The Washington Metrorail Safety Commission

Safety Audit

of the Washington Metropolitan Area Transit Authority

Audit of Communications Systems

Final Report:
September 29, 2022

Table of Contents

Prepared under the authority of the Washington Metrorail Safety Commission

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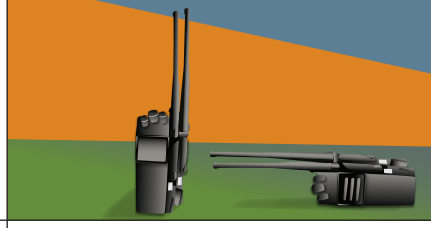

Executive Summary

The Washington Metrorail Safety Commission (WMSC) performed this audit of the Washington Metropolitan Area Transit Authority (WMATA) Metrorail's communications systems through in-depth interviews, site visits, and document and data reviews conducted in 2022. Metrorail's communication systems, such as radios and radio infrastructure and public address systems, play a critical role in safe operations, emergency response, and numerous specific processes and procedures required to ensure the safety of Metrorail riders, workers and first responders. The audit's scope includes the examination of communications systems, including radio communications and other related equipment, as well as associated maintenance, training and engineering. Areas assessed relating to these topics include operational practices, processes and policies, as well as implementation and compliance.

Metrorail is continuing work on long-term plans to install and activate a new radio system. Metrorail stated the project was about halfway to completion, with approximately 80 percent of below-ground work done and 14 of 27 above ground towers completed at the time of this audit. WMATA purchased 5,400 portable digital radios that are multiband, meaning they will work on both the 490 MHz system WMATA currently operates on as well as the new 700 MHz system being installed. Most of the newly purchased radios have been distributed to personnel. This project, when complete, is intended to improve radio communications throughout the Metrorail system.

Communication systems, such as radios and radio infrastructure and public address systems, play a critical role in safe operations, emergency response, and specific processes required to ensure the safety of Metrorail riders, workers and first responders.

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Document review, interviews and site visits demonstrate that Metrorail has safety gaps related to communications system training, supervisory oversight, safety promotion, maintenance, documentation, hazard identification, and procedural compliance. As a result, the WMSC is issuing 9 findings requiring Metrorail to develop corrective action plans (CAPs). The WMSC is also issuing 2 recommendations that Metrorail must address.

Metrorail does not have adequate supervisory oversight and safety promotion to ensure that approved preventative maintenance inspections (PMI) are properly completed to maintain the safety of the rail system. Communications personnel are not using correct and current forms and processes necessary to ensure that safety-critical communications systems are appropriately and safely maintained.

Metrorail does not have sufficiently detailed instructions and procedures specifying how to inspect and maintain each communications asset. For some assets, there are no instructions or procedures at all. Metrorail is also not keeping or maintaining hazard logs. In addition, the responsible departments themselves describe their training as inconsistent and incomplete.

When problems with systems are reported in the field or identified during preventative maintenance work, Metrorail is not following its procedures to ensure that work is properly completed. Metrorail is closing preventative maintenance work orders without correcting known deficiencies, which does not comply with its Systems Maintenance (SMNT) Maintenance Control Policy, and Metrorail personnel are not effectively communicating, responding to and identifying issues related to trouble calls pertaining to communications systems. Metrorail closes communications-related "corrective maintenance" (repair) tickets without effectively identifying, documenting and addressing issues.

Communications rooms that house equipment necessary for the systems to function have signs of recurring water, dirt and dust intrusion. Metrorail is also improperly storing equipment in these rooms. Components in these rooms therefore may not function as required for the safety of riders, workers and first responders. In addition, Metrorail does not have schematics, manuals, and other materials in each Communications Room as required by its procedures so that personnel can properly and safely complete their work.

The WMSC audit team also identified radios in the field that were not current and calibrated as required, creating a risk that this safety equipment will not properly function when needed.

The recommendations in this audit relate to the lack of a comprehensive plan to maintain staffing of existing communications systems positions at all grades through timely hiring practices, and Metrorail job descriptions that have not been updated since the 1970s and 1980s and do not reflect current job responsibilities and necessary qualifications.

Background and Scope

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The scope of this audit includes Metrorail's communications systems (voice or data transmission systems and related equipment). This includes radio and public address (PA) systems. This audit's objectives include the assessment of communications systems inspections, maintenance, engineering, operational practices and procedures, and associated training for purposes of compliance with applicable Metrorail plans and procedures, regulations, and best practices.

This audit does not focus on fire alarms, Rail Operations Control Center (ROCC) microphones/ audio recording devices, automatic fare collection lines, or emergency trip stations (ETS), which the WMSC has assessed through other activities.

The purpose of this audit is not to evaluate radio protocol or compliance, but rather the quality of the systems that make communication possible, the training of personnel responsible for maintaining those systems and compliance with related policies and procedures.

Among other areas, the audit focuses on elements of the System Safety Program Plan (SSPP) for the period through December 2020 and WMATA's Public Transportation Agency Safety Plan (PTASP), titled the WMATA Transit Agency Safety Plan, for the period since it became effective December 31, 2020. The PTASP's first revision became effective on December 31, 2021. Due to the timing of the PTASP's approval and the required phased approach for effective implementation, aspects of the PTASP had not yet been fully implemented at the time of this audit. The specific elements of the SSPP and PTASP covered in this audit are listed in Appendix D.

Open Corrective Action Plans (CAPs)

At the time of this audit, C-0100, related to radio communications system deficiencies in rail yards and shops was open. C-0100 addresses a finding from the WMSC issued on April 30, 2021, that Metrorail is not maintaining a fully functioning radio system in all rail yards and shops. During the Rail Operations Audit issued in April 2022, personnel reiterated issues with radio transmission quality in rail yards throughout the system. As part of this CAP, Metrorail developed a process to identify coverage deficiencies in rail yards. Following grid-by-grid coverage testing, the CAP specifies that Metrorail will rectify all known deficiencies by October 2026. This is in addition to interim mitigations such as creating and maintaining an up-to-date map of areas with poor or no radio communication and

specifying alternate means of communication or safety protections in those areas. However, while conducting onsite work for this audit at Greenbelt Yard, personnel indicated they were unaware of the existence of the Yard Ops 3 channel, which Metrorail management had stated was an example of an interim mitigation in place and functioning to address poor radio communications in the yard. This suggests that Metrorail has undertaken insufficient safety promotion regarding the implementation of this interim mitigation.

Due to the open CAP addressing these issues, the WMSC is not issuing a new finding in this report regarding radio communications in rail yards and shops.

History

NTSB Investigation

During its investigation of the fatal 2015 L'Enfant Plaza Station electrical arcing and smoke accident, the National Transportation Safety Board (NTSB) found that problems with the Public Safety Radio System (PSRS) were identified prior to the accident but were not addressed before the accident. Five days before the accident, the District of Columbia's Office of Unified Communications (OUC) notified WMATA that the D.C. Fire and Emergency Medical Services Department (DCFEMS) lost radio coverage in the tunnels near L'Enfant Plaza Station. WMATA maintains the infrastructure of the PSRS used by DCFEMS and the Metro Transit Police Department (MTPD) during emergency response operations. WMATA personnel requested access to the equipment room where the above and below-ground systems interface, and access was scheduled for January 14, 2015, two days following the event.

The investigation found that during the emergency on January 12, 2015, personnel using the PSRS found radio communications to be unreliable and runners were used to relay information. Additionally, the report concluded that WMATA's radio-testing procedures were insufficient and did not allow for communications problems with the PSRS to be identified in a timely manner. The NTSB noted at the time of its investigation report that PSRS radio testing protocols had improved since the accident, with increased frequency of testing, using an industry standard to conduct voice-quality testing in stations and tunnel entrances.

FTA Oversight

In its 2015 Safety Management Inspection (SMI) report of WMATA that was conducted following the 2015 smoke accident, the Federal Transit Administration (FTA) identified safety lapses including that, despite some improvements, the quality of WMATA's radio system was still poor in some locations. The FTA noted that although the digital radio system is clearer than the analog system, there were still dead spots and transmission issues.

Interviews conducted by the FTA also found that not all locations within the Metrorail System were included in the design for radio coverage. These areas included fan and vent shafts, emergency evacuation stairwells and refuge areas. The FTA also found deficiencies in technical training and determined Metrorail relied significantly on informal on-the-job training that lacked oversight.

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TOC Reports

The Tri-State Oversight Committee's (TOC) 2010 Triennial Safety and Security Review report audited communications facilities and equipment and found that many communications technicians had not received classroom training on the 490 MHz radio system. WMATA was then required to devise a schedule for, and complete, classroom training on the 490 MHz radio system for all communications technicians. The 2010 report also found that the Communications Branch was not sufficiently involved in project design and implementation and should be included in all stages of project lifecycles.

The TOC's 2015 Triennial Review of Radio and Communications report included six findings of non-compliance, including:

- Mobile and portable radio users throughout WMATA lack adequate training to understand limitations on functionality.
- Maximo records showed numerous radios had outdated calibration dates.
- WMATA does not conduct systemwide radio performance testing on a regularly scheduled basis.
- The completeness of preventative maintenance inspection checklist varies considerably.

The report also included 12 other areas where there was no relevant written plan, policy, or procedure in place, or the existing plan, policy, or procedure was not in accordance with industry best practices. These findings included:

- WMATA does not have a mechanism to alert personnel of areas with temporarily inoperable radio infrastructure or poor coverage.
- WMATA departments do not have a consistent program to ensure personnel are using fully charged radios.
- The trouble reporting process for radio users from external agencies is on an ad hoc basis.

WMATA Internal Review

Metrorail's last internal review of the Communications Branch was completed in 2018. WMATA's Quality Assurance, Internal Compliance & Oversight (QICO) group determined that the Maintenance Control Policy (MCP) was comprehensive, current and supported consistent work practices. However, the review identified multiple opportunities for improvement, including:

The review identified multiple opportunities for improvement.

- Timely inspections and calibration of facilities and equipment (see Finding 8 of this audit).
- Maintaining a training and certification program for employees and contractors to maintain competency levels (see Finding 6 of this audit).
- Implementation of the departmental hazard management procedure to promote, identify, analyze and resolve hazards (see Finding 5 of this audit).

WMSC Inspections, Investigations and Other Oversight

WMSC inspections, other oversight work, and multiple safety event investigations have also identified areas that require improvement.

For example, Investigation W-0116 of a customer evacuation and runaway train event near Rhode Island Ave Station found that radio communications were inconsistent throughout the event, with some transmissions that were unclear due to poor audio transmission quality. The WMATA radio communications personnel who were assigned to troubleshoot these reports stated that a combination of radio system "glitches, user error, declining battery power and the radio channels being busy" likely contributed to these difficulties experienced by the Office of Rail Transportation (RTRA) supervisor and Metro Transit Police Department (MTPD) personnel on the scene. The radio communications problem caused the need to repeat instructions and questions multiple times. Metrorail downplayed radio communications problems during the event, did not provide an investigative resolution to the issue, failed to examine and address root causes, and did not offer effective alternatives.

