



# What is ERCES and why is it important?

BOABC Conference 2023

TESS ESPEJO  
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# Speaker



## Tess Espejo

Program Manager  
Codes and Regulatory Services  
(CARS)  
ULC Inc.

### Background

- ❖ More than 20 years of experience on standards, codes, and project / program management
- ❖ 17 years with ULC Standards managing technical committees
- ❖ 2006 to 2019 – member of Standing Committee on Hazardous Materials and Activities (National Fire Code of Canada)
- ❖ 2019 to 2025 – member of Standing Committee on Fire Protection (National Building and Fire Codes of Canada)
- ❖ Honourary life member – Canadian Fire Alarm Association (CFAA) and member of CANASA, SFPE, CFSA, NFPA, CAFCC Codes Committee
- ❖ Secretary and project manager, ISO International Workshop Agreement on safety, security and sustainability of cannabis facilities and operations (ISO IWA 37 in 2022)
- ❖ Vice Chair, ULC Advisory Council, ULC Security Council and ULC Advisory Group on S1001

# Agenda

- ❖ Background / history / need
  - ❖ ERCES in Codes and Regulations
  - ❖ Canadianizing ERCES requirements
  - ❖ Development of ULC/ORD-C2524
- 
- ❖ ERCES Technology
  - ❖ Binational UL ERCES Certificate program



# Terminology

**ERCES** (Emergency Responder Communication Enhancement System) - A combination of **interconnected devices** including RF-emitting devices, antennas, cables, power supplies, control circuitry, installed in a location **to improve wireless communication at that location.**

Also known as...

- ❖ Bidirectional amplifier (BDA) / amplification system
- ❖ In-building radio enhancer
- ❖ In-building two-way radio communication enhancer
- ❖ Public safety radio building amplification system
- ❖ Two-way radio communication enhancement system
- ❖ Zone enhancer

# Background, history and need



# Background



- ❖ Resulted in the death of more than 400 first responders, 343 from the World Trade Center alone
- ❖ Revealed failure of communication systems during the response
- ❖ Responders from different departments / jurisdictions unable to communicate over various radio systems

# History / need

## Post 911

- ❖ NIST was funded by US Congress to conduct building and fire safety investigation
- ❖ Forty 40 code changes were adopted including:
  - Increased egress capacity
  - Stairway stability
  - Increased fire resistance for certain types of structural frames
  - **Improved radio coverage within building envelope**



# NIST Recommendations

Installation, inspection and testing protocols to ensure that emergency radio communication systems:

- ❖ are effective in and around buildings with challenging radio frequency propagation environment, due to:
  - construction elements such as concrete, rebar, e-glass, metal, sheetrock, energy-saving materials;
  - building configuration; or
  - location (underground, parking, stairwells) etc; and
- ❖ can be used to identify, locate, and track emergency responders within indoor building environments and in the field.



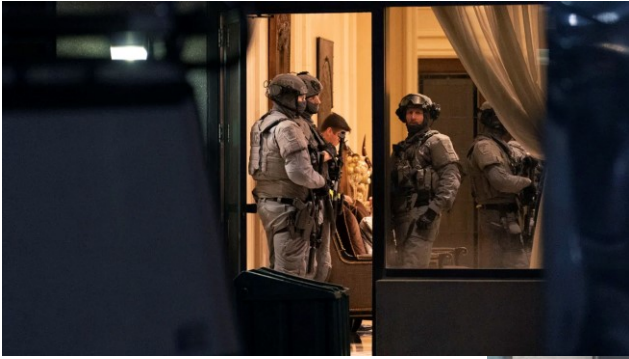


# Thus... ERCES are Needed

***Reliable communications are essential life-safety tools for firefighters and emergency responders!***

- ❖ Ensures radio signals are able to penetrate into all areas of buildings regardless of construction elements and configuration
- ❖ Does not rely on alternate communication equipment or fixed locations for transmission (i.e., firefighters' telephone handsets)
- ❖ Current technology allows economical and reliable installation and maintenance of these systems

