New River Valley Emergency Communications Regional Authority

Request for Proposal
Montgomery County VA RFP 24-16
Regional P25 Radio System

April 2, 2024

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1 General Instructions

1.1 Purpose

The New River Valley Emergency Communications Regional Authority (NRVECRA), and their fiscal agent, Montgomery County, Virginia invites written proposals from qualified offerors to provide a 700 MHz P25 Phase 2 Trunked Simulcast Radio System to serve the public safety agencies for Montgomery County, the Towns of Blacksburg and Christiansburg, and Virginia Tech University. The purpose of this Request for Proposal (RFP) is to provide PROPOSERS with a common, uniform set of instructions to guide them through the development of their proposals. In addition, this RFP will function as a standard from which to evaluate the PROPOSER'S products and services as they compare to other offerors and as they pertain to the needs defined in this document. PROPOSERS interested in providing the specified goods and services shall submit a Proposal to NRVECRA as instructed in this Request for Proposals.

- NRVECRA seeks to replace the legacy NRVECRA UHF conventional analog radio systems. The NRVECRA requires a single contractor to provide a P25 trunked radio system: infrastructure, dispatch consoles, connectivity network, and subscriber radios necessary to support the new radio system that will provide services throughout the entire NRVECRA service area.
- NRVECRA is a regional dispatch center serving multiple public safety agencies throughout Montgomery County, the Towns of Blacksburg and Christiansburg, and Virginia Tech. The NRVECRA service area encompasses 393 square miles. The population of the NRVECRA service area is an estimated 98,000. The existing radio system serves four (4) law enforcement agencies, five (5) fire departments, and six (6) EMS agencies. The current radio systems are nearing end-of-life and no longer provide sufficient coverage or capacity to meet NRVECRA's needs.
- The new NRVECRA radio system will serve all public safety and public service radio users in Montgomery County. The successful PROPOSER shall design and install fixed infrastructure equipment, dispatch equipment, microwave backbone equipment, and physical facilities needed to support the infrastructure equipment. The fixed infrastructure equipment, dispatch equipment, microwave backbone equipment, and physical facilities must be maintainable for at least fifteen (15) years after Final System Acceptance.
- The NRVECRA radio system design includes thirteen (13) new dispatch consoles at the NRVECRA 9-1-1 Center.
- For the new radio system, there should be a public safety grade connectivity network using fiber or microwave equipment configured in a ring topology or with monitored hot standby (MHSB) equipment for microwave spur links.
- NRVECRA desires to have the successful PROPOSER offer maintenance for fifteen (15) years after final acceptance.

1.2 Definitions

Fiscal Agent: Montgomery County, Virginia
PROCUREMENT OFFICER:
Jeff Groseclose,
Purchasing Manager
755 Roanoke Street, Suite 2C
Christiansburg, VA 24073
Phone: (540) 394-2134

PROPOSER: Any firm that submits a proposal in response to this RFP.
CONTRACTOR: The successful PROPOSER with whom a contract is executed pursuant to this RFP.
NRVECRA: New River Valley Emergency Communications Regional Authority
NRVECRA *Representative*: The firm CTA Consultants, LLC assisting the NRVECRA in evaluation of Proposals, and project implementation.
PROJECT TEAM: Representatives (typically project managers, lead engineers and significant assigned project members) of NRVECRA, CTA Representatives', and CONTRACTORS, responsible for management and implementation of the project and communication with other parties on the PROJECT TEAM.

DAYS:

- "Calendar Days" means any day appearing on the calendar, whether a working day, weekend day, national holiday, state holiday or other day.
- "Days" mean Calendar Days, unless specifically listed.
- "Business Days" means Calendar Days excluding Saturdays, Sundays, and national and/or state recognized holidays.

SCOPE OF WORK: The general character and range of Services and supplies needed, the work's purpose and objectives, and an overview of the performance outcomes expected by the NRVECRA.
SERVICES: The services to be performed under the Contract.
TERMINAL HARDWARE: all subscriber equipment (mobile, portables, pagers, and control stations).

1.3 Procurement Method

The procurement method is competitive negotiation as defined in Virginia Code 2.2-4302.2. This RFP indicates, in general terms, the nature of the project and services being sought. Each PROPOSER is to submit a proposal that best suits the requirements of NRVECRA.

The specific requirements for the contents of proposals are contained in this RFP. Proposers are encouraged to provide additional information not specifically identified as a requirement if that additional information enables the proposal to better suit the needs of NRVECRA.

In order to procure a system that best suits the needs of NRVECRA, the competitive negotiation process

and evaluation criteria will consider factors in addition to cost.

1.4 Procurement Schedule

The schedule for this procurement is found in Table 1-1. Proposals are due by the date and time indicated. Proposals submitted after this deadline will not be accepted. Montgomery County reserves the right to postpone the date and time for submission of Proposals at any time prior to the Proposal deadline.

Scheduled Event	Date
RFP Release	April 2, 2024
MANDATORY Pre-Proposal Conference & Site Visits	April 30 - May 2, 2024
Deadline for PROPOSER Questions	May 24, 2024
Deadline for Proposal Submission	August 2, 2024 3:00 PM
Deadline for Redacted Proposal Submission	August 16, 2024
Anticipated Project Completion	Contract Execution + 32 months

Table 1-1 Procurement Schedule

Technical and Price proposals should remain valid without changes for a period of one (1) year after the submission deadline date.

1.5 PROPOSER Point of Contact

PROPOSER shall provide a *primary point of contact*, to send and receive all communications concerning this RFP. Montgomery County Procurement Officer or the NRVECRA Representative will send all communications to the identified single point of contact.

1.6 Mandatory Pre-Proposal Conference & Mandatory Site Visits

A mandatory pre-proposal conference for all interested parties will be held for this RFP. A minimum of one (1) representative from each Proposer shall attend the Mandatory Pre-Proposal Conference in person. A minimum of one (1) representative from each Proposer shall attend the Mandatory Site Visits. Failure to have one (1) representative attend both the Mandatory Pre-Proposal Conference **AND** the Mandatory Site Visits, in person, will result in Montgomery County Procurement Officer rejecting the PROPOSER'S submission.

The schedule for these activities is as follows:

Scheduled Event	Date / Location
Mandatory Pre-Proposal Conference & Site Visits Registration	April 23, 2024
Mandatory Pre-Proposal Conference (In-Person)	April 30, 2024 9:00 am 1 East Main St, 2nd floor, Christiansburg, VA 24073
Mandatory Site Visits	April 30 - May 2, 2024

Table 1-2 Mandatory Pre-Proposal Conference and Mandatory Site Visits Schedule

Written questions regarding the RFP may be submitted to the identified Montgomery County Procurement Officer OR NRVECRA representative in advance of the pre-proposal conference. Questions not submitted by the date and time specified in Table 1-2 may not be fully addressed at the conference.

1.7 RFP Questions, Answers, and Addenda

All questions or comments must be received by the date indicated in Table 1-1. All questions are required to be submitted in writing using Appendix F PROPOSER Question template submitted to:

Jeff Groseclose, Purchasing Manager
755 Roanoke Street, Suite 2C
Christiansburg, VA 24073
Email: nrvecra@cta-c.com

All responses will be provided in writing and distributed to all prospective PROPOSERS. Verbal questions and responses to questions are not official and should not be relied upon for your submission.

PROPOSERS shall not communicate with any other representatives of NRVECRA agencies regarding this RFP unless directed by Jeff Groseclose, Purchasing Manager.

PROPOSERS are highly encouraged to request any RFP wording changes during the RFP Questions period. All requests will be considered. If the PROPOSER submits a request for RFP wording change in their PROPOSAL and Montgomery County Procurement cannot accept the wording change, a request to withdraw the wording change will be issued in the form of a written question and the *question will impact the PROPOSERS technical score as outlined in RFP Appendix A - Responsiveness to the Intent of the Specification – Questions.*

If a PROPOSER believes a specific RFP Question(s) contains proprietary information exempt from public disclosure, the PROPOSER shall clearly identify such question(s). Montgomery County Procurement Officer will determine the validity of the non-disclosure claim. If Montgomery County Procurement determines a question(s) does not meet the criteria of proprietary information exempt from public disclosure, Montgomery County Procurement Officer will inform the PROPOSER and the

PROPOSER will have the right to withdraw the question(s) or allow the question(s) to be answered as part of open process where all PROPOSERS will receive the question(s) and answer(s).

All necessary changes to the RFP will be made via the addendum process and posted to the procurement website. Receipt of all Addenda must be acknowledged in the Transmittal Letter.

1.8 Instructions for Submitting Proposals

PROPOSERS shall submit Technical and Price Proposals and Redacted Submission in **separate** sealed packages labeled as follows:

> Montgomery County, VA
> Regional P25 Radio System
> RFP No. 24-16
> *PROPOSER's Name*
> TECHNICAL PROPOSAL *or* PRICE PROPOSAL or REDACTED SUBMISSION *as applicable*

Technical and Price Proposals will be received at the address provided in section 1.2.

PROPOSERS submission shall contain the following:

1.8.1 Technical Proposal:

- one (1) original hard copy
- seven (7) hard copies
- seven (7) electronic copies of all documents in a ***single*** Adobe Acrobat Portable Document format (PDF). ***Separate PDF files will not be accepted.***
- seven (7) electronic copies of Responsibilities Matrix, Compliance Matrix, and Proprietary/Confidential Information Identification Form in Microsoft Excel format

ABSOLUTELY NO PRICE INFORMATION SHALL BE INCLUDED IN THE TECHNICAL PROPOSAL. TECHNICAL PROPOSAL CONTAINING PRICE INFORMATION WILL RESULT IN THE NRVECRA REJECTING THE PROPOSER'S SUBMISSION.

1.8.2 Price Proposal:

- one (1) original hard copy
- seven (7) hard copies
- seven (7) electronic copies of all documents in Adobe Acrobat Portable Document format (PDF)
- seven (7) electronic copies of Price Pages in Microsoft Excel format

1.8.3 Redacted Submission:

- one (1) electronic copy of a complete ***redacted*** Technical Proposal in a ***single*** Adobe Acrobat Portable Document format (PDF). ***Separate PDF files of the redacted Technical Proposal will not be accepted.***
- one (1) electronic copy of the ***redacted*** Price Proposal in a ***single*** Adobe Acrobat Portable Document Format (PDF). ***Separate PDF files of the redacted Price Proposal will not be accepted.***

Code of the Commonwealth of Virginia does not allow a PROPOSER to redact their line item pricing; therefore, only redaction of the Price Proposal cover letter and Executive Summary will be accepted. Appendix D must be included unredacted.

1.9 Withdrawal of Proposals

PROPOSERS may withdraw Proposals by written notice sent to Montgomery County Procurement Officer any time prior to the Proposal submission deadline. The PROPOSER may retrieve the submitted documents, at their expense, or request Montgomery County dispose of the documents. Montgomery County will not take responsibility of securing the documents during the disposal process.

1.10 Technical Proposal Evaluation

Technical Proposals will be evaluated by a technical evaluation team consisting of NRVECRA staff, stakeholders and NRVECRA Representatives. Technical Proposals will be evaluated in accordance with the technical categories of evaluation found in Appendix A.

1.11 Technical Proposal Questions

The technical evaluation team will generate a list of written questions for each Proposal and will forward the questions to the PROPOSER. *Each question will impact the PROPOSERS technical score as outlined in RFP Appendix A - Responsiveness to the Intent of the Specification – Questions.*

If sections of the technical proposal are missing items, require clarification or require additional explanation to determine if the proposal meets or deviates from RFP requirements, the evaluation team will submit written questions.

If NRVECRA determines a PROPOSER'S 'Comply with Clarification' or 'assumption' cannot be accepted Montgomery County will submit written questions requesting the PROPOSER to withdraw the clarification or assumption and comply with the RFP wording as published and the PROPOSER'S score will be impacted.

Each PROPOSER shall submit redacted and non-redacted written responses to Montgomery County Procurement Officer within five (5) working days (unless otherwise indicated) from the receipt of the written questions. All written responses will take precedence over the Technical Proposal.

1.12 Price Proposal Evaluation

Price Proposals will be evaluated by a price evaluation team consisting of NRVECRA and NRVECRA Representatives. Price Proposals will be evaluated in accordance with the price categories of evaluation found in Appendix A. The price evaluation will be independent of the technical evaluation.

1.13 Price Proposal Questions

The price evaluation team will generate a list of written questions for each Proposal and will forward the questions to the PROPOSER. *Each question will impact the PROPOSERS technical score as outlined in Appendix A - Responsiveness to the Intent of the Specification – Questions.*

If sections of the price proposal are missing items, require clarification or require additional explanation to determine if the proposal meets or deviates from RFP requirements, the evaluation team will submit written questions.

If NRVECRA determines a PROPOSER has bundled pricing, omitted pricing, or included pricing as an option that is required to be included in the base price the NRVECRA will submit a written question to correct the pricing.

Each PROPOSER shall submit redacted and non-redacted written responses to Montgomery County Procurement Officer within five (5) working days (unless otherwise indicated) from the receipt of the written questions. All written responses will take precedence over the Price Proposal.

1.14 Oral Presentation

Montgomery County may, *at their sole discretion*, invite two (2) or more PROPOSERS to make an oral presentation. Suitable time will be scheduled for each PROPOSER's presentation. Each PROPOSER should allow adequate time during this period for questions from Montgomery County and NRVECRA's personnel, stakeholders, or their advisors.

During the oral presentation, discussions shall be limited to the system, equipment and software proposed, including future capabilities for expansion of the system. *Only features and/or equipment offered in the submitted Proposal are allowed to be part of the Oral Presentation,* unless specifically requested by Montgomery County Procurement Officer. Price proposals will NOT be discussed during the oral presentation; the primary purpose of the oral presentation is to provide a forum for discussion of what has been proposed and is not a negotiating session.

The PROPOSER shall provide a PDF version of the Oral Presentation in redacted and non-redacted to Montgomery County Procurement Officer within two (2) working days from the conclusion of the Oral Presentation.

1.15 Competitive Negotiations

The evaluation process shall be based upon the criteria identified in Appendix A of this Request for Proposals. Montgomery County may, *at their sole discretion*, engage in individual discussions with two (2) or more PROPOSERS deemed fully qualified, responsible, and suitable on the basis of initial responses and with emphasis on professional competence, to provide the required services. The results of the competitive negotiations will be factored into both the Technical and Price Evaluations prior to final scoring.

1.16 Best and Final Offer

Montgomery County may, *at their sole discretion*, request PROPOSER(S) submit in writing a Best and Final Offer (BAFO). The PROPOSER'S Technical and Price submission will be re-scored to combine and include the information contained in the BAFO. The decision to award will be based on the final evaluation including the BAFO.

1.17 Best Value

Upon review of all PROPOSER submitted information Montgomery County may, *at their sole discretion*, provide additional points as identified in Appendix A Value Added to any PROPOSER who offers additional services and/or equipment deemed to be advantageous to NRVECRA. Consideration will be given to both the technical value added and any additional cost associated with the technical value added.

1.18 Intent to Award

Montgomery County shall select the PROPOSER which, in its opinion, has made the best proposal and provides the best value to NRVECRA.

The award of a contract shall be determined in the sole discretion of Montgomery County based upon evaluation of all information as Montgomery County may request. Montgomery County reserves the right to waive any informality in proposals submitted in response to this RFP when such waiver is in the best interest of the NRVECRA.

Montgomery County shall notify all PROPOSERS of the Notice of Intent to Award.

1.19 Protest

Any PROPOSER who desires to protest the award or decision to award a contract shall submit the protest in writing to Montgomery County Procurement Officer no later than ten (10) days after the award or the announcement of the decision to award, whichever occurs first. Any protest will be resolved in compliance with Code of Virginia § 2.2-4360.

1.20 Contract Negotiations

After the Protest period has ended Montgomery County will begin Contract Negotiations with the Awarded PROPOSER. The scope, terms, and conditions of that Agreement shall be in substantial conformance with the terms, conditions, and specifications described in this RFP. The form of contract provided in RFP Appendix G will be used as the contract foundation.

Montgomery County reserves the right to negotiate contract terms with the successful PROPOSER for equipment/services other than those specifically stated in this RFP in the best interest of Montgomery County and agreed to by the PROPOSER. Additional work of a reasonable scale shall be priced consistent with the proposal to allow for additions and future expansions.

If Montgomery County determines that negotiations with the highest ranked PROPOSER have reached an impasse, Montgomery County at its sole discretion may terminate negotiations with the highest-ranked PROPOSER and commence negotiations with the second highest-ranked PROPOSER.

1.21 Contract Execution

Upon the successful completion of contract negotiations, Montgomery County will prepare and submit a final negotiated contract to the awarded PROPOSER at the address provided in the Proposal. The awarded PROPOSER shall execute the contract within fourteen (14) days after the receipt of the contract.

1.22 RFP Property of Montgomery County

This RFP in its entirety is the property of Montgomery County. The PROPOSER shall not copy or disseminate any portion of these specifications without express written authorization of Montgomery County except as necessary in the preparation of the Proposal. Any authorized copies of these specifications or portions thereof shall include a similar paragraph prohibiting further copying or dissemination.

1.23 Rights to Submitted Material

All materials submitted by the PROPOSER in response to this RFP shall become the property of Montgomery County.

1.24 Confidentiality

Proposals will not be opened publicly. All Proposals shall be kept confidential and not disclosed to competing PROPOSERS or any outside individuals except as required by the Code of Virginia § 2.2-4342. Public inspection of certain records.

If a PROPOSER believes any portion of its Technical Proposal contains proprietary information exempt from public disclosure, the PROPOSER shall clearly identify such portions using RFP Appendix E Proprietary Confidential Form. Montgomery County will make a determination as to the validity of the

non-disclosure claim. Identifying the entire Proposal as trade secret, confidential or otherwise exempt from disclosure is not acceptable.

The PROPOSERS Price Proposal Appendix D shall not be considered Proprietary or Confidential as stated in the Code of the Commonwealth of Virginia.

Montgomery County shall not be liable for disclosure of any proprietary information that is not clearly identified as such in the Proposal.

1.25 Incurred Costs

Montgomery County shall not be liable for any costs incurred by the PROPOSER in preparing, submitting, or presenting Proposals; or in anticipation of being awarded the contract under this RFP.

Claims for additional compensation or additional time for completion which are based on lack of knowledge or lack of understanding of any part of the RFP shall not be permitted.

1.26 Proposal Errors and Irregularities

Montgomery County reserves the right, *at its sole discretion,* to waive minor errors or irregularities in any Proposal if it appears that such errors or irregularities were inadvertent. Any such errors or irregularities shall be corrected in the Proposal prior to contract execution. Proposals with major irregularities may be considered defective and may be rejected immediately. Montgomery County may, *at its sole discretion*, allow a PROPOSER the opportunity to clarify its Proposal prior to rejection.

1.27 Open Procurement

Montgomery County may reject any or all Proposals in whole or in part and may cancel this RFP or procurement at any time when the rejection or cancellation is in the best interest of the NRVECRA as determined by Montgomery County Procurement *at its sole discretion*. Montgomery County is not liable to any PROPOSER for any loss or expense caused by or resulting from the rejection or cancellation of a solicitation, Proposal, or award. All timely submitted Proposals will become part of the procurement file.

1.28 Identified Lease Costs

Lease Costs for twelve (12) months during implementation (Base Costs) and for years 1 – 15 (Ongoing Costs), commencing after final acceptance, shall be assessed to each PROPOSER. The formula to be used is based upon the PROPOSERS design and location of RF antennas and MW dishes (to include Ice Shields) on the tower. Each RAD Center, which is the center height of the antennas on the structure, including five feet below the RAD Center (antenna base height) and five feet above the RAD Center (antenna tip height), will be assessed a flat fee of one thousand dollars ($1,000.00) per month.

1.29 Mandatory Options

Mandatory Options identify goods and/or services that ***shall*** be offered by the PROPOSER, ***if the mandatory option is available*** as part of the PROPOSERS goods and/or services. Detailed technical descriptions and pricing shall be included in the proposal submission, as a mandatory option for purchase by NRVECRA at their discretion. If a mandatory option is not available, the PROPOSER shall mark N/A for the Mandatory Option section in the Compliance Matrix. ***Costs for these items are not included in the base cost proposal evaluation.*** These mandatory options may be selected for implementation or inclusion with the initial contract, or at any time during the term of the price guarantee for the price quoted in the Proposal.

If the PROPOSER identifies a Mandatory Option as necessary for the functionality of the system as designed by the PROPOSER, the PROPOSER shall move the Mandatory Option to the appropriate system sheet to be included in the base cost. If NRVECRA or NRVECRA Representative identifies a Mandatory Option as necessary for the functionality of the system as designed by the PROPOSER, the Mandatory Option cost will be moved to the base cost proposal evaluation.

1.30 PROPOSER/CONTRACTOR Understanding

It is understood and agreed the PROPOSER/CONTRACTOR has, by careful examination, satisfied themselves as to the nature and locations of the work, the character of equipment and facilities needed, the general and local conditions and all other matters which in any way effect the proposed work under this contract. No verbal agreement or conversation with any officer, agent, or employee of NRVECRA or Montgomery County either before or after the execution of this contract shall affect or modify any of the terms or obligations herein contained.

2 Proposal Outline

2.1 Technical Proposal

ABSOLUTELY NO PRICE INFORMATION SHALL BE INCLUDED IN THE TECHNICAL PROPOSAL. TECHNICAL PROPOSALS CONTAINING PRICE INFORMATION MAY BE REJECTED.

The Technical Proposal ***shall*** use the following outline:

Section 1 Table of Contents
Section 2 Transmittal Letter
Section 3 Executive Summary
Section 4 Scope of Work
Section 5 General System Overview
Section 6 Radio System Description
Section 7 Connectivity Network Description
Section 8 Subscriber Equipment Description
Section 9 Physical Facilities Description
Appendix A Qualifications and References
Appendix B Compliance Matrix
Appendix C Responsibilities Matrix
Appendix E Proprietary/Confidential Information Identification Form
Appendix F Template for PROPOSER Questions
Appendix G Sample Contract

All sections of the Technical Proposal shall be submitted as a ***single PDF document***, in addition to the printed quantities required in Section 1 of this RFP. Appendices B – D shall also be submitted as Microsoft Excel documents, in addition to the printed quantities required in Section 1 of this RFP.

2.1.1 Letter of Transmittal & Executive Summary (Proposal Sections 2-3)

The introduction and letter of transmittal shall provide the necessary certification from the PROPOSER that the signer is authorized to make this Technical Proposal on behalf of the PROPOSER. The letter of transmittal shall designate by name not more than two (2) individuals authorized to negotiate and sign the contract with Montgomery County on behalf of the PROPOSER. The letter of transmittal shall contain acknowledgement of all issued addenda. The Executive Summary shall contain a synopsis of NRVECRA specific scope of the project and the PROPOSER'S general plan for implementation. The Executive Summary may also briefly set forth any particular information the PROPOSER wishes to bring to NRVECRA's attention. The Executive Summary is not intended to contain general corporate information and statistics. The Executive Summary shall not offer services and/or equipment that is not also offered in the Technical Response or Price Proposal. ***The PROPOSER shall include all value-added aspects of the proposal in the executive summary.***

2.1.2 Scope of Work & Technical Response (Proposal Sections 4 - 9)

These sections shall describe PROPOSER's services and design, including maps, figures, tables, photographs, etc. The PROPOSER shall describe the capabilities, limitations, operational procedures of all proposed equipment (including mandatory options) and shall provide a specifications sheet for each major component of the proposed system.

Section 4 of the Proposal shall contain information detailing all known subcontractors and their role in the project.

Proposal Section 4 shall contain ALL Scope of Work and Technical Assumptions. Any assumption included in any other section of the proposal shall not be considered a valid submission.

2.1.3 Qualifications and References (Proposal Appendix A)

2.1.3.1 Project Manager and Project Engineer Resumes and Reference

PROPOSER shall provide a detailed resume for the proposed Project Manager and Project Engineer. Each resume shall contain a ***minimum of three (3) public safety*** critical communications system implementations ***of similar size and complexity*** and a brief description of the team member's role and responsibility on each project. Each reference shall include a *current and verified* point of contact, email, and phone number, which will provide detailed information as to the performance of the Project Manager and Project Engineer. These references shall not be another vendor that the PROPOSER was a subcontractor to on a previous project. ***Failure to provide this information for both the Project Manager and the Project Engineer may result in disqualification or loss of evaluation points.***

2.1.3.2 Warranty and Maintenance Service Organization Experience and References

PROPOSER shall provide information on a minimum of ***three (3) public safety*** critical communications systems the *proposed warranty and maintenance service organization* has provided services ***similar in nature and complexity***. Each reference shall include a *current and verified* point of contact, email, and phone number, which will provide detailed information as to the performance of the proposed warranty and maintenance service organization. These references shall not be another vendor that the PROPOSER was a subcontractor to on a previous project. ***Failure to provide this information may result in disqualification or loss of evaluation points.***

2.1.4 Compliance Matrix (Proposal Appendix B)

The PROPOSER shall provide a compliance statement by completing the Compliance Matrix found in RFP APPENDIX B. This document is included in a Microsoft Excel file named "PROPOSER'S Name for RFP 24-16 Appendix B.xlsx". The PROPOSER shall provide this completed excel file as part of the PDF Proposal submission and in its native Microsoft Excel

format. **Failure to provide this information in its native Microsoft Excel format may result in disqualification or loss of evaluation points.**

The compliance spreadsheet provides space for a compliance response and explanation for each section of the RFP. There are three (3) valid responses:

Response	Meaning
Comply	Proposal *fully* complies with all requirements as stated in the numbered section.
Comply with Clarification	Proposal complies with the intent of the requirements as stated in the numbered section; however, the means of implementing the requirement necessitates clarification. * If PROPOSER provides an unsatisfactory explanation of their compliance, NRVECRA may, at their discretion, consider this an exception.
Exception	Proposal does *not* comply with requirements of the section. Explain the nature of the exception(s). If you take exception to more than one (1) part of a section, identify the number of exceptions taken and provide explanations for each. If revised wording may allow the PROPOSER to comply, use this response category and provide revised wording in ~~strikeout~~ (to remove words) and **bold** (to add words). **Any item not explicitly identified as an exception in the Proposal will be considered compliant.**
Not Applicable	This category should ***only*** be used if the section does not apply to the PROPOSER'S Proposal or system configuration. ***Use this response with caution.*** Use this category to indicate PROPOSER cannot provide a Mandatory Option.

2.1.5 Responsibilities Matrix (Proposal Appendix C)

The PROPOSER shall provide a responsibilities statement by completing the Responsibilities Matrix found in RFP APPENDIX C. This document is included in a Microsoft Excel document named "PROPOSER'S Name for RFP 24-16 Appendix C.xlsx". The PROPOSER shall provide this completed excel file as part of the PDF Proposal submission and in its native Microsoft Excel format. **Failure to provide this information in its native Microsoft Excel format may result in disqualification or loss of evaluation points.**

The responsibilities matrix shall contain, at a minimum, the following categories:

- PM General Responsibilities
- Detailed Design Review (DDR)
- General Site Responsibilities

- Individual Site Responsibilities
- System Integration & Staging
- Shipping and Inventory
- System Infrastructure Installation
- Connectivity Network Installation
- System Optimization
- Field Acceptance Testing
- Terminal Equipment
- Training. Fleetmapping, Cutover
- Final Acceptance

The PROPOSER ***may not*** change the responsibilities as assigned; however, if the PROPOSER does not agree with the responsibilities as assigned the PROPOSER may enter the disagreement in the Grey Notes Column, clearly explaining why the responsibility as assigned is not acceptable to the PROPOSER.

The PROPOSER may include, for consideration, additional categories, and subcategories, as well as additional lines within the subcategories. This document will be used throughout the implementation of the project to enhance organization and efficiency.

2.1.6 Proprietary/Confidential Information Identification Form (Proposal Appendix E)

A redacted technical proposal, in electronic PDF format, is required as part of the PROPOSER'S submission. All sections of the ***redacted*** Technical Proposal shall be submitted as a ***single PDF document.*** PROPOSER must complete the Proprietary Confidential Information Identification Form to explain the reason for redaction of any section or subsection of the PROPOSAL that is redacted. Any request for redaction must be compliant with the Code of the Commonwealth of Virginia, if a redaction request is found to be non-compliant the PROPOSER will be required to re-submit a redacted PROPOSAL that is compliant.

Based upon Virginia Code §2.2-4342, Subsection F, "*A bidder, offeror, or contractor shall not designate as trade secrets or proprietary information (a) an entire bid, proposal, or prequalification application; (b) any portion of a bid, proposal, or prequalification application that does not contain trade secrets or proprietary information; or (c)* ***line item prices or total bid, proposal, or prequalification application prices****."* a ***redacted*** version of the Price Proposal will not be accepted.

2.2 Price Proposal (Proposal Appendix D)

The Price Proposal shall be provided **in a separately sealed package** and follow the outline below:

- Transmittal Letter
- Executive Summary
- Price Proposal Forms Appendix D

2.2.1 Letter of Transmittal

The letter of transmittal shall provide the necessary certification from the PROPOSER that the signer is authorized to make this Price Proposal on behalf of the PROPOSER. The letter of transmittal shall designate by name not more than two (2) individuals authorized to negotiate and sign the contract with Montgomery County on behalf of the PROPOSER. The letter of transmittal shall contain acknowledgement of all issued addenda. The letter of transmittal may also briefly set forth any particular value added information the PROPOSER wishes to bring to NRVECRA's attention.

2.2.2 Price Forms

The PROPOSER shall provide a Price Proposal using the forms in APPENDIX D. A soft copy of this form is found in a Microsoft Excel file named "PROPOSER'S RFP 24-16 Appendix D Price Proposal [**Date of Submission**].xlsx". The PROPOSER shall provide this completed excel file as part of the PDF Proposal submission and in its native Microsoft Excel format.

The following may be grounds for rejection of price proposal:

- Failure to provide all pricing necessary to provide a turnkey project
- Failure to provide pricing information in its native Microsoft Excel format
- Any attempt to redact the Price Proposal
- Any attempt to modify the structure or formulas in the Price Forms
- Failure to fill in **all relevant cells** of the Price Forms to meet the requirements of the RFP
- Failure to complete the Mandatory unit pricing sheet
- Significant inconsistency between the Subscriber sheets and the Mandatory Unit Pricing
- Failure to include pricing for Mandatory Project Options, if the Option is available
- Failure to move a Mandatory Option to the base cost if the Mandatory Option is necessary for operation of the system or is required by the RFP
- Failure to provide all Ongoing Options to meet the requirements of the RFP
- Including required Ongoing Costs on the Ongoing *Options* sheet
- Failure to include Lease costs for commercial sites on the Physical Facilities sheet
- Failure to include Lease costs for commercial sites on the Ongoing Costs sheet
- Any attempt to modify or limit the submitted technical proposal scope or compliance
- Addition of any assumption not listed in your Technical Proposal Section 4

If the PROPOSER finds a need to change the Price Forms a request must be made in writing, and if Montgomery County deems it appropriate to make a change, the document will be re-issued via the RFP Addenda process.

If the PROPOSER wishes to provide additional pricing information, the PROPOSER may submit the information on additional sheets and electronic files. In all cases, the hardcopy of the pricing shall be binding. Submission of additional pricing may not be a substitute for completing the official pricing forms.

3 Terms and Conditions

3.1 Supremacy Clause

Notwithstanding any provision in the PROPOSER's response to the contrary, the PROPOSER agrees that the terms and conditions contained in Montgomery County 's proposal prevail over contrary terms and conditions contained in the PROPOSER's response.

3.2 MANDATORY Compliance to RFP Proposal Instructions / Forms and Terms and Conditions

Failure to submit a proposal in compliance with RFP Section 2 shall be a cause for rejection of the proposal. Modification of or additions to any portion of the request for proposal may be cause for rejection of the proposal; however, Montgomery County reserves the right to decide on a case-by-case basis, in its sole discretion, whether to reject such a proposal as nonresponsive. As a precondition to its acceptance, Montgomery County may, in its sole discretion, request that the PROPOSER withdraw or modify nonresponsive portions of a proposal which do not affect quality, quantity, price, or delivery. No modification of or addition to the provisions of the contract shall be effective unless reduced to writing and signed by the parties.

3.3 Montgomery County Form of Contract

RFP Appendix G Montgomery County Form of Contract will be use as the Contract Agreement. The PROPOSER shall acknowledge acceptance of this Form of Contract.

3.4 Right to Reject

Montgomery County reserves the right to reject any and all proposals and does not commit itself to accepting the lowest bid. Montgomery County also reserves the right to waive any informality in bids.

3.5 Order of Precedence

The following items shall be incorporated by reference into the Contract. These items shall take precedence in the order in which they are listed:

1. Amendments to Contract Agreement
2. Contract Agreement
   - Exhibit A - Compliance Matrix, as amended
   - Exhibit B – Payment Milestones & Pricing Pages, as amended
   - Exhibit C - Project Schedule, as amended
   - Exhibit D - Performance and Payment Bonds
   - Exhibit E - Responsibilities Matrix, as amended
   - Exhibit F – Proposer Software License Agreement
   - Exhibit G – Proposer Maintenance Agreement
3. Written clarifications and negotiated resolutions
4. RFP addenda
5. RFP

6. Proposal amendments
7. Proposal

3.6 Ethics in Public Contracting

By submitting their proposals, PROPOSERS certify that their proposals are made without collusion or fraud and that they have not offered or received any kickbacks or inducements from any other bidder, supplier, manufacturer or subcontractor in connection with their proposal, and that they have not conferred on any public employee having official responsibility for this procurement transaction any payment, loan, subscription, advance, deposit of money, services or anything of more than nominal value, present or promised unless consideration of substantially equal or greater value was exchanged.

3.7 Immigration Reform and Control Act Of 1986

By submitting their proposals, the PROPOSERs certify that they do not and will not during the performance of this contract employ illegal alien workers or otherwise violate the provisions of the federal Immigration Reform and Control Act of 1986.

3.8 Debarment Status

By submitting their proposals, PROPOSERS certify that they are not currently debarred by the Commonwealth of Virginia from submitting bids or proposals on contracts for the type of goods and/or services covered by this solicitation, nor are they an agent of any person or entity that is currently so debarred.

3.9 Applicable Laws and Courts

This solicitation and any resulting contract shall be governed in all respects by the laws of the Commonwealth of Virginia and any litigation with respect thereto shall be brought in the courts of Montgomery County. The CONTRACTOR shall comply with applicable federal, state, and local laws and regulations.

3.10 Antitrust

By entering into a contract, the CONTRACTOR conveys, sells, assigns, and transfers to Montgomery County and the Commonwealth of Virginia all rights, title and interest in and to all causes of the action it may now have or hereafter acquire under the antitrust laws of the United States and the Commonwealth of Virginia, relating to the particular goods or services purchased or acquired by Montgomery County and the Commonwealth of Virginia under said contract.

3.11 Changes to the Contract

Changes can be made to the Contract in any of the following ways:

A. The parties may agree in writing to modify the scope of the contract. An increase or decrease in the price of the contract resulting from such modification shall be agreed to by the parties as a part of their written agreement to modify the scope of the contract.

B. Montgomery County may order changes within the general scope of the contract at any time by written notice to the CONTRACTOR. Changes within the scope of the contract include but are not limited to things such as the method of packing or shipment and the place of delivery or installation. The CONTRACTOR shall comply with the notice upon receipt. The CONTRACTOR shall be compensated for any additional costs incurred as the result of such order and shall give Montgomery County credit for any savings. Said compensation shall be determined by one of the following methods:

1) By mutual agreement between the parties in writing; or

2) By agreeing upon a unit price or using a unit price set forth in the contract, if the work to be done can be expressed in units, and the CONTRACTOR accounts for the number of units of work performed, subject to Montgomery County's right to audit the Contractors records and/or to determine the correct number of units independently; or

3.12 Pricing and Payment

The Total Agreement Price for the Hardware, the Software licenses, and the Services shall be paid by Montgomery County to CONTRACTOR as follows:

3.12.1 Infrastructure Hardware and Services

i.	Ten percent (10%) of the Total Agreement Price (excluding the aggregate price of the Terminal Hardware included in the Total Agreement Price) shall be due upon approval of the Contract Design Review (CDR).
ii.	Ten percent (10%) of the Total Agreement Price (excluding the aggregate price of the Terminal Hardware included in the Total Agreement Price) shall be due upon Montgomery County's approval of the Detailed Design Review (DDR).
iii.	Twenty percent (20%) of the Total Agreement Price (excluding the aggregate price of the Terminal Hardware included in the Total Agreement Price) shall be due upon Montgomery County approval of Infrastructure Hardware (Radio and Microwave) factory staging as described in the project schedule.
iv.	Ten percent (10%) of the Total Agreement Price (excluding the aggregate price of the Terminal Hardware included in the Total Agreement Price) shall be due upon tower construction/remediation.
v.	Fifteen percent (15%) of the Total Agreement Price (excluding the aggregate price of the Terminal Hardware included in the Total Agreement Price) shall be due upon site civil work completion.

vi. Fifteen percent (15%) of the Total Agreement Price (excluding the aggregate price of the Terminal Hardware included in the Total Agreement Price) shall be due upon completion of installation of Infrastructure Hardware. This payment is contingent upon resolution of all site inspection punch list items.
vii. Ten percent (10%) of the Total Agreement Price (excluding the aggregate price of the Terminal Hardware included in the Total Agreement Price) shall be due upon Montgomery County approval of Conditional System Acceptance.
viii. Ten percent (10%) of the Total Agreement Price (excluding the aggregate price of the Terminal Hardware included in the Total Agreement Price) plus any remaining unpaid portion of the Total Agreement Price for all Hardware, Software and Services to be provided under the terms of this Agreement (excluding the aggregate price of the Terminal Hardware included in the Total Agreement Price) shall be due upon Final Project Acceptance.

3.12.2 Terminal Hardware and Services

i. Fifty Percent (50%) of the purchase price of Terminal Hardware shall be invoiced upon shipment of units on a per unit basis upon Montgomery County written authorization. If Montgomery County is requested to accept Terminal Hardware more than six (6) months prior to installation and programming Montgomery County may request an early delivery discount.
ii. Fifty Percent (50%) of the purchase price of Terminal Hardware shall be invoiced upon completion of installation and programming of a unit on a per unit basis.

3.13 Payment Terms

3.13.1 TO PRIME CONTRACTOR:

1) Invoices for items ordered, delivered, and accepted shall be submitted by the CONTRACTOR directly to the payment address shown on the purchase order/contract. All invoices shall show Montgomery County or state contract number and/or purchase order number; social security number (for individual contractors) or the federal employer identification number (for proprietorships, partnerships, and corporations).
2) Any payment terms requiring payment in less than 30 days will be regarded as requiring payment 30 days after invoice or delivery, whichever occurs last. This shall not affect offers of discounts for payment of less than 30 days, however.
3) All goods or services provided under this contract or purchase order, which are to be paid for with public funds, shall be billed by the Contractor at the contract price, regardless of which public agency is being billed.
4) The following shall be deemed to be the date of payment: the date of postmark in all cases where payment is made by mail, or the date of offset when offset proceedings have been instituted as authorized under the Virginia Debt Collection Act.

3.13.2 TO SUBCONTRACTORS:

1) A CONTRACTOR awarded a contract under this solicitation is hereby obligated:

a) To pay the subcontractor(s) within seven (7) days of the contractor's receipt of payment from the Commonwealth for the proportionate share of the payment received for work performed by the subcontractor(s) under the contract; or
b) To notify Montgomery County and the subcontractor(s), in writing, of the contractor's intention to withhold payment and the reason.
The contractor is obligated to pay the subcontractor(s) interest at the rate of one percent per month (unless otherwise provided under the terms of the contract) on all amounts owed by the contractor that remain unpaid seven (7) days following receipt of payment from the Commonwealth, except for amounts withheld as stated in b. above. The date of mailing of any payment by U.S. Mail is deemed to be payment to the addressee. These provisions apply to each sub-tier contractor performing under the primary contract. A contractor's obligation to pay an interest charge to a subcontractor may not be construed to be an obligation of the Commonwealth.