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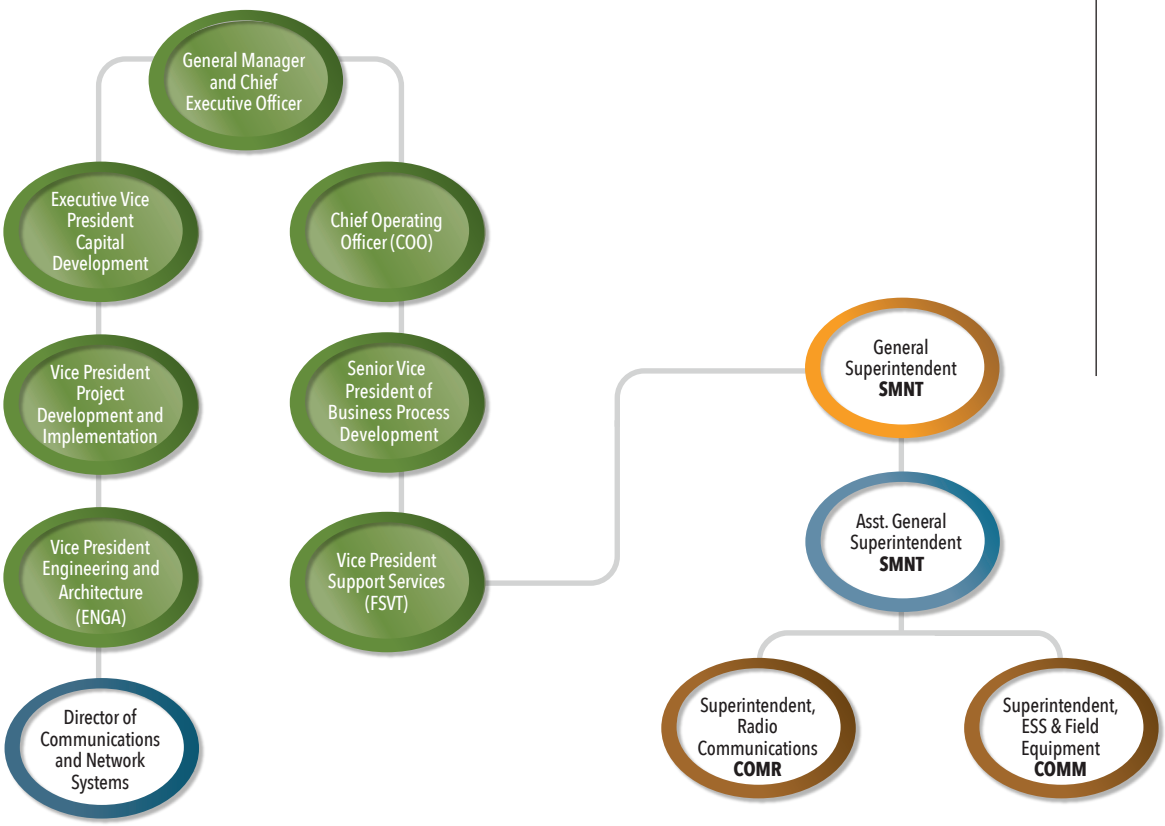
In another example, radio system deficiencies were found at multiple rail yards, including Glenmont (May 4, 2021) and West Falls Church (March 26, 2021) rail yards during radio communications inspections (see C-0100 above). During these inspections, WMSC inspectors observed gaps in communication between the interlocking operator and other personnel, noting negative contact and intermittent loss of radio contact in various locations throughout the yard.

Current Organizational Structure



WMATA's Communications Branch is a part of the Office of Systems Maintenance (SMNT) and consists of two subbranches: the Field Unit (COMM), which maintains Metrorail's communications systems and Radio (COMR), which specifically supports Metrorail's radio systems. Collectively they are responsible for corrective maintenance (repair) and preventative maintenance (PM) of Metrorail communications systems including public safety radio systems in the Metrorail system that are used by entities such as local fire departments.

COMM provides 24/7 maintenance for various systems, including:

- Digital Video Recorder (DVR)
- Metrorail Station and Parking Garage Closed Circuit Television (CCTV)
- Station Public Address (PA) Systems
- Passenger Emergency Response System (PERS)
- Passenger Information Display System (PIDS)

COMR is responsible for the maintenance of the Comprehensive Radio Communications System (CRCS), the Public Safety Radio Systems (PSRS) Interfaces and the Public Safety System Distribution Antenna System.

SMNT is a part of the Office of Facilities, Systems, and Vertical Transportation Maintenance (FSVT), led by the Vice President of Support Services, who reports to the Senior Vice President of Business Process Development. SMNT is led by the General Superintendent of System Maintenance who oversees the SMNT Assistant General Superintendent, who in turn oversees two superintendents each responsible for a group within the Communications Branch. The Field Equipment (COMM) group has three assistant superintendents, one of whom is specifically responsible for the Electronic Safety and Security (ESS) system. COMM personnel consists of fire and intrusion alarm (FIA) system administrators, CCTV administrators, escort support, a Maximo subject matter expert and a parts and materials specialist. The Radio Communications (COMR) group consists of an assistant superintendent and a radio administrator. Both groups also have shift supervisors, technicians and helper positions. Together these two groups are responsible for maintaining communications equipment housed in communications rooms as well as communications equipment throughout the system.

Technical Skills Maintenance Training (TSMT), which is a part of Metrorail's Office of Operations Management Service (OPMS), provides training classes for communications personnel.

Audit Work

The WMSC received initial documents related to this audit from WMATA in February 2022, conducted extensive interviews and site visits in March 2022, and received follow-up documents and conducted final document reviews into April 2022.

Throughout the audit process, during site visits, the WMSC raised specific safety issues to Metrorail personnel as they were identified. This included water intrusion in the communications room at Fort Totten Station (see Finding 10) and radios out of calibration that were in use at Greenbelt Yard Tower (see Finding 8).

Lists of documents reviewed, site visit locations, and personnel interviewed for this audit are provided in the appendices.

An exit conference was held on April 26, 2022, with Metrorail staff to summarize the status of the audit to that point. The WMSC later provided a draft of this report to WMATA for technical review and incorporated any technical corrections as appropriate.

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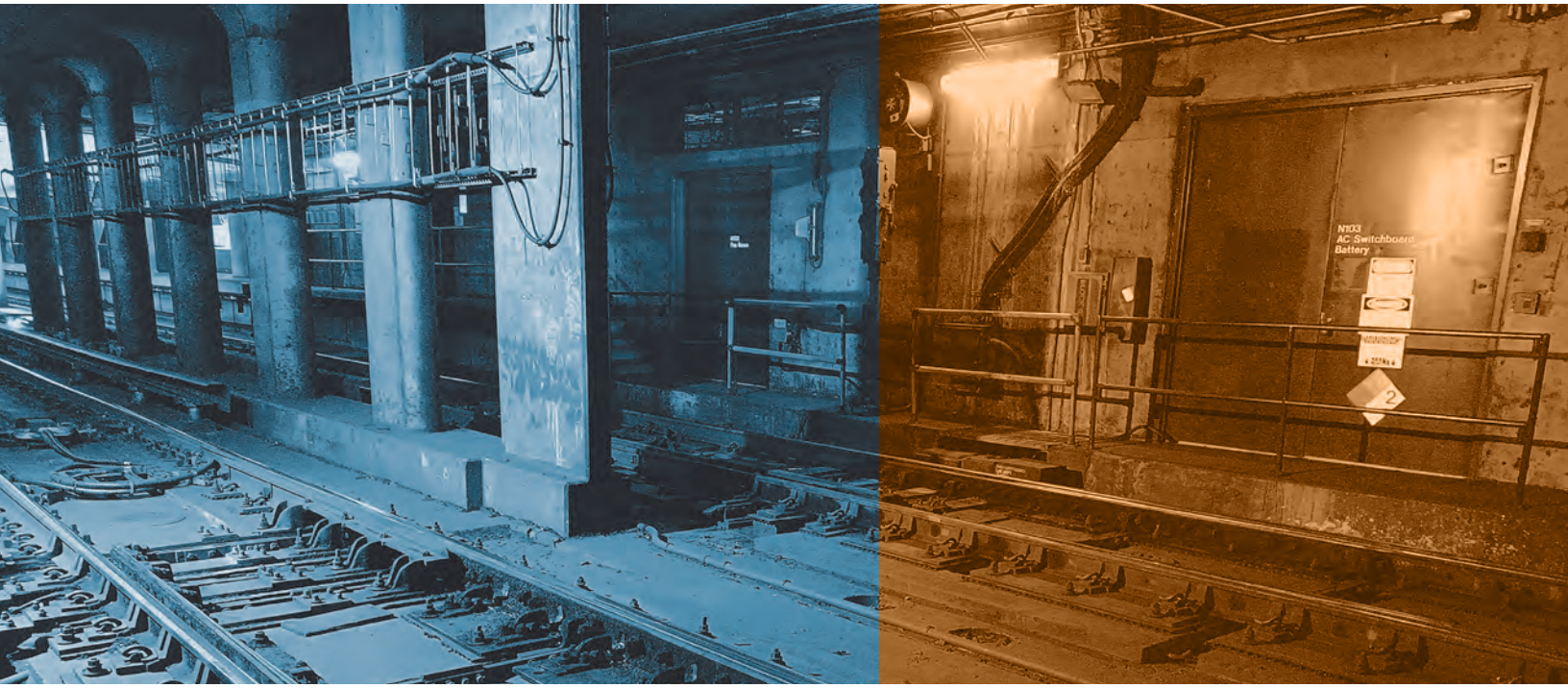

What the **WMSC** Found

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Positive Practices

Metrorail is continuing work on long-term plans to install and activate a new radio system. The Radio Infrastructure Replacement Capital Improvement Project is underway to replace WMATA's existing radio system operating in the 450-490 MHz frequency band with a new system operating in the 700 MHz band, as required by the Federal Communications Commission (FCC). Metrorail stated that approximately 80 percent of the work on the below ground fiber infrastructure has been completed and approximately seven out of twenty tower sites were installed at the time of this audit. The project is intended to increase reliability and performance of the radio system, and to improve the quality of radio communications throughout the Metrorail system.

Metrorail's department of Reliability Centered Maintenance Planning (RCMP) recently began reliability analysis of both COMM and COMR in October 2021 and began publishing reliability reports in February 2022. Continuous data reporting and trend analysis is an important part of Metrorail's PTASP, which requires WMATA to establish safety performance targets and measure against data-driven safety performance indicators. This is a good first step toward better maintenance and management.

1

Findings and Minimum Corrective Actions

Metrorail does not have adequate supervisory oversight and safety promotion to ensure that approved preventative maintenance inspections (PMI) are properly completed to ensure the safety of the rail system. Communications personnel are not using correct and current forms and processes necessary to ensure that safety-critical communications systems are appropriately and safely maintained.

Documents reviewed for this audit demonstrate that supervisors are not following Metrorail's Systems Maintenance (SMNT) Maintenance Control Policy, that inspection forms are not completed as specified in Metrorail's policies and procedures, and that safety documents are not properly controlled to ensure inspections are completed to Metrorail's safety requirements. Metrorail has introduced additional challenges through changes to data entry that no longer allow direct upload of certain information into the Maximo maintenance management system. This has introduced a situation where inspection reports are circulating outside of Maximo, risking their becoming lost and reducing the value of the data that is collected.

As further described below, Metrorail is not providing adequate supervisory oversight and safety promotion to ensure that safety-critical communications systems are appropriately and safely maintained. This creates safety risks such as the failure of these communications systems during an emergency, miscommunication that can lead to safety events, or the failure of these systems in such a way that delays action and causes an otherwise minor issue to become an emergency.

Supervisory Oversight

Supervisors are not adhering to SMNT Maintenance Control Policy, Section 15.1, Preventative Maintenance, which states that SMNT shift supervisors are responsible for reviewing and certifying both the acceptable performance of inspections and the accuracy of the resulting documentation in Maximo.

Metrorail is not providing adequate supervisory oversight and safety promotion to ensure that safety-critical communications systems are appropriately and safely maintained.

A WMSC sampling of 50 forms that were submitted as complete demonstrated that 30 were missing required information. Examples of recurring issues found by the WMSC included missing information that is required to demonstrate that work is being conducted as required, such as missing work order numbers, visual inspection forms, checklists and supervisor signatures.

Several PMIs require visual inspections that are not documented on the completed inspection forms. For other PMIs, checklists and other information that are required were routinely missing and not in accordance with required instructions. For example, PMI ID: COMR-008 - Alignment Procedures for 800 MHz HEAD END and LINE Bi-Directional Amplifiers (BDAs) - Rev. 5 (April 16, 2019) requires a mandatory defects checklist for any inspection or alignment, but there were instances in which the checklist was not included. These amplifiers are a part of the underground Public Safety Radio System (PSRS), which carries radio communications for public safety jurisdictions in the Metrorail system's service area and are an integral element of emergency response operations.

