SECTION 918
IN-BUILDING EMERGENCY COMMUNICATIONS COVERAGE

918.1 General. For localities utilizing public safety wireless communications, dedicated infrastructure to accommodate and perpetuate continuous in-building emergency communication *equipment* to allow *emergency public safety personnel* to send and receive emergency communications shall be provided in new *buildings* and *structures* in accordance with this section.
Exceptions:

1. *Buildings* of Use Groups A-5, I-4, within *dwelling units* of R-2, R-3, R-4, R-5, and U.
2. Buildings of Types IV and V *construction* without basements, that are not considered unlimited area *buildings* in accordance with Section 507.
3. Above grade single story buildings of less than 20,000 square feet (1858 m^2).
4. *Buildings* or leased spaces occupied by federal, state, or local governments, or the contractors thereof, with security requirements where the *building official* has *approved* an alternative method to provide emergency communication equipment for *emergency public safety personne*l.
5. Where the *owner* provides technological documentation from a qualified individual that the *structure* or portion thereof does not impede emergency communication signals.
6. *Buildings* in *localities* that do not provide the additional communication *equipment* required for the operation of the system.

Revise as follows:

918.1.1 Installation. In-building two-way emergency responder communication coverage systems shall comply with Sections 510.4 and 510.5 of the International Fire Code, except that the acceptance testing procedure required by Section 510.5.4 of the *International Fire Code* shall be the responsibility of the *locality.* The *building owner* shall install radiating cable, such as coaxial cable or equivalent. The radiating cable shall be installed in dedicated conduits, raceways, plenums, attics, or roofs, compatible for these specific installations as well as other applicable provisions of this code. The *locality* shall be responsible for the installation of any additional communication *equipment* required for the operation of the system.

918.1.2 Operations. The *locality* will assume all responsibilities for the operation and maintenance of the emergency communication *equipment*. The *building owner* shall provide sufficient operational space within the *building* to allow the *locality* access to and the ability to operate in-building emergency communication *equipment*.

918.1.3 Inspection. In accordance with Section 113.3, all installations shall be inspected prior to concealment.

918.2 Acceptance test. Upon completion of installation, after providing reasonable notice to the *owner* or their representative, *emergency public safety personnel* shall have the right during normal business hours, or other mutually agreed upon time, to enter onto the property to conduct field tests to verify that the required level of radio coverage is present at no cost to the *owner*. Any noted deficiencies in the installation of the radiating cable or operational space shall be provided in an inspection report to the *owner* or the *owner's* representative.

2021 International Building Code

Delete without substitution:

~~**[F] 2702.2.3 Emergency responder communication coverage systems.** Standby power shall be provided for in-building 2-way emergency responder communication coverage systems required in Section 918 and the *International Fire Code*. The standby power supply shall be capable of operating the in-building 2-way emergency responder communicationcoverage system at 100-percent system operation capacity for a duration of not less than 12 hours.~~

Reason Statement: This proposal was developed during the in-building emergency communications (IBEC) study group to provide references to the IFC, which in turn provides technical provisions for IBEC systems that otherwise do not exist in the building code.

Resiliency Impact Statement: This proposal will increase Resiliency
This proposal will increase the resiliency of buildings by providing technical references to the IFC that will enhance in-building emergency communications to allow emergency personnel to better respond to building emergencies.

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

B918.1.1-21

VCC: 918.1.1

Proponents: DHCD Staff on behalf of the following stakeholders represented at the In-Building Emergency Communications Study Group: The Apartment & Office Building Association/Virginia Apartment Management Association, Virginia Department of Fire Programs, Virginia Restaurant, Lodging & Travel Association, Virginia Fire Prevention Association, Virginia Fire Chiefs Association, and the Virginia Building and Code Officials Association.

2018 Virginia Construction Code

Revise as follows:

918.1.1 Installation. The *building owner* shall install ~~radiating cable, such as coaxial cable or equivalent~~ cabling. The ~~radiating~~ cable shall be installed in dedicated conduits, raceways, plenums, attics, or roofs, compatible for these specific installations as well as other applicable provisions of this code. The *locality* shall be responsible for the installation of any additional communication *equipment* required for the operation of the system.

Reason Statement: This proposal was developed during the in-building emergency communications (IBEC) study group and seeks to remove the antiquated language of "radiating cable" by replacing it with the simple terminology, "cabling." The language change removes design restrictions and opens the door for new technologies that can be used for IBEC systems.

Resiliency Impact Statement: This proposal will increase Resiliency
This proposal will increase resiliency by not binding IBEC systems to antiquated technology. Providing the opportunity for newer, more efficient communication systems technology enhances the IBEC system and the resiliency of buildings.

Cost Impact: The code change proposal will decrease the cost of construction
This change can decrease the cost of construction by allowing alternative technologies beyond radiating cable.