3.14 Price Guarantee / Escalation

The CONTRACTOR shall guarantee all prices quoted in the price proposal forms inclusive of contract discount, as negotiated, for equipment, accessories, and services. Prices shall not be increased through the end of the warranty period. This pricing, inclusive of discounts, shall govern all contract change orders.

The CONTRACTOR shall guarantee all prices quoted in the price proposal forms, as negotiated, for equipment, accessories, and services shall not increase at a rate higher than the U.S. Consumer Price Index for five (5) years after the end of the warranty period.

The CONTRACTOR shall guarantee all quoted pricing to Montgomery County beyond five (5) years after the end of the warranty period, shall be 25% lower than the prevailing negotiated home state contract.

3.15 Performance and Payment Bonds

A Performance Bond and a Labor and Material Payment Bond, each in a sum equal to 100% of the negotiated price and duly executed by the CONTRACTOR as principal and by a surety company qualified to do business under the laws of the Commonwealth of Virginia and satisfactory to Montgomery County as surety, will be required for the faithful performance of the contract, the payment from labor and materials, and for the guarantee and maintenance of the work. The prevailing industry standard AIA form is acceptable. The successful PROPOSER shall furnish the Performance and Labor and Material Payment Bonds within fifteen (15) days of the executed contract.

3.16 Transportation and Storage

By submitting their proposals, the PROPOSER certifies and warrants that the price(s) offered are for FOB Destination. The CONTRACTOR shall incur all transportation expenses and make all arrangements for transportation of equipment in suitable vehicles and by experienced and licensed equipment carriers. Supervision of packing, unpacking, detailed inventory, and placement of equipment

shall be furnished by the CONTRACTOR without charge to Montgomery County. The CONTRACTOR is fully responsible for the secure storage of all equipment from contract signing until system acceptance. Secure storage shall be at the expense of the CONTRACTOR.

3.17 Sales Tax Exemption

Sales to Montgomery County and the Commonwealth of Virginia are normally exempt from State sales tax, State sales and use tax certificates of exemption, Form ST-12, will be issued upon request. Deliveries against the contract shall be free of Federal excise and transportation taxes. The Commonwealth's excise tax exemption registration number is 54-73-0076K.

3.18 Contractual Claims

Contractual claims, whether for money or other relief, shall be submitted in writing to the Director of Purchasing, Montgomery County Purchasing Department, 755 Roanoke Street, Suite 2C, Christiansburg, Virginia 24073-3179, no later than sixty (60) days after final payment; however, written notice of the contractor's intention to file such claim shall have been given at the time of the occurrence or beginning of the work upon which the claim is based. Nothing herein shall preclude a contract from requiring submission of an invoice for final payment within a certain time after completion and acceptance of the work or acceptance of the goods. Pending claims shall not delay payment of amounts agreed due in the final payment (Code of Virginia, Section 2.2-4363). A contractor may not institute legal action prior to receipt of the Director of Purchasing's decision on the claim unless that office fails to render such decision within thirty (30) days. Failure of the County to render a decision within thirty (30) days shall not result in the contractor being awarded the relief claimed or in any other relief or penalty. The sole remedy for the County's failure to render a decision within thirty (30) shall be the contractor's right to institute immediate legal action. The decision of the Director of Purchasing shall be final and conclusive unless the contractor, within six (6) months of the date of the final decision on the claim, institutes legal action as provided in the Code of Virginia, Section 2.2-4364.

For good cause and as consideration for executing this contract, the PROPOSER acting herein by and through the person signing this Proposal on behalf of the PROPOSER as duly authorized agent, hereby conveys, sells, assigns, and transfers to Montgomery County all rights, title and interest in and to all causes of action it may now or hereafter acquire under the anti-trust laws of the United States and the State of Virginia, relating to the particular goods or services purchased or acquired by Montgomery County.

3.19 Termination for Convenience

Montgomery County may terminate the Contract at any time for its convenience upon sixty (60) days written notice to the other party. The CONTRACTOR shall be paid for reasonable and authorized services rendered/expenses incurred through the effective date of termination. In the event of termination, all documents and other materials related in the performance of the Contract shall become the property of Montgomery County.

3.20 Termination with Cause / Default

Montgomery County may terminate the contract for cause by sending written notice to the CONTRACTOR of CONTRACTOR'S default in the performance of any items of this agreement. Termination shall be without prejudice to any of Montgomery County's rights or remedies by law. In the event of termination, all documents and other materials related in the performance of the Contract shall become the property of Montgomery County.

Montgomery County, at its discretion, may provide the CONTRACTOR with thirty (30) or more days from the date notice is provided in which to cure the default. Upon failure of CONTRACTOR to cure the default, CONTRACTOR may immediately cancel and terminate this Agreement as of the date of notice. Termination shall be without prejudice to any of Montgomery County rights or remedies by law.

Upon termination, CONTRACTOR shall withdraw its personnel and equipment, cease performance of any further work under the Agreement, and turn over to Montgomery County any work in process for which payment has been or is willing to be made.

In the event of violations of law, safety or health standards and regulations, this Agreement may be immediately cancelled and terminated by Montgomery County. Termination shall be without prejudice to any of Montgomery County's rights or remedies by law.

3.21 Liquidated Damages

For each and every day the system shall fail to be complete, and the delay is attributable to CONTRACTORS's non-performance of its obligations under the Agreement; beyond the date set for Final System Acceptance and any extensions granted under the contract, the CONTRACTOR shall pay to Montgomery County the total amount of $2,500 per day as liquidated damages and not as a penalty. Liquidated damages may be deducted by Montgomery County from any money due or to become due to the CONTRACTOR as compensation under the contract. The total of Liquidated Damages shall not exceed ten percent 10% of the contract value. Montgomery County may, at its sole discretion, agree to a reasonable grace period prior to exercising liquidated damages.

3.22 Indemnity

The CONTRACTOR shall indemnify and save harmless Montgomery County and its officials and employees from all losses, claims, demands, payments, suits, actions, recoveries, and judgments of every nature and description brought or recoverable against Montgomery County, or by reason of any act or omission of the CONTRACTOR, its agent, or its employees, in the execution of the work, or in consequence of any negligence or carelessness in guarding the same, including all liability for, or growing out of any infringement of letter patent or copyright of the United States, in respect to the normal use of the proposed and installed system. Montgomery County will promptly give the CONTRACTOR notice of any such claim.

The CONTRACTOR shall assume all risk and bear any loss or injury to the property or persons occasioned by neglect or accident during the progress of work until the same shall be completed and accepted. The CONTRACTOR shall also assume all blame or loss by reason of neglect or violation by CONTRACTOR of any applicable state or federal law or municipal rule regulation, or order. The

CONTRACTOR shall give to the proper authorities all required notices relating to the work and shall be responsible for ensuring all official construction permits and licenses are obtained prior to the beginning of work, and for paying all proper fees. Montgomery County will sign permit requests as required and as submitted by the CONTRACTOR. The CONTRACTOR shall make good any damage that may have occurred to any adjoining building, structure, or utility by CONTRACTOR in consequence of this work. Montgomery County agrees to notify CONTRACTOR in writing as soon as practicable of any claim, demand, or cause of action for which Montgomery County will request indemnification from CONTRACTOR. Montgomery County will provide CONTRACTOR with the necessary information and assistance to defend or settle such claim, demand, or cause of action. The obligations of CONTRACTOR under this paragraph shall survive the expiration of this Agreement.

At no time shall CONTRACTOR permit any mechanics or similar liens to attach to Montgomery County's premises on account of labor or material furnished to PROPOSER or claimed to have been furnished to PROPOSER, in connection with its work hereunder.

3.23 Liability Insurance

The successful PROPOSER shall assume all risk and bear any loss or injury to the property or persons occasioned by neglect or accident during the progress of work until the same shall be completed and accepted. The CONTRACTOR shall also assume all blame or loss by reason of neglect or violation by CONTRACTOR of any state or federal law, Montgomery County or Virginia code, or municipal rule regulation, or order. The CONTRACTOR shall give to the proper authorities all required notices relating to the work and shall be responsible for ensuring all official construction permits and licenses are obtained prior to the beginning of work, and for paying all proper fees. Montgomery County will sign permit requests as required and as submitted by the CONTRACTOR. The CONTRACTOR shall make good any injury that may have occurred to any adjoining building, structure, or utility as a consequence of this work.

The successful PROPOSER shall carry public liability insurance in the amounts specified below, including the contractual liability assumed by the CONTRACTOR, and shall deliver a Certificate of Insurance to Montgomery County with a 30-calendar day cancellation notice provision from carriers acceptable to Montgomery County and licensed to do business in Virginia. The certificate shall be delivered in conjunction with delivery of the executed contract to Montgomery County.

A. Worker's Compensation and Employer's Liability

Coverage A - Statutory Requirements
Coverage B - $1,000,000 per Occurrence
Coverage C - $1,000,000 Accident and/or Disease
All States Endorsement

B. Automobile Liability, Including Owner, Non-Owner and Hired Car Coverage

$3,000,000 per accident to include Bodily Injury & Property Damage

C. Commercial General Liability

$4,000,000 per occurrence / $8,000,000 aggregate

Commercial General Liability is to include bodily injury and property damage, personal injury, advertising injury, contractual liability, and products and completed operations coverage. Montgomery County, their officers, employees, agents, and volunteers must be named as additional insurers and be endorsed on the policy, as evidenced by the certificate of insurance.

D. Professional Liability (Errors and Omissions)

$5,000,000 limit per claim and aggregate

E. Umbrella or Excess Liability Coverage Umbrella

Umbrella or Excess Liability Coverage Umbrella may be used to achieve the limits required. Coverage must be excess basis over required underlying coverages.

F. The following criteria shall apply to all applicable insurance coverage:

- shall be issued by an insurance carrier eligible to do business within the Commonwealth of Virginia and rated A – VII or better, by A. M. Best Company or equivalent rating from an alternate recognized ratings agency
- shall be kept in effect throughout performance of services
- shall be an occurrence-based policy, except for Professional Liability and Environmental Liability *(if required by special terms of the funding agency)*, which may be a Claims Made policy
- commercial general and professional liability shall include completed operations coverage
- shall contain a separation of insureds clause or endorsement (except for Environmental Liability). Insurance covering the included additional insured shall be primary and non-contributory, and all other insurance carried by the additional insureds shall be excess insurance for Commercial General Liability and Auto Liability
- the CONTRACTOR shall provide thirty (30) day cancellation notice for any of the above described policies.

3.24 Assignment

Assignment by the successful PROPOSER to any third party of any contract based on this RFP or any monies due shall be absolutely prohibited and will not be recognized by Montgomery County unless approved by Montgomery County in writing. Approval will not be unreasonably withheld.

3.25 News Release

The PROPOSER shall at no time make any news or advertising releases pertaining to this RFP for any purpose without the prior written approval of Purchasing Director and then only in coordination with Montgomery County.

3.26 Transfer of Title

The CONTRACTOR shall assume full risk of loss of, or damage to, and operational responsibility, whether or not covered by insurance, until Final System Acceptance by Montgomery County in writing of the System, excepting loss or damage caused by Montgomery County's negligence. Only upon written Final System Acceptance will Montgomery County assume responsibility for and take possession of the System. Under no circumstances shall any warranty begin until Final System Acceptance of the System by Montgomery County in writing.

Transfer of title may be effective upon delivery of Terminal equipment, provided delivery of Terminal equipment is authorized by Montgomery County in writing and Terminal equipment is delivered to the CONTRACTOR designated storage location. Risk of Loss to Terminal Hardware shall pass upon installation and/or programming of Terminal Hardware. Partial deliveries shall be permitted. Under no circumstances shall any warranty begin until Final System Acceptance of the system by Montgomery County in writing.

3.27 Nondiscrimination of Contractors

A PROPOSER or a contractor shall not be discriminated against in the solicitation or award of this contract because of race, religion, color, sex, national origin, age, or disability or against faith-based organizations. If the award of this contract is made to a faith-based organization and an individual, who applies for or receives goods, services, or disbursements provided pursuant to this contract objects to the religious character of the faith-based organization from which the individual receives or would receive the goods, services, or disbursements, the public body shall offer the individual, within a reasonable period of time after the date of his objection, access to equivalent goods, services, or disbursements from an alternative provider.

3.28 Non-Discrimination in Employment

By submitting their proposals, PROPOSERs certify to the Commonwealth that they will conform to the provisions of the Federal Civil Rights Act of 1964, as amended, as well as the Virginia Fair Employment Contracting Act of 1975, as amended, where applicable, the Virginians With Disabilities Act, the Americans With Disabilities Act, and Section 2.2-4311 of the Virginia Public Procurement Act. If the award is made to a faith-based organization, the organization shall not discriminate against any recipient of goods, services, or disbursements made pursuant to the contract on the basis of the recipient's religion, religious belief, refusal to participate in a religious practice, or on the basis of race, age, color, gender or national origin and shall be subject to the same rules as other organizations that contract with public bodies to account for the use of the funds provided; however, if the faith- based organization segregates public funds into separate accounts, only the accounts and programs funded

with public funds shall be subject to audit by the public body. (Code of Virginia, § 2.2-4343.1 E).

In every contract over $10,000 the provisions in A. below apply:

A. During the performance of this contract, the Contractor agrees as follows:

   1) The Contractor will not discriminate against any employee or applicant for employment because of race, religion, color, sex, national origin, age, disability, or any other basis prohibited by state law relating to discrimination in employment, except where there is a bona fide occupational qualification reasonably necessary to the normal operation of the Contractor. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the provision of this nondiscrimination clause.

   2) The Contractor, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, will state that such Contractor is an equal opportunity employer.

   3) Notices, advertisements, and solicitations placed in accordance with federal law, rule or regulation shall be deemed sufficient for the purpose of meeting the requirements of this Section.

B. The Contractor will include the provisions of A. above in every subcontract or purchase order over $10,000, so that the provisions will be binding upon each subcontractor or vendor.

3.29 Drug-Free workplace

In every contract over $10,000 the following provisions apply: During the performance of this contract, the CONTRACTOR agrees to (i) provide a drug-free workplace for the Contractor's employees; (ii) post in conspicuous places, available to employees and applicants for employment, a statement notifying employees that the unlawful manufacture, sale, distribution, dispensation, possession, or use of a controlled substance or marijuana is prohibited in the Contractor's workplace and specifying the actions that will be taken against employees for violations of such prohibition; (iii) state in all solicitations or advertisements for employees placed by or on behalf of the CONTRACTOR that the CONTRACTOR maintains a drug-free workplace; and (iv) include the provisions of the foregoing clauses in every subcontract or purchase order of over $10,000, so that the provisions will be binding upon each subcontractor or vendor.

For the purposes of this section, "*drug-free workplace*" means a site for the performance of work done in connection with a specific contract awarded to a CONTRACTOR the employees of whom are prohibited from engaging in the unlawful manufacture, sale, distribution, dispensation, possession or use of any controlled substance or marijuana during the performance of the contract.

3.30 EO/AA Statement

Montgomery County, an equal opportunity, affirmative action institution covered by presidential executive order 11246 as amended, advises all contractors, subcontractors, vendors, and suppliers

that direct receipt of federal funds may require appropriate action on their part.

3.31 Force Majeure

Neither party will be liable to the other for any failure or delay in rendering performance arising out of causes beyond its reasonable control and without its fault or negligence. Such causes may include, but are not limited to, acts of God or the public enemy, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes and unusually severe weather; but the failure or delay must be beyond reasonable control and without fault or negligence. If the CONTRACTOR's failure to perform is caused by the default of a subcontractor, and if such default arises out of causes beyond the reasonable control of both the CONTRACTOR and subcontractor, and without the fault or negligence of either of them, the CONTRACTOR shall not be liable for any excess costs for failure to perform, unless the equipment or services to be furnished by the subcontractor were obtainable from other sources in sufficient time to permit the PROPOSER to meet the required delivery schedule. Dates or time of performance will be extended to the extent of delays excused by this section, provided that the party whose performance is affected notifies the other promptly of the existence and nature of such delay.

3.32 Site Visits

It is mandatory for the PROPOSER to visit all sites offered for use in the proposed system. The PROPOSER shall have a person with site civil experience perform due diligence in assessing the over site conditions (access road, compound, fencing, etc.), shelter condition (inside and outside), tower condition, tower loading, antenna placement, and grounding. PROPOSER'S price proposal shall include all costs to bring all sites into compliance with the RFP requirements. Ignorance of site conditions shall not relieve the CONTRACTOR of any liability or obligations under the contract as agreed to by both parties.

3.33 Property Damage

The PROPOSER shall be responsible for verifying the completeness and suitability of all work or equipment proposed for this system. The CONTRACTOR shall provide any additional equipment or labor required to meet these specifications, without claim for additional payment, it being understood that a complete operating system is required.

The CONTRACTOR shall be responsible for designing, furnishing, and installing all required interfaces with existing systems and equipment, along with such interfaces as may be specified in the system specification, unless such interfaces are specifically excluded or ascribed to others in this specification. The CONTRACTOR shall be obligated to provide a system that meets all RFP requirements for the price contained therein, unless such requirement is revised by Montgomery County in writing.

3.34 Vendor's Manual

This contract is subject to the provisions of the Commonwealth of Virginia Vendor's Manual and any revisions thereto, which are hereby incorporated into this contract in their entirety. A copy of the manual is available from the Division of Purchases and Supply in Richmond, VA www.dgs.state.va.us/dps

3.35 Use of Brand Names

Unless otherwise provided in this solicitation; the name of a certain brand, make or manufacturer does not restrict PROPOSERs to the specific brand, make or manufacturer named, but conveys the general style, type, character, and quality of the article desired. Any article which Montgomery County in its sole discretion determines to be equal of that specified, considering quality, workmanship, economy of operation, and suitability for the purpose intended, shall be accepted. The PROPOSER is responsible to clearly and specifically indicate the product being offered and to provide sufficient descriptive literature, catalog cuts and technical detail to enable Montgomery County to determine if the product offered meets the requirements of the solicitation. This is required even if offering the exact brand, make or manufacturer specified. Normally in a sealed proposal only the information furnished with the proposal will be considered in the evaluation. Failure to furnish adequate data for evaluation purposes may result in declaring a proposal nonresponsive. Unless the PROPOSER clearly indicates in its proposal that the product offered is an "equal" product, such proposal will be considered to offer the brand name product referenced in the solicitation.

3.36 Equipment, Systems, Software, and Licenses

Any additional limitations, constraints, or warranties on all systems, equipment, software, and licenses provided shall not conflict with the requirements of this RFP. The PROPOSER shall only offer additional systems, equipment, and third-party software limitations or constraints that they are willing to negotiate with Montgomery County in good faith. All systems, equipment, and third-party software shall be supplied and warranted as suitable for the use intended by this RFP.

3.37 System Use before Acceptance

Montgomery County will not use any part of that system for operational use prior to conditional acceptance, other than for training and testing of the system. Conditional acceptance shall be on a system basis only. Once the Acceptance and Coverage Tests have been passed validating all significant functions, features, coverage, and Cutover has been successfully completed, Montgomery County will agree to Conditional Acceptance but will not pay the final milestone until Final Acceptance. Only when the CONTRACTOR has completed all contractual responsibilities and Montgomery County has approved all punch-list items, submittals, as-built drawings, training, maintenance manuals, etc. will Final System Acceptance be achieved.

It may become necessary however, because of unplanned events, for Montgomery County to use a part or all the system or a subsystem. Such use shall not constitute conditional acceptance unless it continues for 30 consecutive days at such time Montgomery County agrees to pay to support the system until warranty begins at final acceptance. The CONTRACTOR will be entitled to seek relief from any damages for delays which result from such unplanned use of the system or subsystems.

3.38 CONTRACTOR Responsibilities

The CONTRACTOR shall assume total responsibility for delivery, installation, acceptance, and warranty of all hardware, software, and engineering and support services offered in the Proposal, whether the PROPOSER is the manufacturer, producer, author, or supplier of them.

The CONTRACTOR may be required to provide information on its project personnel and subcontractors' personnel for criminal background checks and the issuance of temporary identification card. This requirement will be at the discretion of the site owner. Non-compliance with this RFP requirement may cause a stop work order and all resultant price delays shall be at the expense of the CONTRACTOR.

The CONTRACTOR's project manager shall be the sole point of contact regarding all contractual matters, including the performance, service, and payment of any and all charges resulting from the lease and installation of the entire system configuration, and all other services performed. Failure to meet these obligations shall result in the cancellation of any contracts.

3.39 System Responsibility

The PROPOSER shall be responsible for verifying the completeness and suitability of all work or equipment proposed for this system. The CONTRACTOR shall provide any additional equipment or labor required to meet these specifications, without claim for additional payment, it being understood that a complete operating system is required.

The CONTRACTOR shall be responsible for designing, furnishing, and installing all required interfaces with existing systems and equipment, along with such interfaces as may be specified in the system specification, unless such interfaces are specifically excluded or ascribed to others in this specification. The CONTRACTOR shall be obligated to provide a system that meets all RFP requirements for the price contained therein, unless such requirement is revised by Montgomery County in writing.

3.40 Re-Inspections / Re-Testing

If the CONTRACTOR notifies Montgomery County that a site, system, or subsystem is ready for inspection and/or testing at a *mutually agreed* time and place according to a *mutually agreed* test plan; and if the site, system, or subsystem is inspected and/or tested according to the agreed test plan; and if the site, system or subsystem fails the inspection and/or test and requires reinspection and/or retesting at a later date; all costs that may accrue to Montgomery County and Montgomery County representatives', including compensation at Montgomery County and Montgomery County representatives' published rates shall be borne by the CONTRACTOR. All direct expenses (including travel, lodging, meals, etc.) will comply with the current US General Services Administration (GSA) per diem rates and shall be borne by the CONTRACTOR. Testing and inspections shall include, if required by the RFP, but are not limited to: Detailed Design Review; Radio System Staging; Microwave Staging; Site Inspections; Equipment Inspections; Base Station Testing; Field Testing; Dispatch Equipment Testing; Interference Testing; System Acceptance Testing; Coverage Acceptance Testing.

4 Statement of Work

The statement of work applies to all systems, equipment, facilities, services, and software specified in this RFP. No work will begin on this project until NRVECRA has provided written Notice to Proceed (NTP).

4.1 Project Management

The CONTRACTOR shall have experience with projects of similar size and scope as the proposed system. Assigned personnel shall have qualifications and experience to perform their tasks for this project. Provide an organizational chart, names and resumes for the project manager, lead engineer and key positions, including significant subcontractors and their personnel.

4.1.1 Project Manager

The CONTRACTOR shall designate a single project manager to supervise and coordinate the CONTRACTOR's work and to act as the primary point of contact for all project-related issues. The CONTRACTOR's project manager shall direct the CONTRACTOR's personnel and subcontractors in the project and assist in resolving project problems.

The CONTRACTOR's project manager shall be available to NRVECRA between the hours of 8:00am and 4:00pm Monday through Friday, with exception of State and Federal holidays. The CONTRACTOR's project manager shall acknowledge NRVECRA and NRVECRA representative communications (email, text messages, and phone calls) with forty-eight (48) hours, unless the project manager is on official company leave, at which time a pre-approved substitute shall meet this requirement.

The CONTRACTOR shall provide the project manager's contact information after the NRVECRA issues the NTP within the timeframe identified in Table 4-1. The contact information shall include the following:

- Name
- Office phone number
- Cell phone number
- Email address

The CONTRACTOR shall notify NRVECRA and obtain written approval to replace the project manager. Provide name, resume and three (3) project references for proposed replacement project manager. NRVECRA has the right to reject any proposed project manager.

4.1.2 CONTRACTOR's Key Personnel

The CONTRACTOR shall provide each Key Personnel's names, resumes and three (3) project references for review and approval by NRVECRA. Once approved the CONTRACTOR shall

provide contact information within the timeframe identified in Table 4-1. The contact information shall include the following:

- Name
- Office phone number
- Cell phone number
- Email address

The CONTRACTOR's key personnel shall be available to NRVECRA between the hours of 8:00am and 4:00pm Monday through Friday, with exception of State and Federal holidays. The CONTRACTOR's key personnel shall acknowledge NRVECRA and NRVECRA representative communications (email, text messages, and phone calls) with forty-eight (48) hours, unless the key personnel are on official company leave, at which time a pre-approved substitute shall meet this requirement.

The CONTRACTOR shall notify NRVECRA to replace key personnel assigned to the project. Provide names, resumes and three (3) project references for proposed replacement personnel. NRVECRA has the right to reject proposed key personnel.

4.1.3 Subcontractors

The CONTRACTOR shall be responsible for all work performed by subcontractors. The CONTRACTOR shall notify NRVECRA prior to procuring subcontractor(s) to perform tasks and/or provide equipment on the project. *The PROPOSER shall identify all known subcontractors, and the work they will complete, in the proposal*. NRVECRA has the right to reject proposed subcontractors.

4.1.4 CONTRACTOR Registration

Firms performing construction work on behalf of the CONTRACTOR shall be licensed with the appropriate authorities. The firms shall be licensed at the time of the submission of the Proposal and must remain licensed through the completion of the work.

The CONTRACTOR and its subcontractors shall have all federal, state, and local licenses necessary to do the work, and shall remain licensed through the completion of the work.

4.1.5 Project Management Plan

4.1.5.1 Project Schedule

The PROPOSER shall provide a preliminary detailed project schedule that reflects all work described in the submitted proposal. The proposed project schedule shall be displayed as a Linked Gantt Chart and include the following information: ID number, Task Name, Task Duration, Start Date, Finish Date, Dependencies, and stacked bar timeline. The project critical path shall be clearly identified on the preliminary project schedule.

The CONTRACTOR shall maintain a Microsoft Project master project schedule for the design, implementation, and acceptance of the system. The master project schedule shall contain all project activities that are the responsibility of the CONTRACTOR, NRVECRA, and NRVECRA's Representative to ensure successful design, implementation, and acceptance of the system. The CONTRACTOR shall provide a baseline project schedule within the timeframe identified in Table 4-1.

The initial project schedule shall be presented at the Project Kickoff Meeting and once approved by all parties shall be saved as the Project Baseline Schedule. This will be used as the starting point and as the performance metric comparing actual dates.

The CONTRACTOR shall provide an updated master project schedule, in PDF and native Microsoft Project *each month*, as part of the monthly project status report. The updated master project schedule shall reflect actual task completion dates and revisions to future dates based upon the dates of the completed tasks.

The project schedule shall clearly display a breakdown of each task, including the following details:

- Planned Start and End dates
- Actual State and End Dates
- Percentage completed
- Predecessors and Successors
- Responsibility (CONTRACTOR, NRVECRA, and NRVECRA's Representative)
- Critical path

The schedule for the implementation of each communications system site shall be broken out separately on the master project schedule.

4.1.5.2 Project Review Meetings and Teleconferences

The CONTRACTOR shall conduct monthly project review meetings, or video conferences, beginning with the Project Kickoff Meeting until Final System Acceptance. NRVECRA shall determine when a video conference may replace an in person meeting.

The CONTRACTOR shall organize and conduct regular video conferences between scheduled review meetings if the team deems necessary.

NRVECRA's Representative will provide a virtual meeting platform and inform the PROJECT TEAM members of the call-in number, Web URL, and access codes. The CONTRACTOR shall utilize this virtual meeting platform for all PROJECT TEAM meetings.

The CONTRACTOR shall provide an agenda to all invitees at least forty-eight (48) hours prior to the meeting or video conference. Agenda Items shall include as a minimum:

- Review project status

- Review project schedule
- Review action items, completed, in progress, to be completed next period, new action items
- Identified red flag items and resolutions
- Plans for the next period
- Date and time of next meeting or teleconference

The CONTRACTOR shall provide minutes to all attendees and PROJECT TEAM members five (5) business days after the conclusion of the meeting or teleconference.

4.1.5.3 Action Item List

NRVECRA's Representative will develop and maintain an action item list. The action item list shall include the following items:

- Item Number
- Date Assigned
- Site Name
- Description of the Item
- Responsible Entity
- Assigned Person
- Priority
- Due Date
- Date Completed
- Resolution / Transmittal #

4.1.5.4 Project Status Reports

The CONTRACTOR shall submit monthly project status reports to NRVECRA within five (5) days after the end of the month for the duration of the project. Monthly status reports shall follow this general outline:

- Activities completed during the previous month
- Activities planned or scheduled the next month
- High level updated project schedule (Full schedule in PDF attached to the report)
- Critical action items (Full list in PDF attached to the report)
- Red flag items / Risk Issues
- Punch list items

4.1.5.5 Submittals

The CONTRACTOR shall provide project submittals according to the submittal schedule. A preliminary submittal schedule is found in Table 4-1 (calendar days unless specifically listed business days). Each of the submittal items below shall be included in the Proposer's responsibilities matrix.

NRVECRA's Representative will maintain the submittal schedule to identify project deliverables are submitted timely and are complete. The schedule will include the following for each item:

- RFP or contract reference
- Document description
- Scheduled submittal date
- Actual submittal date
- Approval date
- Notes

RFP Section	Submittal	Scheduled Delivery Date
4.1.1	Project Manager's contact information	Fifteen (15) days after NTP
4.1.2	Key Personnel contact information	Fifteen (15) days after NTP
4.1.3	Subcontractor	Thirty (30) days prior to engaging subcontractor
4.1.5.1	Baseline Project Schedule	Thirty (30) days after Project Kickoff Meeting
4.2.1	Contract Design Review (CDR) Meeting	Thirty (30) days after Project Kickoff Meeting
4.2.2	Detailed Design Review (DDR) Meeting	One hundred fifty (150) days after NTP
4.2.2	Detailed Design Documentation	Fifteen (10) business days prior to DDR
4.3.15	FCC Licenses Application(s)	Thirty (30) days after path surveys
9.11.12	FAA Notifications	Sixty (60) days after Approved DDR
9.15	Grounding Plan Documentation	Sixty (60) days after Approved DDR
9.10.4	Concrete Testing Results	Forty-five (45) days after collection of concrete samples
4.3.19	Final Connectivity Network Field Acceptance Test Plan	Thirty (30) days prior to the Connectivity Network Staging Test
4.3.18	Final Radio System Acceptance Test Plan	Thirty (30) days prior to the Factory staging tests
4.3.17	Fleet Mapping Plan	Six (6) months prior to radio system cutover
4.3.16	Interference Analysis and Mitigation	Thirty (30) days after Installation of Radio Equipment
4.4.6	Acceptance Test Results	Thirty (30) days after Acceptance Testing

5.8.4	Statement of Compliance with Electromagnetic Exposure limits	Ten (10) days prior to acceptance testing at a site
4.3.19	Final Connectivity Network Field Acceptance Test Plan	Thirty (30) days prior to the Connectivity Network Field Testing
4.4.2	Connectivity Network Acceptance Test Report & Punch List	Fifteen (15) days after completion of connectivity network testing. When reviewed test report and punch list resolved, NRVECRA will approve.
4.3.18	Final Radio System Field Acceptance Test Plan	Thirty (30) days prior to the Radio System Field Testing
4.4.3	Radio System Acceptance Test Report & Punch List	Thirty (30) days after completion of radio system testing. When reviewed test report and punch list resolved, NRVECRA will approve.
4.4.8	Final Cutover Plan	Thirty (30) days prior Cutover
6.2.3.1	Self-Interference Test	Twenty-one (21) days prior to acceptance testing, submit test results for each channel at each site
4.7.2	Training Materials	Sixty (60) days prior to the beginning of class sessions
4.6.4	Subscriber Documentation	Fifteen (15) days prior to subscriber training
4.6.1	Standard Manuals	Thirty (30) days prior Cutover
4.6.2	Physical Facilities As-Built Documentation	Drafts – at the beginning of the thirty (30)-day performance period Finals – thirty (30) days after cutover
4.6.3	System Maintenance Documentation	at the beginning of the thirty (30)-day performance period
3.32	Damage Release Form	Fifteen (15) days prior Final System Acceptance

Table 4-1 Submittal Schedule

4.1.5.6 Transmittals

The CONTRACTOR shall assign a unique transmittal identification number to each submittal listed in Table 4-1 and to other significant project-related documentation, such as important memoranda, requests for approval, reports, and change order requests. The transmittal ID number shall consist of an identifier for the sending party and a consecutive serial number for the transmittal. Each transmittal shall include the following information:

- Transmittal ID number
- Date
- Sender
- Organization
- Recipient(s)

- Subject
- List of documents delivered

The CONTRACTOR shall maintain a log of its transmittals and shall include it with the monthly project status report.

4.1.5.7 Project Documentation

The CONTRACTOR shall provide and maintain all the project documentation, sharing it with the PROJECT TEAM from the beginning to System Acceptance and Cutover. At the end of the project, the CONTRACTOR will hand-off to NRVECRA for future maintenance, all project documentation pertinent to the definition and implementation of this project, e.g. submittals, transmittals, schedules, agendas, charts, data, diagrams, drawings, photographs, maps, emails, licenses, manuals, minutes, permits, procedures, reports, spreadsheets, text files, written plans, etc. shall be provided in soft copy (and PDF at NRVECRAs request) and supplied without copy protection. When appropriate, documentation shall be professionally bound in three-ring binders with section tabs and a table of contents. When submitted for approval or information, documents shall be clearly marked with the name of this project, date, and other tracking information, e.g. contract information, site name and/or drawing/document number. NRVECRA's Representative will provide a Web-based "cloud drive" to safely store and share documents, drawings, maps, photos with all members from the PROJECT TEAM. This Web-based "cloud drive" shall be used by the CONTRACTOR to store all project documentation.

4.1.5.8 Risk Management

The CONTRACTOR shall identify and assess potential risks to the Project and notify the PROJECT TEAM by including these potential risks under the Red Flag item on the Monthly Status Report. If a risk item develops into a problem, it should be placed on the action item list to determine its status, impact, and the responsible party.

4.1.5.9 Change Orders

If a Change Order is required as stated in the RFP Terms and Conditions, the CONTRACTOR shall submit change order requests to NRVECRA representatives. A separate change order for each request shall include:

- Customer name
- Project number and title
- Issue date
- Tracking number
- CONTRACTOR name
- Reason for change
- Description of change
- Cost impact
- Schedule impact

- Operational or performance impact

All price revisions shall be provided using the Contract Exhibit B Price Pages document. The Contract Exhibit B Payment Milestones structure shall not be altered.

No changes to the work shall commence until the change order request has been approved by the NRVECRA in writing via a Contract Amendment.

4.1.5.10 Punch List

The CONTRACTOR shall establish and maintain a punch list for inspections, staging tests, field tests and acceptance tests. The list will be published monthly to include a sequential punch list item number, site reference, date identified, description of the item, resolution date, and notes. NRVECRA / NRVECRA's Representative will be responsible to review and approve the resolution of each item.

4.2 Planning and Design

The CONTRACTOR shall design, engineer, furnish, install, configure, test, and warranty the systems, equipment and software required by the technical specifications of this RFP. Supply all equipment, software, and services necessary to provide a complete and operational communications system.

4.2.1 Contract Design Review Meeting

The CONTRACTOR shall proceed with project plans and design activities after receiving written NTP.

The CONTRACTOR shall conduct the Contract Design Review (CDR) at a location provided by NRVECRA for the PROJECT TEAM within twenty (20) days after NTP. The following items shall be discussed at the CDR meeting:

- Introduce Project Team Members and Subcontractors
- Implementation Plan
  - Project Communications Process
  - Project Review Meetings Process & Schedule
  - Action Item Checklist Process
- Project Management Plan
  - Project review meetings schedule
  - Risk Management
  - Submittals
  - Punch lists
  - Project status reports
- Project Overview
  - Design Plan
  - Sites Information

  - Schedule for site design visits/ surveys (prior to DDR): it is the expectation of NRVECRA that site visits shall be limited to two (2) visits, inclusive of physical facilities, radio, and connectivity personnel.
  - Baseline Schedule
- Detailed Design Review (DDR) Content / Tentative Date

4.2.2 Detailed Design Review (DDR)

The CONTRACTOR shall conduct the Detailed Design Review (DDR) for the PROJECT TEAM, at a location provided by NRVECRA and within the timeframe identified in Table 4-1. The DDR is expected to be a single event, lasting two (2) days. If the DDR is not completed during the agreed upon scheduled visit, all costs for attending an additional DDR, including those incurred by NRVECRA for its personnel, NRVECRA's Representative and other CONTRACTORS, and any direct expenses (including travel, lodging, meals, etc.), shall be borne by the CONTRACTOR.

The following items are required at the DDR:

- Project Schedule
- Radio System Technical Design
  - System Configuration
    - System Overview Block Diagrams
    - Interoperability Block Diagrams
  - System Operations – Features & Functions
  - Coverage Maps
  - Traffic Loading Analysis
  - Frequency and Combiner Plan
  - Alarm System Plan
  - System Control and Management
  - Failure / Bypass Modes
- List of Deliverables Equipment for each Site (including spare equipment)
- Network Connection Plan / Backhaul Requirements
- Site Design (Physical Facilities)
  - Site Plans
    - Site Plot Drawing
    - Site Access
    - Site Grounding
  - Towers Elevation and Plans
    - Tower Structural Analysis
    - Antenna Placement Diagrams (include Microwave antennas)
  - Building / Shelter Plans
    - Floor plans and Dimensions
    - Equipment Rack Elevations

    - Electrical System Design
    - AC power and BTU Requirements
    - UPS and / or DC Power System
    - Generator
    - Grounding and Surge Protection
    - HVAC
    - Fire detection
- Connectivity Network
  - Network Topology Diagrams
  - Path Survey Reports (photographs, figures, profile paths, data sheets, calculations)
  - Fiber optic maps
- Interfaces (between radio system, connectivity network and facilities)
- FCC Licenses (Radio System and Microwave System)
- NRV 9-1-1 Center
  - Emergency Communications Center (ECC) Block Diagram to include Backup radios
  - Console Configuration Plan
  - Logging Recorder Connectivity Plan
- Draft Acceptance Test Plans
  - Radio Staging
  - Microwave/Connectivity Network Staging
  - Radio System (Field test)
  - Microwave/Connectivity Network (Field test)
  - Coverage (Field Drive Test)
  - 30 Day Operational Test
  - Cutover Plan
- Subscribers
- Fleet Mapping
- Training Plans

The CONTRACTOR shall prepare and submit the above referenced detailed design documentation to the PROJECT TEAM in soft copy within the timeframe identified in Table 4-1. The CONTRACTOR shall prepare and submit three (3) hard copies of the above-referenced detailed design documentation to the PROJECT TEAM at the DDR. Each hard copy shall be provided in a 3-ring binder. Large scale drawings shall be folded to fit in the 3-ring binder.

The PROJECT TEAM will return comments within ten (10) business days after the DDR. The CONTRACTOR shall make appropriate changes within fifteen (15) business days after receiving the PROJECT TEAM's comments. Once all comments have been resolved to the satisfaction of the PROJECT TEAM, NRVECRA will approve the DDR, or may approve separately each subsystem, site, equipment, and/or functions prior to manufacturing and/or procuring by the CONTRACTOR.

4.3 Implementation

4.3.1 Permits and Licensing

The CONTRACTOR is responsible for obtaining the appropriate federal, state, and local zoning, environmental, special use and construction approvals, permits and licenses necessary for the construction of physical facilities. The CONTRACTOR shall pay all fees and costs associated with obtaining all approvals, permits and licenses.

4.3.2 SHPO and NEPA Studies

The CONTRACTOR shall perform SHPO and NEPA studies where required for selected sites. A realistic timeframe for completion of this effort shall be specifically integrated into the project schedule.

4.3.3 Coordination with NRVECRA's Operations

The CONTRACTOR shall coordinate all work with NRVECRA's operating and scheduling requirements. It may be required that certain tasks, such as installation, testing and/or cutover, need to be performed outside NRVECRA's normal working hours.

4.3.4 MANDATORY OPTION: Consoles First Implementation

As an option, the proposer should provide a detailed timeline and additional cost for implementing the new P25 consoles ahead of the radio system implementation. The existing consoles at NRV 9-1-1 are currently at the end of their maintainable life. Replacement parts for the consoles are getting increasingly expensive and difficult to obtain.

The PROPOSER shall provide a detailed schedule, additional cost information, and a technical description of the implementation of new consoles before the radio system implementation is completed. The proposed console for this option will need to integrate with the existing legacy analog conventional radio systems that are used by NRVECRA public safety agencies today. The consoles must also be capable of operating on both the existing NRVECRA radio systems and the new P25 radio system simultaneously during the cutover to the new radio system.