Metrorail provided multiple other forms as "completed" that were, in fact, incomplete. For example, a review of PMIs for the Public Address (PA) system demonstrates other examples including:

- Unchecked box for inspection of service area room for PMIs performed at:
  - Metro Center Station, September 26, 2021, and November 30, 2021
  - Dupont Circle Station, September 27, 2021
- Missing signature for PMIs at:
  - Cleveland Park Station, November 10, 2021
  - West Hyattsville Station, November 25, 2021
  - West Falls Church Station, September 4, 2021
  - White Flint Station, September 26, 2021
- Missing two fields (Damage or defects and PA equipment on [LED lights]) under Communications Room PA section at:
  - Ballston Station, November 24, 2021
  - West Falls Church Station, September 4, 2021
- Several items missing for PMIs at:
  - Eastern Market Station: September 27, 2021

During an interview, a member of the Communications Branch's leadership noted that a future policy change may remove the requirement that supervisors sign off on PMI forms. Supervisors have expressed concerns about providing their signatures because they are unable to personally verify the work and fear possible future implications should a safety event occur. Ensuring that every element of a PMI is completed and properly documented is the responsibility of field supervisors as stated in the SMNT Maintenance Control Policy referenced above. Signing off on and uploading incomplete PMI forms highlights a failure in supervisory oversight regarding the completion and documentation of preventative maintenance work.

Failure to properly perform and document maintenance and any issues encountered while performing PMIs has the potential to create circumstances where equipment has deteriorated and fails in a way that contributes to injury or death.

Safety Promotion and Document Control

Ineffective coordination and a lack of safety promotion among leadership, engineering, training and operations personnel contribute to gaps in communication regarding new documents, policies and procedures.

The main objectives of safety communication under Metrorail's PTASP include explaining why procedures are introduced or changed and conveying safety-critical information. As part of the Safety Management System (SMS) approach, safety promotion includes not only safety communication, but also competencies and training.

Communications personnel in management positions are not conducting adequate safety promotion to properly communicate and explain changes to existing procedures, processes and forms. They also do not provide training on how to properly complete essential tasks such as preventative maintenance during initial training and when new assets are integrated into the system (see Findings 2 and 6). As a result, technicians are not using the most up-to-date forms to document work and are not familiar with the procedures necessary to properly complete and document work tasks.

Metrorail does not have adequate document control practices for safety-critical PMI documents.

Supervisors are even signing off on unapproved PMI forms technicians devised outside of Metrorail's safety processes for proper engineering and maintenance (see Finding 2). The creation of PMIs by technicians outside the required approval process demonstrates deficiencies in safety promotion by management to ensure Metrorail personnel understand the importance of adhering to established policies and completing only approved procedures.

Metrorail does not have adequate document control practices for safety-critical PMI documents. Supervisors are responsible for informing the personnel under their supervision of any updates to documents and procedures and ensuring the current documents are being used to perform and document maintenance through ongoing safety promotion. SMNT Maintenance Control Policy, Section 21.2 provides the requirements of each level of management from the superintendent who creates policies and communicates them on a high level to shift supervisors, as it relates to responsibilities associated with changes to policies and procedures.

WMATA is not following SMNT Maintenance Control Policy, Section 21.1, SMNT Modification Requests, which includes the requirement to store documents related to communications systems/subsystems electronically in Documentum, a content management platform, as well as procedures for change management, including revisions and modifications and the processes necessary to document updates. There is no uniform method for accessing PMI forms. Some personnel retrieve forms from boxes located in communications rooms, while others print them from Maximo, WMATA's asset management system. This inconsistency results in different versions of forms being used, some of which are outdated.

For example, there are two versions of the CRCS Head End BDA Alignment PMI being used, Revision 3, dated April 2016 and Revision 4 dated September 2019. Other examples include the use of two versions of the PA system PMI form, one (labelled Revision 2) dated 2013 and another (labelled Revision 4) dated 2018. For example, 21 out for 64 PA system preventative maintenance inspections conducted in September 2021 were documented using the 2013 form and the remainder were recorded on the 2018 version.

Technicians must now scan PMI forms and email them to supervisors as opposed to uploading the form directly to Maximo, a function that technicians interviewed said was previously possible. The reason for this process change is unclear. This practice creates an extra step and the possibility the form may not be attached to the Maximo entry. It also increases the length of time between an issue being identified and pertinent information regarding the problem being input into Maximo for responsible departments or groups to review and respond.

In addition to issues concerning the availability and accessibility of PMI forms, technicians also have difficulties finding manuals. One technician interviewed described the process for obtaining manuals for systems and components as a process that many are unfamiliar with, saying, "you have to be a search guru" to navigate the (T:) Drive because it is so massive. The (T:) Drive is an online shared drive WMATA uses to house information such as the manuals technicians use to complete their work.

Minimum Corrective Actions: Metrorail must ensure safety promotion activities are performed to make certain all personnel are informed about the importance of and how to complete forms and to inform personnel of any changes to forms or processes. Metrorail must review and provide up-to-date PMI forms for all communications systems in adherence with SMNT Maintenance Control Policy, Section 21.1, SMNT Modification Request, which includes control management of documents, including change management and document updates. Metrorail must ensure that policies, PMI forms, and other documents such as manuals are not only uploaded electronically in Documentum, but available in locations more easily accessible by all personnel required to use them, including the (T:) Drive and physical locations. WMATA must properly communicate, document and ensure understanding of revisions to forms, policies and procedures before implementation through safety promotion to ensure ease of accessibility and use of correct documents. Metrorail must also follow SMNT Maintenance Control Policy, Section 15.1, Preventative Maintenance, which indicates that SMNT shift supervisors are responsible for reviewing and certifying both the acceptable performance of inspections and the accuracy of the documentation in Maximo resulting therefrom. This includes ensuring that all relevant fields are completed accurately for all forms.

2

Metrorail does not have sufficiently detailed instructions and procedures specifying how to inspect and maintain each communications asset. For some assets, there are no instructions or procedures at all.

SMNT Maintenance Control Policy, Section 15.1, Preventative Maintenance, requires SMNT Technicians to perform preventative maintenance according to the established procedures approved by Engineering and Architecture (ENGA) and the schedule contained in Maximo. However, not all preventative maintenance activities have approved procedures. In the absence of such procedures, technicians have resorted to creating–and using–their own unapproved documents or procedures.

Technicians have resorted to creating–and using–their own unapproved documents or procedures.

For example, based on interviews conducted for this audit, technicians are acting independently to inspect PA systems on the Silver Line because the technicians were unaware of any guidance specific to the equipment. This equipment differs from other Metrorail PA systems. Documents provided for this audit demonstrate there is no approved PMI for PA systems on the portion of the Silver Line (Phase 1) that has been open to passengers since 2014. The Quarterly PA PMI (PMI ID: E15000 – Public Address System (PA) Inspection/Alignment, Rev. 4) was last updated in 2018 and should have included procedures for the PA system used on Phase 1 of the Silver Line.

The WMSC observed technicians performing the task without a PMI form or process. Instead, the technicians used a handwritten document.

The existence and use of non-ENGA-approved preventative maintenance procedures is not isolated to PA systems, despite the requirement of SMNT Maintenance Control Policy, Section 26, Preventative Maintenance Procedures, that all preventative maintenance procedures be approved and signed by ENGA. For example, as part of the documentation the WMSC received from Metrorail for this audit, several Excel spreadsheets, unsigned by ENGA and without instructions, were submitted as PMIs. A PMI requires forms and instructions that would have the detail necessary to properly and safely carry out and document this work. Examples include spreadsheets described as in use for Rail Console Inspection, Yard Tower Inspection, and Radio Inspection.

In another example, during an onsite visit to observe a Jackson Graham Building (JGB) console inspection preventative maintenance procedure, the WMSC observed technicians performing the task without a PMI form or process. Instead, the technicians used a handwritten document and acted based on their individual personal understanding. Although the technicians were knowledgeable, there was no way to ensure that they had completed all of the required maintenance and inspection tasks or that a step-by-step procedure was followed correctly because no form or instruction exists. Prior to this field observation, after requesting the PMI for this console, WMATA provided the WMSC with a screenshot of a Maximo task list and an Excel spreadsheet, but could not provide any ENGA-approved PMI form or process.

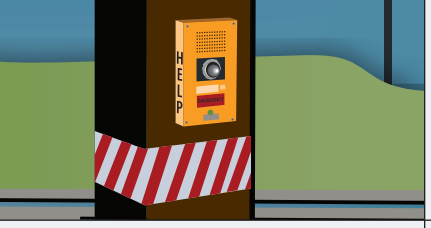
Additionally, there is no instruction, checklist or written PMI process used when performing what was described as monthly Comprehensive Radio Communication System (CRCS) and Public Safety Radio System (PSRS) systemwide Portable Radio Tests.

Metrorail's PTASP requires that manuals and other documents developed for training and certifications of operations and maintenance personnel include instruction in safety procedures and safe methods of operation; however, there were either insufficient instructions or procedures, or no procedures at all for the maintenance and operation of many communications assets.

Without approved, documented processes, there is no assurance that systems will function properly as required for safety or that deficiencies in the systems will be proactively identified and addressed to prevent hazards and emergencies.

The current SMNT Maintenance Control Policy Manual, dated July 22, 2021, does not have any examples of PMIs for personnel to reference or follow. Metrorail does provide such forms in manuals used by other departments. For example, during the WMSC's Automatic Train Control (ATC) Audit (issued May 12, 2021), review of the ATC-3000, Preventative Maintenance Instructions and Technical Procedures Manual, provided detailed PMIs for each inspection, test, and adjustment personnel were required to perform including any required special tools, the name and location of associated forms to be completed, and reference documents.

Members of management within SMNT and other personnel interviewed stated that they had limited engineering support, and that ENGA personnel may be overextended. For example, it was reported that there is a lack of ENGA involvement in training and curriculum development, as well as required revisions to standard operating procedures (SOP) and Operations



Administrative Procedures (OAP). Metrorail is not carrying out all aspects of its policy, which requires coordination between SMNT and ENGA to create new and revise existing PMIs and to develop Engineering Modification Instructions (EMI).

Minimum Corrective Actions: WMATA must develop standard PMI forms, procedures, and instructions for every communications system. These PMIs must be signed and ENGA-approved as required by WMATA Policy/Instruction 4.10/3, Configuration Control Management, which requires ENGA to ensure that all communications systems and subsystems are accurately recorded; that changes are known, approved and documented; and that records are updated such that any system or subsystem can be upgraded, redesigned, rehabilitated, reconfigured for operational changes or restored in the event of its failure or damage. Metrorail must provide training on all forms, procedures, and instructions that are created and provide such training to all relevant personnel on an ongoing basis as the forms, procedures, and instructions evolve over time. Metrorail must assess staffing and provide evidence that ENGA has the necessary resources to conduct required procedural review, EMI creation, assistance on training development, and other support functions.

3

Metrorail is closing preventative maintenance work orders without correcting known deficiencies, which does not comply with its Systems Maintenance (SMNT) Maintenance Control Policy.

Metrorail's SMNT Maintenance Control Policy requires that preventative maintenance work orders (work conducted as proactive maintenance) only be closed after any issues identified during that inspection or test that require repair are fixed. However, contrary to those requirements, WMSC review of documents and interviews during this audit demonstrate preventative maintenance work orders are being closed when, while performing the PMI, technicians detect a problem requiring repair. Following this discovery, a "corrective maintenance" (repair) ticket is created, and the technician improperly closes the preventative maintenance work order before the repair is completed, and before the PMI is resumed and completed.

Technicians often close PMIs and open corrective maintenance tickets as a way to achieve this key performance indicator (KPI).

Metrorail's SMNT Control Policy, Section 25, Scheduled Maintenance Adherence, requires the technician to both create a "corrective maintenance" work order for the discovered problem and link the corrective maintenance work order to the preventative maintenance work order. The preventative maintenance work order is not to be closed until repairs have been satisfactorily completed, the corrective maintenance work order closed, and the PMI resumed and satisfactorily completed.

When the technician closes the preventative maintenance work order without following the policy, there is no mechanism or procedure to complete the PMI after the repair is complete. This results in PMIs not being completed until the next scheduled cycle, which in some cases could be months or more away. In the interim, a safety deficiency may go unaddressed as a result of not completing the remaining aspects of the PMI as scheduled.

Personnel interviewed for this audit said they are under pressure to meet the monthly performance goal of 98 percent PMI completion that is in Section 25 of Metrorail's SMNT

Maintenance Control Policy. To that end, technicians often close PMIs and open corrective maintenance tickets as a way to achieve this key performance indicator (KPI).