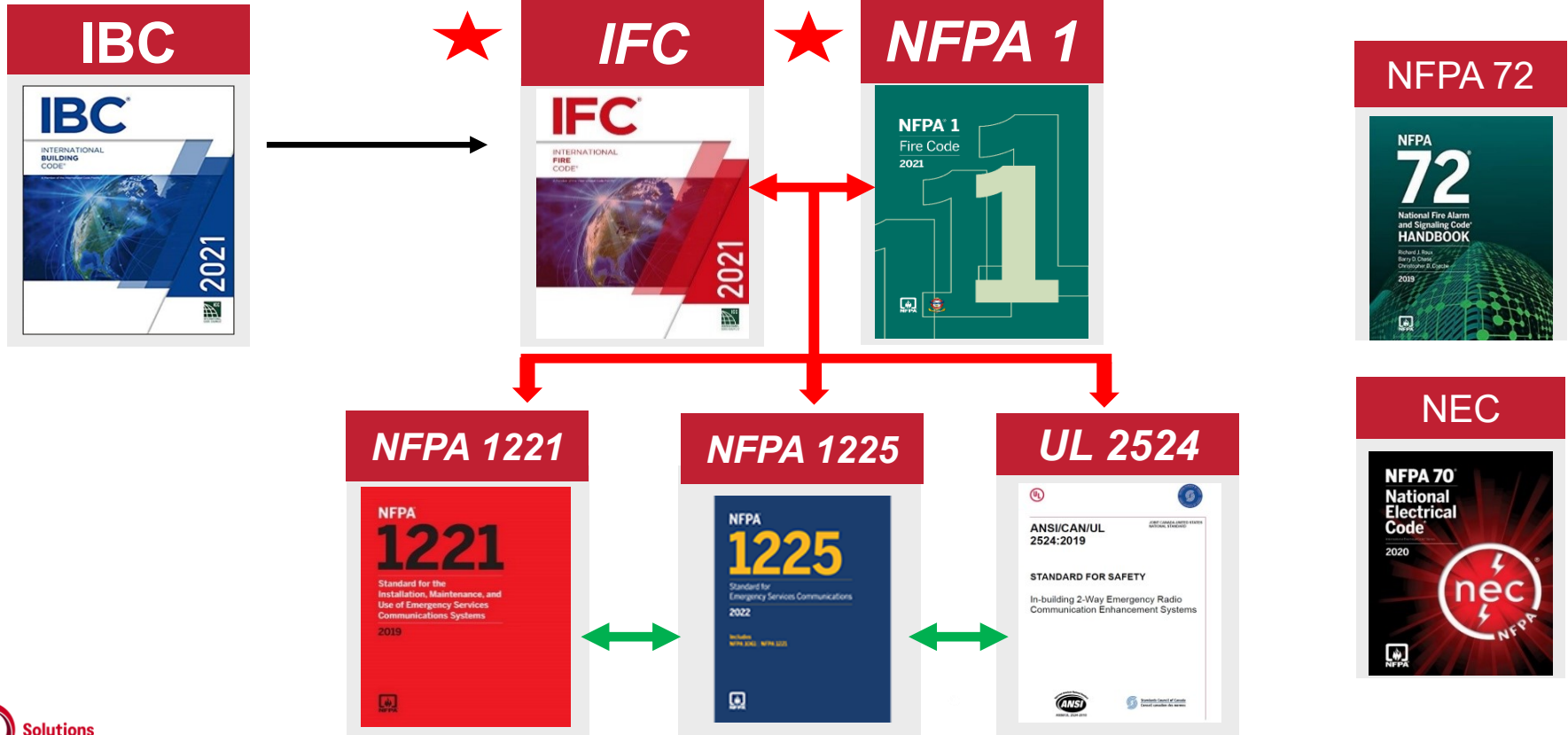




# ERCES in Codes and Regulations



# ERCES Requirements in US Codes



# US Code requirements

- ❖ Covers new and existing buildings (*unless amended by adopting jurisdiction*)
- ❖ All buildings to have *approved* radio coverage level for emergency responders throughout the interior of the building at the same level as outside the building
- ❖ ERCES equipment, devices and component per ANSI/CAN/UL 2524
- ❖ References NFPA 72 and NFPA 1221 (1225) for design, installation and performance requirements
- ❖ Testing: acceptance testing, annual, 5-year and DAQ
- Monitoring (supervisory conditions)



# ERCES in Canadian regulations

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## BC by-laws

- ❖ Burnaby
- ❖ Delta
- ❖ Langley
- ❖ North Vancouver
- ❖ Port Coquitlam
- ❖ Port Moody
- ❖ Surrey
- ❖ Vancouver
- ❖ Victoria
- ❖ West Vancouver
- ❖ White Rock
- ❖ *Kelowna*

## Other jurisdictions

- ❖ Nova Scotia
- ❖ University of British Columbia

## Other initiatives

- ❖ Alberta – Edmonton
- ❖ Nova Scotia
- ❖ Saskatchewan



# Typical ERCES requirements in Canadian regs

- ❖ Applies to new or renovated buildings
  - permit construction >\$1M
  - Gross area >5000 m<sup>2</sup> or >12m in height
  - Constructed of reinforced concrete, structural steel, metal cladding, reflective or low-emissivity glass
  
- ❖ Adequate radio coverage functioning with public safety communications service provider and city network
  - 3.4 Delivered Audio Quality (DAQ)
  - 90% of general floor area
  - 100% within fire command centers, stairwells, protect-in-place areas, equipment rooms, high-hazard areas, etc.
  