4.3.5 Infrastructure Equipment Orders

The CONTRACTOR shall submit factory orders and/or purchase material orders for infrastructure equipment only after NRVECRA has approved, in writing, the detailed system design and authorized factory or material orders. NRVECRA accepts no responsibility for infrastructure equipment orders placed prior to approval of the detailed design.

4.3.6 Subscriber Equipment Orders

Except for a nominal quantity for testing purposes, subscriber equipment and accessories shall not be ordered until after the successful completion of factory staging tests and NRVECRA has authorized, in writing, the CONTRACTOR to proceed with subscriber equipment orders. Under

no circumstances will NRVECRA accept subscribers placed in storage at the convenience of the CONTRACTOR.

4.3.7 Relocation of Existing Equipment

The CONTRACTOR shall assist NRVECRA to identify existing equipment that must be relocated to accommodate new equipment required by this RFP. The CONTRACTOR shall pay any expenses related to existing equipment relocation or disposition of property. If any, relocation of existing equipment must be approved by NRVECRA prior to relocating.

4.3.8 Equipment, Systems and Software

The CONTRACTOR shall furnish all systems, equipment, and software required by this RFP. Any additional limitations or constraints on all systems, equipment, and software provided shall not conflict with the requirements of this RFP.

The CONTRACTOR shall provide all proprietary and third-party software necessary for overall system operation, including, but not limited to, all interface protocols, interoperability protocols, backbone and network interconnections, auxiliary equipment, subsystem interfaces and communications links. The CONTRACTOR shall only provide additional systems, equipment, and proprietary and third-party software limitations or constraints that they are willing to negotiate with NRVECRA in good faith.

4.3.9 Installation

The CONTRACTOR shall install all systems, equipment and software required by this RFP. The CONTRACTOR shall leave all sites in a neat, presentable condition throughout the project. The CONTRACTOR shall remove all rubbish, temporary structures, and equipment generated or used by the CONTRACTOR after installation and prior to acceptance.

4.3.10 Legacy Equipment Decommissioning

4.3.10.1 Legacy Equipment Decommissioning - Infrastructure

The CONTRACTOR shall remove and dispose of decommissioned infrastructure to include shelters, towers, antennas & lines, and legacy radio, paging, and microwave equipment.

4.3.10.2 Legacy Equipment Decommissioning - Subscribers

The CONTRACTOR shall remove decommissioned subscribers to include mobiles, control stations, and antennas and deliver to a designated NRVECRA storage location.

4.3.11 Electrical Power

The CONTRACTOR shall pay all installation fees for electric power (temporary or permanent) and electric bills until system cutover, for any site where NRVECRA does not have existing electrical service.

4.3.11.1 Existing Electric Service

Location of all existing utilities shall be verified before site work begins. Existing utilities must be protected during site work.

4.3.11.2 New Electric Service

Temporary electric service may be necessary for site development. Temporary service must be coordinated and obtained through the local electric utility. Permanent electric service is preferred to be underground.

4.3.12 Inspect Excavations

The CONTRACTOR shall notify NRVECRA and the PROJECT TEAM of any excavation at a site fifteen (15) days prior to completion of the excavation. NRVECRA and the PROJECT TEAM reserves the right to inspect excavations, rock, socket, and reinforcement placement.

4.3.13 Existing AM Radio Station Towers

The CONTRACTOR shall ensure tower construction or alteration shall not disturb the antenna radiation patterns of existing AM broadcast stations.

At the detailed design review, the CONTRACTOR shall provide a report of its initial survey identifying all sites requiring tower construction or alteration that are within one (1) mi of existing non-directional AM stations and within three (3) miles of directional AM stations.

The CONTRACTOR is responsible for the pre-construction analysis. The CONTRACTOR will provide a cost estimate and scope of work for any required remediation of interference and post-detuning testing resulting from the construction or alteration.

The CONTRACTOR shall provide documentation for each site, prior to inspection, either guaranteeing no interference with existing broadcast antenna patterns, or detailing the tower detuning required and the test results confirming that detuning corrected the problem.

4.3.14 Generator Maintenance and Service

The CONTRACTOR shall conduct routine maintenance and operational testing of backup/standby generators until System Acceptance. Following installation, backup/standby generators shall be exercised to at least 30 percent (30%) of nameplate rating for sixty (60) minutes, at least once per month.

After the successful completion of the thirty (30)-day performance test, provide a "preventive maintenance" service contract to NRVECRA for a period of one (1) year starting on the day of Final System Acceptance. The contract shall include all routine preventive maintenance required by the manufacturer, with the exception that weekly and monthly inspections of batteries will be excluded.

4.3.15 MANDATORY OPTION: Frequency Licensing

The CONTRACTOR shall select frequencies, prepare (Regional Planning Committee documentation, if required, and) FCC license application. NRVECRA will sign and submit (Regional Plan documentation,) FCC application and pay coordination and license fees.

The CONTRACTOR shall perform any modification to existing FCC licenses, planning for the new radio system, that will require coordination and preparation of FCC applications, submittals, and documentation.

4.3.16 Interference Analysis and Mitigation

The CONTRACTOR shall verify that all CONTRACTOR installed equipment is operating within the bounds of NRVECRA's FCC license, regulations, and published equipment specifications upon completion of system installation.

Prior to installation, the CONTRACTOR shall identify equipment and analyze collocated RF equipment to discover potential sources of intermodulation, spurious emissions, transmitter noise or receiver desensitization that may affect the new system. The CONTRACTOR shall provide a report on this interference analysis, within the timeframe identified in Table 4-1 and include a description of recommended steps NRVECRA can take to minimize potential interference.

The CONTRACTOR shall be responsible for resolving interference, due to existing collocated equipment, at no cost to NRVECRA if **all** the following criteria are met:

- the interference is reported before final system acceptance
- the equipment causing the interference was installed and licensed prior to the installation of the CONTRACTOR'S equipment
- the collocated equipment is operating within the bounds of its license, FCC regulations and published equipment specifications

If **all** of the prior conditions are not met, the CONTRACTOR shall *cooperate* with the NRVECRA to resolve identified interference to or from collocated equipment; and the Contractor and NRVECRA will execute a mutually agreeable change order to remedy the interference.

If the Radio System coverage and performance are subject to degradation or disruption due to anomalous propagation and interference by natural phenomena or other radio Systems ("Outside

Interference"), beyond that which the CONTRACTOR should reasonably have anticipated based upon best RF engineering practices and further described in this section, the CONTRACTOR shall not be held responsible for the Outside Interference. In the event of a case of degradation or disruption due to Outside Interference by natural phenomena or an outside party, as described in this paragraph, the CONTRACTOR shall cooperate with NRVECRA to resolve the interference; and the Contractor and NRVECRA will execute a mutually agreeable change order to remedy the interference.

4.3.17 Fleet Mapping

The CONTRACTOR shall assist NRVECRA in developing a fleet map for the radio system, with unique templates for each department or agency. NRVECRA will be responsible for establishing standard operating procedures. The CONTRACTOR shall provide a preliminary fleet map plan to NRVECRA within the timeframe identified in Table 4-1.

4.3.18 Final Radio System Acceptance Test Plan

The CONTRACTOR shall provide the final Radio System Acceptance Test Plan (ATP) to the PROJECT TEAM within the timeframe identified in Table 4-1. The testing shall demonstrate proper operation of system features and functions, including fault management functions. All subsystems and equipment shall be exercised during acceptance testing. Tests that cannot be performed at staging should be labeled in the test plan as "Field Test".

This test plan will be repeated for the Field Radio System Acceptance Test, with the addition of any tests labeled "Field Test".

4.3.19 Final Connectivity Network Field Acceptance Test Plan

The CONTRACTOR shall provide the Final Connectivity Network Field Acceptance Test Plan within the timeframe identified in Table 4-1. The CONTRACTOR shall perform careful testing to ensure that the RF path performance and end-to-end voice/data circuit performance requirements are measured and documented. The end-to-end performance tests shall specifically include BER and packet data tests in normal and protected configurations. Tests that cannot be performed at staging should be labeled in the test plan as "Field Test".

This test plan will be repeated for the Field Connectivity Network Acceptance Test, with the addition of any tests labeled "Field Test".

4.3.20 Radio System Staging

The CONTRACTOR shall notify NRVECRA at least ninety (90) days prior to the radio factory staging. The staging tests shall not begin until NRVECRA has approved the final ATP. Staging is expected to be one (1) event, lasting not more than three (3) days.

NRVECRA's representatives will inspect the radio system equipment and witness the radio staging system tests. At completion of the radio system tests, the CONTRACTOR shall provide the following:

- Authenticated and dated equipment inspection and test documentation, notes and three (3) signatures (or initials) for two (2) NRVECRA's representatives and the CONTRACTOR for each test procedure and the results
- A punch list from failed tests and resolution
- When the punch list is satisfied, the NRVECRA will approve the Radio System Staging Test

These staging tests shall become the baseline for tests and measurements performed after field installation, to allow item-by-item comparisons.

4.3.21 Connectivity Network / Microwave Staging

The CONTRACTOR shall notify NRVECRA at least sixty (60) days prior to the factory staging for Connectivity Network/ Microwave. The staging tests shall not begin until NRVECRA has approved the final ATP. Staging is expected to be one (1) event, lasting not more than three (3) days.

NRVECRA's representatives will inspect the Connectivity Network/ Microwave equipment and witness the Connectivity Network/ Microwave staging tests. At completion of the Connectivity Network/ Microwave staging tests, the CONTRACTOR shall provide the following:

- Authenticated and dated equipment inspection and test documentation dated, notes and three (3) signatures (or initials) for two (2) NRVECRA's representatives and the CONTRACTOR for each test procedure and the results
- A punch list from failed tests and resolution
- When the punch list is satisfied, NRVECRA will approve factory equipment and the staging tests

These staging tests shall become the baseline for tests and measurements performed after field installation, to allow item-by-item comparisons.

4.3.22 Shipment and Storage

Upon successful completion of staging tests, and after notification that sites are ready to install fixed network equipment, NRVECRA will authorize the CONTRACTOR to ship equipment to the radio sites.

4.4 System Acceptance

4.4.1 Inspections

NRVECRA will conduct site inspections during construction and a Final Inspection at each site. Deficiencies identified by inspections will be recorded as punch list items.

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4.4.1.1 Facility Inspection and Testing

The CONTRACTOR shall notify the PROJECT TEAM when physical facilities will be complete and ready for inspection at a site prior to installation of infrastructure equipment. All site, building, fence, parking, commercial power, backup power, HVAC, grounding, and tower construction shall be installed in a neat and workman-like fashion in compliance with applicable standards.

The CONTRACTOR shall conduct tests for all facility operations at each site, including testing generator and automatic transfer switch, fire alarm system, HVAC operations, minor and major alarms, etc. NRVECRA's representatives will inspect each site, witness testing operations, and update the project punch list.

4.4.1.2 Final Inspection of Radio Equipment

The CONTRACTOR shall notify the PROJECT TEAM when radio / connectivity infrastructure equipment installation and configuration is complete. NRVECRA's representatives will inspect equipment installation and prepare a punch list of items required.

The CONTRACTOR shall respond to and resolve punch list items before acceptance testing begins. Exceptions may be waived for punch list items that do not affect radio system performance. NRVECRA's representatives will record resolution of punch list items.

4.4.2 Connectivity Network Acceptance Testing

Final acceptance testing shall include the same tests as staging and any additional tests that could not be conducted during staging, such as testing involved in existing or new fiber-optic circuits.

Upon completion of installation and final alignment, the CONTRACTOR will perform and record data in accordance with the collection/analysis process agreed to in the ATP for the same type of equipment tests as were made at staging, so long as they are not exclusive staging type tests. Additional tests shall be required for equipment not tested at the factory or staging area, including the following:

- Battery/Charger Equipment
- Antenna System Equipment
- Fiber-optic links
- Microwave path tests
- Microwave system end-to-end verification
- Loopback testing between sites
- Leased connectivity line testing
- Fiber Link End-to-End Verification
- Optical Transport Acceptance Tests

NRVECRA's representatives will inspect the equipment and witness the field acceptance tests. At completion of the connectivity network acceptance tests, the CONTRACTOR shall provide the following:

- Installed equipment inspection and test documentation dated, notes and three (3) signatures (or initials) for two (2) NRVECRA representatives and the CONTRACTOR for each test procedure and the results.
- A punch list from failed tests and resolution.
- When the punch list is satisfied, the NRVECRA will approve the connectivity network acceptance tests.

All documentation should be provided to the NRVECRA within the timeframe identified in Table 4-1.

4.4.3 Radio System Acceptance Testing

4.4.3.1 Base Station Tests

The CONTRACTOR shall perform base station tests after equipment installation, configuration, and submit test results twenty-one (21) days prior to acceptance testing. Base station tests shall include:

- Transmitter frequency
- Transmitter deviation or modulation integrity
- Transmitter forward and reflected power
- Combiner forward and reflected power
- Receiver frequency
- Receiver static (unfaded) sensitivity for each channel
- Local operating controls

If the system includes satellite receivers, the Contractor shall perform the receiver tests, and submit results as well.

NRVECRA will randomly select base stations and receivers to witness re-tests and confirm results. If any test fails, a punch list may require resolution before continuing the Acceptance Tests.

4.4.3.2 Radio System Field Acceptance Testing

The CONTRACTOR shall perform the radio system acceptance test after the ATP has been approved by NRVECRA and after installation with resolved punch list items. NRVECRA's representatives will inspect the equipment and witness the field acceptance tests. At completion of the radio system acceptance tests, the CONTRACTOR shall provide the following:

- Installed equipment inspection and test documentation dated, notes and three (3) signatures (or initials) for two (2) NRVECRA representatives and the CONTRACTOR for each test procedure and the results.
- A punch list from failed tests and resolution.
- When the punch list is satisfied, NRVECRA will approve the radio system acceptance tests.

All documentation should be provided to NRVECRA within the timeframe identified in Table 4-1.

4.4.3.3 Failure Mode Testing

The CONTRACTOR shall demonstrate failure mode operation of the system during acceptance testing. All equipment and components, both main and standby, shall be exercised during testing.

All standard system functions and failure modes, including continued system operation during major failures, shall be demonstrated. Alarm functions shall also be demonstrated.

4.4.3.4 Simulcast Alignment Testing

After the simulcast system has been properly aligned, the CONTRACTOR shall perform a voice test to verify proper alignment.

The CONTRACTOR shall provide maps of predicted coverage overlap areas. A test drive route shall indicate an adequate sampling within these areas. All sites shall be keyed continuously on a single channel, which is modulated with a common audio signal.

4.4.4 Coverage Acceptance Testing

The CONTRACTOR shall submit the draft Coverage Acceptance Test Plan (CATP) as part of the DDR documentation, within the timeframe identified in Table 4-1. The PROJECT TEAM will review the CATP, and the NRVECRA will approve the CATP at least sixty (60) days prior to beginning coverage acceptance testing.

Coverage testing shall be performed during full foliage between May 15 and September 15.

The CATP shall use a voice test to determine passing or failing. The CONTRACTOR may measure signal strength and bit error rate (BER), but this data will only be used "for information" and will not affect the Coverage Acceptance Test.

Based on the CONTRACTOR's input, each service area will be divided into a grid pattern with test tiles and use the TSB-88 Estimate of Proportions analysis to determine the number and size of the test tiles to ensure a statistically valid result for each service area.
Tests will be performed for both talk-in and talk-out directions. Talk-in and talk-out results will be scored separately and provided as separate statistics.

Tests will be performed while in motion.

In each test tile, a single attempt to access the system will be made by pressing the push-to-talk button (automatic re-tries are allowed). If the test radio does not receive a channel grant tone in that tile, the access test for that location has failed.

Testing will be performed using mobile radios provided by the CONTRACTOR under the Contract. Where the coverage requirement is for portable service area, attenuators and (if necessary) circulators will be used to emulate the portable radios mounted on the hip.

The scoring shall be conducted by a voting "team" consisting of one (1) representative each from NRVECRA, NRVECRA's Representatives, and the CONTRACTOR. The three (3) voting representatives will each listen to the message for each test tile. Two (2) out of three (3) votes shall determine whether a test tile is passed or failed.

The "field team" will test the talk-out path requiring three (3) voting representatives (the NRVECRA, NRVECRA's Representatives, and CONTRACTOR) inside the vehicle, and a driver. The driver is ineligible to vote unless they are the official NRVECRA representative.

The "base team" will test the talk-in path requiring three (3) voting representatives (NRVECRA, NRVECRA's Representatives, CONTRACTOR) at the NRV 9-1-1 Center with an IP Console or a control station.

To "Pass" a test tile, you must be able to understand the entire test message. The Team will vote "Fail" for that test tile if the entire message was not understandable. If a word within the message is missing and changes the meaning of the message, the message will be deemed not understandable.

The voice test messages must be spoken clearly with good diction, using unique sentences or phrases with six (6) to fifteen (15) words taking about three (3) to eight (8) seconds.

4.4.4.1 MANDATORY OPTION: Recorded Audio Messages

The CONTRACTOR may record audio messages (talk-out path) for the mobile radio in the vehicle and use a GPS to record location information (e.g., test tile) and time, and retain it as part of the permanent file. The CONTRACTOR or NRVECRA may also record audio messages (talk-in path) at the NRV 9-1-1 Center. If these audio recordings are available, it may be used in any appeal that arises if the system fails to meet the coverage guarantee.

4.4.4.2 Coverage Test Configuration

Equipment used for testing shall be installed and tested at least forty-eight (48) hours prior to the start of the coverage test. NRVECRA will inspect the equipment configuration and sample test data twenty-four (24) hours prior to the start of the testing.

4.4.4.3 Accessible Test Tiles

Test tiles will use publicly accessible roads and will not require 4-wheeled drive vehicles to navigate, where no special permission is required from entities (other than NRVECRA) to

enter a tile. The field team will determine if it is safe to enter the tile. All accessible test tiles within the service area will be tested.

4.4.4.4 Inaccessible Test Tiles

Inaccessible test tiles will not be included in the calculations of system coverage performance.

4.4.4.5 Tile Retries

Tiles that fail the initial talk-in or talk-out test may be retried. Re-scoring will be performed with the same procedure. *The CONTRACTOR may retest as many failed tiles as desired; however, no more than five percent (5%) of the total tiles tested are allowed to be counted as a pass-with-retry.*

4.4.4.6 Retry Location

Test retries will be conducted in the same test tile.

4.4.4.7 Re-Testing

In the event the coverage test fails to meet the coverage guarantees, the CONTRACTOR shall make any and all necessary corrections and NRVECRA will require a full coverage re-test.

4.4.5 MANDATORY OPTION: Critical Building Coverage Testing

NRVECRA ***does not require a critical building coverage guarantee***. NRVECRA does require as a mandatory option critical building coverage testing for information purposes only.

The CONTRACTOR shall perform coverage testing in each of the critical buildings listed in Table 4-2. Coverage testing will be witnessed by NRVECRA or NRVECRA's Representatives. If coverage within a building is found unusable, NRVECRA may decide to exercise the mandatory option of installing a distributed antenna system in that building. When the distributed antenna system has been installed, the CONTRACTOR will retest the building witnessed by NRVECRA or NRVECRA's Representatives. Testing shall be performed at

locations identified previously to verify that coverage deficiencies have been satisfied. Twenty (20) points, evenly distributed, shall be tested on each floor.

Critical Building Information			
Building Name	**Building Address**	**Jurisdiction**	**existing UHF /DAS / BDA**
Blacksburg Fire Department Station 1	200 Progress St NE	Blacksburg	
Blacksburg Fire Department Station 2	2700 Prices Fork Rd	Blacksburg	
Blacksburg Fire Department Station 3	407 Hubbard St	Blacksburg	
Blacksburg High School	3401 Bruin Ln	Blacksburg	Yes
Blacksburg Middle School	3109 Prices Fork Rd	Blacksburg	
Blacksburg Police Department	200 Clay St SE	Blacksburg	Yes
Blacksburg Rescue Squad	1300 Progress St NW	Blacksburg	
Gilbert Linkous Elementary School	813 Toms Creek Rd	Blacksburg	
Harding Avenue Elementary School	429 Harding Ave	Blacksburg	
Kipps Elementary School	2801 Prices Fork Rd	Blacksburg	
Lewis Gale Hospital Montgomery	3700 S Main St	Blacksburg	Yes
Longshop McCoy Fire/Rescue Department	5770 McCoy Rd	Blacksburg	
Margaret Beeks Elementary School	709 Airport Rd	Blacksburg	
Prices Fork Elementary School	4021 Prices Fork Rd	Blacksburg	
Christiansburg Elementary School	160 Wades Ln	Christiansburg	
Christiansburg Fire Department	110 Depot St NW	Christiansburg	
Christiansburg High School	100 Independence Blvd NW	Christiansburg	
Christiansburg Middle School	1205 Buffalo Dr NW	Christiansburg	
Christiansburg Police Department	10 E Main St	Christiansburg	
Christiansburg Primary School	240 Betty Dr	Christiansburg	
Christiansburg Rescue Squad	190 Depot St NW	Christiansburg	
Falling Branch Elementary School	735 Falling Branch Rd SE	Christiansburg	
Montgomery County Courthouse	55 E Main St	Christiansburg	Yes
Montgomery County Government Center	755 Roanoke St	Christiansburg	
Montgomery County Public Safety Building	1 E Main St	Christiansburg	Yes
New River Valley Medical Center	2900 Lamb Circle	Christiansburg	
Eastern Montgomery Elementary School	4580 Eastern Montgomery Ln	Elliston	
Eastern Montgomery High School	4695 Crozier Rd	Elliston	
Elliston Fire Department	5001 Enterprise Dr	Elliston	
Belview Elementary School	3187 Peppers Ferry Rd	Radford	
Auburn Elementary School	1760 Auburn School Rd	Riner	
Auburn High School	1650 Auburn School Rd	Riner	
Auburn Middle School	4163 Riner Rd	Riner	
Riner Fire Department	3595 Riner Rd	Riner	
Riner Rescue Squad	4171 Riner Rd	Riner	
Shawsville Middle School	4179 Oldtown Rd	Shawsville	
Virginia Tech Police Department	330 Sterrett Dr	Virginia Tech	
Virginia Tech Rescue Squad	320 Stanger St	Virginia Tech	

Table 4-2 Critical Buildings

4.4.6 Acceptance Test Results

Contractor shall provide a comprehensive report detailing the results of all acceptance testing to NRVECRA within the timeframe identified in Table 4-1.

4.4.7 Thirty (30) Day Performance Period

Thirty (30) Day Performance Period will not begin prior to NRVECRA approval of all acceptance test results.

A successful performance period shall consist of thirty (30) consecutive days of successful uninterrupted operation after the completion of field acceptance testing. During the performance period, the CONTRACTOR shall maintain records of any equipment failures and readjustments made. During this period of "system burn-in", some minor equipment failures should be expected. Response times for all minor failures shall be the same during the thirty (30) day performance test period.

The performance period shall be considered interrupted if any of the following conditions occur:

- The system experiences a major failure, as defined in the specifications
- The same device fails more than twice during the performance period
- A failure is not responded to within the time specified by the Warranty

If the thirty (30) day performance period is interrupted by any of the above conditions, the CONTRACTOR shall correct the deficiency and begin the thirty (30) day performance period again as day one (1) of the test. NRVECRA ***will not*** accept thirty (30) cumulative days of performance in lieu of thirty (30) consecutive days of performance for passing this test.

The performance period may be interrupted by mutual written agreement of NRVECRA, NRVECRA's Representatives, and the CONTRACTOR if the downtime is due to causes beyond the reasonable control of the CONTRACTOR. Such downtime will be excluded from the thirty (30) day performance period.

Subject to approval of NRVECRA, as a written exception, coverage performance testing may be concurrent to the thirty (30) day performance period.

4.4.8 System Cutover

The CONTRACTOR shall prepare a plan for cutting over NRVECRA's operations from the old radio system(s) to the new radio system. The draft cutover plan shall be provided as part of the DDR documentation, within the timeframe identified in Table 4-1. The cutover plan shall address the following items:

- Fixed equipment cutover
- Interfaces with and transfer of control from existing systems and equipment
- Dispatching transitions
- Subscriber equipment installation and/or distribution

- Special sequences
- Scheduled downtime
- Dual operation of old and new systems
- Personnel schedules
- Training
- Fallback plans in case of problems or failures

When the Acceptance Testing, Coverage Testing and the thirty (30)-day performance period has been successfully completed, and NRVECRA approves the Cutover Plan, NRVECRA will authorize the day and time to cutover.

Cutover from the existing radio system to the new radio system shall be planned to minimize disruption to NRVECRA's operations.

4.4.9 Beneficial Use

If NRVECRA uses the System or a Subsystem for operational purposes, the CONTRACTOR may request the system or subsystem be deemed in Beneficial Use. NRVECRA will not commence Beneficial Use before Conditional System Acceptance without CONTRACTOR's prior written authorization, which shall not be unreasonably withheld. Upon commencement of Beneficial Use lasting more than thirty (30) consecutive days the CONTRACTOR may request the initiation of the Warranty Period to begin.

4.4.10 Conditional System Acceptance

Conditional System Acceptance shall occur upon successful completion of all Acceptance Tests, Coverage Tests, the thirty (30) Day Performance Period, and successful Cutover. Upon Conditional System Acceptance, the CONTRACTOR will promptly memorialize this event by providing a Conditional System Acceptance Certificate. NRVECRA will sign the Conditional System Acceptance Certificate within ten (10) business days. Upon successful completion of Conditional System Acceptance, the initiation of the Warranty Period will begin. Punch list items that do not materially affect operation of the radio system or its sub-systems will not hinder conditional system acceptance.

4.4.11 Final System Acceptance

NRVECRA will provide "Final System Acceptance" upon successful completion of Conditional System Acceptance, all programmed subscriber units have been issued to all departments, all project punch list items are resolved and approved, all submittals (including as-built documentation, maintenance & operational manuals, etc.) are delivered and accepted, and all services have been satisfactorily performed. Upon Final System Acceptance, the CONTRACTOR will promptly memorialize this event by providing a Final System Acceptance Certificate. NRVECRA will sign the Final System Acceptance Certificate within ten (10) business days. Upon written approval by NRVECRA of Final System Acceptance all remaining

monies will be released to the CONTRACTOR, and the project will be closed.

4.5 Subscriber Equipment Programming, Installation, and Issuance

4.5.1 Subscriber Equipment Programming

The CONTRACTOR shall develop templates based on the fleet map in coordination with NRVECRA and program subscriber units. The CONTRACTOR shall include a second touch programming for all subscriber units to include control stations.

4.5.2 Mobile Radio Equipment Installation

The NRVECRA Radio Shop will perform all installations for new mobile units, vehicular equipment, chargers, and requested accessories. NRVECRA responsibilities shall include removal, as required, of existing equipment in vehicles. The CONTRACTOR shall train and certify all NRVECRA Radio Shop technicians for installation of mobile radio equipment.

4.5.3 Control Station Equipment Installation

The CONTRACTOR shall install all new control station equipment with transmission line, antennas, remotes (if required), and requested accessories. NRVECRA will provide the exact locations for equipment to the CONTRACTOR and coordinate installation.

4.6 Documentation

4.6.1 Standard Manuals

The CONTRACTOR shall provide operational and maintenance manuals for each model of subscriber equipment with shipment within the timeframe identified in Table 4-1. The required quantities are as follows:

Number of Units Purchased	Number of Manuals Required
≤20	Five (5) hard copies One (1) electronic copy
>20	One (1) additional hard copy for each ten (10) additional units

Manuals shall be complete, self-contained and of the same revision level as the equipment provided.

The CONTRACTOR shall provide NRVECRA with an electronic subscription to the latest equipment manuals and technical service bulletins for a period of five (5) years after system acceptance.

4.6.2 Physical Facilities As-Built Documentation

The CONTRACTOR shall submit two (2) draft hard copies of all facilities as-built documentation to NRVECRA for review and approval within the timeframe identified in Table 4-1.

Physical facilities/site construction as-built drawings include, but are not limited to, the following:

- Site layout drawings
- Floor plans
- Site grounding drawings
- Building elevation detail drawings with foundations
- Building layout drawings
- AC and DC electrical distribution drawings
- Site utility connection details
- Fence installation details
- Foundation details for shelter, towers, and LPG tank
- Site lighting details
- Fire detection system drawings
- Tower design detail drawings including light controller wiring
- Antenna, combiner, coax line and antenna placement drawings
- Equipment layout drawings
- Equipment/rack elevation profiles
- Console operator position layout drawings
- Equipment shelter(s) plan: providing AC distribution, lighting, grounding, HVAC, and cable ladder details

The CONTRACTOR shall provide the following quantity of final physical facilities as-built documentation within the timeframe identified in Table 4-1:

- One (1) set per system site in hard copy
- One (1) set per system NRV 9-1-1 and Maintenance Shop in hard copy
- Two (2) additional sets in hard copy
- One (1) set in soft copy as PDF files

4.6.3 System Maintenance Documentation

The CONTRACTOR shall provide system maintenance documentation to allow a properly trained technician to understand, configure, maintain, troubleshoot, and repair the radio system. System maintenance documentation includes, but is not limited to the following:

- System operational description, including a description of the function of each major system component, circuit types and signal flow between system components
- System interconnection drawings and block diagrams depicting system architecture
- Numbering and labeling of all interconnecting cabling
- Pin-out of all cabling connectors
- Numbering and labeling of all connections to punch blocks

- System interconnection and installation documentation as required for vendor equipment and/or physical facilities
- Complete list of all major fixed equipment by model number and revision code and installed firmware/software with revision (configuration control) numbers
- A chart or list of software and firmware version numbers, programming parameters and jumper configurations as they apply
- Record of any telephone circuits interconnected with the equipment by circuit number and telephone number
- System level setting procedures and a log of level settings for all control circuits
- Measured levels of alignment, including level-setting block diagrams and logs of all level settings necessary for setup, alignment, and maintenance activities
- Standard operations and maintenance manuals for all equipment and systems
- Equipment floor layouts and rack elevations
- Detailed HVAC heat load and electrical load calculations

The CONTRACTOR shall provide NRVECRA with two (2) hardcopy sets of draft system maintenance documentation within the timeframe identified in Table 4-1.

NRVECRA will provide comments, recommendations, and corrections to the system maintenance documentation.

The CONTRACTOR shall address these comments, recommendations, and corrections to the satisfaction of NRVECRA.

The CONTRACTOR shall provide the following quantity of final system maintenance documentation within the timeframe identified in Table 4-1:
- One (1) set per system site in hard copy
- One (1) set per system NRV 9-1-1, Maintenance Shop in hard copy
- Two (2) additional sets in hard copy
- One (1) set in soft copy as PDF files

4.6.4 Subscriber Documentation

The CONTRACTOR shall supply the following with each subscriber unit purchased:
- One (1) standard operator’s manual
- One (1) customized quick reference, a small, laminated guide that can be referenced in the field
- One (1) customized quick reference customized for NRVECRA’s radio system

In addition, the CONTRACTOR shall supply five (5) copies of each manual or reference documentation in electronic format.

During warranty and subsequent maintenance contracts, the CONTRACTOR shall supply addenda as needed to the standard operator's manual and standard quick reference.

4.7 Training

4.7.1 Types of Training

The CONTRACTOR shall provide the types of training specified below:

Type of Training
P25 System Training – Fleet-mapping Participants (web based)
Radio User – **All** users trained on site
Radio User – **Per Seat** (web based)
Radio User Train-the-Trainers – **Two** people per agency/department on site
Console Operator– **All** dispatchers trained (on site)
Console Configuration – **All** dispatch supervisors trained on site
Console Train-the-Trainer – **Two** people per ECC trained on site
Radio System Overview Administration & Management
MANDATORY OPTION: Radio System Maintenance
MANDATORY OPTION: Microwave Network Maintenance
MANDATORY OPTION: Radio Programming Software Training –all licenses, programming software and hardware

When multiple training sessions are required, each session should be given during a different week to compensate for scheduling conflicts. Provide the following details on the training offered:

- Course outline
- Recommended class size
- Recommended number of sessions
- Estimated duration
- Class schedule
- Class location

Appendix D provides an estimate of quantities, that may be revised at the discretion of the PROPOSER to successfully train all users, operators, administrators, and maintenance personnel.

4.7.2 Training Materials

The CONTRACTOR shall provide all training materials, manuals, schematics, and other documentation within the timeframe identified in Table 4-1.

Customize radio user and console operator training and training materials, including any quick-reference guides, to NRVECRA's system configuration. Provide draft training materials, within the timeframe identified in Table 4-1, for NRVECRA's review and approval.

NRVECRA will review radio user and console operator training course content and materials and provide comments. When all comments have been addressed, NRVECRA will approve course content and materials prior to beginning class sessions.

4.7.3 Travel and Lodging

NRVECRA prefers on-site training during implementation and limited travel by personnel for training. NRVECRA will be responsible for travel and lodging expenses incurred by NRVECRA's personnel, if appropriate, in the course of the training program.

4.7.4 MANDATORY OPTION: On-the-Job Training

NRVECRA's technicians may work alongside the CONTRACTOR's personnel during installation, configuration, testing, and warranty during this project.

4.7.5 Training Descriptions

The use of audio and visual aids, as well as actual equipment demonstrations, is required for all courses. NRVECRA will not accept a course consisting primarily of a trainer lecturing trainee.

The CONTRACTOR shall provide professionally produced training manuals to all students. The training manuals shall be furnished to NRVECRA for continuing education purposes. The manuals shall contain clean, legible copies of all written material and visual aids used by the instructor.

Each training session shall not have more than 25 people in attendance.

4.7.5.1 P25 Trunked System Training

– Target audience:	– **ALL Fleet-Mapping participants (agency / department)**
– Location:	– **Virtual or Web Based**
– Schedule:	– 60 days prior to Fleet-mapping
– Duration:	– Typically, eight (8) hours
– Description: –	• Basic overview of P25 radio systems • Basic overview of the features and functionality of the NRVECRA specific system

The CONTRACTOR shall provide "User Evaluation Forms" and instruct each student in their use.

4.7.5.2 Radio User Training

– Target audience:	– **ALL** Radio users – typically 20 people / class, per agency / department (Law Enforcement, Fire / Rescue, Emergency Management, Emergency Medical Services, Public Works, Schools, etc.)
– Location:	– **On-site** using installed equipment
– Schedule:	– Prior to system cutover
– Duration:	– Typically, One (1) to two (2) hours
– Description: –	• Basic overview of the radio and trunked radio system operation • Emphasis on types of mobile and portable equipment and features provided with the NRVECRA's system • Includes distribution and review of laminated quick-reference guides to be provided with each subscriber unit

The CONTRACTOR shall provide "User Evaluation Forms" and instruct each student in their use.

4.7.5.3 Radio User Web Based Training

The CONTRACTOR shall provide web-based interactive training sessions that incorporate the above-described radio user training. Pricing shall be provided on a per seat basis.

4.7.5.4 Radio User Train-the-Trainer

Target audience:	Primarily those who will be responsible for training field personnel, service personnel, dispatchers, and all other radio system users. Estimate number of trainers per agency / department.
Location:	**On-site** using installed equipment
Schedule:	After all Radio User Training and Prior to system cutover
Duration:	Typically, Four (4) hours
Description:	• Train-the-trainer for radio users. • In-depth training on the system configuration, operational modes, and the features and functionality specific to the NRVECRA system. • Special emphasis on hands familiarization and operation with all types of mobile, portable and control station equipment furnished with the new system. • Includes distribution and review of laminated quick-reference guides to be provided with each subscriber unit.

The CONTRACTOR shall provide "User Evaluation Forms" and instruct each participant in their use.

4.7.5.5 Console Operator Training

Target audience:	Dispatchers, supervisors, and system managers
Location:	**On-site** using NRVECRA's operational consoles, with no more than two (2) people on a console
Schedule:	Prior to system cutover
Duration:	Typically, Four (4) to eight (8) hours
Description:	• Hands-on familiarization with console operation, including all features and functionality of the console or those which the NRVECRA is implementing. • Hands-on familiarization with the use of the backup control stations furnished with the new system. • An overview of NRVECRA's system and a discussion on the operational theory of the system

The CONTRACTOR shall provide "User Evaluation Forms" and instruct each participant in their use.

4.7.5.6 Console Configuration Training

Target audience:	Dispatch managers, dispatch supervisors, training coordinator, and system managers
Location:	**On-site** using NRVECRA's operational consoles, with no more than two (2) people on a console
Schedule:	Prior to system cutover
Duration:	Typically, Eight (8) hours
Description:	• Hands-on familiarization with console configuration, including all features and functionality of the console or those which the NRVECRA is implementing. • Hands-on implementation of console layout, setup, and configuration • Hands-on familiarization with console supervisory operation • An overview of the NRVECRA's system and a discussion on the operational theory of the system

The CONTRACTOR shall provide "User Evaluation Forms" and instruct each participant in their use.

4.7.5.7 Console Train-the-Trainer

Target audience:	Dispatch managers, dispatch supervisors, training coordinator, and system managers responsible for training console operators. At least two people per ECC.
Location:	**On-site** using NRVECRA's operational consoles, with no more than two (2) people on a console
Schedule:	Prior to system cutover
Duration:	Typically, Eight (8) hours
Description:	• Train-the-trainer for consoles. • In-depth training on the system configuration, operational modes, and the features and functionality specific to the [CLIENT]'s system. • Special emphasis on hands familiarization and operation with consoles and control station equipment furnished with the new system. • Includes distribution and review of laminated quick-reference guides to be provided with each console position.

The CONTRACTOR shall provide "User Evaluation Forms" and instruct each participant in their use.

4.7.5.8 Radio System Overview Administration and Management Training

Target audience:	Engineers, supervisors, and managers involved in radio system administration, management, and control.
Location:	Typically, at the factory
Schedule:	After the detailed design review (DDR) and prior to fleet mapping. This will allow NRVECRA to plan for all the system operations, features, and operations more effectively.
Duration:	As recommended by the CONTRACTOR (typically, 3 to 5 days)
Description:	• May require multiple courses. • At the end of the training, the participants will be able to administer and manage the radio system. The training should include a system overview and theory of operation of the entire radio system. • Hands-on training for the system management, support equipment, and support functions of the radio system. • Database management. • System programming, including console configuration and subscriber equipment programming. • System management.

4.7.5.9 MANDATORY OPTION: Radio System Maintenance Training

Target audience:	Radio System maintenance technicians and supervisors
Location:	Combination of radio system factory training or on-site formal training
Schedule:	During radio system implementation
Duration:	As recommended by the CONTRACTOR
Description:	Training shall be sufficient to enable a competent radio technician to troubleshoot, align, maintain, and program all subscriber and/or fixed network equipment to the board level.

4.7.5.10 MANDATORY OPTION: Microwave Network Maintenance Training

Target audience:	Microwave Network maintenance technicians and supervisors
Location:	Combination of microwave network factory training or on-site formal training
Schedule:	During microwave network implementation
Duration:	As recommended by the CONTRACTOR (or subcontractor)
Description:	Training shall be sufficient to enable a competent microwave technician to troubleshoot, align, maintain, and program microwave network equipment to the board level.

4.7.5.11 MANDATORY OPTION: Radio Programming Software Training

Target audience:	Modify or upgrade software and hardware - technician or manager
Location:	On site
Schedule:	At the end of radio system implementation & installed subscribers, or after cutover
Duration:	As recommended by the CONTRACTOR
Description:	Training shall be sufficient to enable a competent engineer or technician from the CONTRACTOR.

4.8 Warranty and Maintenance

4.8.1 Warranty

4.8.1.1 Infrastructure Warranty

The CONTRACTOR shall warranty the systems, equipment, software, and services provided under the Contract against failures, errors or defects in operation, materials, and workmanship for a period of at least one (1) year after Conditional System Acceptance.

The CONTRACTOR shall warranty all standard physical facilities, e.g. new constructed towers, shelters, generators, HVAC, etc. The CONTRACTOR shall provide a list of physical facilities and equipment that will offer standard warranty beyond one (1) year. (As an example, new towers should include standard five (5) years warranty.)