Minimum Corrective Action: WMATA must develop and implement additional training, supervisory oversight and safety promotion to ensure adherence to their SMNT Maintenance Control Policy, Section 25, which requires that if a problem is encountered during a PMI that requires corrective action, the technician will create a corrective maintenance work order for the discovered problem and link the corrective maintenance work order to the preventative maintenance work order.

4

Metrorail personnel are not effectively communicating, responding to and identifying issues related to trouble calls pertaining to communications systems. Metrorail closes communications-related "corrective maintenance" (repair) tickets without effectively identifying, documenting and addressing issues.

According to the December 2021 Monthly Failure Analysis conducted by WMATA's Reliability Engineering and Asset Management (REAM) group on radio communication performance, 45 percent of trouble calls (corrective maintenance work orders) are listed as "no trouble found." This indicates that, despite problems actually being experienced in the field, upon inspecting the equipment or system, technicians did not identify and address the reported issues.

For example, safety event investigations W-0084, W-0118 and W-0116 each documented radio communication system issues, but in each case the communications inspection claimed there was no trouble found.

In Investigation W-0084, MTPD personnel reported experiencing radio communications issues during a passenger evacuation resulting from an event where third rail power de-energized for an extended period between Georgia Ave-Petworth and Fort Totten stations, leaving trains immobile. As a result, cellphones were used by MTPD personnel to relay information.

As mentioned earlier in this report, in Investigation W-0116, radio communications were inconsistent and unclear due to poor audio transmission quality during a customer evacuation and runaway train event near Rhode Island Ave Station. Communications personnel assigned to troubleshoot these reports stated that a combination of radio system "glitches, user error, declining battery power and the radio channels being busy" likely contributed to these difficulties experienced. Metrorail downplayed radio communications problems during the event, did not provide an investigative resolution to the issue, failed to examine and address root causes, and did not offer effective alternatives.

In Investigation W-0118, a West Falls Church Rail Yard Interlocking Operator attempted to change movement instructions for a Train Operator to prevent a head-on train collision. The Train Operator did not acknowledge the transmission, and proceeded following the originally understood absolute block, but stopped prior to any collision. Both the Interlocking Operator and the Train Operator reported experiencing problems understanding radio transmissions in the yard.

Personnel interviewed for this audit provided varying explanations for why the rate of trouble calls resulting in "no trouble found" is so high. Some communications personnel suggested end users do not understand the limitations of WMATA's radio system, and others suggested that a failure of the system to function should not always be considered a problem.

During interviews, responses varied regarding the steps technicians take when an issue cannot be immediately identified during repair calls. Some technicians described taking steps to see if they could recreate the issue described in the work order, while others just closed the ticket without any further action. For example, one employee indicated that if a CCTV monitor is working when they arrive, a note will be placed in Maximo stating, "monitoring for the next few days and if it goes out again then we'll have to troubleshoot it" and close the ticket. However, monitoring in this instance means checking to see if another work order is entered for the same issue, not actually proactively monitoring the functionality of the system.

Responding to Work Orders

Metrorail's SMNT Maintenance Control Policy maintenance priority matrix lists public address and radio system infrastructure (including the Metrorail radio system and the public safety radio system) as among life-safety critical systems that must be prioritized for immediate action. These systems are critical to preventing and responding to emergencies. Metrorail does not have an effective process to ensure these priority calls are responded to immediately.

During interviews, responses varied regarding the steps technicians take when an issue cannot be immediately identified during repair calls.

Despite having similar processes for other maintenance issues, Metrorail does not have a documented process that includes ensuring notifications to communications technicians are made in a timely fashion when a corrective maintenance work order is opened. The Maintenance Operations Center (MOC) is responsible for coordinating and monitoring all maintenance personnel and equipment responding to emergencies, revenue train delays, unusual occurrences and equipment malfunctions having the potential to disrupt or affect passenger service on the rail system. The Corrective Maintenance Business Process for COMM outlined in the SMNT Maintenance Control Policy begins with notification of the problem to the mechanic but does not include the involvement of the MOC in the process despite this detail being included in processes for identified safety issues that are the responsibility of other SMNT units. In the Low Voltage Electrical Maintenance (LVEM) Reported by MOC Process Flow, for example, the process outlines MOC's role, which includes determining if an emergency response is required, dispatching a mechanic to the problem site, reporting the problem to a LVEM supervisor and opening a CM work order.

This process gap in the Communications workflow results in delays in responding to, assessing and addressing hazards in the field. Communications technicians reported that morning crews routinely respond to work orders input into Maximo the previous night because night shift technicians were not notified of the work order during their shift. This process gap and delay in notification to personnel available on the night shift when the system is closed, has the potential to unnecessarily prolong the inoperability of a life-safety critical system, such as a Ramex (call-for-aid intercom system) that is vital to customers and personnel in an emergency.

Maximo work order entries also do not always include the proper responsibility and trouble codes and sometimes lack specifics necessary to assign the appropriate priority and personnel.

Minimum Corrective Action: Metrorail must require personnel to document detailed information regarding identification and troubleshooting procedures that were attempted when responding to corrective maintenance work orders. Metrorail must provide training to personnel on these documentation improvements and provide evidence that all personnel who respond to corrective maintenance work orders have received that training. WMATA must develop a policy requiring life-safety critical systems be responded to within time limitations that will ensure issues with these systems are addressed immediately. Metrorail must update its Corrective Maintenance Business Process for COMM to include MOC's role in the process. WMATA must update, implement, and monitor standards for personnel entering information in Maximo and coordinating response so that work orders are correctly prioritized and assigned in a timely manner according to policy, and contain sufficiently descriptive and complete information, including correct trouble and responsibility codes to ensure the proper personnel respond with the resources necessary to address the work order.

5

Metrorail hazard logs are not being kept or maintained.

The hazard log provided to the WMSC by Metrorail for this audit only contains three entries, and the most recent entry is from June 2021. Personnel interviewed for this audit, including managers, were not familiar with the hazard log, nor the requirement in Metrorail policies to keep it up to date. Identifying, analyzing, resolving, and communicating safety hazards are among the responsibilities listed in the SMNT Maintenance Control Policy for superintendents, assistant superintendents, managers and shift supervisors. In its 2018 internal safety review, WMATA identified the need for improvement in the implementation of the departmental hazard management procedure to promote, identify, analyze and resolve hazards.

In response to a follow-up request made by the WMSC on February 23, 2022, for the most recent version of the Hazard/Risk Severity Log referenced in the SMNT Maintenance Control Policy, WMATA's response was "Stakeholder does not have a log to provide. COMM is equipped to transport all used batteries to the S&I Shops for proper battery disposal processing. A Risk log entry is not a required task for this activity." This further demonstrates the lack of understanding, awareness and compliance regarding WMATA's own requirement that each department maintain a hazard log.

Personnel interviewed for this audit, including managers, were not familiar with the hazard log, nor the requirement in Metrorail policies to keep it up to date.

WMATA's Hazard Management Program (HMP), a component of the WMATA Transit Agency Safety Plan, is designed to identify, mitigate and implement corrective actions for hazards. The HMP is managed by the Department of Safety (SAFE) and requires employees at every level, including contractors, to report any perceived safety hazards. WMATA, like the FTA, defines a hazard as any real or potential condition that can cause injury, death, or damage to or loss of equipment or property. The SMNT Maintenance Control Policy, Section 5, Hazard Management Program (HMP) requires that for every hazard report completed, the Hazard/Risk Severity Log be updated. The SMNT Control Maintenance Policy, Section 1.5.1, Maintain a Premier Safety Culture, also requires that all safety action items brought to the Branch Superintendent [sic] Safety Committee are addressed and documented in the log and that monthly resolution progress updates be provided.

As demonstrated by management and other personnel's lack of familiarity with these requirements, Metrorail is not meeting its hazard identification and reporting requirements.

Additionally, WMATA's PTASP specifies that managers are to be trained to respond to and investigate hazards, deploy resources at their disposal, and, when additional resources are needed, inform executive management of the need and rationale in a timely manner. "Executive Management," WMATA's PTASP states, "must allocate resources based on risk, and if resources are not available, ensure that no activities take place until risk is mitigated to an acceptable level."

WMATA's PTASP also charges executives with ensuring that employees' reports of hazard and risk are properly mitigated as appropriate and reported to executive management and that employees are kept appraised of activities concerning their reports. The plan also requires executives to ensure that effective mitigations and corrective actions are developed and implemented in a timely fashion and monitored appropriately to assure safety is maintained through the mitigation and corrective action process.

Technical managers are listed as responsible for coordinating implementation of safety mitigations in their areas, ensuring that safety assurance activities are robust for continuous improvement of safety control of practical drift away from documented procedures, and for monitoring change and change management activities appropriately.

Further, as required by SMNT Maintenance Control Policy, Section 2.1, Safety Goals and Accountability, in accordance with the General Duty Clause of the Occupational and Health Administration (OSHA) Act of 1970, employers and employees both have safety accountabilities for maintaining a safe work environment. Under this clause, the employer must protect employees from workplace hazards and employees are required to report hazards immediately.

As demonstrated by management and other personnel's lack of familiarity with these requirements, Metrorail is not meeting its hazard identification and reporting requirements.

Minimum Corrective Action: WMATA must develop and implement a procedure for communications personnel to identify, document, and mitigate hazards. Relevant personnel must be trained in hazard identification and tracking. Hazards identified must be addressed in accordance with the process provided for in WMATA's PTASP.

6

Metrorail has insufficient training for communications personnel, including on-the-job training (OJT) that SMNT itself describes as deficient, and a lack of requirements to ensure that personnel only work on equipment they are trained on and capable of maintaining as required by the PTASP.

Work conducted for this audit identified deficiencies in SMNT initial training, deficiencies in OJT that SMNT itself acknowledges in its documents, and deficiencies in ensuring personnel have the required competencies before being assigned work on new equipment. This is similar to the findings of QICO's 2018 internal review of the Communications Branch that there were opportunities for improvement in maintaining a training and certification program for employees and contractors to maintain competency levels.

Initial training

Interviews and document reviews conducted for this audit demonstrated that new hire training does not adequately prepare communications personnel for the specialized job functions they are expected to perform.

Personnel expressed concerns about insufficient training, including a lack of detail in the curriculum, minimal classroom learning time, a lack of training aids to practice on and only unstructured on-the-job training (see below for OJT deficiencies). One employee stated "I don't know a job that allows you to touch multi-million-dollar systems without some classroom training. It doesn't make sense." For example, new employees are not instructed on how to perform preventative maintenance during initial training. Coupled with PMIs that lack required detail or are non-existent (see Finding 2), this creates a risk that these important safety activities will not be carried out properly. Another employee interviewed for this audit expressed concern that some training instructors have never worked on radios in the field.

OJT instructors are not provided with any training and there is no documentation requirement to detail the progress (or lack thereof) of the person being trained.

Other individuals expressed concerns that courses are not detailed enough or are not of a sufficient duration. During an interview for this audit, one WMATA employee stated that training for mechanical helpers, an entry-level position, is heavily reliant on unstructured OJT. In addition to the concerns about course length, the WMSC's review of training documents shows that courses, such as all those related to communications systems on the Silver Line Phase 2 extension, including the Public Address System (PA) and Integrated Intercom System, only require that participants pass a 10-question multiple choice test to demonstrate understanding or mastery.

On-the-job Training

Metrorail relies heavily on OJT for communications personnel; however, document reviews and interviews demonstrate that Metrorail has no structured program to ensure that this OJT is provided consistently and completely.

Managers expect new hires to learn most of the required specialized skills and processes from technicians they are paired with during OJT. Section 27.4 of the SMNT Maintenance Control Policy states, "On-the-job training typically includes verbal instruction, demonstration and observation, and hands-on practice and imitation."

However, even Metrorail's own documents state that the program is inadequate.

OJT instructors are not provided with any training and there is no documentation requirement to detail the progress (or lack thereof) of the person being trained.