- ❖ Acceptance testing approved by AHJ; annual tests required



# Delivered Audio Quality (DAQ) Levels

DAQ 1	Unusable, speech present but unreadable
DAQ 2	Understandable with considerable effort. Frequent repetition due to noise/distortion
<b>DAQ 3</b>	Speech understandable with slight effort. Occasional repetition required due to noise/distortion
<b>DAQ 3.4</b>	Speech understandable with repetition only rarely required. Some noise/distortion
DAQ 4	Speech easily understood. Occasional noise/distortion
DAQ 4.5	Speech easily understood. Infrequent noise/distortion
DAQ 5	Speech easily understood



# Nationalizing Canadian ERCES Requirements



# Canadianizing ERCES requirements

## GOALS:

Nationalize local requirements and Canadianize existing US standards

## OPTIONS:

1. Code Change requests to NBC, NFC
2. New standard on installation and servicing of ERCES
3. Standards revision
  - CAN/ULC-S573, Installation of ancillary devices connected to the fire alarm system
4. Develop ULC/ORD that will eventually be converted into a National Standard



# Canadianizing ERCES requirements

1. Code Change Requests to NBC, NFC ➤ 2030
2. New standard on installation and servicing of ERCES ➤ 2029
3. Standards revision  
➤ CAN/ULC-S573, Installation of ancillary devices connected to the fire alarm system ➤ Submitted, published in 2023
4. Develop ULC/ORD that will eventually be converted into a National Standard ➤ Ongoing, published in 2023



# Development of ULC/ORD-C2524



# About ULC

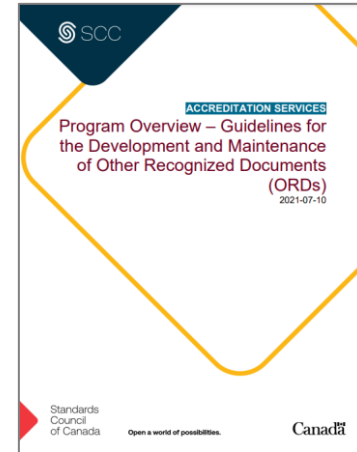
- ❖ Established on August 15, 1920
- ❖ An independent third-party product testing, certification, inspection, testing and standards development organization
- ❖ Accredited by the Standards Council of Canada (SCC)
- ❖ Currently operates as two legal entities in Canada – Underwriters Laboratories of Canada Inc. (**ULC Inc.**) and **ULC Standards**
- ❖ Offices/labs in Toronto, Mississauga, Ottawa, Montreal, Edmonton and Vancouver



# What is an ORD?

## ORD – Other Recognized Document

- ❖ Document developed by SCC accredited certification body (CB)
- ❖ Intended to provide requirements for certification of products, processes and services in regulated areas
- ❖ Temporary, for development into Canadian Recognized Standard within 5 years by SCC accredited Standards Development Organization (SDO)
- ❖ Validated by Regulatory Authority Advisory Bodies (RAABs)
  - Acknowledge need for the ORD
  - Approve draft by ballot



# Proposed ULC/ORD-C2524

## TITLE:

Installation and Services for Emergency Radio Communications Enhancement Systems (ERCES)

**BALLOTING RAABs:** Council of Canadian Fire Marshals and Fire Commissioners (CCFMFC) and Canadian Advisory Council on Electrical Safety (CACES)

## TIMELINE:

- 1<sup>st</sup> Working Draft submitted for comment to stakeholders on March 1, 2023
- 1<sup>st</sup> Official Draft for RAABs Ballot by **June 1**
- Intended Publication by September 2023



# Features of proposed ULC/ORD-C2524

## Scope:

- ❖ sets forth the minimum requirements for the **installation, operation, inspection and tests** applicable to Emergency Responder Communication Enhancement Systems (ERCES)
- ❖ intended to apply to both required and voluntary ERCES

## Terms

- ❖ **EMERGENCY RESPONDER COMMUNICATION ENHANCEMENT SYSTEM (ERCES)** - A combination of interconnected devices including RF-emitting devices, antennas, cables, power supplies, control circuitry, installed in a location to improve wireless communication at that location

In Canada, there are various terms being used to refer to ERCES, including **in-building radio enhancer, bidirectional / radio amplification system, booster amplifiers, emergency radio amplification** or **zone enhancer**.