The CONTRACTOR shall repair, replace, or otherwise correct defective systems, equipment, or software during the warranty period at no cost to NRVECRA. If a device fails more than twice during the warranty period, the CONTRACTOR shall explain such failures to NRVECRA. If these failures indicate the equipment is prone to continuing failures, the CONTRACTOR shall replace such equipment at no cost to NRVECRA.

4.8.1.2 Subscriber Warranty

The CONTRACTOR shall warranty subscribers for three (3) years after final system acceptance. The CONTRACTOR shall repair, replace, or otherwise correct defective equipment or software during the warranty period at no cost to NRVECRA.

If a subscriber fails more than twice during the warranty period, the CONTRACTOR shall explain such failures to NRVECRA. If these failures indicate the subscriber is prone to continuing failures, the CONTRACTOR shall replace the subscriber at no cost to NRVECRA.

4.8.1.3 MANDATORY OPTION: Subscriber Additional Warranty

The CONTRACTOR shall offer an additional three (3) year subscriber warranty at a reasonable cost.

4.8.2 New Equipment Purchases

Equipment purchased after system acceptance shall be covered by its particular warranty period. When new equipment is purchased the maintenance contract will be amended to include the new equipment on a prorated basis from the date of installation to the expiration of the term of the maintenance contract in place at that time.

4.8.3 System Life-Cycle Support

The CONTRACTOR shall support the turnkey system for a period of fifteen (15) years after Conditional System Acceptance by offering at ***reasonable*** cost the following:

- Hardware and software fixes and upgrades for the system, including networking equipment/components
- Professional and timely service and repair
- Readily available parts, materials, and equipment
- Design and engineering counsel
- Any other support as is customary and expected of a service-oriented business

4.8.4 Maintenance Contract – Years Two through Fifteen (2-15)

The CONTRACTOR shall provide maintenance for radio system and connectivity network infrastructure equipment and software provided under this contract. Maintenance contract shall begin at the end of system warranty and remain in place for years two (2) through fifteen (15).

4.8.5 Maintenance Services

The CONTRACTOR shall provide the following maintenance services during the warranty and subsequent maintenance periods.

4.8.5.1 Hardware Maintenance

4.8.5.1.1 Service Plan

The CONTRACTOR and NRVECRA shall develop a service plan that includes the following:

- Contact names and phone numbers
- Procedures for reporting service problems
- Procedures for reporting problem resolution
- Escalation procedures

4.8.5.1.2 Infrastructure Preventive Maintenance

The CONTRACTOR shall provide regularly scheduled preventive maintenance as recommended by equipment manufacturer(s). Performance of systems and equipment shall be maintained to original specifications.

Preventive maintenance that may affect normal operation of the system shall be performed at a time agreeable to NRVECRA and may be outside regular business hours at no additional expense to NRVECRA.

Verification of simulcast alignment shall be performed on a routine basis.

4.8.5.1.3 MANDATORY OPTION: Subscriber Preventive Maintenance

The CONTRACTOR shall provide regularly scheduled preventive maintenance as recommended by equipment manufacturer(s). Performance of subscriber units shall be maintained to original specifications.

Preventive maintenance that may affect normal operation shall be performed at a time agreeable to NRVECRA and may be outside regular business hours at no additional expense to NRVECRA.

4.8.5.1.4 MANDATORY OPTION: Subscriber Maintenance

The CONTRACTOR shall pick up defective subscriber units from a central location, be responsible for repairing units, and is responsible for providing any parts necessary for repair. If the unit cannot be repaired, CONTRACTOR will provide a new unit equivalent or better at no additional charge.

4.8.5.1.5 MANDATORY OPTION: Maintenance Re-used Equipment

The CONTRACTOR shall provide maintenance for any existing equipment the PROPOSER plans to reuse in the proposed system. Contract shall be renewable on an annual basis. Provide

pricing in Appendix D for any maintenance on equipment that may be re-used, including any existing subscriber units planned to receive P25 software upgrades.

4.8.5.2 Emergency Service

Emergency service is reactive maintenance to address any loss of functionality in the radio infrastructure and its supporting equipment.

4.8.5.2.1 Availability

Emergency service shall be available twenty-four (24) hours a day, seven (7) days a week, including weekends and holidays.

4.8.5.2.2 Response Times

A qualified technician shall respond to requests for emergency service within the following time frames:

Failure Type	Time of Notification	Response Time
Major Failure	Any time	Technician shall respond remotely within two (2) hours. If a problem cannot be resolved remotely, a technician shall respond to the location of failure within four (4) hours
Minor Failure	00:00-12:00	Same business day – overtime if needed
Minor Failure	12:01-24:00	Next business day – start job in the morning

Response times are measured from the time the failure is reported. No equipment shall be out of service more than twenty-four (24) hours after failure notification.

The following are considered major failures:

- loss of functionality of any entire site
- failure of the alarm system to report any alarms within its designed alarm reporting cycle
- simultaneous loss of three (3) or more/ or 20% radio channels
- failure of three (3) or more/ or 20% consoles in the system
- loss of simulcast capabilities at any site
- loss of trunking capabilities
- any failure that causes the trunked system to fail or revert to operation as a conventional radio system
- a continual bit error rate (BER) greater than 1E-6 on any link in the radio system's connectivity network
- a continual packet loss on any link in the radio system's connectivity network
- a loss of signal on any microwave hop

A minor failure is any failure not classified as a major failure.

4.8.5.3 Software Maintenance

4.8.5.3.1 Corrective Upgrades

The CONTRACTOR shall provide at no additional cost corrective upgrades to system and subscriber software when such upgrade if not performed will keep the system from meeting the requirements of this RFP. The availability and frequency of corrective upgrades shall be at the discretion of the CONTRACTOR.

When upgrades are made available to NRVECRA, the timing to apply these upgrades will be at the sole discretion of NRVECRA. If deemed necessary by NRVECRA, the CONTRACTOR shall perform software upgrades during evenings or weekends at no additional cost to the NRVECRA.

This covers only upgrades by the CONTRACTOR or through its designated Original Equipment Manufacturer (OEM) or Software Provider that are:

- remedies for defective software
- remedies for security vulnerabilities
- new releases that are corrective revisions for earlier versions

The CONTRACTOR shall ensure that software upgrades do not have a negative impact on other components of the system.

4.8.5.3.2 New Software Release Enhancements

New software releases that contain enhancements (i.e., new features and capabilities) may be offered for purchase at agreed upon prices.

The CONTRACTOR shall make every effort to separate corrective revisions from enhancements. If it is unable to do so, and new releases are necessary to correct problem(s), then the entire release (including enhancements) shall be provided to NRVECRA at no additional cost.

4.8.5.3.3 MANDATORY OPTION: Software Update Enhancement Subscription

The CONTRACTOR shall provide, as an add-on to the maintenance contract, a software update subscription service to keep NRVECRA's equipment operating at the latest version of software.

4.8.5.3.4 Backup Media and Manuals

Backup electronic media and revised software manuals shall be provided at the time of any software revisions to NRVECRA at no additional cost.

All system definition parameters and other unique information (data base) used to operate the system or associated subsystems shall be backed up onto removable media on a quarterly basis during the maintenance period by the CONTRACTOR. This media shall be turned over to NRVECRA for safe, off-site storage. Backup functions shall be designed to run in an unattended mode with no requirement to change media during the process.

4.8.5.3.5 MANDATORY OPTION: Remote Monitoring

The CONTRACTOR shall remotely and continuously monitor the system for alarms, failures, or network security threats.

4.8.5.4 Technical Support

The CONTRACTOR shall provide remote, phone-based technical support, available twenty-four (24) hours a day, seven (7) days a week, including holidays and weekends. This support shall be available to emergency response personnel, the mandatory optional support personnel and NRVECRA's own management and maintenance personnel.

4.8.6 Service Organization

Warranty and maintenance service shall be performed only by properly trained and authorized maintenance personnel.

The CONTRACTOR or authorized service organization(s) shall maintain comprehensive installation and instruction manuals for all system equipment. These manuals shall be the property of NRVECRA and shall be reverted to them at such time as NRVECRA assumes the maintenance responsibility for the system.

4.8.7 Service Records

The CONTRACTOR shall document all services performed on the system. For each maintenance service, the documentation shall include the following:

- Time started
- Location
- Name, telephone number and e-mail address of technician providing service
- Service performed
- Parts required to perform service
- Time finished

For each emergency service, the documentation shall include the following:

- Time problem was reported
- Name, telephone number and email address of person reporting problem
- Name, telephone number and email address of technician responding to problem
- Time technician responded to problem
- Description of problem

- Description of problem resolution
- Parts or repairs required to resolve problem
- Time problem was resolved, and resolution was reported to the appropriate NRVECRA contact

Service records shall be available for NRVECRA's inspection upon request. Records shall be maintained by the service organization for the duration of system warranty and any follow-on maintenance contracts and shall revert to NRVECRA upon termination of the warranty or maintenance contract.

4.8.8 Spare Parts

A sufficient supply of spare parts shall be stored at a location to be determined by NRVECRA, to allow immediate restoration of minimal operation of the system on a rolling repair-and-return basis. Other parts shall be available via emergency request and air freighted within twenty-four (24) hours of the equipment failure. The CONTRACTOR may draw upon this spares inventory as necessary during the warranty/maintenance period, replacing equipment as it is used.

At the end of the maintenance contract, the full complement of spares shall be delivered to NRVECRA in a repaired condition.

Further, if during the one-year warranty period, more than five percent (5%) of repairs are not returned within ten (10) days, the spares inventory counts shall be doubled ***for that specific failed spare part*** at no additional cost to NRVECRA. These additional spares shall also be delivered to NRVECRA as specified above. The purpose of this requirement is to ensure that adequate quantities of available spares are maintained on the shelf.

4.8.9 MANDATORY OPTION: Asset Management

PROPOSERs shall include as a Mandatory Option an asset management system to allow for effective and efficient management of the inventory of assets that make up the P25 radio system, both subscriber and infrastructure assets. The solution shall be a Commercial Off-The-Shelf system, configurable by the end user and the contractor shall perform all conversion/importing of existing and new inventory data necessary to roll out the solution.

In addition to basic asset management requirements (asset #, serial #, location, personnel assignment, vehicle assignment, status, etc.), the solution shall have the capability to track configuration management of the complex radio equipment our agency is responsible to manage. This includes the assignment of one (1) or multiple radio IDs to each subscriber asset record, as well as manage the configuration of each subscriber asset down to the software versions and options.

Configuration management shall include, but not be limited to, the following:

- Programming template / personality version tracking with file attachment capability
- Software versions (i.e. firmware, flash code, personality)
- Radio / unit ID assignments by system and range
  - No duplication of radio / unit ID
  - Lock down ID ranges by user group
  - Allow for multiple radio / unit IDs to be assigned as needed
- Track radio options and accessories
- Allow for custom fields by asset type

The solution will also include a work order management application that can manage both planned and unplanned work requests such that service efforts and related asset modifications can be identified and reported on demand. Work orders should be linked directly to asset records and alerts should be created for work to be done based on time or change-based events, such as preventative maintenance dates.

4.8.9.1 Mandatory Option: Training

The CONTRACTOR shall be responsible for training necessary personnel to perform duties assigned.

4.8.9.2 Mandatory Option: Equipment

The CONTRACTOR shall provide work vehicles and equip personnel with tools and equipment necessary to perform duties assigned.

5 General System Requirements

5.1 Scope

The requirements of this section apply to all systems, equipment and software specified in this RFP.

5.2 Deviations from the Specifications

Systems, equipment, and software shall be based upon the latest technology and communications industry standards. The specifications in this RFP are meant to define a level of functionality without being overly restrictive. Deviations from the specifications *may* be allowed *if* they (1) will improve operational capability, maintainability, or technical quality; or (2) diminish the propensity toward obsolescence.

5.3 Brand Names

The use of brand names in this specification is intended to establish minimum performance standards and is not intended to be restrictive. The PROPOSER may propose alternate but equal equipment. Proposals using alternate but equal equipment shall be accompanied by point-by-point specification comparisons demonstrating the proposed equipment indeed equals or exceeds the specified equipment in all areas germane to the operational requirements of the RFP.

Any specification requirements that cannot be readily verified based on provided equipment data sheets, may be treated as exceptions during the evaluation.

5.4 System Reliability

5.4.1 Single-Point Failures

Failure of a single device or component (a single-point failure) within the communications system shall not reduce the ability of the system to provide the required communications under routine operational conditions.

5.4.2 Multi-Point Failures

Simultaneous failures of multiple devices or components within the system (a multi-point failure) may reduce the ability of the system to provide communications under routine operational conditions, but the system shall be designed to degrade gracefully, providing at least minimal communications under these conditions.

5.5 General Equipment Specifications

5.5.1 New Equipment

Equipment shall be the latest version of new, standard equipment. Except as noted elsewhere in the RFP, used or refurbished equipment shall not be accepted.

5.5.2 Environmental Specifications

All fixed equipment must meet the following environmental specifications:

Condition	Specifications	
	Indoor	Outdoor
Operational Temperature	+5° to +40° C	-30° to +60° C
Operational Relative Humidity	10 to 90% Non-condensing	0 to 100% Condensing

5.5.3 Equipment Power Requirements

All sites involved in the system have or will have available 120/240 VAC, three-wire, single-phase or 120/208 VAC four-wire, three-phase, 60 Hz electric service. All fixed equipment, power supplies, rectifiers or battery chargers must be compatible with the electric service available.

5.5.4 Equipment Grounding

The CONTRACTOR shall ground its equipment to the site ground system in accordance with ANSI J-STD-607-B.

5.5.5 Surge Protection

The CONTRACTOR shall furnish and install surge protective devices (SPDs) on all electrical, communications and control circuits connected to its equipment in accordance with ANSI J-STD-607-B. Where SPDs are or will be provided by others, the CONTRACTOR shall verify the suitability of these SPDs for its equipment. If these SPDs are suitable, the CONTRACTOR is not required to install additional SPDs.

5.5.6 FCC Part 15 Devices

All electrical and electronic equipment must comply with the standards for unintentional and incidental radiators found in 47 CFR 15, “Radio Frequency Devices.”

5.5.7 Proprietary Equipment

The system shall be based as much as possible upon commercial off-the-shelf (COTS) servers, workstations, routers and switches, and associated operating system software. NRVECRA desires the ability to replace this equipment with commercially available equipment, in the event of an emergency.

Specifications for the identified equipment and software must be provided with the system maintenance documentation.

5.5.8 Security Risk FCC Designated Equipment

Pursuant to the Secure and Trusted Communications Networks Act of 2019. The PROPOSER shall not propose any equipment from the vendors listed on the FCC's *List of Equipment and Services Covered by Section 2 of The Secure Networks Act.* FCC Section 1.50002 directs the Public Safety and Homeland Security Bureau to publish a list of communications equipment and services (Covered List) that are deemed to pose an unacceptable risk to the national security of the United States or the security and safety of United States persons. The Covered List and more information on how the Covered List are compiled and updated can be found in the Commission's rules at 47 C.F.R. § 1.50000 *et seq.* The NRVECRA will not accept any equipment from vendors on the Covered List, as part of the proposed system.

5.6 Software and Hardware Versions

Versions of software and hardware must be the latest publicly released versions or revisions at completion of system staging.

5.7 Computer and Network Security

Multi-layered security solutions shall be implemented to minimize the risk that a security incident will reduce the ability of the system to provide the required communications under routine operational conditions.

5.7.1 Computer Security

Computers integrated into the system must be configured and equipped to minimize risk to the reliability and availability of the system. All computers running a standard operating system shall be protected with anti-virus software. This requirement includes configuration, software, and documentation. The CONTRACTOR shall work with the NRVECRA to ensure all installed equipment follows the NRVECRA network security measures.

5.7.2 Network Security

5.7.2.1 Authentication

All network elements (servers, workstations, routers, switches, etc.) that allow access through the network must support username and password authentication. Elements shall support, at a minimum, ten-character complex passwords. Passwords shall expire, at most, every 90 days.

5.7.2.2 Ports and Protocols

The CONTRACTOR shall supply port and protocol information for all devices connecting to the radio system network at the Detailed Design Review (DDR). The information must be of sufficient detail to support the creation of default deny filtering in network and security equipment. The CONTRACTOR shall support troubleshooting and resolution of issues associated with the supplied information.

5.7.2.3 DMZ Support

The CONTRACTOR shall certify any application that resides on a network outside of the communications system network and interfaces with devices in the communications system network will operate correctly through a De-Militarized Zone (DMZ). A DMZ is defined as firewall and intrusion preventive functions in default deny configuration that protects the interface between the radio system network and outside networks.

5.8 Installation

Equipment and physical facilities must be installed in a neat and professional manner, employing the highest standard of workmanship and in compliance with applicable standards. All sites must be left in a neat, presentable condition throughout the installation phase of the project. All rubbish, temporary structures, and equipment generated or used by the CONTRACTOR must be removed after completion of the work, and prior to acceptance.

5.8.1 Calibration of Test Equipment

All measuring and test equipment used for installation and/or acceptance testing must be part of a documented calibration program. Calibration must be traceable to the National Institute of Standards and Technology (NIST). The following equipment must be included in the calibration program:

- oscilloscopes
- service monitors
- spectrum analyzers
- network analyzers
- frequency counters
- signal generators
- multimeters used for quantitative measurements
- wattmeters
- time-domain reflectometers
- RF return-loss bridges
- torque wrenches used where torque wrenches are required

5.8.2 Racks and Cabinets

Except for small ancillary equipment (such as dehydrators, coaxial surge suppressors, modems or punch blocks) and computer equipment for human interface to the radio system (such as consoles and network management system workstations), all fixed communications equipment must be mounted in cabinets or racks.

Cabinets must be suitable for the environment in which they are installed (e.g., NEMA Type 3R or 4X for outdoor installations exposed to rain, sleet, and snow). Shelters or equipment rooms must have appropriate environmental controls (HVAC) for the installed equipment and the environment in which they are installed. Cabinets must be equipped with locking doors or panels.

Racks must meet the requirements of current revision EIA/ECA-310. Racks and cabinets shall be designed and installed to provide easy access to equipment controls and connection points.

5.8.3 Rack and Cabinet Installation

All equipment racks and cabinets must be securely mounted to the floor. If necessary, racks or cabinets must be bolted together or braced from the ceiling to prevent swaying or being dislodged. Racks must be isolated from floors and ceilings using suitable insulators, insulating plates, washers, and sleeves.

Equipment racks and cabinets must be placed to allow a minimum of thirty-six (36) inches access front and back unless all connection and maintenance points are in the front. Under no conditions shall an equipment rack or cabinet need to be moved for maintenance after installation.

5.8.4 Electromagnetic Exposure

All sites must be designed, protected, and posted to meet the limits for both public and occupational human exposure to radio frequency (RF) electromagnetic fields in accordance with FCC rules and FCC OET Bulletin 65.

Where required by 47 CFR §1.1307(b), the CONTRACTOR shall provide to the NRVECRA, a statement of compliance with the electromagnetic exposure limits found in 47 CFR §1.1310 for each licensed radio system site within the timeframe identified in Table 4-1.

5.8.5 Labeling

All cables and wiring between equipment must be clearly labeled at both ends indicating source and destination equipment, connector designation and termination points.

5.9 Contractor Commitment

The CONTRACTOR shall maintain and upgrade the operational software to its most recent revision level prior to cutover, upon approval of the NRVECRA. There shall be no requirement on the NRVECRA's part to incorporate any new features. The Contractor shall provide equipment software patch, upgrade or release notes.

Any change shall have minimal impact on system operations, or the cost shall be assumed by the CONTRACTOR.

6 Radio System

6.1 New System Description

6.1.1 Trunked Radio System

NRVECRA needs to implement a P25 Phase 2 (TDMA) 700/800 MHz simulcast, trunked radio system that meets Project 25 standards. Dispatch consoles shall be installed at the NRV 9-1-1 Center, Blacksburg Police Department, and Virginia Tech Police Department. Each proposal shall provide radio coverage, traffic load, and all requirements to meet specifications.

6.1.2 Radio Sites

A list of existing and potential radio sites is provided in Table 9-1 Section 9 Physical Facilities Requirements. The PROPOSER may recommend other sites not listed in the table for inclusion in the system design based on the following criteria:

- Radio coverage
- Connectivity network availability
- Facility availability
- Licensing and permitting
- Physical access
- Availability of electric power
- Cost

6.1.3 Frequency Plan and Traffic Loading Analysis

The CONTRACTOR shall develop and recommend a frequency plan for the radio system based upon a traffic loading analysis and identify the most appropriate frequencies for its system design. The NRVECRA requires:

- **Busy Hour Impact** – Must measure the **busiest hour** in a year to use mobiles, portables, desktop radios and consoles
- **Delayed Call Grade of Service Limits < 1%**
- **Maximum Acceptable Call Delay < 1 second**

The CONTRACTOR shall use the initial number of radios (mobiles, portables, desktop radios and consoles) for all Departments and Agencies from NRVECRA listed in Appendix D Price Proposal Workbook and project the future growth for fifteen (15) years after Final System Acceptance. NRVECRA estimates 1% growth per year; so, the CONTRACTOR shall multiply the initial number of radios by 15% to obtain the number of radios for traffic loading analysis for the next 15 years. The number of channels shall include talk-paths (voice) and the control channel.

	Single-band Mobile Trunk Mount	Single-band Dual Control Head Mobile Trunk Mount	Dual-band Mobile Trunk Mount	Single-band Portable	Dual-band Portable	Control Station	Pagers	Console	Backup Control Stations for Console
Blacksburg Police Department	80				80	1		3	
Blacksburg Fire Department	38				75	4	80		
Blacksburg Rescue Squad	6	14			80	3	60		
Blacksburg Transit	85			40		5			
Christiansburg Fire Department	26				80	2	50		
Christiansburg Parks & Rec	4			25					
Christiansburg Police Department	70				95	2			
Christiansburg Public Works	85			20		5			
Christiansburg Rescue Squad	6	7			25	1	7		
Montgomery County Sheriff's Office	95				164	2			
Elliston Volunteer Fire Department	12				48	1	30		
Longshop McCoy Rescue	5	2			15		15		
Longshop McCoy Fire	9				25	1	25		
Montgomery County Fire/Rescue	8	8			30	2	4		
Montgomery County Public Schools Staff				120		25			
Montgomery County Public Schools Transportation	125			2		7			
Riner Fire Department	15				40	1	30		
Riner Rescue Squad	2	3			19	1	20		
Virginia Tech PD	35				85	2		3	
Virginia Tech Rescue Squad	3	7			34	1	30		
NRV 9-1-1					20		4	13	12
Radio Shop			4		8	1			

Table 6-1 Subscribers by agency and NRV 9-1-1 Center consoles (including back-up control stations)

The PROPOSER shall use public safety industry best practices traffic data in their traffic loading analysis – number of messages per unit per hour (Busy Hour Impact), and the length of each message, usually separated by discipline.

The PROPOSER shall include and identify the Working Channel Call Overhead to the number of seconds needed for channel access time.

6.1.4 MANDATORY OPTION: Additional Channel

NRVECRA requires one (1) additional channel pair of frequencies beyond the number of channels needed to meet the system capacity requirements.

6.1.5 Interoperability

NRVECRA requires interoperability channels for mutual aid, and other special events. NRVECRA requires the ability to talk with all surrounding jurisdictions both within and outside NRVECRA's service area.

The PROPOSER shall describe in detail and shall provide all equipment and pricing, hardware and software, necessary to provide interoperability to each of the agencies/jurisdictions provided in the table below. The PROPOSER shall provide all new control stations for each of the interoperability channels required in the table below.

NRVECRA Interoperability Channels						
Item #	**Name**	**Existing / New**	**Frequency Band**	**System Type**	**Analog / Digital**	**Conventional/ Trunked**
1	Craig County	Existing	UHF	Legacy	Analog	Conventional
2	Floyd County	Existing	UHF	DMR	Analog / Digital	Conventional
3	Giles County	Existing	UHF	DMR	Analog / Digital	Conventional
4	Pulaski County	Existing	UHF	DMR	Analog / Digital	Trunked
5	Roanoke County	Existing	800 MHz	P25	Digital	Trunked
6	City of Salem	Existing	800 MHz	P25	Digital	Trunked
7	City of Radford	Existing	UHF	NXDN	Digital	Conventional
8	Virginia State Police	New	VHF	P25	Digital	Trunked
9	Virginia Department of Wildlife Resources	New	VHF	P25	Digital	Trunked
10	LifeGuard Helicopter	Existing	UHF	Legacy	Analog	Conventional
11	Blacksburg Public Works	Existing	UHF	Legacy	Analog	Conventional
12	Blacksburg Transit	Existing	UHF	DMR	Digital	Conventional

Table 6-2 NRVECRA Interoperability Channels

6.1.5.1 Interoperability Channel Recording

All interoperability channels shall be recorded by the logging recorder at the NRV 9-1-1 Center. Describe how the proposed interoperability solution will interface with the logging recorder. PROPOSER shall include all costs for hardware/software required to interface the interoperability solution to the logging recorder.

6.1.5.2 MANDATORY OPTION: ISSI

NRVECRA may add an Inter-RF Subsystem Interface (ISSI) to facilitate connection with regional jurisdictions. As an option provide cost for a single ISSI connection to a neighboring jurisdiction's P25 system. This cost should include all software licenses, hardware equipment, NRVECRA Features and Functions, and configuration and installation of the ISSI.

6.1.6 Project 25 Phase 2 TDMA Compliance

The communications system must be fully compliant with the latest versions of the P25 (TIA-102) Phase 2 (12.5 kHz TDMA) standards and shall be fully interoperable with all (TIA-102) compliant portable and mobile radios.

6.1.7 System Identification Codes

The system shall utilize digital system ID codes to prevent interference between systems of like protocol. The PROPOSER shall guarantee that it will not assign the same unique system ID to any system other than NRVECRA's for the life of NRVECRA's system.

6.1.8 Unit and Talkgroup Identifiers

The system shall support at least sixty-four thousand (64,000) non-fixed consoles and subscriber units, each with a separate discrete numeric identifier (ID). The system shall be capable of supporting a minimum of sixteen thousand (16,000) talkgroups. When a unit transmits, its ID shall be displayed at properly equipped consoles and subscriber units.

6.1.9 Talkgroup Calls

Each unit shall be affiliated with a talkgroup. When a unit transmits, all units affiliated with the same talkgroup receive the call.

6.1.10 Individual Calls

A user may call an individual user, whether that user is on the same talkgroup or not. Depending upon the features of the subscriber unit, a user may select a target user from a list or may enter the target unit ID by keypad.

6.1.11 Late Entry

When a unit affiliates with a talkgroup while a conversation is already in progress, the unit shall automatically switch to the appropriate traffic-bearing channel and receive talkgroup transmissions.

6.1.12 Busy Queue and Callback

When all channels or talk paths in the system are busy, the calling unit shall receive a unique busy tone and be placed in a queue for the next available channel or talk path. The user shall be alerted by another unique tone when he has been assigned a channel or talk path for communications.

6.1.13 Priority Levels

The radio system shall offer at least five (5) priority levels. When the system is busy and units are placed in queue, units with the highest level of priority shall be placed ahead of units with lower levels of priority.

When callers of the same priority level are placed in queue, the most recently active caller shall be placed ahead of the others to maintain message continuity.

The highest priority level shall be the emergency priority level and shall not be the normal priority level of any unit or talkgroup.

6.1.14 Emergency Access

Emergency access shall be by means of an emergency button on the unit. Depressing the emergency button shall have two (2) results:

- Preemptive emergency notification to a continuously manned dispatch position within 0.5 second will be ensured.
- The talkgroup of the user pressing the emergency button shall be assigned the highest priority and shall be brought up for use within the same 0.5 seconds even if there is traffic on all working channels. All members of the talkgroup shall be automatically notified that there is an emergency in progress.

6.1.15 Trunking Modes

The system shall be capable of operating in either a message-trunked mode (with an adjustable hang time) or a transmission-trunked mode (no hang time). Hang time shall be terminated by activation of a switch or reprogramming via the network management system.

6.1.16 Denial of Access

The system shall deny access to selected units under the control of the system manager. When a unit is denied access to the system, that unit shall not be able to transmit to the system on any channel and it shall not be allowed to receive any operational voice or data traffic from the system on any channel. The unit shall monitor the control channel to allow reactivation by the system manager.

6.1.17 Unit Disable

The system shall remotely disable compromised units under the control of the system manager. When a unit is disabled, that unit shall not be able to operate until reprogrammed. Once disabled, the unit shall not monitor the control channel to allow reactivation by the system manager.

6.1.18 MANDATORY OPTION: Over-the-Air Programming (OTAP)

The radio system shall be equipped with over-the-air programming so subscriber unit operational parameters may be modified securely without removing a unit from service and returning it to a central location.

6.1.19 Programming Over Wi-Fi

The radio system shall be equipped with the ability for batch programming over Wi-Fi so subscriber unit operational parameters may be modified securely without removing a unit from service and returning it to a central location.

6.1.20 Encryption

6.1.20.1 Encryption Algorithms and Keys

The system and designated subscriber units shall be equipped with AES encryption.

6.1.20.2 End-to-End Encryption

The system shall provide end-to-end encryption, i.e., there shall be no point between a sending unit and receiving unit, whether subscriber unit or console, where an encrypted message is decrypted and transported unencrypted. If the radio system infrastructure equipment and the consoles are in the same building, it is acceptable to transport unencrypted audio between the consoles and infrastructure equipment provided that the equipment room is inside the secured NRV 9-1-1 Center.

6.1.20.3 Manual Key Fill Device

All equipment shall be capable of being manually rekeyed by interfacing with a portable key fill device (KFD).

6.1.20.4 Over-the-Air Rekeying

The system shall support over-the-air rekeying (OTAR) of encrypted subscriber units.

6.1.20.4.1 Key Management Facility (KMF)

OTAR shall be accomplished, and encryption keys shall be maintained by a key management facility (KMF). The KMF shall be capable of managing the rekeying subscriber units in groups and/or individually. The KMF shall incorporate means of tracking the rekeying process, identifying which units are rekeyed and which have not been rekeyed.

The KMF shall incorporate security partitioning to allow multiple agencies to utilize the same KMF without compromising security across operational groups.

The KMF shall support and shall be capable of managing manual rekeying via a KFD.

The KMF shall have a means to clear all keys in a compromised subscriber unit.

6.1.20.4.2 KMF Workstations

The following quantity of KMF workstations shall be installed at these locations:

Location	Workstations
NRV 9-1-1 Center	1
Radio Shop	1

Table 6-3 KMF Workstations

6.1.21 Station Identification

The system shall use an automatic means to conform to FCC requirements regarding station identification.

6.2 Performance

6.2.1 System Access Time

System access time is the time from the radio user's pressing the push-to-talk button to the radio unit's transmission on a working channel (assuming working channels are available). The system access time shall be less than following:

- 691.5 ms for a talkgroup call on a single trunked radio site
- 841.5 ms for a talkgroup call on a simulcast trunked radio system

6.2.2 System Throughput Delay

System throughput delay is the time from the transmission of an audio signal into a transmitting digital radio microphone to reception of the identical audio signal from a receiving digital radio speaker. The system throughput delay shall be less than the following:

- 250 ms for direct radio-to-radio communications
- 350 ms for direct radio-to-radio communications through a single repeater station
- 500 ms for direct radio-to-radio communications within an RF subsystem

–

6.2.3 Interference

6.2.3.1 Self-Interference

The radio system shall not cause self-interference. At each radio site, the static sensitivity of each radio system receiver shall be degraded by no more than 3 dB with any combination of radio system transmitters in operation.

6.2.3.2 Interference to Collocated Equipment

The radio system shall not cause interference to incumbent collocated RF equipment within one thousand (1000) ft of the new radio system equipment.

6.2.4 Radio System Reliability

6.2.4.1 System Failure Modes

All possible system failure modes shall be defined in the system's operational capabilities and limitations:

- GPS timing system failure
- Master oscillator failure
- Voter/comparator failure
- Interconnection circuit failure
- Transmitter failure

- Control channel failure
- Receiver multicoupler failure
- Tower top amplifier failure
- Trunking controller failure
- P25 system core failure
- Simulcast controller failure

The Proposer shall describe typical and maximum fault detection and failover times associated with redundant controller equipment. System acceptance testing shall demonstrate that each of these failures results in system recovery within the maximum failover thirty (30) seconds.

6.2.4.2 MANDATORY OPTION: Geo- Redundant P25 System Cores

The radio system shall have two (2) geographically separated redundant cores. The two cores must separate a minimum distance of five (5) miles, and both cores must be at sites on the connectivity network with a ring.

6.2.4.3 Simulcast System Failures

The simulcast system must maintain reliability in the event of system failure and must operate in a bypass mode of operation. In the event of a multi-point failure of wide-area or simulcast capabilities, the trunked radio system shall revert to either local trunking, where the individual site continues to function as a standalone trunked radio site, or conventional operation where each subscriber unit is assigned to a specific channel.

6.2.4.4 Control Channel Redundancy

The radio system shall incorporate control channel redundancy. When a single control channel fails, the control channel should automatically switch to another available frequency pair on the system, and the system shall continue to operate as a full-featured trunked system.

6.2.5 Radio System Coverage

6.2.5.1 Service Areas

The radio system shall provide coverage in the service areas shown in Figure 6-1.

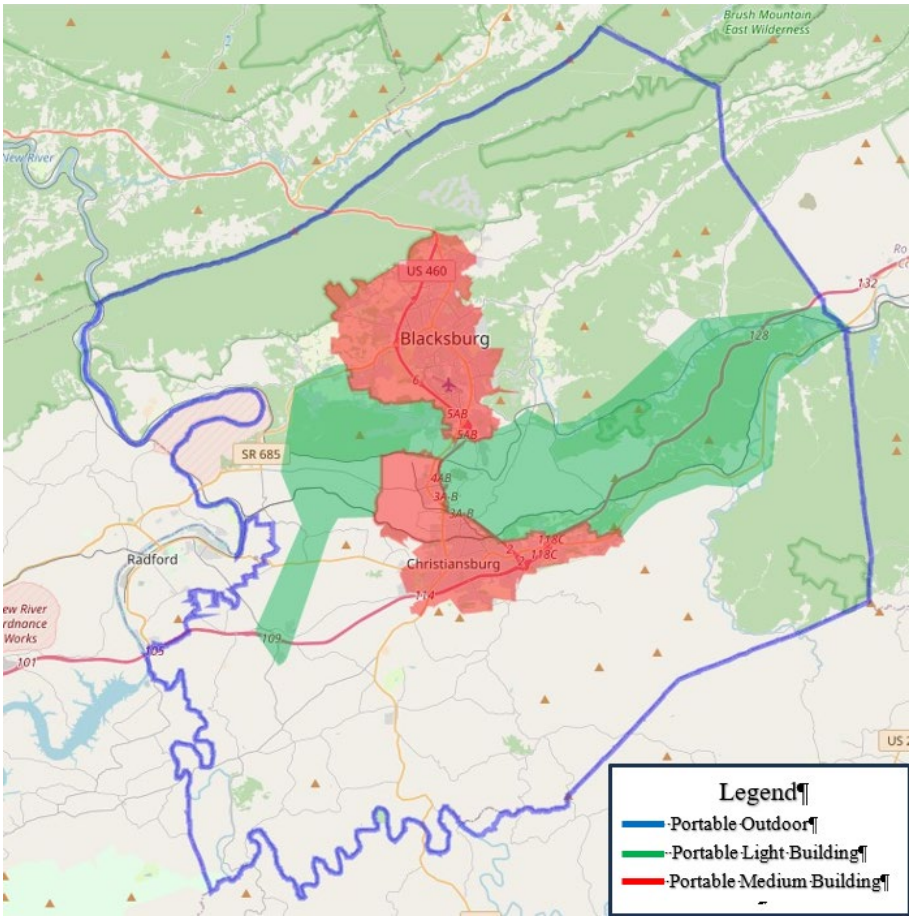

Figure 6-1 Service Areas

There are three (3) separate service areas required for the coverage guarantee. The area shaded in green is the portable inside light building service area. The two areas shaded in red are the portable inside medium building service areas. The area inside the County border (blue outline) and not included in the portable inside building service areas is the portable outdoor service area The level of signal loss required for indoor portable service areas is provided in the table below Building Attenuation.

6.2.5.2 Building Attenuation

The portable inside light building and medium building service areas require coverage to and from portable radios in light and medium buildings within the defined service area. The following building attenuations are assumed:

Service Area	Building Characterization	Building Attenuation (dB)
Portable Outdoor	Outdoor	0
Portable Light Building	Light Building	8
Portable Medium Building	Medium Building	12

Table 6-4 Building Attenuation for Service Areas

6.2.5.3 Required Coverage Level

The radio system shall provide a minimum delivered audio quality (DAQ) of 3.4 to the receiver in both the talk-out (base to mobile) and talk-in (mobile to base) directions. DAQ is defined in Telecommunications Industry Association (TIA) Telecommunications Systems Bulletin TSB-88.1-F, *Wireless Communications Systems – Performance in Noise and Interference-Limited Situations – Recommended Methods for Technology-Independent Modeling, Simulation, and Verifications*.

For test sectors requiring portable radio coverage, talk-in and talk-out coverage shall be based on the portable radio mounted at waist level.

6.2.5.4 Service Area Reliability

The radio system shall provide the specified service area reliability (as defined in TSB-88.1-F) to each of the service areas and radio transmission direction (talk-out and talk-in) as follows in the Table 6-6 below.

Service Area	Conditions	Talk-Out	Talk-In
		Service Area Reliability	
Portable Outdoor	Portable on the Hip Outdoors	95%	95%
Portable Light Building	Portable on the Hip in Light Building	95%	95%
Portable Medium Building	Portable on the Hip in Medium Building	95%	95%

Table 6-5 Service Area Reliability Requirements

The PROPOSER shall provide a percentage guarantee for each service area as described in the Table above. There is no time availability aspect to this specification. The PROPOSER is independent and may choose its propagation model, terrain database, statistical prediction method, and coverage charts. Areas of TDI shall be displayed as not having coverage and shall not be represented as a separate color on provided maps.

PROPOSERS shall provide separate unbounded coverage maps for each service area and direction (talk-out and talk-in) to support your guarantees. Include your propagation model(s), identify radio models, site locations (longitude, latitude, elevation, Tx and Rx antennae AGL), and detailed parameters.

Also provide the following unbounded coverage maps (for information only) with your proposal:

- Mobile Talk-out and Talk-in Coverage
- Portable Inside Heavy Building (20 dB) Talk-out and Talk-in Coverage

6.2.5.5 MANDATORY OPTION: In-building BDA

NRVECRA understands the radio system may not provide portable radio coverage inside some medium and heavy buildings. As an option, please provide cost information for equipment and installation of a Bi-Directional Amplifier (BDA) for the following three (3) scenarios:

- Single Story Box Store (Walmart, Lowe's, etc.)
- Multi-story Building (Apartment Complex, Hotels, Schools, etc.)
- Hospital/Prison/Airport

6.3 Radio System Equipment

Equipment shall be of the highest quality, most durable public-safety-grade equipment available. Equipment shall meet or exceed current standards of the Electronic Industries Alliance (EIA) and the Telecommunications Industry Association, and the rules and regulations of the Federal Communications Commission (FCC), in addition to these specifications.

The absence of detailed specifications implies the best general practice will prevail, and high-quality material and workmanship will be applied.

6.3.1 Base Station

Base stations shall meet or exceed the performance requirements of a Class A transceiver as defined in the following standards:

- ANSI/TIA-603-E, *Land Mobile FM or PM Communications Equipment Measurement and Performance Standards*; and
- ANSI/TIA-102.CAAB-E, *Project 25 Land Mobile Radio Transceiver Recommendations, C4FM/CQPSK Modulation*.
- ANSI/TIA-102.CCBA, *Project 25 Phase 2 Land Mobile Radio Transceiver Performance Recommendations, H-CPM/H-DQPSK Modulation*

6.3.2 Voting Comparator

Voting comparators shall vote both voice and data transmissions. Digital voting comparators shall select the best received signal based on bit error rate (BER). The digital voter shall be capable of selecting the best signal on a frame-by-frame basis.