Metrorail's insufficient on-the-job training is codified in its SMNT Maintenance Control Policy by including a section that appears to dispute and ignore the need for such documented training that is required by Metrorail's PTASP and that has been identified by Metrorail as a safety gap in internal safety reviews dating back to at least 2010. This even includes acknowledging in its SMNT Maintenance Control Policy that unstructured on-the-job training has many disadvantages:

> “
> - **Inconsistent** – SMNT OJT relies on an experienced employee to provide the instruction based on topics that they select; however, this allows training topics to vary from one OJT trainer to another. The result is what is taught may vary greatly, depending on who is assigned as the trainer.
> - **Incomplete** – Without a structured lesson guide, OJT trainers may not cover important information. What is taught on a given day is likely to be based on the work assignments of that day, rather than the range of skills required by a new employee.
> - **Lack of Founding Principles** – Although the hands-on aspect of OJT may appeal to the practical learner, often the underlying theories of operation are not covered in sufficient detail or accuracy. Without this foundation of knowledge, trainees often learn what to do, not why they are doing it, resulting in poor decision making when things don’t go exactly right.
> - **Bad Habits** – The trainee observes and may adopt the trainer’s habits and attitudes about all aspects of the job including safety, quality, customer service, and relationship with management. Poorly selected trainers can have many unintended consequences. ”
>
> Source: Washington Metropolitan Area Transit Authority, 2021, Systems Maintenance (SMNT) Maintenance Control Policy, Pp. 128)

Despite findings from its own internal safety review, Metrorail has not acted to correct the inadequacies of its OJT program.

A 2010 WMATA Internal Safety Review resulted in a corrective action plan to create a structured on-the-job training program for each grade of Field Equipment Technician and Radio Maintenance Technician. As previously stated, Metrorail acknowledges in its SMNT Maintenance Control Policy, dated July 2021, that this unstructured approach has many disadvantages; however, improving the program has not been a priority for WMATA. Despite findings from its own internal safety review, Metrorail has not acted to correct the inadequacies of its OJT program, stating in the policy just referenced:

> **“Due to the variety of communications systems installed from a myriad of vendors, the Communications Branch does not have the resources currently to devote to this effort. The finding was not that we had untrained technicians or that OJT was not occurring. The finding was the lack of structured on-the-job training.”**
>
> Source: SMNT Maintenance Control Policy

Additionally, records kept regarding OJT for communications personnel are limited to notes included in Maximo work orders, primarily for timekeeping purposes. This insufficient documentation was reinforced by WMATA’s response on March 30, 2022, to the WMSC’s request for all documentation of OJT related to communications systems over the past year.

WMATA's response stated, "Section 27.4 of the SMNT Maintenance Control Policy states "On-the-job training typically includes verbal instruction, demonstration and observation, and hands-on practice and imitation." This type of training is not structured, therefore there is a limited amount of OJT recorded in Maximo."

Insufficient Training on New Equipment

Personnel are allowed to work on equipment that they have not been adequately trained on. One employee stated, "Sometimes I just feel like people are out here just trying to figure stuff out. I don't think that's such a good idea. At the end of the day we're still dealing with voltage, which can get you shocked or cause problems with fire alarms." Another employee shared the same sentiments, describing technicians as "flying by the seat of their pants," when referring to the lack of training on the GE700 passenger intercom system.

Personnel not receiving training on safety-critical systems that they are assigned to service poses a hazard with potentially catastrophic consequences. For example, when a technician works on a PA system that they are not trained on, that system may not operate as intended, which could result in a minor event becoming an emergency.

Environmental Systems Support Technicians AA and Mechanic AA Field Equipment Technicians are the two classifications that require training on the passenger intercom system according to the training matrix submitted to the WMSC by WMATA for this audit. While reviewing the training report also submitted by WMATA, the WMSC identified that only 3 of the 12 employees required to have training on the system had completed it as of January 10, 2022.

Personnel reported relying on their own knowledge of similar equipment or the knowledge of their peers to attempt to teach themselves how to maintain equipment. This does not meet the requirements of Metrorail's PTASP that employees are trained to implement processes and tools commensurate with their skillset.

The request for more training was a common refrain of many of the WMATA employees the WMSC interviewed and interacted with during this audit.

Minimum Corrective Action: WMATA must review and update training curricula for communications personnel to include refresher training and training more specific to specialized job functions, including PMIs. WMATA must create a formal, structured on-the-job training program that includes standards, curricula, and documentation as well as selection criteria and training for OJT Instructors. Metrorail must ensure that all personnel who may work on communications equipment have the necessary training on each piece of equipment that they may be assigned to service. This must include providing training on current models and each new model installed, tracking that training, and establishing processes to ensure that personnel have the necessary training to carry out each assigned task.

7

Metrorail does not have schematics, manuals, and other materials in each Communications Room required by Metrorail's Communications Room Bi-weekly Cleaning and Inspection PMI.

During field visits for this audit, the WMSC audit team observed a lack of schematics, manuals, and other pertinent materials in the communications rooms at Greenbelt, Wheaton and Fort Totten stations. PMI E30102, Communications Room Bi-weekly Cleaning and Inspection, requires technicians to indicate whether there are plans or drawings available, which demonstrates Metrorail's expectation that they be kept in the rooms for use by personnel. These materials are necessary to carry out various maintenance activities and job tasks.

There is also a lack of organization and proper storage for the limited documents available within communications rooms. The documents that were present during the WMSC's onsite visits were in disarray, in no particular order or centralized location, and, in some instances, covered in dirt. For example, in Communications Room 209 at Greenbelt Station, drawings and plans were observed scattered across desks and on top of both current and obsolete equipment.

Improper storage of such materials, especially when water intrusion is an ongoing concern in some communications rooms as was the case with Communications Room 124 at Fort Totten (see Finding 10), can result in damage to or destruction of documents necessary for personnel to complete their duties.

This lack of pertinent documents readily available in each communications room is an example of deficiencies in document control and accessibility (see Finding 1).

Minimum Corrective Action: Metrorail must institute a process to ensure and document that all communications rooms have current manuals, schematics and pertinent materials, and that these documents are stored in a well-organized and accessible manner.

8

Metrorail lacks the safety assurance and safety promotion activities required to ensure that only current and calibrated radios are in use as required by Metrorail instruction and procedure, creating a risk that this safety equipment will not properly function when needed.

During a field visit to the Greenbelt Yard Tower, the WMSC audit team found three handheld radios that were out of calibration. In addition, an analog radio was observed in use at the tower operator's console. Through our direct access to WMATA's network, the WMSC found an undated notice during a search of WMATA's intranet site that stated on December 31, 2014, the VHF Analog radio system would be deactivated. During its 2015 Triennial Review of Radio and Communications Systems, the TOC identified among its findings that Maximo records showed numerous radios had outdated calibration dates.

This demonstrates that while WMATA has developed a program to ensure portable radios are not used beyond calibration dates as required by the TOC (TOC-OTR-15-012A), there is still a long-standing issue with Metrorail not ensuring that each radio in use is current and calibrated in accordance with policies. Metrorail has not ensured that all personnel are aware of and follow these requirements.

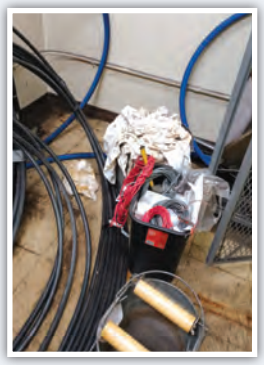
The WMSC also previously found instances where radios were out of compliance during our Rail Operations Audit, published in April 2022. The WMSC issued a finding that Metrorail does not provide safety oversight of all safety equipment that is or may be past its calibration date that may be in use by operations personnel. Office of Rail Transportation (RTRA) checks of supervisors and interlocking operators identified 7 of 9 radios past their calibration date.

SMNT Maintenance Control Policy, Section 22.4.4, Handheld Radio Certification Report, specifies the process for generating Handheld Radio Certification Reports using Maximo to determine equipment overdue for calibration. Handheld radios that are uncertified (past their calibration date and have not been recalibrated) for greater than 60 days must be disabled and removed from service by SMNT Shops and Materials Section (SAMS) in accordance with SMNT Maintenance Control Policy, Section 22.4.6, Branch Overdue Handheld Radios Reports. While reviewing a spreadsheet of expired equipment submitted by WMATA, the WMSC found that there were no expired radios listed. In response to the draft of this report, Metrorail provided a copy of a WMATA Reliability Engineering and Asset Management (REAM) report that did include digital radios that were past due for calibration. The WMSC's discovery of radios out of calibration at Greenbelt Yard and the absence of those radios on the list of expired equipment that was initially provided as part of this audit, demonstrates that Metrorail is not ensuring that radios are calibrated and in good working condition. Metrorail is also not ensuring that obsolete radios have been replaced with current, digital radios.

Minimum Corrective Action: Metrorail must ensure any remaining analog radios still in use systemwide are disabled and decommissioned. WMATA must submit Handheld Radio Certification Reports to demonstrate adherence to SMNT Maintenance Control policies related to SMNT Control Policy 22.4, SMNT – Calibration and Certification Report. WMATA must ensure on a recurring basis that personnel are aware of the proper procedures and that personnel understand their role in ensuring handheld radios remain calibrated.

9

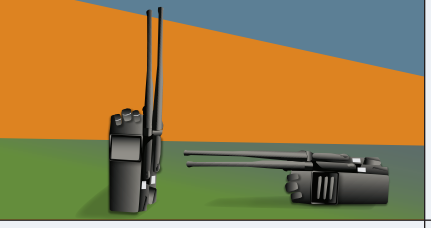
Metrorail communications rooms have signs of recurring water, dirt and dust intrusion. Metrorail is also improperly storing equipment in these rooms. Components in these rooms therefore may not function as required for the safety of riders, workers and first responders.



During a site visit for this audit, evidence of ongoing water intrusion was observed in the communications rooms at Fort Totten and Wheaton stations. Communications equipment was not properly protected from accumulated dirt and debris and possible water damage.

Metrorail's Communications Room Bi-Weekly Cleaning Inspection includes a checklist that requires the rooms be mopped and a section to notate leaks and drains and requires a visual inspection of all communications equipment.

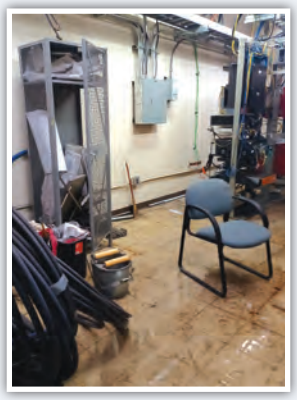
Despite these requirements, the WMSC observed a panel cover on the floor, a locker ajar with outdated equipment and various documents covered in dirt, and wires on the ground, with some near water that had accumulated at Fort Totten Station. Similar conditions with



In Communications Room 124 at Fort Totten Station, the WMSC encountered standing water, used rags, a bucket, and a squeegee tool used to redirect water.

regards to dirt and materials not stored in accordance with Metrorail policy were observed at all communications rooms visited during this audit.

In Communications Room 124 at Fort Totten Station, the WMSC encountered standing water, used rags, a bucket, and a squeegee tool used to redirect water. These tools along with an associated entry found in the communications room logbook, dated February 5, 2022–40 days prior to the WMSC's visit on March 17, 2022–are evidence of a recurring problem that had not been properly remediated. MOC was contacted by WMATA personnel during the site visit to report the issues and discovered that Work Order 16865775 had already been created regarding this issue on the date the issue was entered into the communications room logbook. The WMSC later reviewed this work order and found a discrepancy in location: The work description was listed as E06 (Fort Totten Station), but the asset and location were listed as E05 (Georgia Ave-Petworth Station). This may have been why the issue was not being properly addressed.



On March 18, 2022, the WMSC advised Metrorail that the water intrusion in the communications room at Fort Totten Station was an urgent safety concern requiring immediate action. After performing necessary repairs to address the flooding, the ticket was closed on March 21, 2022, and the resolution reported to the WMSC on May 3, 2022. Following completion of this work, QICO conducted a Communications Field Assessment after several rainfall events and found the floor to be dry. In its report, just as observed by the WMSC, QICO found buckets, used rags and trash inside the room.

The WMSC audit team observed dirt accumulation in the communications rooms at Fort Totten, Greenbelt and Wheaton stations. Dirt, dust, debris, moisture and water pose risks to the proper function of the components housed in the rooms. For example, corroded electrical contacts can short causing circuit failures and intermittent anomalies that cannot easily be detected.