# Features of proposed ULC/ORD-C2524

## Terms

CRITICAL AREAS - Areas designated by the AHJ as essential for occupant and emergency responder life safety and should have the highest level of emergency responder radio coverage (*typically - fire command centres, protect-in-place areas, fire pump rooms, exit stairs, elevators, standpipe cabinets, areas of refuge, etc.*)

DAQ (Delivered Audio Quality) – A measure of speech intelligibility of Land Mobile Radio

## Terms

DOWNLINK – The measurement of the signal from the donor site to the radio tower.

UPLINK – The measurement of signal from the radio tower site to the donor site.

NOISE FLOOR – The signal created from adding up all the unwanted signals within a measurement system.

# General requirements

- ❖ Equipment in accordance with ANSI/CAN/UL 2524
- ❖ All system components - designed, installed, tested, inspected, and maintained per manufacturers' installation instructions and the ORD
- ❖ ERCES to be supervised by the fire alarm system in accordance with CAN/ULC-S573, Standard for Installation of Ancillary Devices Connected to the Fire Alarm System



# Technical requirements

## INSTALLATION

- ❖ Donor antennas
- ❖ Radio coverage
- ❖ Signal strength and quality
- ❖ Frequencies
- ❖ System Components

**DOCUMENTATION** – standardized forms

## TESTING AND INSPECTION

- ❖ Initial acceptance testing
- ❖ Annual inspection and testing



# Technical requirements

- ❖ Radio coverage as percentage of floor area\*
  - Critical areas shall have 99% floor area radio coverage
  - General areas shall have 95% floor area radio coverage
- ❖ Minimum Delivered Audio Quality (DAQ) of 3.4
- ❖ Primary and secondary power source (12-hr)
- ❖ Acceptance testing
  - Testing personnel acceptable to the AHJ
- ❖ Periodic testing – annually and 5-years



# Proposed revisions to CAN/ULC-S573

*(Standard for the Installation of Ancillary Devices Connected to the Fire Alarm System)*

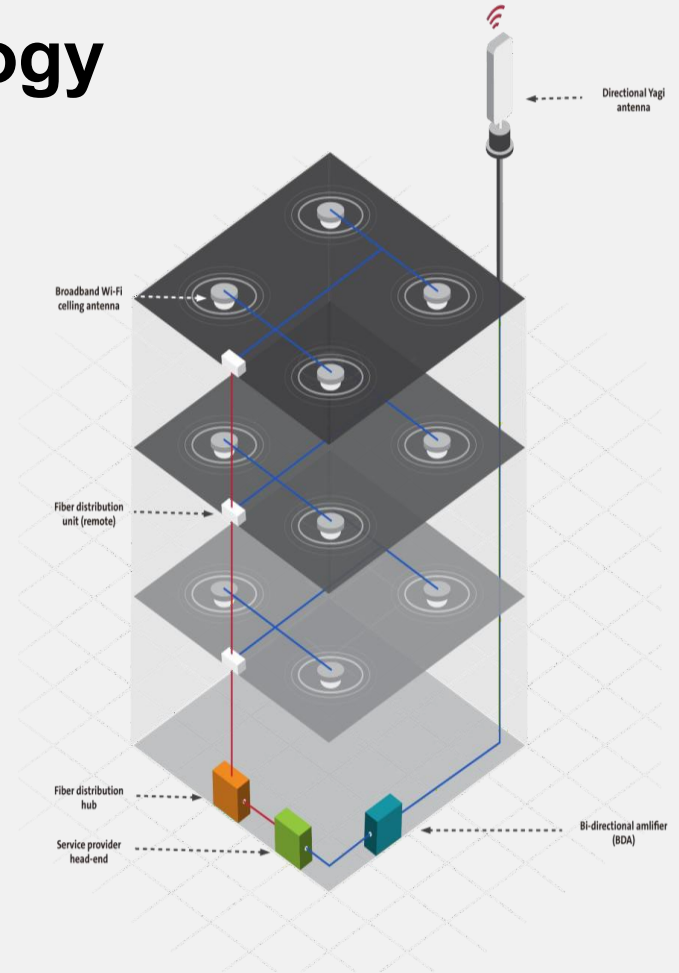
- ❖ ERCES shall be supervised by the fire alarm system using compatible interface
- ❖ Conditions causing non-latching supervisory signal:
  - A Signal source malfunction;
  - B Active RF-emitting device failure;
  - C Low-battery capacity indication when 70% of the 12-hour operating capacity has been depleted;
  - D Active system component failure; and
  - E Any other fault conditions or trouble signals from the Emergency Responder Communications Enhancement System (ERCES).
- ❖ Power supply supervisory signals for each RF-emitting device and active system component:
  - A Loss of primary power supply;
  - B Failure of battery charger.
- ❖ The communications link between the fire alarm system and ERCES shall be monitored for integrity.
- ❖ Where authorized by the AHJ, a single supervisory input to the fire alarm system is permitted to monitor all system supervisory signals as required