6.3.3 Antenna Systems

The following minimum specifications, for each fixed antenna system proposed, shall be provided:

- Antenna mounting height and location on tower
- Antenna type and gain
- Transmission line type and loss
- Combining and multi-coupling network

6.3.3.1 Transmission Lines and Antenna System Accessories

Transmission lines shall be one (1) continuous length with a copper conductor and weatherproof jacket. All RF connectors shall be installed in accordance with their manufacturer's installation requirements.

All RF connectors shall be weathertight gold- or silver-plated contacts. All connectors shall be torqued to the manufacturer's specifications using a torque wrench. All connectors shall be soldered, not crimped. Manufacturer-approved wrapping and sealer shall be utilized on all outdoor transmission line in-line and grounding connections to prevent water intrusion. Outdoor installations shall include the proper minimum diameter drip loops in all cabling. Transmission lines shall be securely fastened to a cable tray or ladder attached to the tower using manufacturer approved devices and methods. Mounting hardware, cable hangers, grounding kits and other miscellaneous items shall be supplied to ensure proper installation of the antenna and transmission line. All metal components shall be intrinsically corrosion resistant. A hoisting grip shall be used at the top and at manufacturer recommended intervals to provide strain relief.

6.3.3.2 Transmit Combiners

Combiner insertion loss shall not vary from specifications by more than 0.5 dB on any port.

6.3.3.3 Receiver Multi-couplers

Each unused multi-coupler port shall be terminated with a 50-ohm load.

6.3.3.4 Tower-top Amplifier Systems

Receive antenna systems may utilize a tower-top amplifier (TTA) system comprising a tower-mounted pre-selector and amplifier, and an indoor rack-mounted multi-coupler. The TTA shall receive DC power transmitted via the transmission line.

The gain of the TTA and multi-coupler preamplifier shall be distributed between the two (2) amplifiers so that failure of the TTA will cause minimum degradation of system sensitivity.

The TTA shall be equipped with redundant amplifiers. The TTA shall automatically switch to the backup amplifier upon failure of the primary amplifier.

The TTA system shall include alarm contacts to indicate a failure, an RF test port to measure gain and a bypass switch to bypass the TTA.

6.4 Simulcast Requirements

If a simulcast system is proposed the system shall meet the specifications of this section. The following simulcast system details shall be provided:

- System timing
- Launch delay
- Frequency stability
- Frequency deviation
- Simulcast alignment

6.4.1 Simulcast Design

A simulcast system shall be designed so once aligned, it shall remain aligned and shall not need routine realignment. Under no conditions of failure shall the system be allowed to operate with two (2) co-channel transmitters transmitting simultaneously unless that operation is in the intended simulcast bypass mode. Parameters for simulcast alignment shall be determined by the CONTRACTOR in order to meet coverage requirements.

6.4.2 Transmitter Frequency Stability

The system shall be designed such that the radio frequency difference between any pair of co-channel transmitters operating in the simulcast mode shall not exceed 1.0 Hz.

6.4.3 Automated Simulcast System Timing

Automated simulcast system timing shall be referenced to GPS. Automated timing system shall allow for initial simulcast launch timing (bulk delay and offset) settings for each transmitter site. The system shall automatically readjust timing to maintain proper simulcast timing in the event a path reroute changes the transport delay from the simulcast prime/control site to a remote simulcast site.

6.4.4 Simulcast System Alignment

Simulcast system alignment procedures shall be straightforward and logical. After the system is initially aligned and accepted, there shall be procedures and alignment test facilities in place to allow routine verification of system alignment and equalization. There shall further be procedures, alignment equipment and facilities in place to allow realignment and re-equalization of the system under extraordinary situations such as replacement or repair of system components.

Routine verification of system alignment shall be possible using a single maintenance technician, preferably at a single location. Realignment may require more than one (1) maintenance technician at more than one (1) location.

6.5 Existing UHF Paging System Integration

NRVECRA currently uses a UHF analog Kairos paging system to alert Fire/Rescue and EMS personnel for active 9-1-1 incidents. NRVECRA will continue using the existing UHF analog Kairos paging system at the sites listed in Table 6-6. The PROPOSER's design shall integrate the existing paging system into the new P25 dispatch consoles. Paging for Fire/Rescue and EMS shall occur simultaneously on the new P25 radio system and the existing UHF analog paging system. The paging system shall operate over the new connectivity system.

Site #	Site Name	Lat/Long
1	Marshall	37 01 45 N 80 26 02 W
2	Buffalo Water Tank	37 07 12 N 80 25 41 W
3	Pedlar Hill	37 13 16 N 80 14 48 W
4	Poor Mtn. VSP	37 09 46 N 80 11 33 W
5	Price Mtn.	37 11 14 N 80 27 22 W
6	Brush Mtn.	37 15 48 N 80 27 56 W
7	Fisher View Mtn.	37 05 33 N 80 18 20 W
8	Ingles Mtn.	37 06 18 N 80 33 47 W

Table 6-6 Paging Site Locations

6.6 Console System

6.6.1 Console Quantities

NRVECRA currently operates thirteen (13) dispatch consoles located in the NRV 9-1-1 center, 3 consoles at the Blacksburg Police Department, and 3 consoles at the Virginia Tech Police Department.

NRVECRA requires replacement of all existing dispatch consoles with new P25 dispatch consoles. The new dispatch consoles will interface with the existing UHF paging system and the interoperability channels described in Table 6-2. The console system will also interface with the existing logging recorder.

New consoles and all necessary ancillary equipment needed to meet the requirements of this RFP should be provided with the new P25 radio system.

6.6.2 Console System Configuration

The new console system shall maintain and provide the functionality of existing systems and equipment to the same level of performance as the existing configuration.
New dispatch consoles shall be installed at the following locations:

ECC Location	Quantity of New Consoles
NRV 9-1-1 Center	13
Blacksburg Police Department	3
Virginia Tech Police Department	3

Table 6-7 Console Locations

6.6.3 Features and Functions

6.6.3.1 Trunked Radio System

The console system shall interface with the trunked radio system and shall provide all console control features over the trunked radio system. The console system shall support both P25 Phase 1 and P25 Phase 2.

The console system shall provide full P25 open-standard encryption/decryption capabilities (AES) that are compatible with P25 subscriber units. The encryption/decryption functionality shall be under the control of authorized users through the radio console system. The console system shall support encrypted voice calls. The consoles shall support emergency call operation and have both a visual and an audible notification of emergency calls initiated by the subscriber units.

6.6.3.2 Conventional Radio Channels

The new console system must interface with existing conventional channels and provide the same level of operation as the existing console system. The conventional channels must be capable of being patched to the trunked radio system.

6.6.3.2.1 Tone Remote Control

The console system shall be equipped with tone remote control capability. The system shall be compatible with industry-standard tone remote control protocols.

6.6.3.2.2 E&M Signaling

The console system shall be capable of E&M signaling to control any conventional radios, if necessary.

6.6.3.2.3 System Guard Tone

A system guard tone shall be available for the conventional radios. All modules shall be capable of generating EIA tone sets, which may be required for special purposes. In compliance with FCC regulations, if control circuit facilities should be lost, the system shall be designed such that the base station transmitter ceases transmitting within five hundred (500) milliseconds.

6.6.3.3 Backup Control Stations

Each console position shall be equipped with one (1) full-featured single-band backup control station. The control station shall be rack-mounted in the equipment room with a remote control head located at the dispatch console position.

6.6.3.4 Instant Recall Recorder

Each console shall be equipped with an instant recall recorder (IRR). The IRR shall be capable of recording radio communications from the selected channel or talkgroup. If telephone communications are performed through the console headset, the IRR shall be capable of recording audio from telephone communications. The IRR shall be capable of storing at least thirty (30) minutes of audio. IRR audio shall be replayed through the console select speaker.

The IRR shall be equipped with the following features:
- Fast forward and reverse
- Simultaneous record and playback

6.6.3.5 Paging Encoder

The console system shall be equipped with integrated paging encoder capabilities and support the two-tone sequential paging format. The encoder shall be capable of initiating a single page or multiple pages at once. The console operator shall be able to review paging sequences before transmission is initiated. Paging sequences shall be queued while other paging sequences are being transmitted. An indication shall be provided at the console to indicate when a paging sequence is complete.

6.6.3.6 MANDATORY OPTION: Auxiliary Inputs and Outputs

The console system shall be equipped with auxiliary inputs and dry contact relay outputs (Aux I/Os) for doorbells, door controls and remote alarms. Auxiliary inputs shall be visible at each console. Auxiliary outputs shall be operable at each console position. The system shall be equipped with at least eight (8) inputs and eight (8) outputs.

6.6.3.7 Concurrent Console Operation

Allowances shall be made for parallel console operation with the existing radio system and the new radio system until complete conversion to the new radio system.

6.6.4 Console Equipment

6.6.4.1 Physical Configuration

Console equipment shall be installed in the existing NRV 9-1-1 Center, Blacksburg PD, and Virginia Tech PD.

The individual consoles shall be modern workstations with CPU and audio cabinets, as necessary. Console monitors shall use flat-panel technology. Workstation CPUs may be housed in the console furniture to maximize operator work surface.

New Console hardware shall be compatible with existing Black Box Freedom 2 KVM so that dispatchers can use a single mouse and keyboard across multiple PCs at each dispatch position.

6.6.4.2 Operator Position Hardware

The CONTRACTOR shall provide the following equipment:

Footswitch:	One (1) single pedal footswitch per console.
Microphone:	One (1) per console, high-quality microphone preferably on a pedestal.
Headset Jacks:	Two (2) headset jacks per console, below table edge mountable, automatically disconnect external microphone and select speaker, the capability to converse on the telephone using the same operator headset and jack that is used for radio conversations shall be provided. Separate volume controls shall be provided to control radio volume and telephone volume to the headsets.
Speakers:	One (1) select speaker and one (1) unselect speaker per console, with volume controls.

6.6.4.3 Workstation

The workstation shall be mounted below the work surface, but controls shall be accessible to the console operator with minimal effort. The workstation shall use a mouse or similar pointing device. The operator can transmit using either the left or the right mouse button. The workstation shall also have a standard PC keyboard.

6.6.4.4 Flat-panel Display

The display shall be a 24-in flat-panel LCD display. Minimum resolution shall be 1920 x 1080 pixels. Display controls shall be accessible to the console operator. The monitors shall be touch screen capable.

6.6.4.5 Select and Unselect Speakers

Speaker audio output shall be at least 3.5 W. Each speaker shall have its own volume control. The selected speaker shall reproduce the audio from the selected talkgroups or channels. The unselected speaker shall reproduce the audio from the other talkgroups, or channels being monitored by the console.

6.6.4.6 Foot Switch

The footswitch shall permit the console operator to key the selected talkgroup or channel. On conventional channels, the footswitch may be programmed to disable coded squelch.

6.6.4.7 Headset Jacks

Each position shall be equipped with two (2) headset jacks. Jacks shall be standard four- or six-wire connections for headsets with integrated microphones. Inserting the headset plug into either jack shall route the select audio to the headset and disable the console select speaker. Headset jacks shall interface with the existing telephone system so that dispatchers can use the same headset for telephone and radio communications.

6.6.4.8 Wireless Headset Adapter

Each position shall be equipped with a wireless headset adapter.

6.6.5 Console System Operation

6.6.5.1 Console Operating Characteristics

The consoles shall be designed to enhance the operator's capabilities in performing resource management tasks and minimize the effort and concentration required for radio control. Transmitting over the displayed selected talkgroups or conventional channel(s), and instant transmitting over a displayed talkgroup or conventional channel shall be performed with only one (1) operator action.

To minimize operator confusion and mistakes, all channels, talkgroups, and users shall be indicated by actual aliases, not numeric resource references. Cross-referencing a number to a talkgroup or conventional channel name shall not be required when performing a dispatching operation. For maximum flexibility, these aliases shall be defined by NRVECRA at system installation and shall be easily changed at any time after system installation. Aliases coding shall allow at least eight (8) alphanumeric characters.

6.6.5.2 Display Areas

Display screens shall be configured to minimize distractions to operators while providing access to all radio dispatch functions from a single screen. The screen shall display:

- System Status
- Radio Controls

- Call History
- Date and Time

6.6.5.3 Active Status Indicator

For each radio resource shown in the radio controls portion of the console screen, the following indications shall be available:

- Permanent indications
  - Resource Alias
  - Volume
  - Mute Status

- On-demand indications
  - Call Status
  - Select
  - Patch
  - Simultaneous Select
  - Busy
  - Multi-Frequency Transmitter
  - Squelch Disable
  - Emergency Call indication and alarms

6.6.5.4 Console Capabilities

The console shall be capable of the following operations:

- **Supervisory Control**: Allows supervisor to override or disable a console position.
- **Patch**: Allows multiple talkgroups or channels to be patched together. The console shall be capable of at least three (3) patches simultaneously.
- **Simultaneous Select**: Allows console operator to call multiple talkgroups or channels at once. The console shall be capable of at least three (3) simultaneous select groups.
- **Intercom**: Allows console operator to selectively talk to another console directly.
- **Console Cross Mute**: Prevents feedback between consoles.
- **Alert Tones**: The console shall be capable of transmitting alert tones over the radio system.
- **Console Pre-Empt**: The console shall have priority or console pre-emption transmit capabilities on either the trunked or conventional radio systems.

6.6.5.5 Time Synchronization

All consoles shall be synchronized to the radio system common time signal reference.

6.6.6 MANDATORY OPTION: Remote Dispatch Consoles

Remote dispatch operations shall be supported by the Console System to allow NRVECRA to operate console positions at locations other than the NRV 9-1-1 center. Remote dispatch consoles shall be accessible to the network by direct connection to the network or via other means, such as satellite connectivity. This shall be a fully functional console for radio dispatch. Aux I/O is not required to be supported. It is envisioned this application could operate on an existing PC or laptop using the microphone and audio/speaker connectors of the PC.

6.7 Logging Recorder

NRV 9-1-1 has recently replaced their logging recorder with a new Eventide Nexlog 740DX. The CONTRACTOR shall upgrade the existing logging recorder to interface with the new P25 trunked radio system. The recorder shall function as a full featured "trunked" recorder with the capability of recording all talkgroups, encrypted and clear, on the radio system, conventional channels and all the NRV 9-1-1 Center telephone lines. The recorder shall capture full call data for each such as date and time, caller unit ID and alias, talkgroup or individual ID and alias, emergency, and encrypted status. Calls shall be retrievable later by searching date and time, talkgroup and/or unit ID. This upgrade shall include all software, licenses, and hardware necessary to record the new P25 radio system. The logging recorder system shall remain operational throughout the radio/console system and logging recorder transitions.

6.8 Radio Network Management System

6.8.1 General

Network management consists of the following functions:

- configuration management
- performance management
- security management
- fault / alarm management

The Network Management System (NMS) may comprise one (1) or more subsystems to perform these functions. For example, configuration, performance, and security may be provided on one (1) NMS network, while alarm reporting may be provided on a separate NMS. The NMS shall be a GUI-based, multi-protocol network management tool. The NMS shall provide remote access via VPN with SSL web access control security. The NMS shall be capable of automatic notifications of threshold events that require immediate response and deployment.

NMS access shall be available at the following locations:

- NRV 9-1-1 Center (function shall be available on at least two (2) workstations in this center)
- Radio Shop
- Remote VPN

6.8.2 Configuration Management

The NMS shall provide the human-machine interface for configuration of the radio system and associated subsystems. Radio system configuration includes items such as the following:

- channel partitions
- control channel designations
- encrypted channel designations
- enabling or disabling channels
- enabling or disabling sites
- trunking modes
- system fault definitions
- console configurations or personalities

Subscriber or user configuration includes items such as the following:

- allowable call length
- talkgroup definitions
- unit IDs
- enabling or disabling subscriber units

The NMS shall provide a database for all radio system elements. The NMS shall allow the system administrator to perform multiple simultaneous database operations.

6.8.3 Performance Management

The NMS shall display and store system status and traffic data for functional and organizational management of the user base. The NMS shall display system performance information on an NMS workstation with a summary printer. The system shall be capable of displaying channel activity for the entire system on screen. The NMS shall store performance data on electronic media. Real-time storage capacity shall be sufficient to store system activity records for one (1) full week.

Data displayed and stored shall include the following items as a minimum:

- System Traffic Data
  - Channels in use
  - Total channel minutes on the air
  - Transmitter use balance
  - System busy time
  - Emergency Priority utilization
  - Usage Optimization

- System Status Data
  - System failures in progress
  - System organizational changes (unit reassignments)
  - Report Building
  - Activity Details

  - Activity Summaries
  - Alarm Control, Display, and Logging
  - Channel Statistics
  - Site Statistics
  - Event Logs
  - On Screen Reports

- Subscriber Traffic Data
  - Unit (including consoles) making call and the time the call was successfully completed
  - Length of transmission
  - Time in waiting queue
  - Type of call (e.g. group, individual, telephone, data, etc.)
  - Destination of call (e.g. group ID, individual ID, etc. that received call)

6.8.4 Security Management

Access to the NMS shall be password protected. There shall be at least two (2) levels of password access. Access to status, activity, alarms, and other system information shall be available to several authorized users. Control and diagnostic operations shall be accessible to a limited number of administrator-level users authorized to control these operations.
The servers shall have the ability to be remotely supported by VPN. The database administrator shall have the capability to monitor all VPN access and activities being performed by the remote entity.

Web browser access shall be provided with support monitoring and control functions and administratively restrictive database modifications. Multiple locations and users should be able to access the monitoring screens concurrently.

6.8.5 Fault/Alarm Management

The NMS shall monitor the radio system and microwave network for critical and non-critical failures and status changes. The system shall be continuously and automatically monitored for failure of any key component. Any failure of a key component shall be automatically indicated at the NMS workstations.

6.8.5.1 Alarm Points

The NMS shall monitor and alarm major and minor failures, abnormal conditions of operation, and status changes of the radio system and connectivity network. Alarms monitored shall include equipment failures or link failures of or to the following equipment or systems:

- GPS receivers
- Repeaters
- Tower-top amplifiers
- Antenna systems
- Control systems

- Network management systems
- Database management systems
- Consoles
- Summary alarms from connectivity system
- Channel banks
- Loop switches
- Routers
- Network switches

The above list is a minimum requirement. The NMS shall allow any failure or abnormal operating condition to be traced to the equipment level.

In addition to radio system alarms, the following facility alarms at each communications location are to be integrated into the NMS:

- Building Intrusion
- Building Low/High Temperature
- Tower Lighting
- Building Smoke/Fire
- Air Conditioner Failure
- Commercial Power Failure
- Generator Run
- Generator Control Switch Not Set
- Generator Low Oil Pressure Pre-Alarm
- Generator Low Oil Pressure Alarm
- Generator Low/High Coolant Temperature Pre-Alarm
- Generator Low/High Coolant Temperature Alarm
- Generator Low Fuel in Tank
- Generator Failure Summary Alarm

6.8.5.2 Alarm Point Inputs

The alarm system shall accommodate the following types of status inputs, at a minimum:

- Form C relay (either N/O or N/C)
- TTL
- RS-232

Where available, SNMP is the preferred method for capturing and reporting alarms to the NMS. Any additional third-party equipment that supports the overall communications system shall be provisioned with alarm ports that are compatible with the proposed alarm system.

6.8.5.3 Alarm Indication

When a major or minor failure or status change occurs, an indication shall be displayed on the alarm system terminal within thirty (30) seconds of the alarm occurrence. The alarm system terminal shall display a report for each alarm containing, at a minimum, the following information:

- Station name
- Point name
- Point status description
- Optional instruction line

Alarms shall remain active until the failure is corrected and the alarm is reset by the operator.

6.8.5.4 Alarm Point Attributes

The primary alarm description text field shall provide a minimum of forty (40) characters for each alarm status. A secondary alarm description field shall assign the change of state severity: Critical, Major, Minor & Status. The third field shall provide condition indicators for fail and clear, Door Open, Door Closed, etc.

The system shall be capable of classifying alarms into selectable groups such as Critical, Power Alarm Group, Generator, etc.

The NMS Master shall have independent control of whether specified alarms are displayed on the workstation screen or are directly recorded within the history file.

The system shall have the capability of assigning special resolution instructions per alarm point to provide operator directions. The operators shall have the ability to notate comments on alarm points. These comments shall be time stamped and log the operator who created the entry.

6.8.5.5 MANDATORY OPTION: Geo-Redundant NMS Server

The NMS shall be fully redundant for both hardware and software, with a primary and a backup server. The geo-redundant backup server shall be co-located with the backup radio system core, and must be updated with all alarm, provisioning, and measured data daily at a minimum, without interruption to the functionality of the NMS. In the event of equipment failure of the primary server, the backup server shall automatically switch in a seamless manner to the primary mode of operation. If the primary server loses visibility of any remote sites due to microwave equipment or hop outage, the backup server shall assume the primary function of operation for sites that have lost connectivity to the primary server but retain connectivity to the backup server.

6.8.5.6 Visible and Audible Annunciation

Each alarm indication shall provide a visible and audible annunciation when an alarm occurs. The audible alarm may be silenced when the alarm is acknowledged by the operator.

6.8.5.7 Historical Data

The alarm system shall store historical alarm data. Historical alarm reports shall be capable of querying, allowing the operator to produce alarm reports based on individual alarm, equipment, equipment type, subsystem, or time. Historical data shall be exportable to other software for analysis. The system shall store historical alarm data for a period of ninety (90) days at a minimum.

6.9 MANDATORY OPTION: Subscriber Mapping System

The subscriber mapping system shall utilize the location data reported from the P25 subscribers via the radio system infrastructure to display the location of each P25 subscriber reporting its GPS location over a background map display. The background map display shall be capable of being set to different background types, such as RoadMap and Satellite Overview. The system shall be able to zoom into the background map and the background map shall rescale as it zooms in and out.

Subscriber locations shall be capable of being displayed with a minimum of four (4) different icons and the icons colors shall be able to be changed. Subscriber location shall have an adjustable update time with minimum updated time of one (1) second.

The subscriber mapping system shall be capable of simultaneously access at each dispatch position in the NRV 9-1-1 center and shall be able to be displayed on a wall mounted display. The minimum display resolution shall be 1920 x 1080.

7 Connectivity Network

The connectivity network shall provide IP/MPLS digital connectivity among the trunked radio system RF sites and core network equipment at the NRV 9-1-1 Center. The capacity of the network links must be at least 150 Mbps to support the radio system, other existing circuits (such as circuits for conventional radio channels) and future applications of NRVECRA. Commercial fiber-optic cable may be available to link existing NRVECRA-owned radio sites and the NRV 9-1-1 Center. The remainder of the telecommunications links shall be IP/MPLS microwave provided by the CONTRACTOR.

The connectivity network shall be designed to meet the availability requirements specified in this RFP. True redundancy shall be provided for all LMR traffic and alarm system circuits, such that the failure of any single path or piece of equipment must not degrade radio system performance. It is expected that each RF site will be part of a telecommunications ring providing redundant routing to/from each RF site to the NRV 9-1-1 center.

7.1 Existing Connectivity Network

NRVECRA's current microwave system supports the existing UHF conventional analog radio system. The current system operates in the 4.9 GHz public safety band. However, the existing microwave system does not have sufficient bandwidth to support the new P25 radio system.

7.2 Microwave System Requirements

7.2.1 Configuration

The microwave system shall provide redundant routing to/from each RF site to the core equipment location and to the NRV 9-1-1 center. Failure of a single telecommunications circuit shall not diminish the ability of the connectivity network to provide required connectivity between the RF sites and the NRV 9-1-1 center. The connectivity design shall have path or equipment redundancy. The system shall be scalable and capable of upgrading capacity by adding additional microwave RF channels via the proposed antenna system. NRVECRA expects the designed connectivity system to utilize a ring topology. If any spur site cannot join the ring realistically, then this site must follow § 7.5.1.3 (MHSB).

Figure 7-1 is an example conceptual design of the general desired connectivity network topology. The connectivity network shall be designed to meet the availability requirements specified in this RFP.

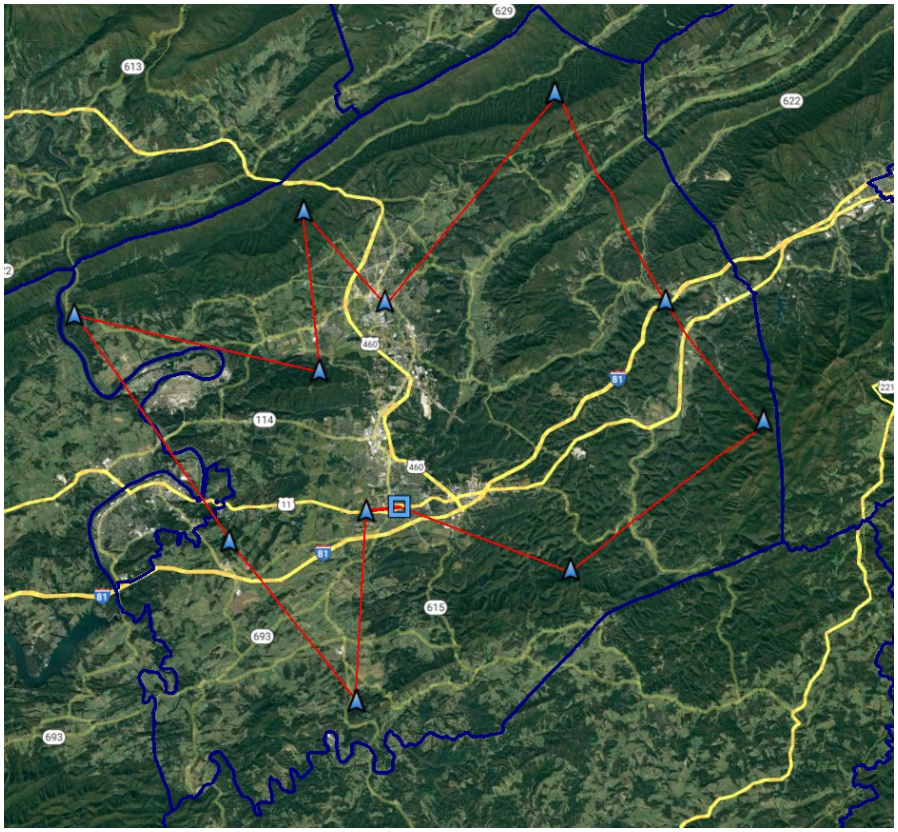

Figure 7-1 Example Conceptual Connectivity Network Topology

7.2.2 Microwave Frequency Bands

The microwave network shall use licensed frequencies in the 4.9, 6, 11, 18 and 22 GHz fixed service bands.

7.2.3 Microwave System Performance

7.2.3.1 Path Availability

Each microwave path shall be designed to provide a minimum two-way path (round-trip) availability of 99.9995 percent at a BER threshold of 1E-6. Note that a one-way microwave path (outbound or inbound) requires the minimum availability of 99.9999 percent at a BER threshold of 1E-6.

Microwave path propagation predictions and designs shall be based on line-of-sight conditions conforming to the following obstruction clearance criteria:

- 0.6 F1 + 10 feet at K = 1.0
- 0.3 F1 at K = 2/3
- F1 at K = 4/3

7.2.3.2 Circuit Quality

The microwave system shall be designed to provide a minimum of 1E-6 BER for each DS1 end-to-end circuit, including any combination of contiguous microwave hops.

7.3 Connectivity Network Management System

The NMS shall provide a single platform for personnel to monitor the connectivity network and to provide adequate alarm information for first level response to system degradation and outages. The NMS shall be a GUI-based, multi-protocol network management tool. The NMS shall provide remote access via VPN with SSL web access control security. The NMS shall be capable of automatic notifications of threshold events that require immediate response and deployment.

Network management consists of the following functions:
- equipment provisioning
- configuration management
- performance management
- security management
- alarm management

The NMS shall provide summary alarm outputs to the radio system NMS.

7.3.1 Configuration Management

The NMS shall provide the interface for configuration of the connectivity network. Connectivity configuration includes items such as the following:
- Provisioning of the microwave radio equipment
- Administrative functions

The NMS shall provide a database for all network elements and configuration parameters. The NMS shall allow the system administrator to perform multiple simultaneous database operations.

7.3.2 Performance Management

The NMS shall display and store system status, alarm indications, administrative functions, and NMS system access. The NMS shall store performance data on electronic media. Real-time storage capacity shall be enough to store system activity records for one (1) full month. The NMS shall display system performance information on an NMS workstation.

Data displayed and stored shall include the following items at a minimum:
- System failures (static and intermittent)
- Historical Report
- Activity Details
- Activity Summaries
- Alarm Control, Display, and Logging

- Equipment Statistics
- Site Statistics
- Event Logs
- On-Screen Reports
- Receive signal level (RSL)
- IP packet statistics such as collisions, jabbers, packet sizing and fragments

Data stored and reported, and thresholds for upper and lower limits shall be customizable.

7.3.3 Security Management

Access to the NMS and other system elements shall be password protected. There shall be at least two (2) levels of password access. Access to status, activity, alarms, and other system information shall be available to three (3) authorized users. Control and diagnostic operations shall be accessible to a limited number of administrator-level users, authorized to control these operations.

The servers shall have the ability to be remotely supported by VPN. The database administrator shall have the capability to monitor all VPN access and activity while being performed by the remote entity.

Web browser access shall be provided with support monitoring and control functions and administratively restrictive database modifications. Multiple locations and users should be able to access the monitoring screens concurrently.

7.3.4 Fault Management

The NMS shall monitor the connectivity network for critical and non-critical failures and status changes. The system shall be continuously and automatically monitored for failure of any key component. Any failure of a key component shall be automatically indicated at the NMS workstations.

7.3.4.1 Self-Diagnostic Capabilities

The system shall have the following diagnostic capabilities to facilitate and enhance the troubleshooting ability of the NMS system and associated hardware.

- Monitor master and backup server hardware components (disk drives, fans, temperature).
- Gather statistics on quality of polling per address.
- Gather statistics on quality of polling per polling port.
- Ability to view polling activity in text as well as protocol (byte) level.
- Internal operational alarms shall be monitored and appear as other system event alarms.

7.3.4.2 Alarm Points

The NMS shall monitor and alarm major and minor failures, abnormal conditions of operation, and status changes of the radio system and connectivity network. Alarms monitored shall include equipment failures or link failures of or to the following equipment or systems:

- Network management systems
- Database management systems
- Microwave radios
- Network routers
- Network switches

The above list is a minimum requirement. The NMS shall allow any failure or abnormal operating condition to be traced to the shelf sub-system level.

The connectivity NMS shall provide summary alarm outputs connected to inputs of the radio system NMS.

7.3.4.3 Alarm Point Inputs

The alarm system shall accommodate the following types of status inputs, at a minimum:

- Ethernet (SNMP)
- Form C relay (either N/O or N/C)
- TTL

7.3.4.4 Alarm Indication

The NMS GUI screen display shall display the complete monitored network and associated programmed alarms, controls, and status. The GUI layer display progression shall be as follows:

- **Global View:** This shall be a mapped representation of all sites. If an alarm condition exists at a site, a single-colored icon shall illuminate red for critical/major, yellow for minor, green for normal, and blue for manual control.
- **Site Level View:** The site level views shall illustrate the equipment at each individual site. Each equipment sub-system shall be represented by an illuminated colored icon.
- **Equipment View:** The equipment view shall expand the equipment subsystem in the Site Level View and display the individual racks, shelves and modules generating the alarm. Each displayed rack, shelf and module shall have a colored icon illuminated.

When a major or minor failure or status change occurs, an indication shall be displayed on the alarm system terminal within thirty (30) seconds of the alarm occurrence. When an alarm is generated, the icon shall blink the appropriate color and continue to do so until acknowledged. Once an alarm point is acknowledged, the icon shall cease to blink and maintain the color associated with the priority level until the alarm status is normal.

The alarm system terminal shall display a report for each alarm containing, at a minimum, the following information:

- Date and time (stamped by either the master or RTU)
- Station name
- Point name
- Point status description
- Optional instruction line

The user shall have the capability to customize the system's alarm display field's format as to which fields are to be displayed, in what order and in what colors. Clear or normal alarms and/or conditions shall have the capability to be displayed in various colors independent of the coloration of the failed alarms. The system workstations shall have the capability of displaying text and GUI representation all current system monitored alarm status. All event state changes that have not been acknowledged by the user shall be displayed in a separate list of event state changes.

7.3.4.5 Alarm Point Attributes

The primary alarm description text field shall provide a minimum of forty (40) characters for each alarm status. A secondary alarm description field shall assign the change of state severity: Critical, Major, Minor & Status. The third field shall provide condition indicators for fail and clear, Door Open, Door Closed, etc.

The system shall be capable of classifying alarms into selectable groups such as Critical, Power Alarm Group, Generator, etc. The NMS Master shall have independent control of whether specified alarms are displayed on the workstation screen or are directly recorded within the history file.

The system shall have the capability of assigning special resolution instructions per alarm point to provide operator directions. The operators shall have the ability to notate comments on alarm points. These comments shall be time stamped and log the operator who created the entry.

7.3.4.6 Alarm Notification Media

The NMS shall provide remote access via VPN with SSL web access control security. The NMS shall provide automatic notifications of threshold events that require immediate response and deployment, utilizing the NRVECRA's existing Internet connections and/or any new connections provisioned for purposes of contracted network monitoring services.

7.3.4.7 Alarm Analysis

The NMS shall have the capability to establish truth table and threshold routines for leveled response. For example: Site A reports "*Microwave PA output, Low*" (This alarm by itself would not constitute an after-hour's callout). However, coupled with a site B intermittent "*Microwave*

Signal Degrade" and a site B "*MPLS BER Threshold Alarm*" the NMS routine script would report "*Site A Microwave Transmitter Alarm, Major, Immediate callout, John Doe*."

7.3.4.8 Visible and Audible Annunciation

Each alarm indication shall provide a visible and audible annunciation when an alarm occurs. The audible alarm may be silenced when the alarm is acknowledged by the operator.

7.3.4.9 Historical Data

The alarm system shall store historical alarm data. Historical alarm reports shall be capable of querying, allowing the operator to produce alarm reports based on date and time, site or subsystem, alarm classification, equipment, or equipment type. Historical data shall be exportable to other software for analysis. The system shall store historical alarm data for a period of at least thirty (30) days.

7.3.5 MANDATORY OPTION: NMS Backup

A backup server must be updated with all alarm, provisioning, and measured data daily at a minimum, without interruption to the functionality of the NMS. In the event of equipment failure of the primary server, the backup server shall automatically switch in a seamless manner to the primary mode of operation. If the primary server loses visibility of any remote sites due to microwave equipment or hop outage, the backup server shall assume the primary function of operation for sites that have lost connectivity to the primary server but retain connectivity to the backup server.

7.3.6 Protocols

The NMS platform shall have the ability to support concurrently polled protocols on multiple ports. It shall be capable of alarm mediation, such as receiving collected alarms from another monitoring platform or element manager using one (1) or more of the following protocols: SNMPv1, SNMPv2, SNMPv2c, SNMPv3, MODBUS, and TL1. The NMS shall have a MoM SNMPv2c (minimum) port that will report all alarm information to a higher order MoM.

7.4 Software

The system shall support software modularity, which shall allow for selective functionality enhancements to be added or removed based on the specific requirements of the NRVECRA.

7.5 Equipment Requirements

The microwave system shall include all equipment required for a complete operational system. The equipment shall be complete, mounted, and wired in racks, ready for operation. Accessories shall include specialized test fixtures, test cords, and adapters. All equipment shall be completely tested at a staging location. Staging tests shall be documented.

The equipment shall be completely solid-state, employing the latest technology, and shall be convection-cooled. All necessary standby switching, alarm sensing, and control shall ensure fully automatic operation. Equipment shall have remote alarm/control capability for any equipment failure.

7.5.1 Digital Microwave Radio

RF terminal equipment shall meet the following requirements:

Primary Power Input:	-48 VDC
Max Residual BER:	1E-10
Capacity:	100 Mb/s

RF Terminals are expected to be indoor units unless a special circumstance is encountered. The use of outdoor units ***may*** be considered by the NRVECRA on a case-by-case basis; however, this is not the desired configuration.

7.5.1.1 Redundancy

The microwave equipment shall utilize redundancy against failure. All packets shall be automatically protected using BER threshold sensing, IP QoS monitoring and packet switching. All packet loss failures shall be sensed and remotely indicated. The microwave equipment shall have fault-sensing capability that will detect transmitter and receiver failures and bit error rate degradation. The equipment shall provide alarm outputs to the alarm system. The equipment shall provide status indications for local observation.

7.5.1.2 Mesh-Configured Microwave Equipment

In a mesh configuration, the microwave equipment shall be fully protected utilizing two (2) or more microwave or fiber-optic routes to each site. If there is a failure or path/equipment degradation which exceeds the BER threshold of the primary link or equipment, the packets will reroute to alternate links before there is any degradation to traffic or loss of network and/or equipment synchronization.

7.5.1.3 Spur-Configured Microwave Equipment

Spur-configured microwave equipment shall be fully protected with monitored hot-standby (MHSB) transmitters and receivers. (However, if the microwave equipment is connected with fiber-optic, and a site/location is in a ring topology, microwave is not required to be MHSB.) The receiver outputs shall be switched in a “hitless” (fewer than ten (10) bit errors) manner. The MHSB transmitters shall be switched to provide proper termination and isolation to the standby transmitter. Either the primary or secondary transmitter may be active. Provisions shall be included for testing and alignment of the standby units without disturbing the active units.

7.5.2 Microwave Power Supplies

All proposed microwave equipment shall be powered from a nominal -48 VDC supply.

7.5.2.1 Battery Charger/Powerboard Equipment

Microwave and multiplex sites shall be equipped with -48 VDC, positive-ground redundant charger/powerboard units. Charger/powerboard unit's recharge time shall not exceed eight (8) hours to charge a discharged battery plant to its specified capacity. The charger/powerboard supplied shall operate so that it provides adequate current output to support the microwave equipment site load. The charger/powerboard shall be equipped with and wired for operation in an EIA standard rack and shall consist of the following components:

- N + 1 multiple charger units configured for load sharing and redundancy
- Circuit breaker panel equipped with individual distribution circuit breakers
- Ground bar
- Volt/ammeter panel
- System load disconnect panel
- High/low voltage disconnect panels

The charger/powerboard units shall have the capability to operate in a battery-eliminator configuration.

7.5.2.2 Battery Plant Equipment

The battery system shall consist of sealed maintenance-free cells and shall meet or exceed eight (8) hours of operating time for supplied microwave equipment. Battery operating life expectancy shall be at least eight (8) years.

Battery racks shall be installed, assembled, and wired as a complete operational system. Vendor-recommended corrosion-resistant hardware shall be provided to facilitate long-life operation of battery plants. Steel racks used to support battery units shall be protected by an acid-resistant material or coating. System shall be designed for easy access in the event batteries must be replaced.

7.5.3 Microwave Antenna Systems

The antennas, radomes, waveguide, and associated mounting hardware shall be rated to withstand winds and icing conditions common to the NRVECRA's service area.

Antennas shall be of solid construction with pressurized feed horns. Antennas may be single polarized or dual polarized. Antennas shall be furnished with long life radomes.

7.5.3.1 Microwave Antenna Mounting

All antennas 6 ft. or greater in diameter shall be secured to the tower with a minimum of two (2) side-braces. Standard 4.5-inch diameter pipe mountings shall be utilized to support the microwave antennas.

7.5.3.2 Microwave Antenna Ice Shield

Ice shields shall be installed above microwave antennas.

7.5.3.3 Microwave Transmission Lines

High quality copper elliptical waveguide shall be employed in continuous lengths for all transmission line runs. Splicing is not permitted. The waveguide shall be installed and grounded in accordance with the manufacturer's recommendations, using hardware approved by the manufacturer for that purpose.

7.5.4 Dehydrator/Pressurization System

The pressurization equipment shall maintain at least five (5) psig of positive pressure in the elliptical waveguide and antenna feed horn. The CONTRACTOR shall include all required fittings, regulators and pressurization lines, gauges, distribution manifolds, and installation hardware. Separate pressure metering shall be provided for each waveguide pressurized. Alarm outputs for low pressure, high pressure, high humidity, and excessive run time shall be provided and connected to the network monitoring and control system.

All installed antenna/transmission lines shall be purged, pressure-tested, and tested for low Voltage Standing Wave Ratio (VSWR) using return loss measurements over the specified frequency band.