Minimum Corrective Action: WMATA must conduct a special inspection of all communications rooms to check for water intrusion or signs of water intrusion. Metrorail must prioritize and address all identified hazards and safety deficiencies in a timely fashion. Metrorail must provide the records of these inspections and this prioritization and schedule for addressing each issue on at least a quarterly basis along with documentation of all implemented mitigations. Metrorail must then institute a process that ensures water intrusion is identified and addressed on an ongoing basis going forward. WMATA must develop processes to ensure all equipment and documents in communications rooms are kept clean, organized and protected, including routine verification inspections conducted and documented by supervisors.

RECOMMENDATIONS

❶ There is no comprehensive plan to maintain staffing of existing positions at all grades through timely hiring practices.

Due in part to promotions, there are consistently vacancies at the helper level. At the time of this audit, there were 21 budgeted Mechanic Helper positions with nine vacancies. Helpers assist technicians in the completion of their duties and obtain crucial knowledge that prepares them for more advanced levels and creates a pipeline from entry-level to the Mechanic (technician) AA position, which is the highest level. Each level requires one year in grade before an employee can be promoted to the next level, giving ample time to plan for, recruit, hire and train new personnel to fill the future opening.

Technicians with the appropriate knowledge and technical backgrounds required to maintain, troubleshoot and repair the varying communications systems used by Metrorail are crucial to maintaining a state of good repair and safety throughout the system. There is no focused recruiting or attrition plan to ensure that Metrorail is recruiting candidates specialized in the skills necessary to successfully complete the training and work required for the positions they seek to fill. Fostering strategic partnerships with trade schools and applicable skilled workers' unions or other similar strategies would help to increase the quality of candidates. That in conjunction with creating more comprehensive initial training (see Finding 6) will create a more skilled workforce.

Possible Corrective Action: Metrorail may conduct an analysis of recruiting and retention practices to determine the best approach and resources necessary to maintain the optimal level of staffing of highly qualified professionals and act upon such an assessment.

❷ Some job descriptions have not been updated since the 1970s and 1980s and do not reflect current job responsibilities and necessary qualifications.

These outdated descriptions create a risk that employees will not have or be provided with the knowledge, technical background, or familiarity with specific assets, tools, software and processes required to complete their work in the safest possible manner.

There have been significant technological advances and changes to Metrorail's communications systems since many job descriptions have been updated.

Outdated job descriptions include:

- **Mechanic B (General Communications, Installer/Repairer)** – June 11, 1975
- **Supervisor (Area), Communications, TS-6** – July 24, 1989
- **Mechanic AA (Field Equipment Technician)** – March 10, 1983
- **Mechanic A (General Communications, Installer/Repairer)** – March 10, 1983

A Mission Essential Worker Designation sheet was added to all of the descriptions above on January 27, 2020, but the job descriptions themselves have not been updated.

The WMSC has issued similar findings and recommendations in other audits:

- **Fitness for Duty** – August 31, 2021 (see finding 5)
- **Railcar audit** –September 14, 2021 (see recommendation 3)
- **High voltage and traction power audit** – October 27, 2021 (see recommendation 4)

WMATA has committed to addressing these communications and recommendations through the CAP process by developing and implementing a procedure to ensure that job descriptions are reviewed on a specified basis to reflect current operating realities. As of May 1, 2022, all associated CAPs were open.

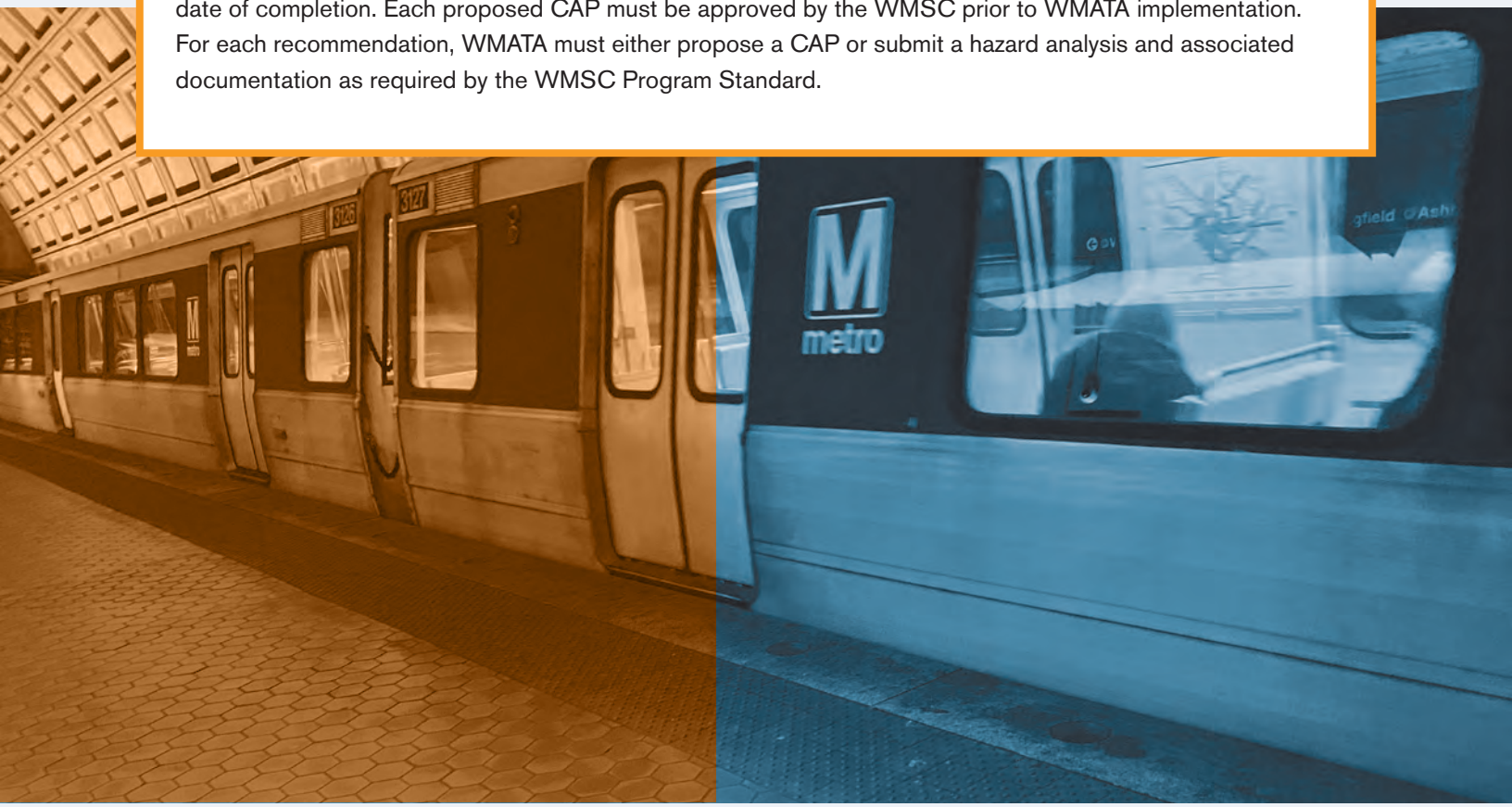
Possible Corrective Action: Metrorail may review and update communications job descriptions to reflect the current requirements of the role, including experience and expertise in the subject area.

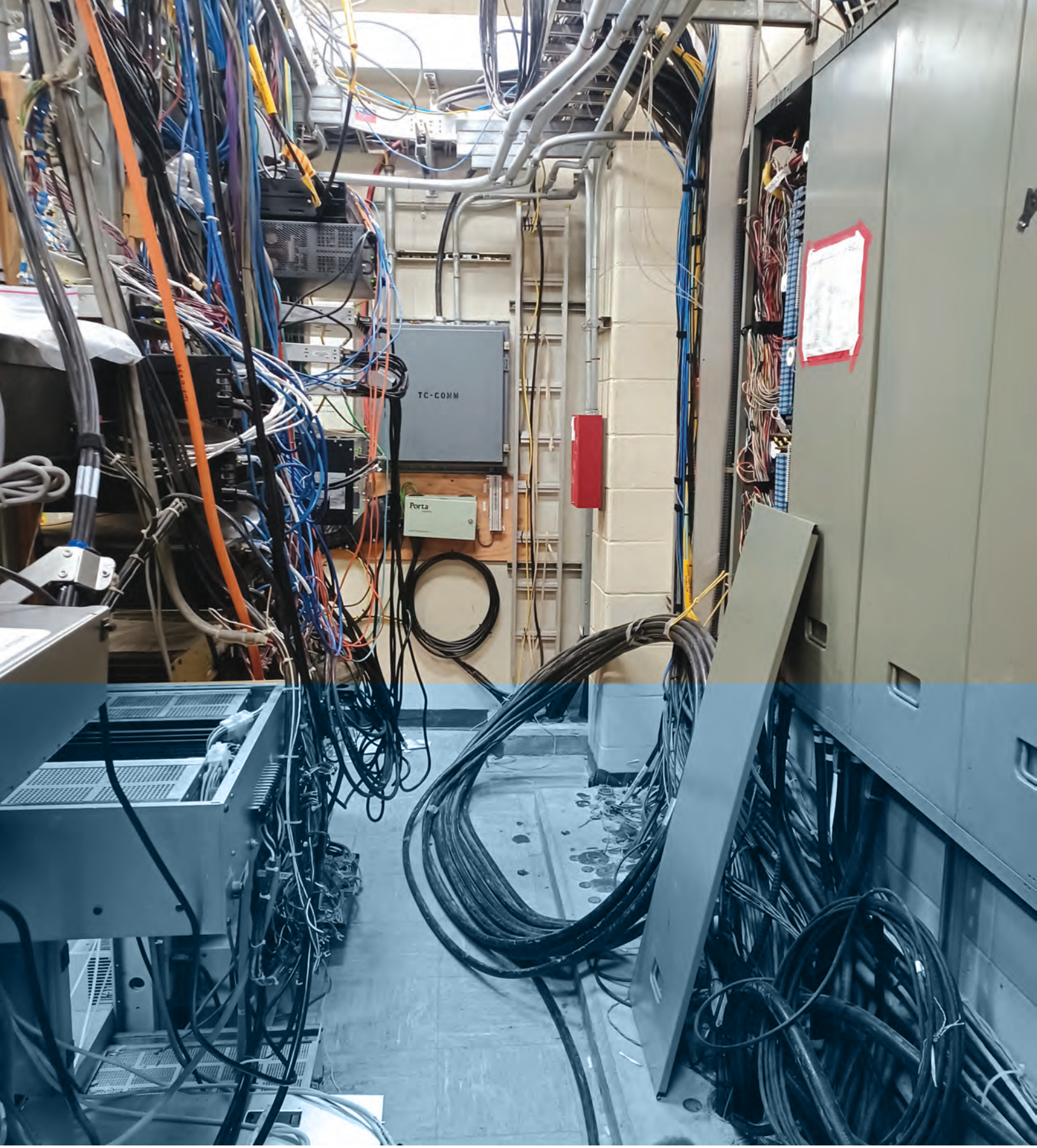
Other Observations

While conducting work for this audit the WMSC found several work orders open for extended periods related to closed-circuit television (CCTV). This includes two work orders open since 2016 (approximately six years), one from 2017, five from 2018, 15 from 2019 and 42 from 2020. The WMSC reviewed information related to the 2016 work orders and identified coordination or work planning gaps that contributed to some specific delays. However, due to the lack of available documentation regarding each step in the process, the WMSC cannot make a more specific determination about the cause or scale of these issues. Therefore, the WMSC is not issuing a finding in this area. Metrorail should consider as part of its continuous improvement process whether changes would be beneficial to ensure work orders are addressed in a timely fashion.

Next Steps

WMATA is required to propose CAPs for each finding and to respond to each recommendation no later than 30 days after the issuance of this report. Each proposed CAP must include specific and achievable planned actions to remediate the deficiency, the person responsible for implementation, and the estimated date of completion. Each proposed CAP must be approved by the WMSC prior to WMATA implementation. For each recommendation, WMATA must either propose a CAP or submit a hazard analysis and associated documentation as required by the WMSC Program Standard.