# ERCES – Available technology / Sample configurations



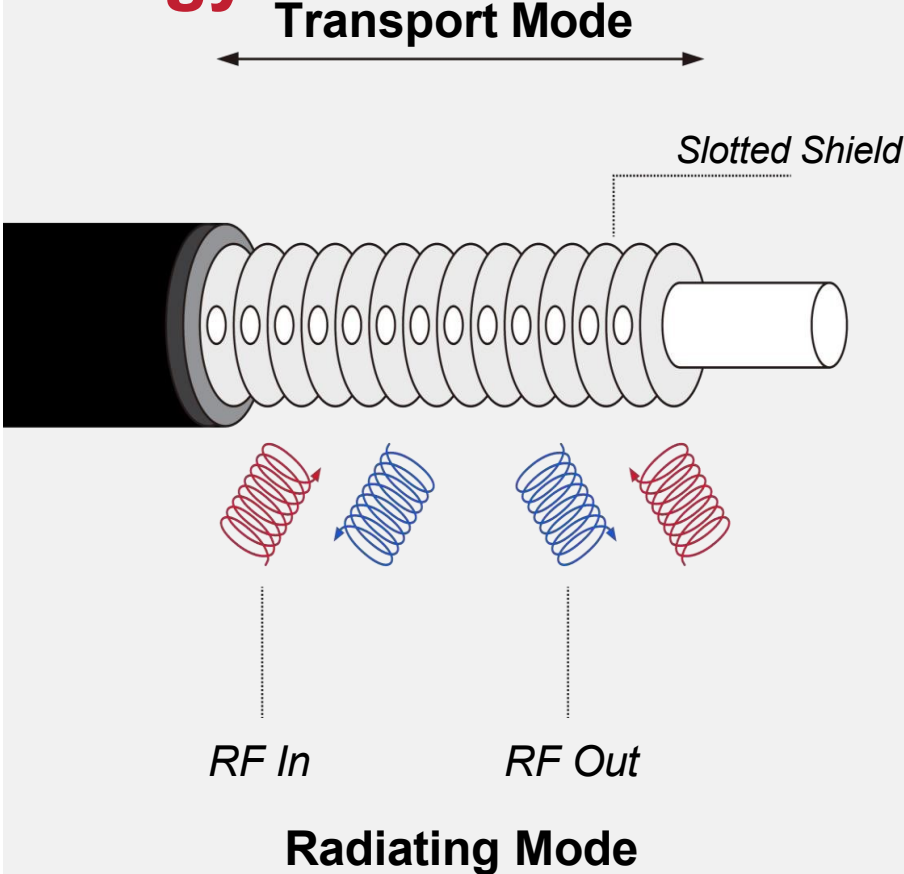
# Overview of Available Technology

## Distributed Antenna System (DAS)



# Overview of Available Technology

Radiating Coax Cable / Leaky Cable





# Emergency Responder Radio Coverage System

Engineered System of Antennas & Repeaters Capture, Re-Broadcast + Amplify Public Safety Radio Signal Inside

- **ROOFTOP DONOR ANTENNA:** Sends/receives signal from nearest Public Safety radio tower
- **VERTICAL BACKBONE:** Coax/ fiber cable connects active ERRCS equipment in Headend Room to Rooftop Donor Antenna + active equipment to passive components on each floor
- **PASSIVE COMPONENTS:** Omni-Directional Antennas, splitters, connectors, couplers + coax/ fiber cable distribute signal throughout the building
- **ACTIVE EQUIPMENT:** BDA, Battery Backup Unit + Alarm Panel located in ERRCS Headend Room