7.6 Optical Transport Network Equipment

Dedicated fiber optic links and/or leased lines may be used as components in the connectivity network.

7.6.1 Fiber Optic Cable

Fiber optic cable shall be constructed and installed in accordance with applicable TIA/EIA standards and the manufacturer's recommendations.

The system design shall use redundant cables routed utilizing separate conduits to facilitate communications redundancy between each node. Redundancy configurations should support ring protection and secondary routing capabilities to protect against operational failures along routes.

A cross-connect (x-con) junction rack will be provided to house the splice tray equipment and x-con panels. The rack shall be a standard EIA/ECA-310 relay rack with standard hole spacing and will include the following:

- Fiber management panel to facilitate x-con cable routing
- Universal cable clamp for cable support
- Fiber identification flip chart

7.6.2 Transport Node Equipment

Transport node equipment shall be configured to support loop, or single path with 1+1 or N+1 redundancy switching architectures.

Transport node equipment shall adhere to the base rate and format along with multiplexing scheme specified in the ATIS 0900105(2015) standards and the optical specifications, transmission capabilities, and interface as detailed in ATIS 0900105.06(2002). Optional units shall be provided for 1310 nm and 1550 nm.

In a loop configuration, the transport node equipment shall be fully redundant at the optical network line side and the DS3/DS1 electrical drop side. The network loop will provide a primary (clockwise) DS1 link with a dedicated secondary (counterclockwise) DS1 link for all sites on the loop. The receive section on the line or network side will monitor the OC3, STS-1, DS3 or DS1 signals from both directions and perform a comparative selection according to BER or loss of signal (LOS), then switch to the non-degraded path. The switch function BER threshold at the OC3 level shall be 1E-6. If there is a failure in the primary link or equipment, the traffic will switch to the secondary route. The optical node equipment will transmit the DS1 circuits in both directions to allow for receiver-side switching only. The electrical drop side of the transport node equipment shall perform error-free manual and automatic switching functions of all circuits.

The transport node equipment shall fully protect traffic, overhead orderwire, digital service channels and wayside circuits in the event of equipment failure, fiber cut or single link failure.

The transport node equipment shall have fault-sensing circuitry that will detect optical and electrical transmitter, receiver, and sub-rate card failures and BER degradation. The equipment shall provide serial, contact and Simple Network Management Protocol (SNMP) alarm interfaces for reporting to the network management alarm system via a remote terminal unit (RTU). All available alarm points in the equipment and all external control inputs, which may be utilized for remote equipment control functions, shall be described.

Transport node equipment shall meet the following requirements:

- Primary power input of ±24 or ±48 VDC
- Link residual BER of less than 1E-10

7.6.3 Digital Multiplexer Equipment

The digital multiplex equipment shall provide modulation and processing for the DS1 signals between the channel banks/routers and the fiber equipment.

The equipment shall be complete, mounted and wired in racks, ready for operation. Accessories shall include specialized test fixtures, test cords, and adapters. All equipment shall be completely factory-tested and documented in the final configuration.

The equipment shall be completely solid-state, employing the latest technology, and shall be convection-cooled. All necessary standby switching, alarm sensing, and controls shall ensure fully automatic operation, and it shall have remote alarm/control capability for any equipment failure.

Test points and facilities shall enable alignment and testing of all signal levels, including DS1 signals to and from the carrier equipment, levels, clock frequency, BER levels, framing, power supplies, and all interface signals, all with no interruption of service. Built-in alarms shall be provided for major, minor, power failure, BER, and loss of clock or framing.

In addition, a system-wide redundant master oscillator incorporating synchronization signals routed to all 1.544 Mb/s clocks shall be provided to ensure absolute phase coherence of the land mobile simulcast transmitter sites.

Optional clocking should be provided as follows:

- Receive side recovered clocking.
- Transmit master clocking.
- External clocking: GPS, Stratum and Telco reference.

They shall have local and remote provisioning access, be capable of performing loop back functions and testing, and have full diagnostic capabilities.

8 Subscriber Equipment

8.1 Definitions

Subscriber unit: a mobile, portable or control station radio are considered Terminal Hardware.

Accessory: a device that interfaces with a subscriber unit such as an external microphone, antenna, control head or battery charger.

8.2 Tiers

Subscriber units shall be provided in two (2) tiers:

- Public Safety
- Non-Public Safety

Public Safety radios shall be the same family of radios with the only differences being equipped features or mandatory options, and price. Accessories for the same family of radios (such as microphones, antennas, batteries, and other features or mandatory options) shall be interchangeable. Non-Public Safety radios are single band radios, typically less expensive, and not necessarily in the same family as the Public Safety radios, with limited features and mandatory options. All subscribers typically include a keypad; some radios may offer a selection – full keypad, limited keypad, or without a keypad.

Subscriber units shall be equipped with the features and functions specified in Table 8-1. All subscribers shall be capable of operation in both the 700 and/or 800 MHz frequency bands (768-861 MHz). Selected units shall be dual band (UHF and 700/800 MHz) or all-band including operation in the VHF band (136-174 MHz), UHF band (380-520 MHz) and 700/800 MHz.

Feature	Configuration					
	Mobile		Portable		Control Station/Desktop Remote	
	Public Safety	Non- Public Safety	Public Safety	Non- Public Safety	Public Safety	Non- Public Safety
Multiband (Dual Band or All Band)	Yes		Yes		Yes	
Trunked Talk Groups or Conventional Channels	128 - 512	128	128 - 512	128	128 - 512	128
Time-Out Timer	Yes	Yes	Yes	Yes	Yes	Yes
Dynamic Regroup Capable	Yes	Yes	Yes	Yes	Yes	Yes
Out-of-Range Signal	Yes	Yes	Yes	Yes	Yes	Yes
Group Call Capable	Yes	Yes	Yes	Yes	Yes	Yes
Emergency Call Button	Yes	Yes	Yes	Yes	Yes	Yes
Talk-around Operation	Yes	Yes	Yes	Yes	Yes	Yes
Private Call Receive	Yes	Yes	Yes	Yes	Yes	Yes
Private Call Initiate	Option		Option		Option	
Vehicular Charger	Option		Option			
Keypad	Option	Option	Option	Option	Option	Option
Priority Group Scan	Yes	Yes	Yes	Yes	Yes	Yes
All Call Receive	Yes	Yes	Yes	Yes	Yes	Yes
All Call Initiate	Option		Option		Option	
Encryption Capable	Yes	Option	Yes	Option	Yes	
On/Off Switch	Yes	Yes	Yes	Yes	Yes	Yes
Volume Control	Yes	Yes	Yes	Yes	Yes	Yes
Eight-Character Alphanumeric Display	Yes	Yes	Yes	Yes	Yes	Yes
Transmit Indicator	Yes	Yes	Yes	Yes	Yes	Yes
System Busy Indicator	Yes	Yes	Yes	Yes	Yes	Yes
Low Battery Indicator			Yes	Yes		
Over-the-air Rekey (OTAR)	Yes		Yes		Yes	
Intrinsically Safe			Option			
Over-the-air Program (OTAP)	Option		Option		Option	
GPS Location Services	Option	Option	Option	Option	Option	Option
PTT Cellular Application	Yes		Yes		Option	
Call Alert	Yes	Yes	Yes	Yes	Yes	Yes
Radio/Data Interface Port	Yes		Yes		Yes	
Selective Radio Inhibit	Yes	Yes	Yes	Yes	Yes	Yes
Wi-Fi Radio	Yes		Yes		Yes	
LTE Radio	Option		Option		Option	
Bluetooth	Yes	Yes	Yes	Yes	Yes	Yes

Table 8-1 Subscriber Unit Features

8.3 Standards

Subscriber units shall meet or exceed the performance requirements of a Class A transceiver as defined in the following standards:

- ANSI/TIA-603-E, *Land Mobile FM or PM Communications Equipment Measurement and Performance Standards*; and
- ANSI/TIA-102.CAAB-E, *Project 25 Land Mobile Radio Transceiver Recommendations, C4FM/CQPSK Modulation*.
- TIA-102.CCAB-B, *Project 25 Two-Slot Time Division Multiple Access Transceiver Performance Recommendations H-CPM / H-DQPSK Modulation.*

8.4 Environmental Specifications

Subscriber equipment shall meet or exceed the environmental specifications listed in Table 8-2.

Standard	MIL-STD 810C Method/Procedure	MIL-STD 810D Method/Procedure	MIL-STD 810E Method/Procedure	MIL-STD 810F Method/Procedure	MIL-STD 810G Method/Procedure
Low Pressure	500.1 / I	500.2 / II	500.3 / II	500.4 / II	500.5 / II
High Temperature	501.1 / I, II	501.2 / I, II	501.3 / I, II	501.4 / I Hot, II Hot	501.5 / I A1, II A2
Low Temperature	502.1 / I	502.2 / I, II	502.3 / II	502.4 / I C3, II C1	502.5 / I C3, II C1
Temperature Shock	503.1 / I	503.2 / I	503.3 / I	503.4 / I	503.5 / I C
Solar Radiation	505.1 / II	505.2 / I	505.3 / II	505.4 / I	505.5 / I A1
Rain	506.1 / I, II	506.2 / I, II	506.3 / I, II	506.4 / I, III	506.5 / I, III
Humidity	507.1 / I	507.2 / II	507.3 / II	507.4	507.5 / II Aggravated
Salt Fog	509.1 / I	509.2 / I	509.3 / I	509.4	509.5
Dust	510.1 / I	510.2 / I	510.3 / II	510.4 / I	510.5 / I
Immersion (for portables	512.1	512.2	512.3	512.4 / I	512.5
Vibration	514.2 / VIII Cat. F, Curve W	514.3 / I Cat. 1, 10, 11, Cat. 3	514.4 / I Cat. 1, 10	514.5 / I Cat. 24	514.6 / I Cat. 24
Shock	516.2 / I, II	516.3 / I, IV	516.4 / I, II	516.5 / I, IV	516.6 / I, IV, V, VI

Specification	
Temperature (Operating)	-30 to +60° C
Temperature (Storage)	-40 to +80° C
Altitude	15,000 ft
Altitude (Transit)	40,000 ft
Humidity	95% @ 50° C
Shock	1 m
Vibration	5 G
Immersion	IEC 60529 IP67

Table 8-2 Environmental Specifications for Subscriber Equipment

8.5 Project 25 Compliance

Subscriber units shall be fully compliant with the latest versions of the Project 25 Phase 1 (12.5-kHz FDMA) and Project 25 Phase 2 (12.5-kHz, two-slot TDMA) operation as defined in the TIA-102 series of standards and shall be fully interoperable with all TIA-102-compliant trunked and conventional radio systems.

The Supplier's Declarations of Compliance (SDoCs) and Summary Test Reports shall be provided in accordance with the Project 25 Compliance Assessment Program for any offered subscribers. Identify any features or functions of the proposed subscribers that do not comply with the TIA-102 standards. Also identify any proprietary features or functions of the proposed subscribers that are not defined in the TIA-102 standards.

8.6 MANDATORY OPTION: Over-the-Air Programming (OTAP)

Subscriber equipment shall be capable of over-the-air programming (OTAP) so subscriber unit "personality" may be modified remotely without removing a unit from service and returning it to a central location.

8.7 MANDATORY OPTION: All-band

Subscriber equipment shall be capable of operating in all public safety bands (VHF, UHF, and 700/800 MHz) and shall be equipped with appropriate antennas, features, and accessories.

8.8 Dual-band

Subscriber equipment shall be capable of operating as dual-band radios (UHF + 700/800 MHz) and shall be equipped with appropriate antennas, features, and accessories.

8.9 Encryption

8.9.1 Single Key AES Encryption

All public safety subscriber units shall be equipped with P25 compliant single key AES encryption.

8.9.2 Multiple Key AES Encryption

Selected subscriber units shall be equipped with P25 compliant multiple key AES encryption.

8.9.3 Key Fill Device

The encryption key fill device (KFD) shall interface with subscriber units and shall provide the user the ability to load, erase and read key information.

8.9.4 Over-the-Air-Rekeying (OTAR)

Subscriber units shall be capable of P25 compliant over-the-air rekeying (OTAR).

8.10 MANDATORY OPTION: GPS Location Services

Subscriber equipment shall be equipped with GPS receivers and appropriate software to support P25 Phase 2 Location Services to provide location data to the fixed network for display on a subscriber mapping system (location service host system).

8.11 PTT Cellular Application

The PROPOSER shall offer a PTT over cellular smartphone application that will allow users to talk on the radio system from a smartphone device. The application shall be capable of operation on 3G/4G LTE cellular data networks. The application may be capable of operating on Wi-Fi connections as well. The PROPOSER shall provide pricing for fifty (50) PTT over cellular licenses as part of the base system offering.

8.12 Wi-Fi Radio Module

Subscriber equipment shall be equipped with a Wi-Fi module.

8.13 MANDATORY OPTION: Wi-Fi Radio System Communications

Subscriber equipment shall be capable of voice communication to the home radio system over Wi-Fi networks.

8.14 MANDATORY OPTION: LTE Radio Module

Subscriber equipment shall be equipped with an LTE module.

8.15 MANDATORY OPTION: LTE Radio System Communications

Subscriber equipment shall be capable of voice communication to the home radio system over LTE networks.

8.16 Bluetooth

Subscriber equipment shall be equipped with Bluetooth.

8.17 Mobile Radio Equipment

Mobile radios shall include the following components and accessories:

- transceiver
- control head
- palm microphone and mounting hook
- speaker
- cabling
- antenna
- mounting hardware

The mounting hardware shall securely fasten the housing to the vehicle.

8.17.1 Trunk-Mounted Mobile Radio Units

Trunk-mounted radios shall come equipped with a key to lock the radio into the housing. The trunk-mounted radio shall be available in a dual-control-head unit option.

8.17.2 Dash-Mounted Mobile Radio Units

The dash-mounted radio shall have the controls mounted on the front panel or surface of the radio. No separate control head shall be required for proper operation of the radio. The radio's speaker shall be an integral part of the radio package. For configurations requiring a front-panel keypad, the speaker may be at a remote location from the unit.

8.17.3 Mobile Radio Antennas

The mobile radio antenna shall consist of a stainless-steel antenna element, antenna mount and low-loss antenna cable. The mobile radio antenna shall be available in two (2) styles: standard and disguised. Each shall be supplied with a minimum of 15 ft of antenna cable and shall meet or exceed the following specifications:

Frequency Range	VHF: 136 - 174 MHz UHF: 380 - 520 MHz 700/800 MHz: 768 - 861 MHz
Maximum VSWR	1.5:1 (dual-band or all-band VSWR < 2.0:1)
Power Capability	50 W (VHF, dual-band, or all-band: 100 W)

8.17.3.1 Standard Mobile Radio Antennas

Standard mobile radio antenna radiating element shall be removable and replaceable without disturbing the antenna mount. The antenna mount shall be suitable for mounting on a vehicle roof, trunk, light bar, or other similar locations.

8.17.3.2 MANDATORY OPTION: Disguised Mobile Radio Antenna

The disguised mobile antenna shall be similar in design and appearance to cellular mobile antennas. The disguised antenna shall provide "no-hole" mounting.

8.17.3.3 Mobile Antenna Installation

The CONTRACTOR shall observe NRVECRA's current antenna mounting practices and recommend antenna mounting locations.

8.18 Portable Radio Equipment

The portable radio unit shall be small and of such a form factor that normal operation can be accomplished with one hand. The portable radio shall be supplied with a belt clip, shoulder speaker/mic, antenna, and two (2) Li-ion polymer rechargeable batteries. The batteries shall maintain a minimum capacity of 80% rated after one (1) year of service. Each portable radio shall be provided with a carrier or belt clip options and a single-unit charger.

The housing of the portable radio shall be of high impact-resistant material. The Li-ion battery supplied shall provide at least eight (8) hours of operation on a 5% transmit, 5% receive and 90% monitor duty cycle and shall be a positive lock, and quick disconnect type. The battery housing shall be constructed of a material as durable as the portable radio housing and shall match the color and footprint of the portable radio. The antenna provided with the unit shall be covered with soft plastic or rubber and be provided with a blunt safety tip.

8.18.1 Portable Battery Chargers

AC single- and multi-battery chargers shall be available to charge the portable radio batteries. Chargers shall be capable of charging batteries while either attached or not attached to the portable radio.

Chargers shall be capable of charging a mix of models of batteries. Chargers shall be suitable for either desk or wall mounting and shall be capable of recharging batteries to a full charge in eight (8) hours or less. Illuminated LEDs shall be provided to indicate whether the unit is charging or fully charged. Charging current shall be regulated and over-charging shall be electronically monitored, controlled, and prevented. Multi-battery chargers shall be capable of recharging a minimum of five (5) batteries at any one time.

8.18.2 MANDATORY OPTION: Intrinsically Safe Portable Radio

As an option, some portable radios for Fire personnel may be certified by Factory Mutual that their operation is intrinsically safe for Classes I, II and III; Division 1; Groups C, D, E, F and G; and non-incentive for Class I, Division 2, Groups A, B, C and D. The batteries should also be intrinsically safe in the portable radios.

8.18.3 MANDATORY OPTION: Vehicular Charger

The vehicular charger package shall accept the portable radio and automatically provide the proper charging current from the vehicle's electrical system. The charger package shall be suitable for mounting under the dashboard or in other suitable locations in passenger vehicles, pick-up trucks, vans, and other types of vehicles such as fire engines.

The portable radio shall be secured in the vehicular charger. An illuminated LED shall indicate that the unit is charging. An illuminated LED shall also indicate that the unit is fully charged. Charging current shall be regulated and overcharging shall be electronically monitored, controlled, and prevented.

8.18.4 Speaker / microphone

Speaker / microphones shall meet the same environmental requirements as the portable radio.

8.18.5 MANDATORY OPTION: Intrinsically Safe Speaker / microphone

Intrinsically Safe Speaker / microphones shall meet the same environmental and intrinsically safe requirements as the intrinsically safe portable radio. The batteries should also be intrinsically safe in the portable radios.

8.18.6 MANDATORY OPTION: P25 Pagers

As an option, the CONTRACTOR shall provide new dual-band (UHF and 700/800 MHz) P25 pagers, that will operate on the new trunked radio system. The P25 pager should be provided with a cradle base charger.

8.19 Control Station

The control station shall be provided in a small, attractive cabinet. The PROPOSER is to determine the type of cabinet most suitable for the installation of each control station. The cabinet may be designed for desktop, floor, or wall mounting. The station shall be powered from a 120-VAC, 60-Hz single-phase source. The station shall be operated either locally or remotely under control of the console equipment or a remote-control unit. All control stations provided shall be capable of functioning in either the trunked or conventional mode. The control station may also be used as a limited system backup component in the event of a loss of the system trunking capabilities.

A desktop remote control unit shall be available for operation with the control station. The remote-control unit shall interface with and provide all the features and functions of the control station. The remote-control unit shall provide the capability to control a minimum of five (5) talk groups. The remote-control unit shall be housed suitable for operation in an office or administrative area. The unit shall include a built-in speaker, volume control, and desk style microphone. The unit shall be furnished with control line and power line surge protectors. The unit shall provide control functions compatible with the control station.

The control station antenna system shall comprise a directional antenna, transmission line, connectors, and miscellaneous hardware. The control station antenna shall meet or exceed the following requirements:

Frequency Range	VHF: 136 - 174 MHz UHF: 380 - 520 MHz 700/800 MHz: 768 - 861 MHz
Maximum VSWR	1.5:1 (dual-band or all-band VSWR < 2.0:1)
Power Capability	50 W (VHF, dual-band, or all-band: 100 W)

9 Physical Facilities Requirements

9.1 General Requirements

Communications facilities shall be of proven design to withstand severe weather including lightning, wind, flooding, ice and snow accumulation, wildfires, and earthquakes.

Facilities shall protect the communications system from the public and shall protect the public from potentially hazardous parts or emissions of the communications system.

Facilities shall be designed and installed in accordance with applicable current codes, ordinances and regulations imposed by authorities having jurisdiction; these current standards; and the communications equipment manufacturer's design and installation current revision standards. Where there is a conflict between requirements, the more stringent requirement shall apply.

9.2 References

9.2.1 Normative References

The following documents, either in whole or in part, are referenced in this physical facilities specification:

American Association of State and Highway Transportation Officials (AASHTO) • AASHTO HB, *Standard Specifications for Highway Bridges*
American Concrete Institute (ACI) • ACI 301-16, Specifications for Structural Concrete • ACI 302.1R-15., Guide for Concrete Floor and Slab Construction • ACI 318-19(22), Building Code Requirements for Structural Concrete and Commentary
American National Standards Institute (ANSI) • ANSI J-STD-607, Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.
American Society for Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) • ASHRAE Handbook—Fundamentals
American Society of Safety Engineers • ANSI/ASSE Z359, Fall Protection Code
ASTM International • ASTM A615/A615M-22, Standard Specifications for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement • ASTM C31/C31M-22, Practice for Making and Curing Concrete Test Specimens in the Field • ASTM C33/C33M-18, Standard Specifications for Concrete Aggregates • ASTM C39/C39M-21, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens

• ASTM C150/C150M-22, Standard Specification for Portland Cement • ASTM D420-18, Standard Guide to Site Characterization for Engineering Design and Construction Purposes • ASTM D1556/D1556M-15e1, Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method • ASTM D1557-12(2021), Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000-ft-lbf/ft3 (2,700 kN-m/m3)) • ASTM D2487-17e1, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System) • ASTM D6938-17ae1, Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth) • ASTM G57-20, Standard Test Method for Field Measurement of Soil Resistivity Using the Wenner Four-Electrode Method
Electronics Industry Alliance (EIA) • EIA/ECA-310-E, Cabinets, Racks, Panels and Associated Equipment
Federal Aviation Administration (FAA) • Advisory Circular 70/7460-1M, Obstruction Marking and Lighting • Advisory Circular 150/5245-43F, Specification for Obstruction Lighting Equipment
Federal Communications Commission (FCC) • Code of Federal Regulations, Title 47, Telecommunications (47 CFR) • Office of Engineering and Technology (OET) Bulletin 65, Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields
Institute of Electrical and Electronics Engineers (IEEE) • IEEE Std. 81-2012, IEEE Guide for Measuring Earth Resistivity, Ground Impedance and Earth Surface Potentials of a Ground System • ANSI/IEEE Std. 81.2-1991, IEEE Guide to Measurement of Impedance and Safety Characteristics of Large, Extended or Interconnected Grounding Systems
National Electrical Contractors Association (NECA) • NECA 1, Standard Practices for Good Workmanship in Electrical Contracting
National Fire Protection Association (NFPA) • NFPA 70, National Electrical Code • NFPA 72, National Fire Alarm Code • NFPA 101, Life Safety Code • NFPA 110, Standard for Emergency and Standby Power Systems • NFPA 111, Standard on Stored Electrical Energy Emergency and Standby Power Systems • NFPA 780, Standard for the Installation of Lightning Protection Systems • NFPA 1221 Standard for Installation, Maintenance, and Use of Emergency Services Communications Systems • NFPA 2001, Standard on Clean Agent Fire Extinguishing Systems
Telecommunications Industry Association (TIA) • TIA-222, Structural Standard for Antenna Supporting Structures

Underwriters Laboratories (UL) • UL 467, Grounding and Bonding Equipment • UL 752, Standard for Bullet-Resisting Equipment • UL 1449, Standard for Surge-Protective Devices • UL 1778, Uninterruptible Power Systems

9.2.2 Informative References

The following references provide additional useful information but are not included in this document:

Alliance for Telecommunications Industry Solutions (ATIS) • ATIS 0600311, DC Power Systems – Telecommunications Environment Protection • ATIS 0600313, Electrical Protection for Telecommunications Central Offices and Similar Type Facilities • ATIS 0600316, Electrical Protection of Telecommunications Outside Plant • ATIS 0600318, Electrical Protection Applied to Telecommunications Network Plant at Entrances to Customer Structures or Buildings • ATIS 0600330, Valve-Regulated Lead-Acid Batteries Used in the Telecommunications Environment • ATIS 0600334, Electrical Protection of Communications Towers and Associated Structures
American Society of Civil Engineers (ASCE) • ASCE 7, Minimum Design Loads for Buildings and Other Structures
Illuminating Engineering Society (IESNA) • IES Lighting Handbook Revision 10T, 2011
Institute of Electrical and Electronics Engineers (IEEE) • IEEE C2, National Electrical Safety Code (NESC) • IEEE 3003.1-2019, Grounding of Industrial and Commercial Power Systems
International Code Council • International Building Code
Telecommunications Industry Association (TIA) • TIA-568.0, Generic Telecommunications Cabling for Customer Premises • TIA-568-C.1, Commercial Building Telecommunications Cabling Standard • ANSI/TIA-568-D, Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted-Pair Cabling Components • TIA-568-C.3, Optical Fiber Cabling Components Standard • TIA-569-B, Commercial Building Standard for Telecommunications Pathways and Spaces

9.3 Sites

9.3.1 General

A typical, dedicated communications site layout is shown in Figure 9-1. The actual layout for each site will vary depending upon the:

- Size and shape of the lot
- Size and type of tower and building
- Number of current and future site tenants
- Existence and location of site utilities
- Federal, State and Local codes, ordinances, and regulations

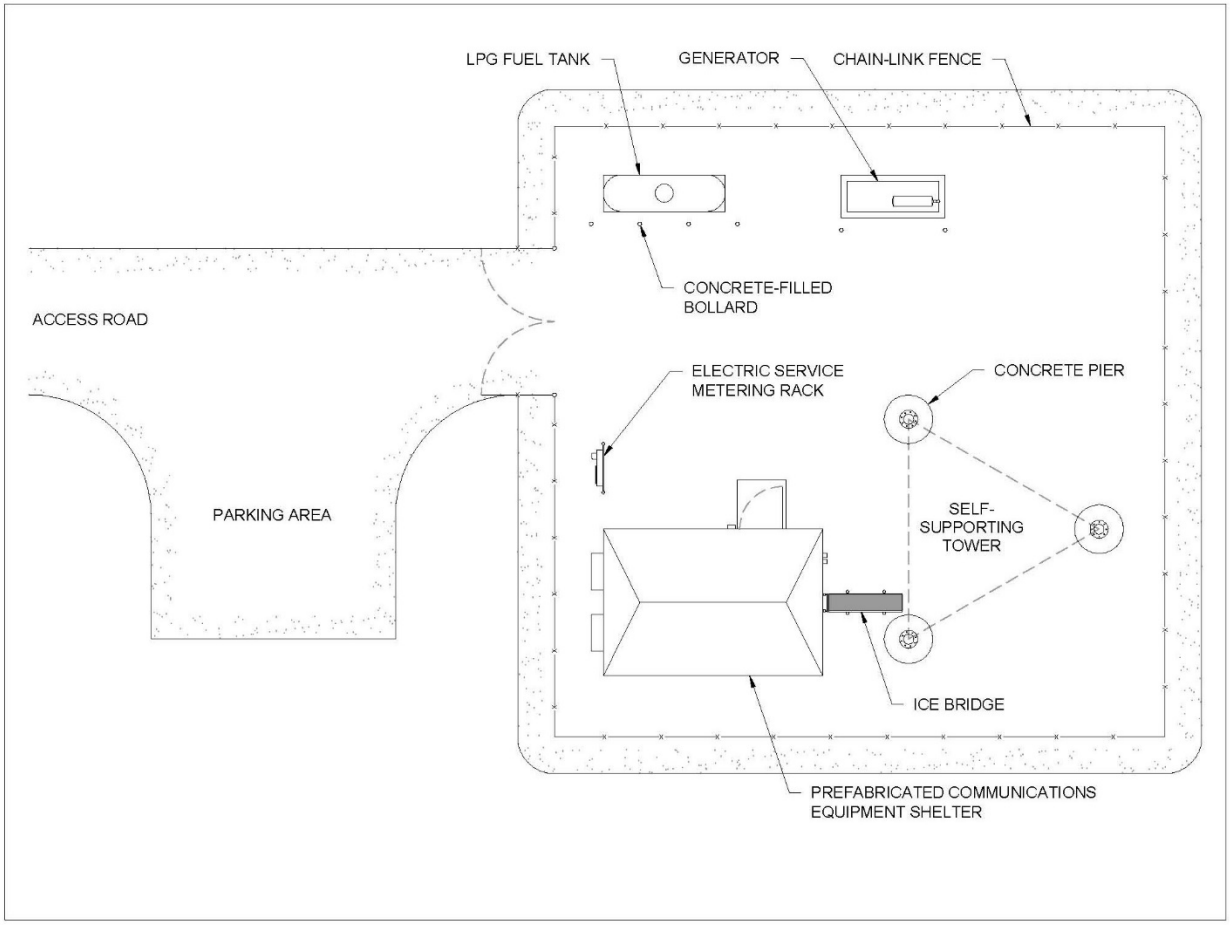

Figure 9-1 Typical Communications Site Layout

9.3.2 Existing Sites

The use of existing sites is encouraged as is appropriate or required. Table 9-1 provides name and address, tower type and height, building or shelter description, owner of property, and briefly lists existing radio equipment at each of the existing sites.

If the PROPOSER intends to reuse existing sites that are leased, the PROPOSER shall provide correspondence from the land/tower owners validating the use of the site(s) are technically feasible and verification the desired RAD center height is available. ***All equipment shall be in as few RAD centers as possible****, if using multiple RAD centers consider this when estimating ongoing lease costs.* Provide the estimated annual lease cost for a fifteen (15)-year period in the appropriate tab in Appendix D Pricing Workbook.

Site #	Site Name	Lat/Long	Tower Height	Building / Shelter	Owner	Radio Equipment
1	NRV 9-1-1 Center	37 07 48 N 80 24 29 W	Rooftop	Existing Building	Montgomery County	Existing Dispatch
2	Marshall	37 01 45 N 80 26 02 W	195 ft	Existing NRVECRA Shelter	American Tower	Existing UHF System
3	Buffalo Water Tank	37 07 12 N 80 25 41 W	120 ft	Existing NRVECRA Shelter	Christiansburg	Existing UHF System
4	Pedlar Hill	37 13 16 N 80 14 48 W	198 ft	Existing NRVECRA Shelter	Crown Castle	Existing UHF System
5	Poor Mtn. VSP	37 09 46 N 80 11 33 W	199 ft	Existing NRVECRA Shelter	VSP	Existing UHF System
6	Price Mtn.	37 11 14 N 80 27 22 W	185 ft	Existing NRVECRA Shelter	NRVECRA	Existing UHF System
7	Brush Mtn.	37 15 48 N 80 27 56 W	160 ft	Existing NRVECRA Shelter	Blacksburg FD	Existing UHF System
8	Fisher View Mtn.	37 05 33 N 80 18 20 W	150 ft	Existing Shelter	Private Land Owner / Monticello Media	Existing UHF System
9	Lane Stadium	37 13 15 N 80 25 01 W	120 ft	Existing Equipment Room	Virginia Tech	Existing UHF System
10	North Main Water Tank	37 15 15 N 80 24 28 W	100 ft	Existing NRVECRA Shelter	Town of Blacksburg	Existing UHF System
11	Clay St Water Tank	37 14 08 N 80 23 58 W	No Tower	Existing NRVECRA Shelter	Town of Blacksburg	Existing UHF System
12	Tyler Rd. Water Tank (Potential Site)	37 06 20 N 80 30 39 W	No Tower	None	Montgomery County PSA	None
13	Paris Mtn. (Potential Greenfield Site)	37 13 59 N 80 20 09 W	No Tower	None	Private Land Owner	None
14	Snowville FD Tower	37 01 17 N 80 36 07 W	170 ft	Existing Shelter	Pulaski County	None
15	McCoy (Potential Greenfield Site)	37 12 52 N 80 36 19 W	No Tower	None	Virginia Tech	None

Table 9-1 Existing and Potential Radio / Microwave Sites

9.3.3 New Sites

New sites (sites not currently in use by NRVECRA), leased or "greenfield", will require various levels of development and construction as determined by the CONTRACTOR.

For any new sites proposed, lease or greenfield, the PROPOSER shall provide correspondence from the land/tower owners articulating they are agreeable to a new lease agreement (or purchase land) with NRVECRA. The PROPOSER shall also provide correspondence from the land/tower owners validating the use of the site(s) are technically feasible and verification the desired RAD center height is available. ***All equipment shall be in as few RAD centers as possible****, if using multiple RAD centers consider this when estimating ongoing lease costs.* Provide the estimated annual lease cost for a fifteen (15)-year period in the appropriate tab in Appendix D Pricing Workbook.

Greenfield sites shall be designed to accommodate one (1) future 10 ft. by 16 ft. shelters. Ingress and egress shall be designed to allow for installation of these shelters or cabinets.

9.4 Utilities – New Sites

Any site that does not have existing electrical service shall be installed according to the specification in this section. Depending on the site layout and the number of tenants at the site, electric meters and service disconnects may be located on a meter support structure near the fence so that meters may be read by utility personnel without entering the compound. At new sites, where additional future tenants are planned, two (2) underground conduits each shall be installed from the service entrance point to planned locations of future shelters.
As much as possible, building or shelter electric service entrance should be located near coaxial cable and telephone service entrances. The electric service ground shall be bonded to the site grounding system.

9.5 Earthwork

9.5.1 Geotechnical Investigations

Geotechnical investigations shall be performed for all new towers. Geotechnical investigations and reporting shall be performed in accordance with ASTM D 420-18. Geotechnical reports shall be prepared and sealed by a professional engineer.

9.5.2 Erosion Control

An erosion control system shall be utilized to protect adjacent property in accordance with federal, state, and local standards and specifications for soil erosion and sediment control.

All areas disturbed by construction activities shall be seeded or vegetated with grass or other plants that are indigenous to the local area. All seeded areas shall be covered with straw. Erosion control measures shall be removed when the site has been stabilized and erosion control measures are no longer necessary.

9.5.3 Materials for Fill, Sub-Grade Preparation and Backfill

Soils shall be classified by test procedures outlined in ASTM D 2487. Moisture-density relations shall be established in accordance with ASTM D 1557 for all fill material to ensure its suitability.

Material for fill and backfill beneath buildings, structures, and towers; for backfill adjacent to buildings, structures, and towers; for trench backfill in every location; and for sub-grade preparation shall be GW, GP, GM, GC, SW, SP, SM, or SC. The largest particles in this fill and backfill shall be no greater than two (2) in. diameter.

Fill material for non-structural applications shall consist of unclassified material from the excavations.

9.5.4 Clearing and Grubbing

Fenced compounds, access roads and parking areas shall be cleared and grubbed of trees and other vegetation, stumps, roots and other material or structures that would hinder the development of the site. Such materials shall be removed to a depth of at least eighteen (18) in. Depressions made by grubbing shall be filled with suitable material and compacted as required. Materials unsuitable for fill shall be removed from the site and disposed of in accordance with local, state, and federal regulations.

9.5.5 Fills

Where fill is required to raise the subgrade for concrete slabs, fill material shall be placed in horizontal layers not exceeding six (6) in. compacted thickness. Frozen material shall not be used for this purpose.

9.5.6 Backfilling Beneath and Adjacent to Buildings, Structures and Towers

For depths greater than five (5) ft. select fill shall be used from the top of the footing to a point five (5) ft. below finished grade. The select fill, defined as GW or SW material in ASTM D2487, shall extend from the outside and inside faces of the wall to the faces of the excavation if the excavation is sheeted and braced or five (5) ft. from the outside and inside faces of the wall if the excavation is un-sheeted.

9.5.7 Backfilling Trenches

Fuel pipe joints shall be left exposed for testing. After testing, trenches shall be backfilled with suitable materials free from large clumps of earth and rock fragments. Material shall be deposited in six (6) in. horizontal layers and thoroughly and carefully tamped until pipe and conduit have a cover of not less than one (1) ft. Wrapped, coated and plastic material shall be backfilled six (6) in. above the utility line with sand or other finely graded material. For trenches in open areas, remainder of backfill material shall then be placed in the trench in one-foot horizontal layers.

Trenches shall be backfilled simultaneously on opposite sides and compacted simultaneously without dislocating the utility line from installed positions. For trenches beneath pavement, buildings and structures, the entire depth of the trench shall be filled in six (6) in. horizontal layers. Each layer shall be moistened or dried and compacted. Trenches improperly backfilled or where settlement occurs shall be reopened to depth required for proper compaction, refilled, and compacted, with surface restored to required grade and compaction, mounded over in open areas, and smoothed off.

9.5.8 Plastic Marking Tape

Warning tapes shall be installed directly above pipe and conduit at a depth of six (6) in. below finished grade unless otherwise indicated. Tape color shall be as specified and shall bear a continuous printed inscription, identifying the specific utility.

Utility	Color
Electric	Red
Water	Blue
Telephone	Orange
Sewer	Green

9.5.9 Compaction

The degree of compaction required is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D1557. Fill and backfill material shall be moistened or aerated as necessary to provide a moisture content that falls within three percent (3%) of either side of optimum.

The minimum compaction effort required for various fills, backfills, and sub-grades shall be as follows:

Fill, Backfill and Sub-Grade Compaction	Percent of Maximum Density
Under buildings, structures, towers, or adjacent to buildings, structures, or towers	95
Under exterior concrete slabs, including related utility trench backfill and scarified sub-grades	90
Under utility trench backfill in other areas	85

If required, field density tests shall be performed in accordance with ASTM D ASTM D1556/D1556Mor ASTM D 6938.

9.5.10 Soil Sterilization

Areas specified to receive cover material shall be sterilized with a pre-emergent herbicide solution. Treatment shall be applied on the subgrade prior to placing cover material. Application shall be in accordance with the manufacturer's recommendations.

9.5.11 Fenced Compound

Inside the site fence (and guy anchor locations), geotextile fabric shall be installed in areas not covered by concrete. The geotextile fabric shall extend eighteen (18) in. outside the fence. The fabric shall be installed in accordance with manufacturer's instructions. The area under the fabric shall be cleared and sterilized. The top covering over the fabric shall be six (6) in. of #57 aggregate compacted by roller.

9.6 Access Road

Access roads shall be twelve (12) ft. wide and shall be designed for H20 vehicle (as defined in AASHTO HB-17) surface loading. Road surfaces shall be at least six (6) in. of graded aggregate base course, compacted by roller.

Access roads shall be graded to provide positive drainage. Culverts shall be installed to prevent storm runoff from crossing the access road. Access roads shall be designed to allow for delivery of equipment shelters to the site. Access road entrances shall meet state or local requirements for driveway or uncontrolled intersection sight distances.

At some remote sites, an entrance barrier gate may be required across the access road at the entrance from the road. Entrance barriers shall be swinging tubular steel gates with standard padlock hardware. Entrance barriers shall be set at least twenty-five (25) ft. from the road. Entrance barriers shall be equipped with reflectors to increase visibility at night.

9.7 Parking Area

Outside each fenced site, there shall be adequate parking and turnaround space for two (2) pickup trucks. The parking area shall be designed for H20 vehicle surface loading. The area shall be cleared, sterilized, and covered with six (6) in. of #57 aggregate cover material compacted by roller.

9.8 Chain-Link Fencing

Chain-link fencing shall be installed around communications tower site compounds and around tower guy anchors. Fencing shall include locking gates and other accessories required to provide security for tower sites. Gates shall be equipped with reflectors to increase visibility at night. Appropriate signage shall be installed on the fence and entrance gates.

9.9 Bollards

Bollards shall be installed at the corners of shelters, generators, and fuel tanks where these objects are exposed to vehicular traffic. Bollards shall be four (4) in. O.D. concrete-filled steel pipe.

9.10 Foundations

Concrete foundations for towers, shelters, generators, fuel tanks and other site equipment shall be designed and installed in accordance with ACI 318-19, ACI 301 and ACI 302.1R. and other applicable standards of ACI.

9.10.1 Design

Foundation designs shall be based on the geotechnical conditions at the site. Foundations for towers shall be designed in accordance with TIA-222. All foundation engineering design documentation shall be prepared and sealed by a professional engineer.

9.10.2 Installation

Forms shall be used to ensure proper pouring and forming of foundations. Forms shall be true, rigid, and strong enough to carry loads to which they will be subjected. Steel reinforcement, anchor bolts and other embedded items shall be held rigidly in place during pouring and curing of concrete. Concrete shall be vibrated during pours to eliminate air pockets. Care shall be taken to ensure concrete does not freeze before curing.