Appendices

Appendices **A, B, C** and **D**

Appendix A: Personnel Interviewed

- **Communications & Network Systems/Services**
  - Director of Communications & Network Systems/Services
  - Project Manager
  - Manager, Engineering
  - ESS (Electronic Security Systems)-Manager, Engineering
  - Radio Systems Integration-Manager, Engineering
  - 3 Sr. Comm Engineers
- **SMNT**
  - General Superintendent
  - Assistant General Superintendent
  - 2 Superintendents, Communications Systems Maintenance
  - Mechanic AA Electrical Technician COM
  - Mechanic A Gen COM IN/RP
  - Mechanic B Gen COM IN/RP
  - Mechanic Helper Gen COM
  - Mechanic AA Comm Radio System Technician
  - Environmental Systems Support Technician AA
  - Electrical Safety and Security Systems Support Technician
  - System Administrator for Radio/Automatic Vehicle Location
- **TSMT**
  - Technical Skills Training Instructor
  - Systems Training Instructor
  - Supervisor
- **IT NCS Integrated Network Services**
  - Integrated Network Engineer
- **SAFE**
  - Safety Certification and Engineering Manager

Appendix B: Site Visits, Radio Blocks Reviewed

- **3/15/2022**
  - New Carrollton Yard radio checks
- **3/17/2022**
  - Greenbelt Yard Radio transmission tower, communications rooms, and related aspects
  - Independent observation of communications rooms and other related aspects at:
    - Greenbelt Station
    - Fort Totten Station
    - Wheaton Station
  - Equipment and radio checks at all sites
  - Observed console check out procedure at JGB (SOCC)
- **3/24/2022**
  - Radio checks from track 1 walking from Archives-Navy Memorial-Penn Quarter Station
- **Reviewed the following radio blocks:**
  - Ops 1 (Red Line) communications on 3/2/2022, 8:15-9:15 a.m.
  - Ops 2 (Part of Blue, Orange and Silver Line) communications on 2/2/2022, 4:15-5:15 p.m.
  - Ops 3 (Part of Blue, Yellow and Green Line) communications on 2/28/2022, 5:30-6:30 a.m.
  - Ops 4 (Part of Orange and Silver Line) communications on 3/1/2022, 5:00-6:00 p.m.
  - All Communications on the Greenbelt Yard Channel on 3/7/2022, 4:30-5:30 a.m.

Appendix C: Documents Reviewed

ORGANIZATIONAL CHARTS

- Communications and Network Services Org Chart
- Office of Technical Skills Maintenance Training Org Chart
- SMNT Communications Org Chart 2022

BUDGETED POSITIONS

- SMNT Budgeted and Vacant Positions (1/10/2022)
- TSMT Budgeted and Vacant Positions (1/10/2022)

POSITION/JOB DESCRIPTIONS

- Assistant Superintendent Communications System Maintenance (5/2017)
- Mechanic A General Communications Installer/Repairer (1983)
- Shift Supervisor Communications Systems Maintenance (1983)
- Mechanic B General Communications Installer/Repairer (6/1975)
- Mechanic AA – Electronic Technician-Communications (6/1975)
- Mechanic AA Field Equipment Technician (3/1983)
- Communications Area Supervisor (8/1989)
- Mechanic C General Communications Installer/Repairer (3/1991)
- Mechanic Helper (12/1998)
- Radio/Automatic Vehicle Location Systems Administrator (12/2006)
- Systems Training Instructor (4/2015)
- Systems Training Instructor Position Description (4/17/2015)
- Superintendent, Communications System Maintenance (12/2016)
- Mechanic AA – Communications Radio Technician (12/17/2018)
- Technical Skill Maintenance Training Instructor (2/2019)
- Environmental Systems Support Technician AA (4/24/2019)
- Systems Maintenance Clerk job description (8/2019)

TRAINING MATERIALS

- 490 MHz CRCS Refresher Basic Electrical Experiments Trainee Workbook (2/1/2022)
- 9001-00 Field Equipment Training, slides (Rev 1.1)
- Access Control & Swing Gate Assessment
- Access Control System Training Assessment
- Access Control Systems Lesson Plan for Comm Field Technicians
- Access Control Systems Training Assessment (no date)
- ADT-3000/EST3 Fire Alarm Operation and Maintenance Training (no date)
- Axis Communications, slides (no date)
- Basic Access Control Wiring Diagram
- Basic Networking Syllabus (no date)
- Basic Networking Syllabus (no date)
- Basic Wiring and Soldering Techniques Training Manual (no date)
- CCTV System Training Assessment
- CCTV Training Assessment (no date)
- Cisco Switch Configuration: Simple Explanation (7/2019)
- Cisco Switch Configuration: Simple Explanation (7/2019)
- Closed Circuit Television Lesson Plan (no date)
- Closed Circuit Television Training Materials (9/10/2019)
- Closed-Circuit Television System Demonstration and Training Course (9/10/2019)
- COMM Systems IP Based PAS Timeline, spreadsheet (no date)
- Communication Systems Dulles Phase 2 Training: IP Based Public Address Systems, slides (4/22/2021)
- Communication Systems Dulles Phase 2 Training: Passenger Information Display System, slides (7/20/2020)
- Communications Systems Dulles Phase 2 Training Integrated Intercom System (7/20/2020)
- Communications Systems Dulles Phase 2 Training, Access Control Systems Lesson Plan (no date)
- Communications Systems Dulles Phase 2 Training: IP Based Public Address Systems, slides (4/22/2021)
- Communications Systems: Dulles Phase 2 Training, Electronic Access Control Systems, slides (no date)
- Configuration of a New PW6K1ICE on Pro-Watch Typical Access Control Door with One Reader, (Version 1, no date)

TRAINING MATERIALS: (CONTINUED)

- Course Outline (no date)
- Demonstration and Training Information: Internet Protocol (10/17/2019)
- Dulles Corridor Metrorail Project (DCMP) Penta Station Field Equipment Training slides (no date)
- Dulles Corridor Metrorail Project Operation and Maintenance Data Operation Manual (no date)
- Dulles Phase 2 Training Report – Comm. B04 (no date)
- Dulles Training Personnel Records (no date)
- Electronic Access Control Systems Concepts and Components (2/1/2022)
- Electronic Access Control Systems, slides (no date)
- EST 3 An introduction to the 3-SDU, slides (Rev 2.0, 11/2007)
- EST Developing Labels and a Labeling Plan (Rev 2.0, 11/2007)
- EST Front Panel Operations, slides (Rev 2.0, 11/2007)
- EST3 Inspection, Testing, and Maintenance Student Workbook, (Rev. 6, 4/21/2014)
- EST3 Series Student Workbook (Rev. 6, 2/25/2011)
- EST3 Series Technician Certification Course: Logical Addressing training (no date)
- FIA Lesson Notes (no date)
- FIA Preventative Maintenance Inspection Checklist (no date)
- Fire alarm panel and access control panel diagram
- Fire Alarm System Training Assessment (no date)
- Fire Alarm Systems ADT-3000-EST3 Training, slides (4/20/2020)
- Fire Alarm Systems Lesson Plan (no date)
- Fire Detection and Alarm Systems, slides (no date)
- FSVT SMNT Communications systems-related training completed, spreadsheet (no date)
- Herndon Station Demonstrations and Training Information for Internet Protocol (IP) Public Address System (10/17/2019)
- Integrated Intercom System Training Assessment (no date)
- Integrated Intercom Systems Training, slides (7/20/2020)
- Internet Protocol Public Address System Operation and Maintenance Data Manual (no date)
- Introduction to Computer Networking Post Test (1/31/2022)
- Introduction to Computer Networking, TSMT, WMATA Post Test (1/31/2022)
- IP Based Public Address System Training Assessment (no date)
- IP Based Public Address Systems (PAS) Lesson Plan (no date)
- IP Based Public Address Systems Lesson Plan (no date)
- IP Based Public Address Systems, slides (4/22/2020)
- Kiosk Swing Gates Time Delay Crash Bars System Description (no date)
- Kiosk System Training Assessment (unfinished Word document, no date)
- Kiosk Systems Training Manual (7/9/2019)
- Locking of Emergency Gates Phase 2 Part 2, Communications (Rev. 5, 3/15/2018)
- National Fire Alarm Code 2002 Edition
- Networking Class 2 Notes (June 21, 2019)
- Operation and Maintenance Data Operation Manual, Closed Circuit Television System (no date)
- Operation and Maintenance Data Systems and Equipment Maintenance Manual (no date)
- OPMS/TSMT Training Inventory Checklist (9/10/2018)
- Passenger Information Display System Demonstration and Training, Dulles Corridor Metrorail Project (no date)
- Passenger Information Display System Dulles Phase 2 Lesson Plan
- Passenger Information Display System Lesson plan (no date)
- Passenger Information Display System Operation and Maintenance Manual (Rev 0, 10/15/2018)
- Passenger Information Display System Training (7/20/2020)
- Passenger Information Display System Training Assessment (no date)
- Passenger information Display System Training Exam
- Penta Field Equipment Training Course Objectives (no date)
- Penta Field Equipment Training Course Outline
- Penta Station Field Equipment Training Assessment (September 2020)

- Penta Station Field Equipment Training Assessments (various 2019 and no date)
- Penta Station Field Equipment Training Course Objectives (no date)
- Penta Station Field Equipment Training, slides (2018)
- Penta Station Field Equipment Training, slides (no date)
- Radio Communication Course Overview (no date)
- Radio Communications 5 Day Course Module Overview
- Solder Practice Project, slides (no date)
- Soldering and the soldering process exam
- Soldering Fundamentals, slides (11/1/2021)
- Station Kiosk Systems Lesson Plan (no date)
- Station Kiosk Systems Training, slides (9/22/2020)
- Swing gate Installation Syllabus (no date)
- Technical Training Course: Commend GE800 Passenger Intercom System Installed at WMATA Dulles Ext. Phase 2, slides (no date)
- Trainee Workbook: 490 MHz CRCS Refresher, Basic Electrical Experiments (2/1/2022)
- TYCO IS3000 Fire & Intrusion Communications Systems Field Maintenance Training Student Guide
- UL Code 864 9th Edition, slides (no date)
- Wiring and Soldering Techniques Syllabus (2/1/2022)
- WMATA Platforms Rehabilitation Phase 2 Project CCTV Training & Demonstration, slides (no date)
- WMATA ProWatch Door Access and Intrusion Alarm Operation and Maintenance Training, slides (Rev. 1, no date)
- WMATA's CRCS Overview, slides (no date)

PROCESS/SOP/PROCEDURES

- Communication Preventative Maintenance Instructions Remote Site Facility Cleaning (Rev. 3.0, 3/2019)
- Communication Train Wash Motion Warning System Preventative Maintenance Instructions (Rev. 0, 4/4/2019)
- Communication, CCTV Preventative Maintenance Instructions, Video Camera Inspections and Cleaning (10/11/2018)
- Communication, Preventative Maintenance Instruction, Assessment Procedures for WMATA Underground 490 MHz Head End and Line Bi-Directional Amplifiers (Rev. 4.0, 9/20/2019)
- Communication, Preventative Maintenance Instruction, Communication Room Bi-Weekly Cleaning and Inspection (Rev 3, 12/16/2016)
- Communication, Preventative Maintenance Instructions, Alignment Procedures for the 800MHZ Head End and Line Bi-Directional Amplifiers, part of the underground Public Safety Radio System (Rev. 5.0, 4/16/2019)
- Communication, Preventative Maintenance Instructions, Intercom System (Rev .005, 7/19/2018)
- Communication, Preventative Maintenance Instructions, Kiosk Information Displays Cleaning and Visual Inspection (9/11/2018)
- Communication, Preventative Maintenance Instructions, Passenger Information Display Signs (Rev. 3, 2/2017)
- Communication, Preventative Maintenance Instructions, Procedures of the optimization of the CRC's Quantar mixed-mode base stations (Rev. 2, 3/21/2019)
- Communication, Preventative Maintenance Instructions, Public Address System Inspection/Alignment (Rev .004, 11/30/2018)
- Communications, Preventative Maintenance Instructions, Panic Buttons System Inspection (10/23/2018)
- COMR Console Check Out Procedure, Maximo activity list
- Console PMI Procedure used spreadsheet (no date)
- Console PMI procedure, list of tasks (spreadsheet)
- CRCS Line Amp Alignment Failure Checklist Sheet (3/16/2022)
- Engineering Modification Instruction Operational Activity (1/21/2010)
- Environmental Standard Operating Procedures (10/2021)
- Infrastructure Break/Fix SOP, SOP (Version 6.0, last reviewed 4/19/2021)
- OAP 200-05, Corrective Maintenance (last reviewed 10/23/2000)
- PMI Access Control System Inspection (Rev. 1.2, 11/14/2019)
- PMI COMR-008, Alignment Procedures for 800 MHz Head End and Line BDA (Rev. 5.0, 4/16/2019)
- PMI Locking of Emergency Gates (11/14/2019)
- PSRS Line Amp Alignment Failure Checklist Sheet (2/10/2022)
- PSRS Line AMP Alignment Failure Checklist Sheet, A09 (2/10/2022)
- SMNT Maintenance Control Policy Book (7/22/2021)
- SMNT_COMR-OAP105-03-rev03, Quarterly Testing of the Public Safety Radio System (PSRS) and Comprehensive Radio Communication System (CRCS) (3/24/2022)