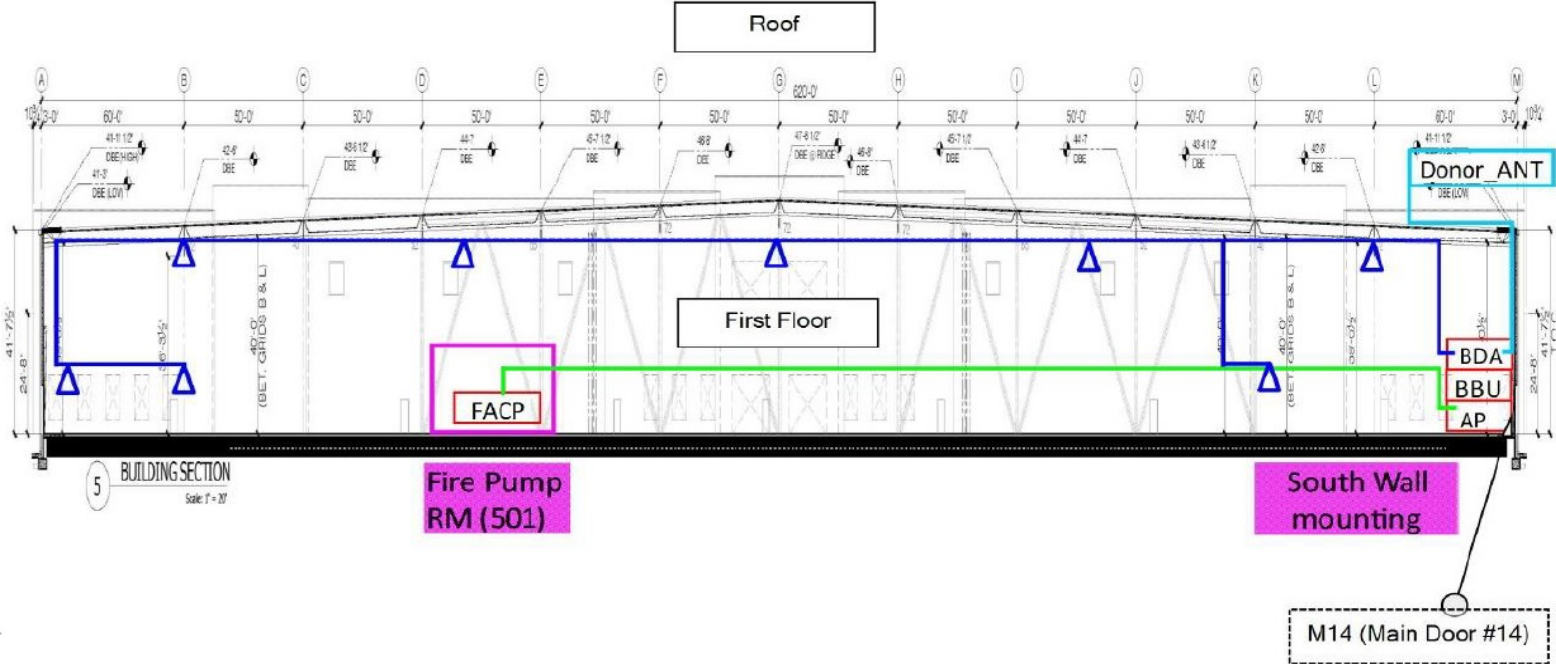
# Sample Timeline for ERCES in Construction Phase

- MEET WITH ARCHITECT + ENGINEER: Early Recommendations: Headend Location, Rooftop Donor Antenna, Cable Routes, Timeline + Budget
- CONFIRM AHJ REQUIREMENTS: Contact AHJ Re: Code Enforcement, Technical Requirements, Plan Review, Permit, Inspection, Etc.
- CONFIRM RADIO SYSTEM REQUIREMENTS: Contact PS Radio System FCC Licensee Re: System, Control Channel(s), Frequency(s) + Towers
- CONDUCT RF SIGNAL TESTING: RF Analysis of In-Building Unamplified Signal Coverage + Donor Signal Strength
- PRODUCE SYSTEM DESIGN: Engineered iBwave ERRCS System Design, BOM + Predictive Signal Coverage Model
- SECURE APPROVALS: Plan Review, Permit + FCC Re-Broadcast Authorization: AHJ/Bldg. Dept. + Radio System Admin
- INSTALL SYSTEM: Penetrations, Cable + Active & Passive Components: Donor Antenna, BDA, DAS, BBU, Alarm Panel, Etc.
- CONNECT TO FACP: Fire Alarm Contractor Connects ERRCS Supervisory Alarm Points to FACP
- COMMISSION, START UP + TEST: Commission, Start Up + Post Installation 20 Grid RF Signal Test
- ACCEPTANCE TESTING: Accompany AHJ Inspection/ Acceptance Testing
- CLOSEOUT PACKAGE: As-Built System Design, RF Test Report, Cert. of Compliance, Data Sheets & Owner's Manuals + Warranty
- ANNUAL RE-CERTIFICATION: Yearly System Test + 20 Grid RF Signal Test