9.10.3 Materials

Cement shall meet the requirements of ASTM C150/C150M. Aggregates shall meet the requirements of ASTM C33/C33M. Reinforcing steel shall meet the requirements for Grade 60 reinforcing steel as defined in ASTM A615. Minimum compressive strength of concrete shall be 3000 psf at twenty-eight (28) days or higher as specified by foundation design documentation.

9.10.4 Concrete Testing

During concrete pours, four (4) test cylinders shall be poured in accordance with ASTM C31/C31M for each twenty-five (25) cubic yd. concrete poured. Concrete tests and test reports shall be in accordance with ASTM C39/C39M. If tests indicate that concrete strength is not adequate, the concrete shall be removed and replaced. The CONTRACTOR shall submit concrete testing results report within the timeframe of Table 4-1.

9.11 Towers

New towers and other antenna support structures shall be designed and installed according to TIA-222, Revision H or later and codes, ordinances and regulations of authorities having jurisdiction. Where these standards contain conflicting requirements, the more stringent requirements shall apply.

Upgrades to existing towers or structures where new antennas or other equipment are to be installed shall meet the same requirements of TIA-222, Revision H or later for new towers or structures.

9.11.1 Tower Classification

Towers for the use of public safety or critical infrastructure industry communications systems shall meet the requirements of Class III structures as defined in TIA-222, Revision H or latest version.

9.11.2 Loads

Each tower shall be designed by a professional engineer in accordance with TIA-222, Revision H or latest version, so its design strength exceeds the loading of the tower, antennas, and appurtenances (antenna support hardware, waveguides and transmission lines, grounding kits, tower lighting systems, tower climbing systems, etc.), ice, wind, and seismic loads. As practical, transmission lines shall be evenly distributed on tower faces to distribute loads.

All proposed current and future loads, including antennas and appurtenances from existing towers or structures, shall be carefully verified before tower analysis is performed. The following information for each proposed antenna shall be provided to the structural engineer:

- Manufacturer, model, size, weight, and effective projected area of the following:
  - Antennas
  - Antenna support hardware
  - Transmission lines or waveguide
- Antenna mounting height
- Tower leg or face on which the antenna will be mounted
- Routing of transmission lines or waveguide

A new tower shall be designed with all planned loads and for the future installation of up to one (1) heavy wireless carrier platforms as defined in TIA-222, Annex C.

It is highly desired that the antennas are place in adjacent RAD centers, when possible, to minimize ongoing costs. If using multiple RAD Center this shall be reflected in the initial and ongoing lease estimates.

9.11.3 Twist and Sway

Towers and antenna support structures for the support of microwave antennas shall be designed to meet the twist and sway requirements of the microwave system design as defined in TIA-222.

9.11.4 Analysis of Towers and Antenna Support Structures

A structural analysis shall be performed in accordance with TIA-222, Revision H or later on new towers and on existing towers where new antennas or other appurtenances are to be installed. The analysis shall include the antenna mount analysis. The analysis shall state the model and all assumptions used and shall be prepared and sealed by a professional engineer.

9.11.5 Existing Tower Condition Assessment and Mapping

To analyze the structural strength and integrity of an existing tower or other antenna support structure, detailed information is required on the structure and its appurtenances. If this information is unavailable or insufficient, a tower condition assessment and mapping of appurtenances and structural components shall be performed in accordance with TIA-222, Section 15 and Annex J. The condition assessment and mapping shall be prepared and sealed by a professional engineer.

9.11.6 Materials and Fabrication

Materials and fabrication of all towers, guy assemblies, insulators and foundations shall meet the specifications of TIA-222, Revision H or later.

9.11.7 Tower Construction

All work associated with the construction of towers shall be inspected and approved by a professional engineer. The erection of towers shall be in accordance with TIA-222, Revision H or later. The tower shall be grounded continuously during erection.

9.11.8 Tower Climbing Facilities

A climbing ladder or other climbing facility shall be provided for each new tower in accordance with TIA-222, Revision H or later. Each climbing facility shall be equipped with a safety climbing device. Each tower shall be furnished with two (2) personnel belts compatible with the safety climb device. Safety climb devices and personnel belts shall meet the requirements of ANSI/ASSE Z.359.

9.11.9 Obstruction Marking and Lighting

Towers shall be marked and lighted in accordance with FAA Advisory Circular AC 70/7460-1M. Where tower marking or lighting is required, dual lighting systems are preferred. Tower lighting systems shall meet the standards of FAA Advisory Circular AC150/5345-43J. Lighting equipment shall be the same throughout the system to permit commonality of spare parts.

Lighting control systems shall be mounted inside the equipment building and shall have alarm outputs for connecting to remote alarm systems. Alarm outputs shall be wired to the radio system alarm system and displayed at the associated alarm system workstations.

9.11.10 Ice Bridges

An ice bridge shall be installed between the communications shelter and the tower to support and protect transmission lines and other cables. The ice bridge may be self-supporting, or it may be supported at one or both ends. Where the ice bridge is supported at both ends by the shelter and the tower, one of those supports must be electrically insulated to prevent the flow of lightning

surge currents through the ice bridge.

9.11.11 Cable Installation

Vertical transmission lines that runs on towers shall be installed neatly on cable ladders. Horizontal transmission line runs between the tower and the building shall be protected by an ice bridge. Drip loops or another method to prevent water entry into the shelter shall be utilized.

Cables shall be installed as follows:

- Ice bridges shall be supported by angle brackets. Threaded rod assemblies shall be used to support the angle brackets.
- Cable hangers and hoists shall be installed per cable manufacturer's recommendations.
- For single or multiple cable entry ports, a rubber boot, clamp, and copper panel shall be used at the cable entry bulkhead.
- Cables shall be secured by hardware specially designed for the cable. Tie-wraps are not acceptable means of securing cables to cable ladders or ice bridges. They may be used to secure cables to cable trays.

9.11.12 FAA Notifications

The FAA shall be notified of proposed or actual construction or alteration by completing FAA Forms 7460-1 and 7460-2 and providing supporting data.

9.11.13 MANDATORY OPTION: Site Security Cameras

The CONTRACTOR shall provide security cameras at all sites and a centralized digital video recorder. Security cameras shall be capable of 360 degree views.

9.12 Equipment Shelters – Arrangement & Size

All radio communications equipment shelters shall be bullet-resistant, prefabricated shelters that meet industry standards and the specifications stated herein. Shelters shall be weatherproof and insulated as required by local climate. The roof shall be designed to survive the impact of falling ice. Floors shall be designed for at least 300 psf (for new shelters). All building penetrations shall be sealed.

New equipment shelters shall be sized to house the new radio and connectivity network equipment, existing equipment moved from existing shelters and at least 25% to 50% for future growth.

A typical shelter arrangement is shown in Figure 9-2; however, other configurations will be considered to meet requirements. Equipment racks shall have a minimum clearance of thirty-six (36) inches front and rear. All exterior doors shall be provided with intrusion alarm sensors, which are to be connected to the radio system alarm reporting system. All building alarm connections are to be terminated at a building alarm bus using Type 66 connector blocks.

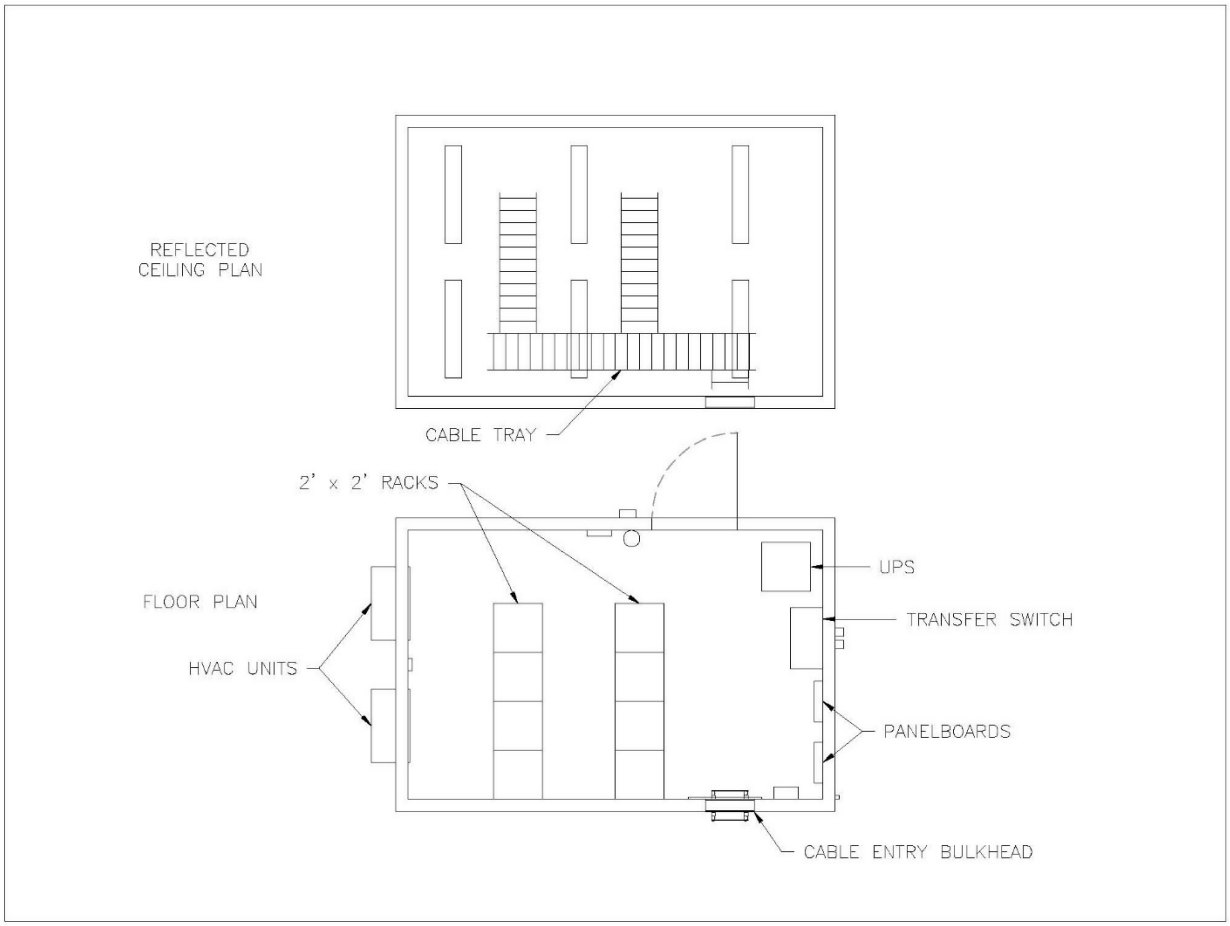

Figure 9-2 Typical Shelter Layout

9.12.1 MANDATORY OPTION: Refurbished Equipment Shelters

PROPOSER shall provide new shelters as part of the base proposal. If the PROPOSER desires refurbished shelters may be proposed as an option. If a refurbished shelter is proposed, as an option, the PROPOSER shall clearly state each instance where the refurbished shelter does not meet the specifications of this RFP.

9.13 Building Systems

9.13.1 HVAC

The heating and cooling system for the radio room shall be sized and selected based on ambient conditions as indicated in the current ASHRAE Handbook Fundamentals for the nearest area applicable and shall include capacity for future building heat loads. The HVAC system shall be capable of maintaining an interior temperature between 70- and 75-degrees Fahrenheit. Heating for the radio room shall be sized to heat the room without equipment heat loads considered. Cooling system is to cool room with equipment, current and future, energized. Future equipment loads shall be assumed to be approximately two (2) kW per additional 2 ft. x 2 ft. rack space.

The system shall consist of redundant units with either unit being able to carry the load. Redundant lead/lag controls with alternating timers allowing approximately equal operating time on each air conditioning unit shall be provided.

Load calculations shall be based on actual equipment loads, considering anticipated duty cycles and measured power consumption under operating conditions.

9.13.2 Fire Alarm System

Shelters shall be equipped with a fire alarm system. The fire alarm system shall meet the requirements of NFPA 72. Each zone shall have three (3) detectors. When two (2) of the three (3) detectors enter an alarm condition, all louvers in the zone actuated shall be automatically closed.

9.13.3 Electrical System

9.13.3.1 Codes and Standards

Electrical and cabling work for each shelter shall conform to all local codes, NFPA 70, NFPA 101, ANSI C2 and local utility company standards. Where a product is commercially available as a UL-listed device, a UL-listed device shall be used.

9.13.3.2 Electrical System Design

The general design of the electrical system shall be in accordance with applicable codes and standards. The PROPOSER shall provide a one-line electrical diagram, similar to Figure 9-3.

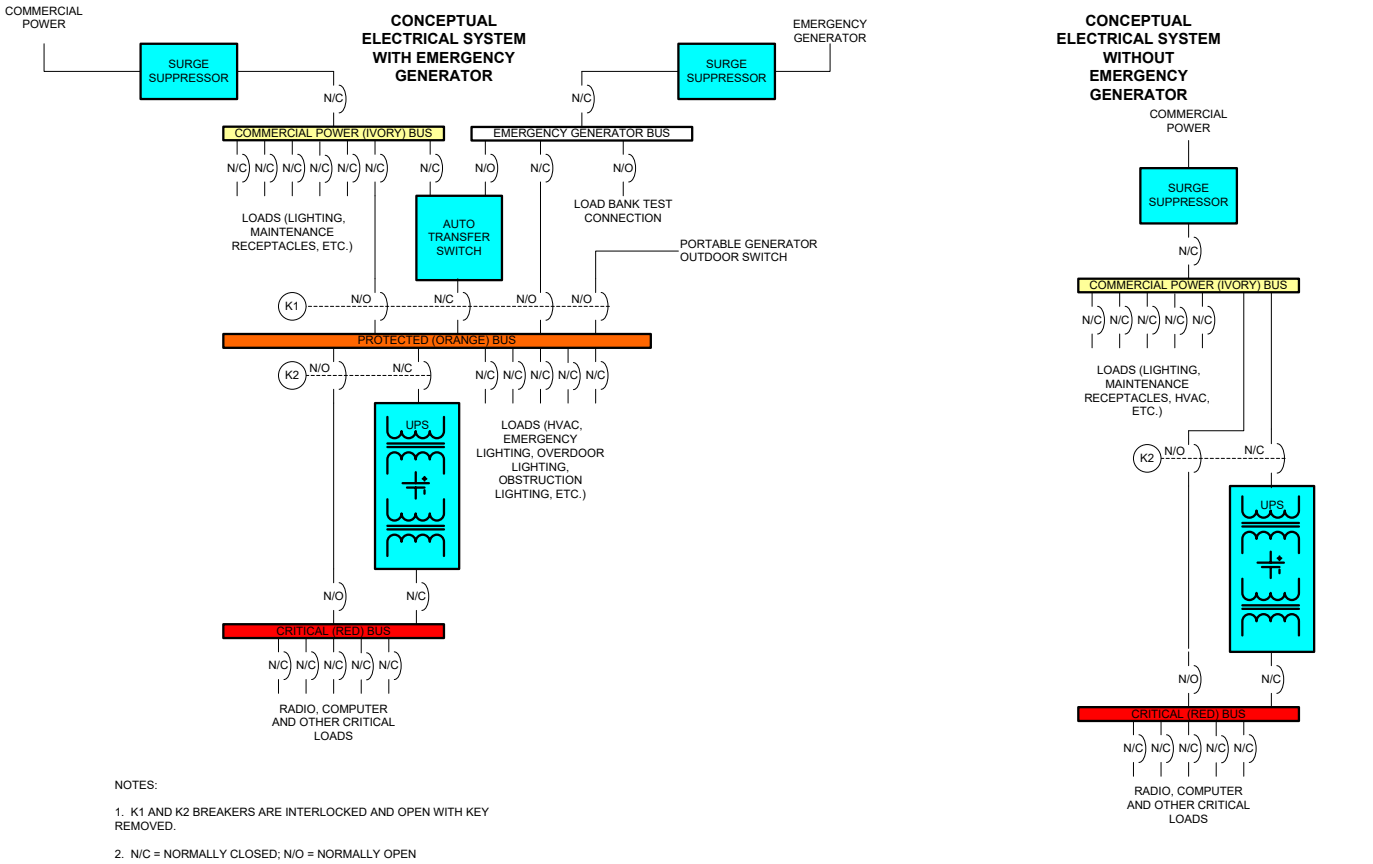

Figure 9-3 Typical Shelter One-Line Diagram

9.13.3.3 Buses

All equipment critical to the proper uninterrupted operation of the communications system shall be served by the critical bus or panelboard, which shall be served by an uninterruptible power supply (UPS).

All equipment that may accept brief temporary interruptions (such as HVAC equipment) or has its own integrated emergency power supply (such as emergency lights) shall be served by the protected bus or panelboard, which shall be served by an emergency generator.

All other equipment not essential to the operation of the communications system may be served by the service bus or panelboard, which will be without power during electric service power failures. Service circuits shall not be run in the same conduit or raceway as critical or protected circuits. The service bus may be eliminated, and all circuits can be served by the protected bus.

9.13.3.4 Bypass Switches

Manual switches shall be provided to allow complete bypass and isolation of the UPS and the automatic transfer switch for maintenance purposes. The switches shall utilize interlocks (Square D Kirk Key interlocks, or equivalent) to prevent simultaneous connection of more than

one power source to the bus. Out-of-position switches (i.e. bypass operation) shall be an input to the radio system alarm system.

9.13.3.5 Temporary Backup Generator (New Shelter Only)

Provisions shall be made for placement and connection to the electrical system of a mobile generator outside the shelter in case the permanently installed standby generator fails. Standby generator operating instructions shall be posted in the room or outdoor cabinet.

9.13.3.6 Surge Suppression

The service entrance and the emergency generator output shall each have independent, appropriately designed surge suppression devices installed. Additionally, because of potential operation with the UPS bypassed, all critical (red) bus branch circuits shall be supplied with surge protection devices at the output of the UPS. Devices shall incorporate current technology and as a minimum should utilize metal oxide varistors (MOVs), gas tube devices and/or equivalent avalanche protection. These units shall have contact alarm and visual indication for device failure.

9.13.3.7 Equipment and Raceways

Minimum conduit size shall be 3/4 in. and all except underground conduit shall be of metal with a zinc coating (EMT or heavier construction). Conduits exposed to the outside shall be rigid, not EMT. Underground conduit shall be two (2) in. or larger rigid PVC with a minimum of twenty percent (20%) excess capacity over code limits, or spare underground conduits shall be included.

9.13.3.8 Receptacles and Plugs

Shelters shall be equipped with one (1) 20-amp double duplex receptacle every ten (10) feet or closer as required by local codes, around the interior perimeter of each shelter. A minimum of two (2) 20-amp circuits shall be provided for this purpose with one (1) circuit supplied from the protected bus using orange receptacles and one (1) circuit supplied from the service bus using ivory receptacles. One (1) exterior 20-amp GFCI receptacle on its own circuit shall be installed on the service bus. Where power cords are plugged into overhead receptacles, twist lock components shall be used.

9.13.3.9 Lighting

Shelter interior lighting shall be provided by fluorescent or LED (preferred) lighting to a level of fifty (50) foot-candles at a working plane of 30 in. above the floor. Fluorescent light fixtures shall be supplied with 0°F ballasts.

Exterior LED lighting is to be mounted on exterior wall at each exterior door. This light should be equipped with a photocell for dusk-to-dawn operation.

9.13.4 Safety

Emergency eyewash kit / stations and fire extinguishers shall be installed in the radio room.

9.14 Backup Power Systems

9.14.1 Standby Generators

Standby generators shall meet the requirements of a Class 168 (168 hour runtime, 7 days), Type 60 (power restoration in 60 sec.), Level 1 (failure could result in loss of human life) emergency power supply system (EPSS) as defined in NFPA 110 and the requirements of NFPA 70, Article 700.

Generators shall be sized to serve one hundred and twenty-five percent (125%) of current and future facility electrical loads. Future equipment loads shall be assumed to be approximately 2 kW per additional 2 ft. x 2 ft. rack space.

Generators shall include control-panel and alarm functionality that provides remote, TCP/IP-based status, configuration, and control. Remote control functions shall include start/stop functionality.

9.14.1.1 Generator Location

Generators may be located inside (preferred) or outside buildings or shelters. Standby generators located outside of the building or shelter shall be located to protect against ice, moisture, vehicles, vandalism, and rodents.

The automatic transfer switch, line surge suppressors and associated equipment should be located inside the building or shelter unless space limitations dictate otherwise. The system shall be designed to facilitate on-site full load testing.

9.14.1.2 Generator Installation

Generators located outdoors shall be mounted on a concrete pad according to the generator manufacturer's recommendations.

Generators located indoors shall be mounted on spring deflection vibration isolators according to generator manufacturer's recommendations. A drip pan shall be installed beneath the unit to collect spills and leaks.
All electrical connections to the unit shall have a section of flexible conduit for vibration isolation. Generators shall have a drain with a plugged ball valve accessible from the outside of the enclosure for draining oil.

9.14.1.3 Automatic Transfer Switches

Automatic transfer switches shall perform site load to generator transfer with an adjustable timer of one (1) to five (5) minutes. The transfer switch shall retransfer the site load to restored

commercial power with an adjustable timer of one (1) to five (5) minutes followed by an adjustable five (5) to twenty (20)-minute generator cool down before shutting off. A make before break bypass switch shall be provided to disconnect the transfer switch and isolate it from the commercial AC power and all site load equipment. This feature will permit transfer switch maintenance and troubleshooting without disconnecting the AC power from the site equipment.

Operating manuals shall be supplied with each generator.

9.14.1.4 Starting System

Batteries shall be maintenance-free with sealed cells. A battery charger shall be utilized to maintain the amp-hour rating and sufficient starting power of the generator battery when the generator is not running. If water-cooled generators are provided for outdoor installations, crankcase heaters and jacket water heaters shall be provided to facilitate cold weather starting. All external generators shall have oil pan heaters.

9.14.1.5 Fuel System

The fuel tank shall be of an approved design and installed in accordance with the local building codes. Standby generators may be powered by liquified petroleum gas (LPG, propane). Fuel systems shall meet the requirements of NFPA 110 Section 7.9 or NFPA 58, LPG Code.

The fuel tank shall be of appropriate size to power and operate 100% of equipment at the site for a minimum of 24 hours x 7 days.

9.14.1.6 Noise Abatement

Where standby generators are located within one thousand (1,000) ft. of residences or occupied buildings, generators shall be of a quiet design, with appropriate mufflers or other devices making the unit suitable for installation in residential locations. Noise emissions in all locations shall be limited to levels in compliance with state and local regulations. Outdoor generators shall be installed in sound-attenuating enclosures.

9.14.1.7 Alarms

Safety indications listed in NFPA 110, §5.6.5.2 as Remote Audible shall be inputs to the radio system alarm system. Standby generator run status shall also be an input to the alarm system. Because sites are generally unmanned, audible alarms at the sites shall not be required.

9.14.1.8 Spare Parts

To reduce the need for spare parts inventories from various vendors, backup/standby generators should be from the same manufacturer. “High mortality” spare parts referenced in NFPA 110, §8.2.4 may be stored offsite if typically stocked by the generator owner or the local backup/standby generator repair facility.

9.14.2 Backup Power Supplies

At sites with a standby generator, the uninterruptible power supplies (UPSs) or DC power plants, shall meet or exceed the functional requirements for a Type 0 (non-interruption of power), Class 0.25 (functions fifteen (15) min. at full load), and Level 1 (protection of human life) device as specified in NFPA 111. UPSs or DC power plants shall be of proven design. They shall meet the requirements of NFPA 70, Article 700 and the requirements for an Emergency Power System as defined in NFPA 111. The unit shall continuously protect and condition power for a fully loaded critical bus during normal operation. The unit shall power all infrastructure (radio communications system equipment) for a minimum of thirty (30) minutes for local facilities or with personnel on duty 24 hours x 7 days a week ***and*** within five (5) miles. Any site located beyond five (5) miles shall provide power a minimum of two (2) hours runtime.

Units shall provide TCP/IP Ethernet-based management facility, including SNMP network management and web-based status and configuration.

If a UPS is provided, the UPS shall meet the requirements of the following two sections.

9.14.2.1 UPS Emergency Shutoff

The UPS shall have an emergency shutoff switch on the UPS cabinet. Additionally, provisions shall be made to de-energize the facility by operation of a clearly marked emergency switch in proximity to the circuit breaker panel. To prevent inadvertent shutoff, two (2) actions shall be required to engage any emergency UPS shutoff switch (i.e. lift a cover then push a switch, or similar).

9.14.2.2 UPS Bypass Switch

For maintenance and troubleshooting, the UPS shall have an external manual switch that will bypass the UPS AC input to output and disconnect the UPS from the site load and AC input. This will be a make-before-break function switch design in such a way as to prohibit the loss of AC power to the site equipment during and after the switch transfer. This switch shall contain a contact closure that will provide an indication that the bypass function has been activated. The contact closure shall be wired to the alarm system.

In the event of a UPS failure or reduction in output voltage, the UPS shall perform an internal automatic bypass from the AC input to the AC output. This function shall be designed so AC power will be continuous to the site equipment contingent on the presence of commercial or standby generator AC sources.

9.15 Grounding

All site grounding and lightning protection shall be in accordance with the National Electric Code and the grounding and surge protection requirements of ANSI J-STD-607 or:

- Motorola R56 – Standards and Guidelines for Communication Sites
- L3Harris AE/LZT-1234618/1 - Site Grounding and Lightning Protection Guidelines

CONTRACTOR shall provide a grounding plan for each site as identified in Table 4-1.

9.15.1 Common Ground System

There shall be only one (1) common ground system at a communications facility. Grounds for all systems and equipment (including electric service, telephone service, water pipes, etc.) and all metal objects at a site shall be interconnected to equalize voltage rise among all conducting objects at the communications site. The ground system shall be designed to achieve an overall resistance of five (5) ohms or less from any point in the ground system to ground.

9.15.2 Grounding Conductors

All grounding conductor sizes specified are minimum sizes. Flat metal straps or bars may be used in place of wire where the cross-sectional area of the strap or bar meets or exceeds the cross-sectional area of the specified wire. Grounding-conductor insulation shall be green, green with a yellow stripe or marked with green tape or adhesive labels or otherwise colored green at termination points. Grounding conductors shall be supported or secured at intervals of three (3) ft. or less. Grounding conductors shall not be run in metal conduit unless the wire is permanently bonded at both ends of the conduit. PVC conduit is preferred.

9.15.2.1 Exterior Grounding Conductors

Unless otherwise stated, exterior grounding conductors shall be solid or stranded, bare copper. Solid conductors are preferred. Conductors installed below grade or partially below grade shall be #2 AWG solid. Below-grade conductors larger than #2 AWG may be stranded. If below-grade conductors are stranded, tinned copper conductors are recommended. Unless otherwise stated, exterior conductors installed entirely above grade shall be #6 AWG. Insulated conductors are preferred for above-grade conductors. Conductors bonded to galvanized steel shall be tinned, bare copper.

9.15.2.2 Interior Grounding Conductors

Interior grounding conductors shall be tinned or untinned stranded copper wire. Interior grounding conductors shall be insulated unless otherwise specified.

9.15.2.3 Grounding Conductor Bends

Grounding conductor lengths shall be kept as short as possible with the minimum number of bends. Conductor bends shall exceed an eight (8) in. radius with an included angle of at least ninety (90) degrees. Bends made at connection points shall turn in the direction of earth ground.

9.15.3 Grounding Equipment

Where a product is commercially available as a UL-listed device, a UL-listed device shall be used.

9.15.4 Connections

Above- and below-grade connections to the grounding electrode system shall be made by exothermic welding or irreversible high-compression connectors. All other above-grade connections shall be made using exothermic welding, lugs, compression connectors, clamps, or other approved means. Connectors shall be designed for the size and type of grounding conductor(s), the surface being grounded, and the metals being bonded. An anti-oxidation compound shall be applied to the surfaces of all mechanical connections. Where lugs are used, two-hole lugs are preferred. Lugs may not be stacked; each lug shall be in direct contact with the surface to which it is being bonded. The removal of galvanization for the purpose of grounding is strictly prohibited. When making connections between dissimilar metals, precautions must be taken to prevent deterioration of grounding surfaces or protective surfaces.

9.15.5 Exterior Grounding System

An exterior grounding system consists of a grounding electrode system, tower ground bar, external building grounding bus bar and grounding conductors from ground bus bars, towers, buildings, fences, cable bridges, generators, and fuel tanks.

9.15.5.1 Ground Rods

Ground rods shall be solid copper, hot-dipped galvanized steel, copper-clad steel, or stainless steel, at least 5/8 in. diameter and eight (8) ft. long. Ground rods shall be driven into the earth using appropriate tools. The depth of the upper end of the ground rod shall be at the same depth as the ground ring, at least thirty (30) in. below grade. If a ground rod cannot be driven straight down the total length of the ground rod, it shall be driven at an angle not greater than forty-five (45) degrees. Auguring and backfilling are not permissible unless used in conjunction with doping. Maximum distance between ground rods shall be twice the length of a single ground rod.

9.15.5.2 Electrolytic Ground Rods

Electrolytic ground rods may be used in locations with poor soil conductivity or limited space where standard ground rods are insufficient to provide a low-impedance ground. Electrolytic ground rods should be considered for use in locations where the grounding electrode system will be covered by pavement or concrete. Electrolytic ground rods shall be UL-listed, maintenance-free and shall meet all federal, state, and local environmental regulations.

9.15.5.3 Ground Plates

Ground plates may be used in special locations where conditions prevent the use of standard ground rods. Ground plates shall be at least 0.06 in. thick with a surface area of at least two (2) sq ft. They shall be installed at least thirty (30) in. below grade.

9.15.5.4 Doping of Ground Systems

Doping of the soil may be necessary to enhance soil conductivity or protect the grounding electrode system from highly acidic soils. The doping material is added around the ground rod in an augured hole or around a conductor in a trench. The doping material shall have a constant cured resistivity of twelve (12) ohm-cm or less. It shall set up to a hard, permanent material and shall not decompose or dissolve over time. It shall not require any maintenance after installation. It shall not accelerate corrosion of the grounding system. The doping material shall meet all federal, state, or local environmental regulations.

9.15.5.5 Grounding Electrode System Conductors

Grounding electrodes shall be interconnected by grounding electrode system conductors to create the grounding electrode system. Grounding electrode system conductors shall be #2 AWG. Grounding electrode system conductors shall be installed at least thirty (30) in. below grade.

9.15.5.6 Ground Rings

Ground rods shall be interconnected to form a ground ring around each tower and communications shelter. Tower ground rings shall be installed at least two (2) ft. beyond tower foundations. Building ground rings shall be installed three (3) ft. beyond building foundations or 2 to 6 ft. beyond the roof dripline. All ground rings at a site shall be connected to each other with at least two (2) #2 AWG wire.

9.15.5.7 Ground Radials

Ground radials are recommended at lightning-prone sites, sites with high soil resistivity or sites normally occupied. Radials may be twenty-five (25) to eighty (80) ft. in length. They shall be cut to different lengths to prevent resonance. Radials shall be equally spaced and radiate from the tower ground ring. They shall be installed thirty (30) in. below grade. Ground rods shall be installed and connected to the radials separated by no more than the sum of their lengths.

9.15.6 Grounding of Towers and Other Antenna Support Structures

The following sections provide general instructions for grounding towers and other antenna support structures. Special situations, such as the use of cathodic protections systems, shall be designed by a professional engineer specializing in the design of these systems. Drilling holes in towers or loosening tower bolts to install grounding is strictly prohibited.

9.15.6.1 Steel Monopoles

Steel monopoles shall be bonded to a tower ground ring by four (4) #2 AWG wires. The ground ring shall consist of at least four (4) ground rods.

9.15.6.2 Self-Supporting Towers

Each leg of a self-supporting steel lattice tower shall be bonded to a tower ground ring by #2 AWG wire. The ground ring shall consist of at least one (1) ground rod per leg with additional ground rods as required to keep the distance between ground rods to less than twice the length of a single ground rod.

9.15.6.3 Guyed Towers

The base of a guyed tower shall be bonded to a tower ground ring by three (3) #2 AWG wire. The grounding conductors shall be bonded to the ground ring within two (2) ft. of the ground rods. The ground ring shall consist of at least three (3) ground rods. At each guy anchor point, a ground rod shall be installed approximately two (2) ft. from the anchor footing. Guy wires shall be bonded to the ground rod by one (1) #2 AWG wire. The grounding conductor shall be connected to the guy wires using UL-listed mechanical clamps. Exothermic welds are not allowed. Where the guys are anchored within the fenced site compound, each ground rod shall be tied back to the tower ground ring below ground, using #2 AWG wire.

9.15.6.4 Antenna Support Structures on Buildings

Buildings on which an antenna support structure is mounted shall have a lightning protection system designed and installed in accordance with NFPA 780. A typical lightning protection system has a grounding conductor around the perimeter of the roof and at least two (2) down conductors to the grounding electrode system. The lightning protection system may be bonded to building steel in at least two (2) locations in lieu of the down conductors. Metal objects on the roof shall be bonded to the lightning protection system.

For a roof-mounted, self-supporting steel lattice tower, the tower legs shall be interconnected with #2 AWG wire to form a tower ground ring. The tower ground ring (or the base plate of antenna masts or guyed towers) shall be bonded to the lightning protection system by two (2) #2 AWG wires. The conductors shall be extended in opposite directions and bonded to the lightning protection system within two (2) ft. of a down conductor or a connection to building steel.

Guy wires associated with towers on top of buildings shall be grounded at their anchor points to the lightning protection system in a similar manner.

9.15.6.5 Ice Bridges Grounding

Each support post of an ice bridge shall be bonded to the grounding electrode system by a #2 AWG wire. The ice bridge shall be bonded to each support post by #6 AWG wire. If the ice bridge consists of more than one (1) section, the sections shall be bonded together by #6 AWG jumpers.

Where the ice bridge is supported by the tower and/or the building and does not have support posts, the following shall apply:

- Where an ice bridge is supported by the tower, it shall be bonded to the tower and electrically isolated from the building. Bonding to the tower may be accomplished by multiple mechanical connections or by bonding the ice bridge to the tower by a #6 AWG wire, to the TGB by a #6 AWG wire, or directly to the grounding electrode system by a #2 AWG wire in flexible non-metallic conduit.
- Where an ice bridge is supported by the building, it shall be bonded to the building and electrically isolated from the tower. At the building, the ice bridge shall be bonded either to the external ground bus bar by a #6 AWG wire or directly to the grounding electrode system by a #2 AWG wire.
- Where an ice bridge is supported by both the building and the tower, the tower end shall be isolated from the tower by an insulating slip-joint device. At the building, the ice bridge shall be bonded either to the external ground bus by a #6 AWG wire or directly to the grounding electrode system by a #2 AWG wire. At the tower, the ice bridge shall be bonded directly to the grounding electrode system by a #2 AWG wire in flexible non-metallic conduit.

9.15.6.6 Tower Ground Bus Bar

A tower ground bus bar (TGB) shall be mounted at the base of each tower or antenna support structure below the point where transmission lines turn toward the communications building or room. The TGB shall be solid copper at least two (2) in. wide and 0.25 in. thick mounted on 2-in. insulators. In locations where the tower is not protected from runoff from the TGB, the TGB shall be tinned. The length of the TGB and the number of conductors mounting holes are determined by the expected current and future number of conductors to be attached.

The TGB shall be bonded to the grounding electrode system by a #2 AWG tinned, solid, bare copper wire in flexible non-metallic conduit. In addition, the TGB may be bonded to the tower either directly using approved hardware or by a jumper.

Additional TGBs may be installed on the tower for the grounding of transmission line grounding kits. These TGBs shall be bonded to the tower by #2 AWG tinned, solid, bare, copper wire.

9.15.6.7 Tower-Top Amplifiers

Tower-top amplifiers shall be grounded to the tower by a #6 AWG wire. Connections to the amplifier shall be made according to the manufacturer’s recommendations.

9.15.6.8 Transmission Lines

The outer conductor of each transmission line, including waveguide, shall be grounded with appropriate coaxial cable grounding kits. These shall be installed per manufacturer's recommendations at a minimum of three (3) locations:

- At the top of the vertical run near the antenna. The grounding kit grounding conductor shall be connected to a vertical structural member of the tower using the clamp provided with the grounding kit or to a TGB using an appropriate two-hole lug.
- At the bottom of the vertical run, just above where the transmission line turns from the tower toward the communications building or room. The grounding conductor shall be connected

to the TGB using an appropriate two-hole lug. This point shall be as low to the ground as feasible.
- Immediately outside the cable entrance to the equipment building, just ahead of the coaxial suppressor. The grounding conductor shall be connected to the external ground bus bar (EGB) using an appropriate two-hole lug.

Additional grounding bonds shall be installed to keep the distance between grounding kits to less than seventy-five (75) ft. along the vertical run.

9.15.7 Grounding of Buildings or Shelters

9.15.7.1 Exterior Ground Ring

An exterior ground ring (EGR) shall be installed around the perimeter of each dedicated communications building or shelter. The EGR shall incorporate one (1) ground rod at each corner of the building. As necessary, additional ground rods shall be added so the maximum distance between rods is less than the sum of the length of the ground rods. A ground rod shall be installed directly below the transmission line entrance to the building.

9.15.7.2 Exterior Ground Bus Bar

An exterior ground bus bar (EGB) shall be mounted on the exterior of the building below the cable entrance panel. The EGB shall be solid copper at least 2 in. wide and 0.25 in. thick mounted on 2 in. insulators. The length of the EGB and the number of conductors mounting holes are determined by the expected current and future number of conductors to be attached.

The EGB shall be bonded to the grounding electrode system by a #2 AWG wire. A larger size wire or copper straps are preferred.

The EGB may be eliminated where a cable entrance panel is installed that includes integrated coaxial ground clamps.

9.15.7.3 Cable Entrance Panel

The cable entrance panel shall be bonded to the EGB by a #2 AWG wire.

9.15.8 Grounding of Fences

All metal fences, including gates, within six (6) ft. of the grounding electrode system or any grounded object shall be bonded to the grounding electrode system as follows:
- Each corner fence post and each gate support post shall be bonded to the grounding electrode system by #2 AWG wire.
- Each gate shall be bonded to the gate support post by a flexible copper grounding conductor (#6 AWG wire or equivalent). The flexibility of the grounding conductor shall not be compromised by the bonding process.

9.15.9 Grounding of Metal Objects

The following items must be bonded to the grounding electrode system:

- Emergency generator and generator support base
- Fuel tanks and metal fuel pipes, whether above or below ground
- Electric service and telephone service ground systems
- Any other sizable metal object within six (6) ft. of the grounding electrode system or any grounded object

9.15.10 Interior Grounding System

9.15.10.1 Single-Point Grounding System

Communications buildings, shelters or equipment rooms shall have a single-point grounding system. All equipment and metallic objects shall be connected to the exterior grounding system at a single location.

To facilitate creation of a single-point ground, transmission lines, electric service, telephone circuits, etc., shall enter the communications building or shelter near one another and the master ground bus bar.

9.15.10.2 Master Ground Bus Bar

A master ground bus bar (MGB) shall be installed below the cable entry panel. The MGB shall serve as the single-point ground connection for all internal communications system equipment. The MGB shall be solid copper at least 2 in. wide and 0.25 in. thick mounted on 2 in. insulators. The length of the MGB and the number of conductors mounting holes are determined by the expected current and future number of conductors to be attached. The MGB shall be bonded to the EGR by a #2 AWG wire. The grounding conductor shall extend downward from the MGB and exit the building at a forty-five (45) degree angle. The grounding conductor shall be run in flexible non-metallic conduit from the point it passes into the wall until in runs below ground.

9.15.10.3 Secondary Ground Bus Bars

Secondary ground bus bars (SGBs) may be installed in the same room or in other rooms as needed to simplify connections to the MGB. Equipment may be bonded to the SGB rather than directly to the MGB. The SGB shall be at least 2 in. wide and 0.25 in. thick mounted on 2 in. insulators. The SGB shall be bonded to the MGB by a #2 AWG wire.