PROCESS/SOP/PROCEDURES (CONTINUED)

- SMNT-SAMS-W02-01 Radio Certification Work Instruction (11/23/2020)
- System Wide CRCS PSRS Portable Radio Test Spreadsheet (2/2022 – 3/2022)
- Testing the Public Safety Radio System and Comprehensive Radio Communications System throughout the WMATA Underground Operations Administrative Policy (12/10/2020)
- Yard Desk Top Radio PMI (no date)

MANUALS

- Access Camera Field Adjustment Diagram (1/7/2013)
- Axis P3367 SD Card Replacement (no date)
- Communications Room Bi-Weekly Cleaning and Inspection reports, K Line (September 2021)
- DX7100 Series Digital Video Recorder Installation Manual (11/2003)
- Fiplex Preventative Maintenance Instructions for Box A & Box B+C (8/25/2020)
- Fiplex WMATA 800 MHz Interim Troubleshooting Guide (8/14/2019)
- First View Administrative Guide & User Manual (8/2008)
- Fluke Networks MicroScanner2 Cable Verifier User Manual (Rev. 1, 1/2007)
- Fluke Networks OptiFiber Pro OTDR User's Manual (Rev. 1, 2/2012)
- IP 68/NEMA 6 Outdoor Weatherproof HD/LCD Display Manual (2002)
- Maintenance and Material Management System Work Order List (9/1/2021 – 11/28/2021)
- NPA-PoE Set: Quick Install MOBOTIX (11/2009)
- Passenger Information Display System SMNT PIDS User Manual (no date)
- Public Address System quarterly PMI inspections (data sheets) for September, October, November of 2021
- Q24M: Camera Manual MOBOTIX (1/2013)
- RAMEX (intercom) PMI inspections (data sheets) for October 2021
- RAMEX Intercom and PERS Communications Systems Field Maintenance Training Student Guide (Rev. 6/6/2009)
- Ramex Work Orders (October 2021)
- Readdressing DVR for New Station (no date)
- SMNT Safety compliance checks, levels I and II (September through December 2021)
- SR-Series Thermal Camera Installation and Operation Manual (Revision 210, 2008)
- Suncoast LED Displays Installation and Power (Rev. G, No Date)
- Technical Training: Commend S3-based Passenger Intercom System Installed at WMATA (2/5/2020)
- User Manual AXIS Q6035-E PTZ Dome Network Camera (Version M1.8, 6/2012)
- User Manual: AXIS P3367-V Fixed Dome Network Camera (Version M2.2, 7/2011)
- User Manual: AXIS P3367-VE Fixed Dome Network Camera (Version M2.2, 7/2011)
- User Manual: AXIS Q19 Thermal Camera Series (no date)
- User's Guide: AXIS T84 Installation Display (Version 1.00, 1/2012)

OTHER

- 2000/3000 Series C-Inspection, inspect and test communications systems (Version 9.0)
- 2018 WMATA Internal Review: Internal Safety & Security, Office of Systems Maintenance (SMNT) Communications Branch (COMM) (4/27/2018)
- 6000 Series C-Inspection, inspect and test communications systems (Version 10.0)
- 7000 Series C-Inspection, inspect and clean TWDT Radio Unit (TRU) and Antenna (Version 10.0)
- 7000 Series C-Inspection, inspect and test communications systems (Version 10.0)
- Aggregated Radio Checks Test Results (September – November 2021)
- APX 800 Handheld Radios Excel Spreadsheet
- Calibrated Equipment, spreadsheet (Version 1, no date)
- Calibration and Certification September 2021 Through December 2021
- Calibration Test Equipment September 2021 Through December 2021
- CIL Radio and Neutral Host, spreadsheet (no date)
- Class 2 rail vehicle inspection of radio, section 8.13 (excerpt)
- COMM FIELD Open corrective maintenance work orders (as of 3/3/2022)
- COMM PM and Frequency Data Spreadsheet (no date)

OTHER (CONTINUED)

- COMM RADIO Open corrective maintenance work orders (as of 3/2/2022)
- COMM/COMR Hazardous Waste (Batteries) description of handling, spreadsheet (no date)
- Comms Hazard Log, spreadsheet (12/31/2020)
- Communications Inspections, spreadsheet (2021)
- Dulles Corridor Metrorail Project, Operation and Maintenance Data, Operations Manual, CCTV Specification Section 28 23 11 (no date)
- Dulles Phase 2, Mobile Radio System, slides (6/23/2020)
- Field Communication Performance metrics draft report (12/2021)
- FY2023 - FY2028 Proposed Capital Improvement Program & 10-Year Plan (12/2021)
- List of all Environmental Management Training Requirements
- List of COMM Rooms by line route
- Memorandum: Motorola APX8000 Series Radios (10/28/2020)
- Motorola Radio Hazard and Conformance Checklist, spreadsheet (8/1/2019)
- Networking Essentials: Fourth Edition, A COMPTIA Network+ N10-006 Textbook, Instructor Edition (2016)
- Notice: VHF Analog Radio System to be Turned Off (No Date)
- Personal Protective Equipment Table from the SMNT Maintenance Control policy (Version 4.0, 7/2021)
- QC Inspection Report for FSVT (3/4/2022)
- QC Inspection Report for FSVT, Maximo list (September through November of 2021)
- Radio Checks, spreadsheet (May 2021 – November 2021)
- Radio Communication Performance metrics draft report (12/2021)
- Reliability Reports for COMM/COMR Memorandum (2/4/2022)
- RTRA Operations Personnel Notice: RTRA UHF (Digital) Radio Zones and Channels (12/30/2014)
- RTRA Operations Personnel Notice: Station Manager Digital Radio Upgrades (July 3, 2013)
- Summary of COMM Intercom System Problem (no date)
- Test equipment calibration list, spreadsheet (September through December 2021)
- Test equipment overdue for calibration list, spreadsheet (September through December 2021)
- Tunnel Distributed Antenna Subsystem Alarm Subsystem Schematic Design Network Map, A01-A06 (9/18/2001)
- Tunnel Distributed Antenna Subsystem Network Map, F03-F08 (9/18/2001)
- WMATA Certification Status Report, spreadsheet (2/16/2022)
- WMATA Manual of Design Criteria, Section 27 Communications (Rev. 5/19/2020)
- WMATA System Block Diagram (Version 5, 1/21/2016)
- WMATA's Handheld Active Radios as of 4/22/2022 (spreadsheet)
- Work orders of radio coverage problems (September to December of 2021)
- Yard Tower PM Inspections, spreadsheet (no date)

Appendix D: Public Transportation Agency Safety Plan (PTASP) (and, for System Safety Program Plan (SSPP) Elements Reviewed

- **SSPP elements covered include:**
  - Implementation Activities and Responsibilities (element 5)
  - Hazard Management Process (element 6)
  - System Modification (element 7)
  - Safety Certification (element 8)
  - Safety Data Collection and analysis (element 9)
  - Internal Safety Audits (element 12)
  - Rules Compliance (element 13)
  - Facilities and Equipment Inspections (element 14)
  - Maintenance Audits and Inspections (element 15)
  - Training and Certification for Employees and Contractors (element 16)
  - Configuration Management and control (element 17)
- **PTASP elements covered include:**

1. Safety Management Policy

d. Functional area common SMS responsibilities

e. Functional area specific SMS responsibilities

i. Executive level responsibilities

ii. Technical Management level

iii. Front Line and Represented Employees

iv. Safety risk coordinators (key personnel)

f. Accountable Executive responsibilities

g. SMS documentation

2. Safety Risk Management

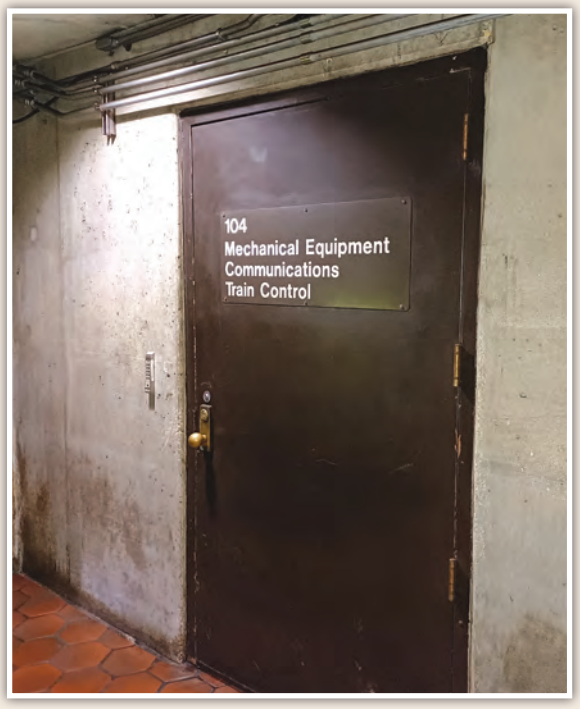
d. Hazard identification

e. Hazard investigation

f. Hazard analysis and evaluation of safety risk

g. Hazard resolution (mitigation, elimination)

h. Hazard tracking



3. Safety Assurance

a. Systematic, integrated data monitoring and recording of safety performance

b. Real-time assessment with timely information as to safety management and performance

c. Internal safety reviews

d. Departmental controls

e. Compliance and sufficiency monitoring

f. Document assurance activities

g. Preventive, Predictive, and Corrective Maintenance

h. Event reporting/investigations

i. Change management

j. Safety and Security Certification

k. Corrective action plans

4. Safety Promotion

a. Training

i. Competencies and Training

ii. Employee Safety Training

iii. Safety Rules and Procedures Training

iv. SMS-specific training requirements

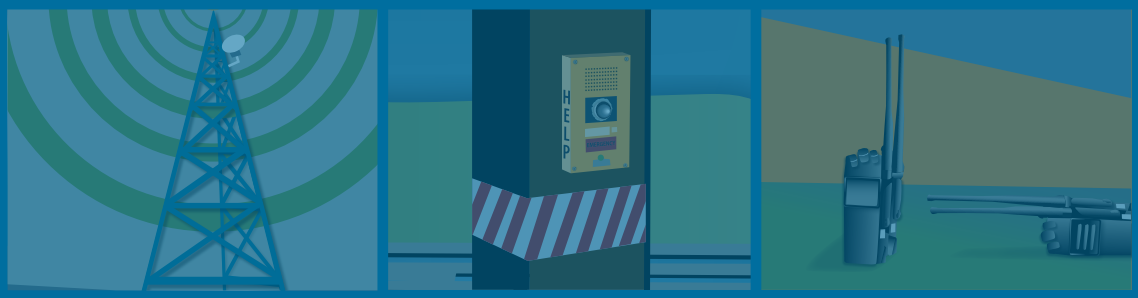
v. Training Recordkeeping and Compliance with Training Requirements

c. Safety Communications

d. Hazard and safety risk information

f. Hazardous materials

g. Environmental management



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