# Sample Layout

## Warehouse/ Distribution Center

700,000 SF; 1 Level



# Sample Layout

## Hotel

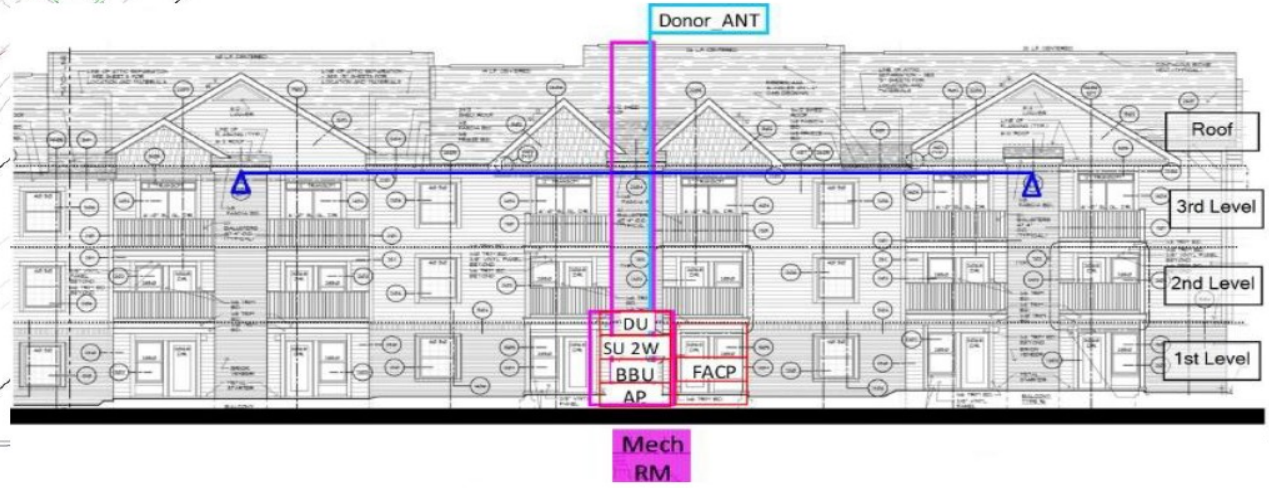
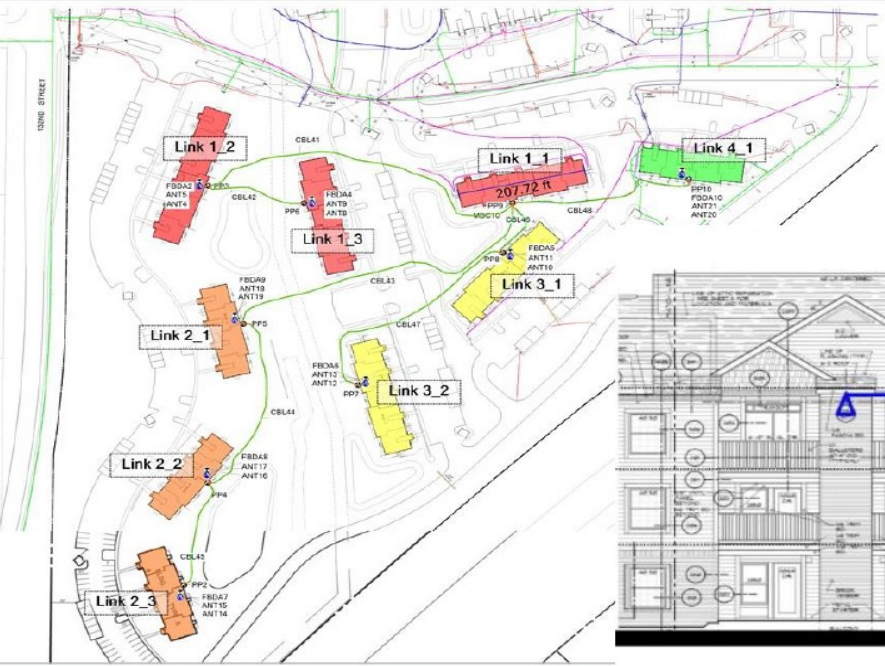
350,000 SF; 23 Levels



# Sample Layout

## Apartment Campus w/Fiber Infrastructure

16 Building Campus  
30,500 SF; 3 Levels (Each Bldg.)



# UL ERCES Binational Certificates Program



# Codes / regulatory concerns

- Improper ERCES design / installation issues
- ERCES design / installation prior to model codes / standards process
- Acceptance testing ~ floor coverage and DAQ measurement
- Reliability / component failures
- Adaptability to new frequencies



# UL Solution - ERCES Certification Program

## To ensure reliability:

- Model Code compliance (2021 IFC)
- Standard compliance (NFPA 72 and 1221/1225)
- Equipment certification (UL 2524)

UL Program provides confidence and reliability to stakeholders that ERCES is code compliant after system installation