9.15.10.4 Grounding of Surge Suppressors

Each coaxial surge suppressor installed at the cable entry point shall be bonded to the MGB by a #6 AWG wire. As an option, a secondary ground bus bar (SGB) may be installed below transmission lines in order to facilitate grounding of multiple surge suppressors. The SGB shall be bonded to the MGB by a #2 AWG wire. Some cable entry panels may include an integrated surge-suppressor SGB. This SGB is bonded directly to the EGR through the cable entry panel, so bonding to the MGB is unnecessary.

9.15.10.5 Interior Grounding Ring

An interior grounding ring (IGR, often called a halo ground) shall be installed around the perimeter of the equipment room. The IGR shall be mounted on 2 in. insulators approximately one 1 ft. below the ceiling or eight (8) ft. above floor level, whichever is lower. The IGR shall consist of two (2) #2 AWG wires of approximately equal length. There shall be a gap between the two (2) conductors of at least four (4) in. at the opposite end of the room from the MGB.

9.15.10.6 Connections to the Interior Ground Ring

Items mounted along the perimeter of the equipment room, including the following, shall be bonded to the IGR by a #12 AWG wire:

- Electrical panelboards and transient-voltage surge suppressors (TVSSs)
- Telephone terminal block enclosures and surge suppressors
- Emergency generators (if located indoors)
- Metal battery racks
- Doors
- Door frames
- Ventilation ducts
- Water pipes
- Electrical conduits
- Any significant metal object within six (6) ft. of any other grounded object

9.15.10.7 Equipment Grounding Bus

An equipment grounding bus (EGB) consists of a conductor bonded to the MGB or SGB and radiating outward to equipment locations. The EGB typically runs within cable tray. The EGB may have multiple taps to branch to multiple rows of equipment racks or cabinets. The EGB conductors shall be #2 AWG wire. EGB conductors shall be routed to minimize the distance from the equipment to the MGB or SGB.

9.15.10.8 Rack and Cabinet Ground Bus

A rack or cabinet ground bus (RGB) shall be installed at each rack or cabinet. The RGB shall be #6 AWG wire. The rack or cabinet shall be grounded to the EGB or the RGB by #6 AWG wire.

9.15.10.9 Grounding of Equipment

Each equipment chassis within a rack or cabinet shall be connected to the RGB by #12 AWG wire. Equipment grounds shall not be daisy chained. Communications equipment shall not be connected to the IGR. All equipment, whether mounted in racks or cabinets or in some other manner, shall be connected either to the MGB, an SGB or an EGB.

9.15.10.10 Cable Trays

Cable trays shall be connected to the MGB by a #2 AWG copper wire. Cable tray sections shall be bonded together by #6 AWG copper wires.

9.15.11 Communications Center Grounding

A communications center ground bus (#2 AWG copper wire) shall be run under the flooring for each equipment row, if possible, in a manner to allow each equipment to tie into this ground with a #6 AWG solid or stranded, green-insulated copper wire. The ground bus shall be short and direct with no sharp bends and shall not run parallel within 2 in. of any power or signal leads. The ground bus shall connect to a single-point master ground bus bar, and then connect to the exterior building ground, except if no external ground system is being installed as part of the equipment installation. Any ground system installed shall be effectively connected to the existing building ground or electrical service ground.

Console bays shall be bonded together and shall be connected to the communications center ground bus with a short, direct run of #6 AWG or larger solid or stranded, green-jacketed copper wire, avoiding sharp bends.

9.16 Surge Suppression

All power and communications circuits entering and exiting the communications shelter or room shall be protected by the application of appropriate surge protective devices (SPDs) employing metal-oxide varistors (MOVs) or silicon avalanche diodes (SADs).

9.16.1 Transmission Line Surge Protective Devices

All RF transmission lines, including unused spares, must be protected by coaxial SPDs. Transmission line SPDs shall be located within 2 ft. of the entrance to the building, or if the communications equipment room is not near the building entrance, within 2 ft. of the entrance to the communications equipment room. Coaxial SPDs shall be grounded as indicated above.

9.16.2 Tower-Top Amplifier Protection

TTA protective measures shall be verified with the amplifier manufacturer. An input port surge suppression device shall be installed per the manufacturer’s recommendation. Internal preamplifier output port protective measures shall be verified with the amplifier manufacturer, and output port surge suppression devices shall be installed per amplifier manufacturer's recommendations. Tower-top pre-amps with outputs carrying both DC and RF via the coaxial line shall be protected by an impulse suppressor with DC injection. These units shall be installed according to the manufacturer's instructions. All surge protection devices shall be located and installed to be easily replaceable.

9.16.3 Electric Service Panelboard Surge Suppression

A Type 1 transient voltage surge suppressor (TVSS) shall be placed on the source side of service entrance panels, and on the load side of transfer switches or distribution panels. The suppressor shall be installed in parallel via a circuit breaker sized according to the manufacturer's recommendation (typically 60-amp) rated for the interrupting current of the panel. The lead lengths from the protective devices shall be as short as possible. The TVSS enclosure shall be grounded to the IGR with #6 AWG wire. A remote status indicator must be available.

9.16.4 AC Power In-Line Protection

When the above TVSSs are used, no additional TVSSs are required on site. If main/branch panel TVSS is not available, each AC utility power line shall be equipped with a two-way surge protector.

9.16.5 Telephone Lines

All telephone lines, T1 lines, data, and control lines (excluding all fiber-optic lines) entering a site shall be equipped with bi-polar, bi-directional SAD surge protectors. The location for these protectors can be at the equipment or telephone patch panel depending upon the application. For these hazards, protectors shall be connected with a #6 AWG or larger solid copper wire or strap to either the equipment ground or telephone patch panel ground.

9.16.6 GPS Receiver

When a GPS receiver with an active antenna mounted outside of the building is employed, a GPS system coaxial protector shall be installed to protect against the surge from a GPS antenna. The protector shall be located between the GPS antenna and GPS receiver with a #6 AWG or larger solid copper wire or strap to connect to the equipment rack ground.

10 Abbreviations & Acronyms

Abbreviations and Acronyms List			
AASHTO	American Association of State and Highway Transportation Officials	DMZ	Demilitarized Zone
AC	Alternating Current	DS1	Digital Signal 1
AC	Advisory Circulars	DS3	Digital Signal 3
ACI	American Concrete Institute	DVD	Digital Video Disc
AES	Advanced Encryption Standard	DVR	Digital Vehicular Repeater
AM	Amplitude Modulation	E&M	Ear & Mouth
ANSI	American National Standard Institute	EGB	Equipment Grounding Bus
ASCE	American Society of Civil Engineers	EGR	Exterior Ground Ring
ASHRAE	American Society for Heating, Refrigeration and Air-conditioning Engineers	EIA	Electronic Industries Association
ASSE	American Society of Safety Engineers	EMT	Electrical Metallic Tubing
ASTM	American Society for Testing and Materials	EPSS	Emergency Power Supply System
ATIS	Alliance for Telecommunications Industry Solutions	ERP	Effective Radiated Power
ATP	Acceptance Test Plan	F1	First Fresnel Zone Height
AUX I/Os	Auxiliary Inputs/Outputs	FAA	Federal Aviation Administration
AWG	American Wire Gauge	FCC	Federal Communications Commission
BER	Bit Error Rate	FDMA	Frequency Division Multiple Access
C4FM/CQPSK	Continuous 4-level Frequency Modulation / Continuous Quadrature Phase Shift Keying	GC	Clayey Gravel
CAD	Computer Aided Dispatch	GM	Silty Gravel
CD-ROM	Compact Disc Read-Only Memory	GP	Gravel Poorly Graded
CFR	Code of Federal Regulations	GPS	Global Positioning System
COTS	Commercial Off-the-Shelf	GUI	Graphical User Interface
CPU	Central Processing Unit	GW	Gravel Well-Graded
DAQ	Delivered Audio Quality	HIPS	Host-Bases Intrusion Prevention Software
dB	Decibel	HVAC	Heating, Ventilation, and Air Conditioning
dBm	Decibel-milliwatt	Hz	Hertz
DC	Direct Current	I/O	Input / Output
DDR	Detailed Design Review	ID	Identifier

Abbreviations and Acronyms List			
IDU/ODU	Indoor Unit/Outdoor Unit	P25	APCO Project 25
IEEE	Institute for Electrical and Electronics Engineers	PA	Power Amplifier
IESNA	Illuminating Engineering Society of North America	PC	Personal Computer
IGR	Interior Ground Ring	PDF	Portable Document Format
IP	Internet Protocol	PSF	Pounds-Force Per Square Foot
IRR	Instant Recall Recorder	psig	pounds per square inch gage
K	K factor	PVC	Polymerizing Vinyl Chloride
KFD	Key Fill Device	QoS	Quality of Service
KMF	Key Management Facility	RF	Radio Frequency
LED	Light-Emitting Diode	RFP	Request for Proposal
LMR	Land Mobile Radio	RGB	Rock or Cabinet Ground Bus
LPG	Liquefied Petroleum Gas	RSL	Received Signal Level
MGB	Mater Ground Bus Bar	RTU	Remote Terminal Unit
MHSB	Monitored Hot Stand-by	RX	Receiver
MoM	Manager of Managers	P25	APCO Project 25
N/C	Normally Closed	PA	Power Amplifier
N/O	Normally Opened	SAD	Silicon Avalanche Diodes
NECA	National Electrical Contractors Association	SC	Clayey Sand
NEMA	National Electrical Manufactures Association	SGB	Secondary Ground Bus Bar
NEPA	National Environmental Policy Act	SHPO	State Historic Preservation Offices (National Register)
NESC	National Electrical Safety Code	SM	Silty Sand
NFPA	National Fire Protection Association	SNMP	Simple Network Management Protocol
NIST	National Institute of Standards and Technology	SNMPv1	Simple Network Management Protocol Version 1
nm	nanometer	SNMPv2	Simple Network Management Protocol Version 2
NMS	Network Management System	SNMPv2c	Simple Network Management Protocol Sub-version 2
NTP	Notice to Proceed	SNMPv3	Simple Network Management Protocol Version 3
O.D.	Outside Diameter	SP	San Poorly Graded
OC3	Optical Carrier 3	SPD	Surge Protection Devices
OEM	Original Equipment Manufacturer	SSL	Secure Sockets Layer
OET	Office of Engineering & Technology	STD	Standard
OTAP	Over the Air Programming	STS-1	Synchronous Transport Signal 1
OTAR	Over the Air Rekeying	SW	Sand Well-Graded

TGB	Tower Ground Bus Bar		
T1	T-Carrier		
TIA	Telecommunications Industry Association		
TL1	Transaction Language 1		
TSB	Telecommunications Systems Bulletin		
TTL	Time to Live		
TVSS	Transient-Voltage Surge Suppressor		
TX	Transmitter		
UHF	Ultra-High Frequency		
UL	Underwriters Laboratories		
UPS	Uninterruptible Power Supply		
USB	Universal Serial Bus		
VAC	Voltage Alternating Current		
VDC	Voltage Direct Current		
VHF	Very-High Frequency		
VPN	Virtual Private Network		
VSWR	Voltage Standing Wave Ratio		
W	Watt		

Appendix A – Evaluation Criteria

Proposals will be evaluated based on the categories below:

Category	Points Allocation
Pricing (30 Points)	
Infrastructure / Subscriber Costs	25
14 Year Ongoing Costs (Operations & Maintenance)	5
Technical (70 Points)	
System Configuration and Design – Major Exceptions	10
Coverage Adequacy	20
Responsiveness to the Intent of the Specification – Minor Exceptions	10
Responsiveness to the Intent of the Specification – Questions	5
Project Manager Experience	5
Lead Engineer Experience	5
Warranty and Maintenance Service Organization Experience	5
Schedule	5
Total Base Evaluation Points	**100**
OPTIONAL Additional (10 Points)	
Oral Presentation	5
Value Added	5
Total Evaluation Points	**110**

Grounds for Rejection

A proposal may be rejected for any of the following reasons:

- Failure to accept the Terms and Conditions as written in Section 3 of the RFP
- Failure to accept the Montgomery County Form of Contract Document.
- Submitting a Technical Proposal containing pricing information.
- Failure to provide a *redacted* Technical Proposal, in electronic PDF format, that is compliant with Code of the Commonwealth of Virginia.
- Failure to provide a complete proposal, based upon the requirements of RFP Section 2.
- The proposed system is incomplete, e.g. specified subsystems or interfaces to existing equipment are not proposed.
- The proposed radio system will not provide the capacity to support the number of users specified in the RFP.
- Failure to provide a coverage guarantee.

- The PROPOSER'S schedule is unrealistic. A schedule may be deemed unrealistic if *important tasks or milestones are omitted* or if insufficient time is allocated to tasks.
- The PROPOSER's Price Proposal Worksheet does not provide the required details in the Pricing Sheets. Bundling pricing will not be accepted.
- Including scope of work and technical assumptions in sections other than Section 4 of the Technical Proposal.

Evaluation Categories

PRICING

Pricing shall be scored based upon the last pricing workbook submitted to Montgomery County prior to final evaluation.

The pricing evaluation is separated into two subcategories: Infrastructure / Subscriber Costs, and 14-year running costs.

Infrastructure / Subscriber Costs: Shall comprise the total initial cost for the system infrastructure and all subscriber units.

Infrastructure:
Infrastructure costs shall include all fixed equipment (Radio and Microwave systems), physical facilities (shelters, towers, generators, HVAC, access roads, etc.) all dispatch equipment (consoles, back-up control stations, logging recorder, etc.), alarm system, software, all costs associated with acquisition, designing, staging, delivery, installation, construction, implementation, configuration, testing, cutover, and all services (project management, engineering, training, etc.).

Infrastructure costs shall include all costs associated with first-year operation of the base system, including the following:
- purchase or 1st year lease of sites or property
- 1st year lease of equipment room and/or tower space
- 1st year lease of connectivity network (e.g. fiber-optic)
- regulatory fees
- setup and implementation of utilities
- initial full tank of generator fuel
- 1-year warranty

Subscribers:

Subscriber costs will be based on pricing information in the Price Proposal worksheet, provided the proposed subscribers are compliant with the RFP. Where proposed subscriber equipment is not compliant or list prices are unavailable, the evaluation team will estimate the cost for compliant subscriber equipment based on proposed list prices.

Subscriber costs include the following:

- subscriber units (mobiles, portables, pagers, control stations)
- all ancillary items required to operate and charge the unit
- subscriber services (delivery, programming, installation)
- required features and functionality specified by the RFP
- accessories requested by Montgomery County in the RFP
- 3-year warranty

The following costs are excluded in the calculation of infrastructure/subscriber costs:

- operations and maintenance
- contingent discounts
- mandatory options identified in the RFP
- options offered by the PROPOSER.

Points will be awarded to each proposal based on the following formula:

$$PIC_n = \frac{MinIC}{IC_n} \times PIC_0$$

Where:

PIC_n is the points awarded to Proposal n for this subcategory
$MinIC$ is the lowest Initial Costs of all valid proposals
IC_n is the Initial Costs of Proposal n; and
PIC_0 is the total points allocated to this category.

Where infrastructure or subscriber costs are not included in the Proposal, they will be estimated by the evaluation team.

14 Year Ongoing Costs

14 Year Ongoing Costs include the following long-term costs:

- Years 2-15 maintenance plan
- annual radio infrastructure preventive maintenance and site inspections
- bi-annual subscriber preventive maintenance

- system refresh or any incremental upgrades necessary to maintain system operations for 15 years
- software and system updates/upgrades necessary to maintain system operations for 15 years
- new site lease costs – if Montgomery County must lease property to build a tower
- existing site lease costs - tower space and/or ground space for shelter/generator
- connectivity network maintenance
- dispatch equipment maintenance plan (consoles, control stations, logging recorder, etc.)

Where these costs are not included in the Proposal, they will be estimated by the evaluation team. These costs will be based on pricing information in the Price Proposal worksheets, provided that proposed warranty and maintenance services are compliant with the RFP. Where proposed services and support is not compliant, the cost will be estimated based on proposed prices for compliant services and support. If proposed prices are unavailable for RFP required services and support, the evaluation team will estimate the cost of compliant support.

Points will be awarded to each proposal according to the following formula:

$$P14YearCost_n = \frac{Min14YearCost}{14YearCost_n} \times P14YearCost_0$$

Where:
$P14YearCost_n$ is the points awarded to Proposal *n* for this category
$Min14YearCost$ is the lowest 14 Year Ongoing Costs of all valid proposals
$14YearCost_n$ is the 14 Year Ongoing Costs of Proposal *n*; and
$P14YearCost_0$ is the total points allocated to this category.

TECHNICAL

System Configuration and Design

Evaluation points will be awarded for proposed system configurations and designs that meet the RFP requirements. This category also evaluates system capacity (current and future), guaranteed coverage, planned locations with existing or new radio sites, connectivity network topology, simulcast design, interoperability, redundancy, reliability, functions, and features. If the evaluation team determines that the Proposal has not met the RFP requirements, the evaluation team will mark the non-compliance as a major exception at their discretion.

The following are examples of possible major exceptions, not meant to be exhaustive or all-inclusive:
- failure to ***substantially*** comply with RFP Terms and Conditions
- failure to accept the Sample Contract Document

- submission of additional Terms and Conditions that are in conflict with the RFP Terms and Conditions
- failure to propose all equipment and services (to include physical facilities upgrades) necessary to provide a complete and working system as specified in the RFP
- proposing equipment that fails to meet specifications at numerous points
- proposing equipment that does not meet the specifications, however the PROPOSER has a product line that does meet the specifications
- proposing equipment that is not public safety grade
- the proposed system's modes of operation inhibit the ability of a user to perform his duties safely and efficiently
- a system configuration that significantly affects dependability
- system redundancy that is significantly less than specified in the RFP
- system traffic loading capacity fails to meet current and future voice & data communications specified by the RFP and/or does not comply with public safety industry standards
- Acceptance Test Plan not compliant with the RFP requirements
- failure to comply with the RFP re-testing requirements

Points for this category will be awarded based on the higher score obtained by one of the following two methods:

1. Two (2) points will be deducted for each major exception; or
2. Points will be awarded based on the following formula:

$$PConfig_n = \frac{E_1 + E_2 + \ \ldots + EN - E_n}{E_1 + E_2 + \ldots + E_N} \times PConfig_0$$

Where:
$PConfig_n$ is the points awarded to Proposal n for this category
E_n is the number of major exceptions found in Proposal n
N is the number of valid proposals; and
$PConfig_0$ is the points allocated to this category.

Coverage Adequacy

Evaluation points will be awarded according to coverage guaranteed. All PROPOSERS meeting the coverage specifications will be provided 100 percent (100%) of the points for this category.

For proposals not meeting the coverage specifications, a one-point deduction shall be assessed for each

one percent inadequacy in meeting the specification in any direction (talk-out and/or talk-in) for each service area.

Responsiveness to the Intent of the Specifications – Minor Exceptions

Points in this category will be deducted if minor exceptions in equipment, system specifications, or pricing are found by the evaluation team. The following are examples of minor exceptions, though this list is not intended to be all-inclusive or exhaustive:

- Equipment proposed does not meet the specifications, and the PROPOSER'S product line does not meet the specifications.
- Proposed equipment does not meet the specifications, and the Proposal states "Exception" in the Compliance section (Appendix B).
- Proposed equipment does not meet the specifications, but the Proposal states "Comply" or "Comply with Clarification" in the Compliance section (Appendix B).
- Proposed equipment can meet the specifications and stated "Comply", but the Proposal would require purchasing additional system features or functions listed "optional".

1. One quarter (1/4) points will be deducted for each minor exception; or
2. Points will be awarded based on the following formula:

$$PMinorexp_n = \frac{E_1 + E_2 + \cdots + E_N - E_n}{E_1 + E_2 + \cdots + E_N} \times PResponse_0$$

Where:

$PMinorexp_n$ is the points awarded to Proposal *n* for this subcategory,

E_n is the number of minor exceptions found in Proposal *n,*

N is the number of valid proposals; and,

$PResponse_0$ is the points allocated to this category.

Responsiveness to the Intent of the Specifications – Questions

If sections of the technical or price proposals are missing items, require clarification or require additional explanation to determine if the proposal meets or deviates from RFP requirements, the evaluation team will submit written questions. The total number of questions for each proposal will be calculated and points will be awarded using the following:

1. One quarter (1/4) points will be deducted for each question; or
2. Points will be awarded based on the following formula:

$$PQuestion_n = \frac{Q_1 + Q_2 + \cdots + Q_N - Q_n}{Q_1 + Q_2 + \cdots + Q_N} \times PResponse_0$$

Where:

$PQuestion_n$ is the points awarded to Proposal *n* for this subcategory,

Q_n is the number of questions asked for Proposal *n*,

N is the total number of valid proposals; and,

$PResponse_0$ is the points allocated to this category.

Project Manager Experience

The evaluation team will contact each of the three (3) references submitted by the PROPOSER, for the project manager. The evaluation team will ask several questions and the reference will submit a rating response to each question: 5 Excellent, 4 Good, 3 Satisfactory, 2 Fair, 1 Poor. If no response is received from a reference, or a question is not answered, the evaluation team will assign 0. The responses to each question from a single reference will be averaged to produce a total score for that reference. The total scores from all references will be averaged to produce an overall score for the category.

Lead Engineer Experience

The technical evaluation team will contact each of the three (3) references, submitted by the PROPOSER, for the lead engineer. The evaluation team will ask several questions and the reference will submit a rating response to each question: 5 Excellent, 4 Good, 3 Satisfactory, 2 Fair, 1 Poor. If no response is received from a reference, or a question is not answered, the evaluation team will assign 0. The responses to each question from a single reference will be averaged to produce a total score for that reference. The total scores from all references will be averaged to produce an overall score for the category.

Warranty and Maintenance Service Organization Experience

The technical evaluation team will contact each of the three (3) references, submitted by the PROPOSER, for the service organization proposed to perform the warranty and maintenance work. The evaluation team will ask several questions and the reference will submit a rating response to each question: 5 Excellent, 4 Good, 3 Satisfactory, 2 Fair, 1 Poor. If no response is received from a reference, or a question is not answered, the evaluation team will assign 0. The responses to each question from a single reference will be averaged to produce a total score for that reference. The total scores from all references will be averaged to produce an overall score for the category.

Schedule

All points in this category will be awarded to each PROPOSER that proposes a schedule that meets the specified schedule in Section 2. If the proposed schedule does not meet the specified schedule, points will be awarded based on the following formula:

If $Sched_n \leq$ RFPSched, then

$$PSched_n = PSched_0$$

If RFPSched $< Sched_n <$ 2 x RFPSched, then

$$PSched_n = PSched_0 \times \left(2 - \frac{Sched_n}{RFPSched} \right)$$

If $Sched_n \geq$ 2 x *RFPSched*, then

$$PSched_n = 0$$

Where

$PSched_n$ is the points awarded to Proposal *n* for this category;
RFPSched is the number of days in the schedule specified in the RFP
$Sched_n$ is the number of days in the schedule proposed in Proposal *n*; and
$PSched_0$ is the points allocated to this category.

OPTIONAL Additional

Montgomery County may elect, at their sole discretion, to exercise the following Optional Additional Evaluation Categories if they believe it is in best interest of the project.

Oral Presentation

Points in this category will be allocated based on the following criteria:

- oral presentation agenda, as provided by the Montgomery County, is followed;
- each topic on the agenda is substantively covered;
- if specific questions are provided by the Montgomery County, each question is adequately addressed;
- if demonstrations are allowed by the Montgomery County, each piece of equipment demonstrated works properly;
- proposed Project Manager and Lead Engineer participate in the presentation;
- time constraint for the oral presentation is met;
- no discussion/reference of pricing during the oral presentation.

Each criteria described above will be given a score: 5 Excellent, 4 Good, 3 Satisfactory, 2 Fair, 1 Poor and all criteria will have equal weighting. Each Montgomery County representative attending the oral presentation will be given the opportunity to provide a score and all scores will be totaled and averaged to determine the final score for the PROPOSER.

Value Added

Montgomery County may elect, at their sole discretion, to award points for any value-added radio system, subscriber, and maintenance elements offered in proposal submissions. Each review team member will complete a written evaluation form with a score. Scores will be averaged for the evaluation team and awarded to PROPOSERs.

FINAL SELECTION

Montgomery County shall select the PROPOSER which, in its opinion, has made the best proposal and provides the best value to Montgomery County.

Montgomery County shall notify all PROPOSERS of the Notice of Intent to Award. Upon issuing a Notice of Intent to Award, Montgomery County will expect the selected PROPOSER to negotiate in good faith and execute a contract within sixty (60) days. Failure to execute a contract within sixty (60) days may be grounds for Montgomery County to end negotiations with the selected PROPOSER and begin negotiations with the next highest ranked PROPOSER.

Montgomery County reserves the right to waive any informalities or irregularities. Montgomery County may cancel the RFP at any time and may reject all Proposals, or any portion thereof, if it is deemed in their best interest.

Appendix B - Compliance Matrix

See attached excel file

Appendix C - Responsibilities Matrix

See attached excel file

Appendix D – Price Proposal Forms - Instructions

D.1 General Instructions

ABSOLUTELY NO PRICE INFORMATION SHALL BE INCLUDED IN THE TECHNICAL PROPOSAL. TECHNICAL PROPOSALS CONTAINING PRICE INFORMATION MAY BE DISQUALIFIED.

The PROPOSER shall enter detailed prices for the proposed system(s), equipment, software, and services in the Microsoft Excel workbook provided. The PROPOSER shall submit this completed workbook in its native Microsoft Excel format, failure to do so may result in rejection of the Proposal or loss of evaluation points. The PROPOSER shall also submit all sheets in the Microsoft Excel pricing pages as a PDF, and included in the Price Proposal submission, failure to provide all pricing information as a PDF copy may result in rejection of the Proposal.

The following notes apply, as appropriate, to all the cost pages:

- The PROPOSER shall include all costs for a turnkey system related to each specified cost area.
- PROPOSER **shall not bundle pricing**, when line items are available to submit detailed pricing.
- PROPOSER shall complete each worksheet in the pricing pages to allow for detailed evaluation.
- Items with no associated cost shall be indicated by zero (0) dollars in the appropriate cost column.
- Items that are not required or not applicable to the proposed system shall be noted as “N/A”, in the Note column, and no costs shall be included for these items.
- The PROPOSER shall enter costs not specifically requested in the “Other Related Costs” cells that have been provided.
- Where costs for a line Item are included as part of another line item, the PROPOSER shall reference the item number which includes the cost.
- In case of calculation errors or inaccuracies in the submitted pricing forms, the unit pricing shall prevail.
- All equipment required for a complete operational system shall be assumed to be included in the total system cost.

Failure to adhere to the above notes may result in rejection of the Proposal or loss of evaluation points.

D.2 Specific Instructions

D.2.1 General Setup

The price forms are provided in Microsoft Excel workbook file named "*Appendix D - Price Proposal Workbook.xlsx*". Tabs are provided as follows:

- Project Information Worksheet
- Project Summation
- A. Physical Facilities
- B. Radio System
- C. Connectivity Network
- D. Dispatch Centers
- E. Services
- F. Public Safety Subscribers
- G. Non-Public Safety Subscribers
- H. Project Discount
- I. Project Options
- J. Ongoing Costs
- K. Ongoing Costs Options
- L. Mandatory Unit Pricing
- Notes

D.2.2 Color Definition

The colors black, gray, and white are used throughout this workbook to simplify data entry. **Data or text shall only be entered into gray cells**. Text and data shall not be entered in cells that are not gray, to do so will create errors on the workbook and may result in rejection of the Proposal or loss of evaluation points. If an error occurs the PROPOSER shall reach out to Montgomery County in writing, to request a revised Appendix D.

D.2.3 Project Information

The PROPOSER shall enter the date of submission, the PROPOSER's legal name, and the site names into the gray cells.

D.2.4 Base Quote Totals

The worksheet labeled "Project Summation" is used to display all the section totals, total base system, project discount, grand total, maintenance, project options, and maintenance options. Project options and maintenance are not summed into the grand total price.

The worksheet contains formulas that pull the numbers from the individual worksheets and performs elementary arithmetic for adding and subtracting. This page is for display purposes only and no information shall be added by the PROPOSER.

D.2.5 Infrastructure Related Costs

Worksheets are included for the following categories of systems:

- Physical Facilities
- Radio System
- Connectivity Network
- Dispatch Centers

The PROPOSER shall use these worksheets to enter all related costs for systems, equipment, software, installation, and programming for that category.

Columns A and B list equipment and installation totals per individual line item. Cells A3 and B3 sum all equipment and installation costs for the entire category. Cell A2 sums cells A3 and B3 together. The total from cell A2 (on each worksheet) is reported on the "Project Summation" worksheet and, if clicked, will take you to the Project Summation sheet.

If there are significant detailed notes the PROPOSER believes necessary, enter a designated note number next to the line item in column C and insert the note in the worksheet labeled "Notes" at the end of the Price Proposal Workbook. Columns D and E list numbers and titles of each line item. The PROPOSER shall denote all pricing information for each line item in the proposed system.

D.2.6 Services

The PROPOSER shall use this worksheet to enter all costs related to project management, engineering, testing, training, documentation for that category. This includes the following:

- Labor (services/qty)
- Out-of-Pocket (expenses/qty)

D.2.7 Subscriber Related Costs

Worksheets are included for the following categories:

- Public Safety Subscribers
- Non-Public Safety Subscribers

The PROPOSER shall use this worksheet to enter all related costs for equipment, installation, and programming for that category. The PROPOSER shall denote all pricing information for each line item used for a specified subscriber unit.

PROPOSERS shall enter the Model Number in the grey cells of Column C. Column F provides the total number, all departments, for that line item. The next two columns are gray for PROPOSER input: column G is for equipment per unit costs; column H is for install/program per unit cost. The next column I has a mix of gray and white cells; the gray cell may be used to enter quantities and the white cells have pre-populated qualities based upon Montgomery County's agency needs. Columns J & K calculate total equipment and installation/program costs for that line item for Montgomery County's Agency. The two cells in columns J & K above the agency name total equipment and installation costs per site. Above these cells is a single cell that totals both equipment and installation costs per agency.

Columns G - K are repeated for each agency that will operate on the PROPOSED system.

D.2.8 Project Discount Worksheet

This worksheet is separated into the following categories:

- Infrastructure Project Discount
- Subscribers Project Discount

The PROPOSER shall use this worksheet to insert any discount associated with the proposed system design. The PROPOSER shall complete Column F to provide the monetary discount offered. The PROPOSER shall separate the discounts offered for infrastructure and subscribers as outlined in the worksheet.

D.2.9 Project Options

The PROPOSER shall use this worksheet to enter all costs related to options. The PROPOSER shall offer the options as described on this worksheet. If the PROPOSER desires to offer additional options, they may be included after the named options.

Columns A and B list equipment and installation totals per individual line item. The total from cell A2 is reported on the "Project Summation" worksheet. The next two columns are gray for PROPOSER input: Column F is for equipment costs and column G is for installation costs.

D.2.10 Ongoing Costs (Years 1 through 15)

The PROPOSER shall use this worksheet to enter all costs related to ongoing costs for years 1 -15.

It is expected the only costs to be included in 1st Year Maintenance will be the Lease Costs for each site not owned by Montgomery County.

Columns A and B list services and spare parts totals per individual line item. Cells A3 and B3 sum all equipment and installation costs for the entire category. Cell A2 sums cells A3 and B3 together. The total from cell A2 is reported on the "Project Summation" worksheet.

The PROPOSER shall denote all pricing information for each line item that is necessary for maintaining the implemented system. The PROPOSER shall separate all necessary services and spare parts for complete maintenance as outlined in the worksheet.

The next two columns are gray for PROPOSER input: Column F is for 2nd year maintenance services costs; column G is for 2nd year spare parts costs. Columns F & G are repeated for each year of maintenance costs, through year 15.

D.2.11 Ongoing Costs Options (Years 1 through 15)

The PROPOSER shall use this worksheet to enter all costs related to Ongoing Costs Options. The PROPOSER shall offer the options as described on this worksheet. If the PROPOSER desires to offer additional options, they may be included after the named options.

The PROPOSER shall denote all pricing information for each line item that is necessary for maintaining the implemented system. The PROPOSER shall separate all necessary services and spare parts for complete maintenance as outlined in the worksheet.

The next two columns are gray for PROPOSER input: Column F is for optional 1st year warranty/maintenance services costs; column G is for 1st year warranty/maintenance spare parts costs. Column H is for optional 1st year warranty/maintenance services costs; column G is for 1st year warranty/maintenance spare parts costs. Column H is for 2nd year optional maintenance services costs; column I is for 2nd year optional spare parts costs. Columns H & I are repeated for each year of optional maintenance and spare parts costs, through year 15.

D.2.12 Mandatory Unit Pricing Worksheet

The PROPOSER shall use this worksheet to enter the subscriber equipment unit and unit installation costs that will be used for future purchasing. The PROPOSER shall offer the options as described on this worksheet. If the PROPOSER desires to offer additional options, they may be included after the named options.

This worksheet will not be included in the base quote total and will only be used as a reference in future purchases by Montgomery County. PROPOSERS shall enter Model Number in the gray cells of column C, enter the per unit equipment cost in column D, and enter the per unit installation and program costs in column E.

The pricing provided on this sheet **shall not** be different than the pricing on sheet for Public Safety Subscribers and the sheet for Non-Public Safety Subscribers.

D.2.13 Notes

The PROPOSER shall use this worksheet to enter any detailed notes of explanation. The PROPOSER shall enter the following information: column A shall reference the specific worksheet to which the note corresponds; column B shall reference the assigned note reference # as entered in column C of the specified worksheet; and column C shall be the detailed notes of explanation.

APPENDIX E

PROPRIETARY/CONFIDENTIAL INFORMATION IDENTIFICATION FORM

Code of Virginia 2.2-4342F *(updated 07/01/18)*: "Trade secrets or proprietary information submitted by a offeror or contractor in connection with a procurement transaction or prequalification application submitted pursuant to subsection B of § 2.2-4317 shall not be subject to the Virginia Freedom of Information Act (§ 2.2-3700 et seq.); however, offeror or contractor shall (i) invoke the protections of this section prior to or upon submission of the data or other materials, (ii) identify the data or other materials to be protected, and (iii) state the reasons why protection is necessary. An offeror or contractor shall not designate as trade secrets or proprietary information (a) an entire proposal or prequalification application; (b) any portion of a proposal or prequalification application that does not contain trade secrets or proprietary information; or (c) line-item prices or total proposal or prequalification application prices."

Trade secrets or proprietary information shall be identified in writing on this form, either before or at the time the data or other material is submitted. Note: If proprietary/confidential information is identified, Offeror must submit a redacted copy (in electronic PDF format) of their proposal in addition to the required number of copies requested. The proprietary or trade secret material must be clearly identified in the redacted proposal copy by a distinct method such as highlighting or underlining and must indicate only the specific words, figures, or paragraphs that constitute a trade secret or proprietary information. The designation of an entire proposal document, line item prices, and/or total proposal prices as proprietary or trade secrets is not acceptable. If, after being given reasonable time, the offeror refuses to withdraw such a classification designation, the proposal will be rejected.

SECTION NUMBER	PAGE NUMBER	REASON

Authorized Signature

Date

Appendix F – PROPOSER Questions

E1 General Instructions

The PROPOSER shall enter any questions in the Appendix F PROPOSER Questions spreadsheet prior to submission of the proposal. The format of entering RFP information and questions should follow the example below:

Date Submited	#	RFx Document	RFP Section Number/ Name	RFP Outline Item Number	RFP Requirement	Clarification Request	Client Response/ Clarification
	1	CLIENT - Name of Clinet's RFP	5 Microwave Network Requirements	5.1.1			
	2						
	3						

Montgomery County
Virginia

CONTRACT
FOR

_____

THIS AGREEMENT, executed this _____ day of _____ 2024 by and between _____Contractor Name_____ (Contractor Address) hereinafter called "Contractor" and _____Montgomery County_____, party of the second part hereinafter called "Owner".

WITNESSETH, that for the consideration hereinafter mentioned, the Owner and the Contractor shall agree to the terms and conditions contained in this contract. The Exhibits and documents below are expressly incorporated herein by reference and, together with this Contract constitute the Contract Documents. Attached to and hereby incorporated into this Contract are the following exhibits, enumerated as follows, and these items shall take precedence in the order in which they are listed:

1. Contract Agreement including:
   a. Exhibit A - Compliance Matrix as amended, DATE
   b. Exhibit B - Payment Milestones & Pricing Pages as amended, DATE
   c. Exhibit C - Project Schedule as amended, DATE
   d. Exhibit D - Performance and Payment Bonds
   e. Exhibit E - Responsibilities Matrix, as amended, DATE
   f. Exhibit F- Proposer Software License Agreement, DATE
   g. Exhibit G – Proposer Maintenance Agreement, DATE
2. Proposer BAFO Response, DATE
3. Proposer Response to Price Questions, DATE
4. Proposer Response to Technical Questions, DATE
5. Addendum 3 Montgomery County RFP 24-16 Regional P25 Radio System, DATE
6. Addendum 2 Montgomery County RFP 24-16 Regional P25 Radio System, DATE
7. Addendum 1 Montgomery County RFP 24-16 Regional P25 Radio System, DATE
8. Montgomery County RFP 24-16 Regional P25 Radio System, DATE
9. Additional Documentation, DATE
10. Technical Proposal, DATE

THE OWNER shall pay the Contractor for the performance of this contract in the sum of _____$_____) dollars in accordance with the terms of this contract.

This contract shall not be altered in any particular without the written consent of all parties to this contract. All alterations to this contract must be in writing and authorized as such by both signing parties to this contract.

The Contractor shall not delegate, assign or transfer any of its duties delineated in the scope of services without prior written consent from the Owner.

In the event the Contractor is a corporation a certificate that the person executing this contract is duly authorized to sign, must accompany this contract.

Notwithstanding anything in the Contract documents to the contrary, any and all payments which the Owner is required to make under this Contract shall be subject to appropriation or other availability of funds as certified by the Owner. Obligations for payments beyond the current fiscal year are subject to appropriation and this Contract shall be canceled in the event of non-appropriation upon written notification to Contractor.

Final payment on this contract shall release and discharge the Owner from any and all claims against the Owner on account of any work performed hereunder, or any alteration hereto.

By signing this contract, the Contractor agrees to subject any dispute to mediation, at the option of the Owner, prior to filing suit in any forum.

This contract shall be deemed to be a Virginia contract and its interpretation and construction shall be governed by the laws of the Commonwealth of Virginia and the Charter and Ordinances of the Owner.

The provisions of this contract are severable. If any provision of this contract shall be held unconstitutional by any court of competent jurisdiction, the decision of such court shall not affect any other provisions of this contract.

I certify under the penalties of perjury that I have, to my best knowledge and belief, complied with the law of the Commonwealth of Virginia relating to taxes, reporting of employees and contractors, and withholding and remitting child support. I further authorize the Owner to deduct from the amounts due under this contract, any overdue taxes, real or personal, or any other fees due to the Montgomery County from the Contractor which become due and payable by the Contractor or its officers, directors, or agents during the term of this contract or until the final amounts due under this contract are paid in full.

IN WITNESS WHEREOF the Owner caused these presents to be signed and the said Contractor has caused these presents to be signed in quadruplicate and its official seal to be hereto affixed by its officer or agent thereunto duly authorized (by the attached corporate resolution). This instrument shall take effect as a sealed instrument.

Montgomery County**:**

_____ _____

Name: Date

Title:

STATE OF _____,
COUNTY OF _____, to-wit:

I, the undersigned, a Notary Public in and for the County and State aforesaid, do hereby certify that _____, representing the Montgomery County, whose name as such is signed to the foregoing Agreement, has acknowledged the same before me in my County and State aforesaid.

GIVEN under my hand this _____ day of _____, 2024

_____
Notary Public

My Commission Expires: _____

CONTRACTOR:

_____ _____
Name: Date
Title:

STATE OF _____,
COUNTY OF _____, to-wit:

I, the undersigned, a Notary Public in and for the County and State aforesaid, do hereby certify that _____, the _____ of _____, whose name as such is signed to the foregoing Agreement, has acknowledged the same before me in my County and State aforesaid.

GIVEN under my hand this _____ day of _____, 2024.

_____
Notary Public

My Commission Expires: _____

END OF CONTRACT

Please attach one W-9 to this contract when you return it to the Owner.