## Program requirements will address:

- Safety testing
- Inspection
- Operational requirements
- Listing of Contractor
- Issuance of System Certification by Listed Company



# US jurisdictions requiring UL ERCES Certs

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## Adopted UL Program

- San Francisco
- San Mateo County
- San Mateo City
- Menlo Park
- East Palo Alto
- City of Atherton

## Adopting by EOY 2023

- City of Memphis
- Palm Beach County
- Boca Raton
- Miami Dade
- Redwood City
- City of Austin Tx
- South San Francisco
- Santa Rosa County
- Baltimore County
- Reading
- Lancaster County

# Conclusion

- ❖ ULC will continue to work on Canadian requirements for ERCES
- ❖ ULC will continue to work with stakeholders to publish a robust ORD
- ❖ ERCES Certificates program will be developed to assist AHJs and building owners in enforcing code requirements



# Free preview of UL/ULC standards

- Go to [www.shopulstandards.com](http://www.shopulstandards.com)
- Browse and select from more than 1700 UL and ULC standards
- Select digital view in English or French
- Register an account
- Read the standard!!

The screenshot displays the UL Standards Sales Site interface. The browser's address bar shows the URL <https://www.shopulstandards.com/ProductDetail.aspx/UniqueKey=36229>, which is circled in red. The page header includes the UL logo and the text "UL Standards Sales Site". Below the header, there are navigation tabs: "Browse & Buy UL Standards", "UL Resources", "Other Products", and "Sales Site Info". The main content area features a sidebar on the left with links such as "Complete List of UL Documents", "View Top Sellers", "What's New", "Request a Quote", "UL Certification Customer Information", and "UL now developing Standards for the Canadian Market". The main content area displays the product details for "INTEGRATED SYSTEMS TESTING OF FIRE PROTECTION AND LIFE SAFETY SYSTEMS" (ULC Standard CAN-ULC-S1001-11-Rev1). The price is listed as \$242.00. Below the product details, there is a "Purchase Options" section with buttons for "Get Update Alerts", "Digital View - English", and "Digital View - French". The "Digital View - English" button is circled in red. At the bottom of the page, there is a section for "Revisions and Related Documents".

# ULC ONLINE RESOURCES

## UL PRODUCT IQ RESOURCE CENTRE

The screenshot shows the UL Product IQ website in a browser. The address bar displays <https://iq.ulprospector.com/en>. The page features a red header with the text "UL Product IQ" and navigation links for "SEARCH", "MY SEARCHES", "MY TAGS", and "THERESA". A large blue banner contains the text "Create a Search Now" and a search input field with the placeholder "Enter a file number, CCN, model or other keyword". Below the banner, a central heading reads "Find what you need faster with iQ Plus Search Tools!". On the left, there are three vertical panels: "Product IQ Tour" (Get the most out of your Product IQ experience. Take a tour of the app to learn more about it.), "iQ™ Family of Databases" (For enhanced search functionality.), and "UL Architectural Services" (Find enhanced information related to fire rated walls, floors, roofs, beams, columns, joints and firestops.). On the right, there is a list of "iQ PLUS SEARCH TOOLS" with expandable options: "Authorized Service Providers", "Building Materials, Systems and Installation Codes", "Finished Goods", "Materials", and "Other". Two promotional banners are visible on the right side: "Learn more about Product IQ™ features" and "Try more gadgets search options with the Caskets iQ Plus Tool".

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#### PRODUCT INCIDENT REPORTS (MARKET SURVEILLANCE)

Form for reporting discrepancies with UL/ULC listed products. If you observe a situation in which the ULC Mark or UL Mark has been applied in the field, the ULC/UL Mark is being misused, a company's...



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Certification and Information Bulletins are available for download on this website. To obtain copies of Bulletins for the year 2003 and prior, please contact ULC Customer Service via e-mail at [CEC@ul.com](mailto:CEC@ul.com) or by phone 1-866-937-3852.




#### SAFETY ALERTS

Please note that all CPSC recalls are available in English only. Please refer to

#### CODE AUTHORITIES IN CANADA

A Quick find for authorities responsible for codes in Canada, Building, Plumbing and Fire Codes Responsibility for building regulation in Canada rests with the provinces and territories; each province and territory can adopt any code...



#### ANTI-COUNTERFEITING OPERATIONS

Counterfeiting / Intellectual property crime remains a serious and growing issue in Canada and around the world. The World Intellectual Property Organization estimates that counterfeit goods account for hundreds of billions of dollars worldwide. Counterfeiting is not...

#### TECHNICAL TOPICS

Technical information on topics of interest to code authorities. ULC Technical





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