Research on Technical Safeguard Countermeasures for Safe Broadcasting in TV Station Equipment Rooms (Postprint)

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Abstract

Television programs constitute a vital channel through which modern citizens access information and entertainment, rendering the assurance of their uninterrupted broadcast profoundly significant. The maintenance of regular broadcasting for television station programs necessitates reliance upon secure and efficient technical support systems for broadcast safety within station machine rooms. As diverse television program formats grow increasingly sophisticated, broadcasting operations impose novel requirements upon these broadcast safety technologies. Accordingly, this paper adopts the significance of safeguarding radio and television broadcast security as its point of departure, conducts an in-depth investigation into the typology of broadcast safety technologies deployed in television station machine rooms, and provides a concise exposition of auxiliary measures for television station broadcast safety technologies, thereby furnishing relevant stakeholders with innovative approaches to problem resolution.

Full Text

Preamble

Title: Research on Technical Support Strategies for Safe Broadcasting in TV Station Machine Rooms

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Abstract: Television programs serve as a crucial channel for the public to access information and entertainment, making it imperative to ensure their normal broadcasting. Maintaining normal broadcasting relies on safe and efficient technical support systems in TV station machine rooms. As television program

formats become increasingly complex, new demands are placed on broadcasting safety technologies. Accordingly, this paper examines the significance of maintaining safe radio and television broadcasting, explores the types of safety broadcasting technologies for TV station machine rooms, and outlines auxiliary measures for broadcast safety technologies, offering new perspectives for relevant practitioners.

Keywords: Radio and television station; Broadcast room; Technical support; Machine room hardware system
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The broadcast control room serves as the key control unit for TV station output, directly affecting the stability and security of television signal transmission. A safe and stable broadcast control room holds great significance for improving television program broadcast quality. Therefore, conducting in-depth research on technical support measures for safe broadcasting in TV station machine rooms is of important practical significance for maintaining overall broadcast effectiveness and ensuring stable machine room operation.

1. The Significance of Maintaining Safe Radio and Television Broadcasting

Radio and television constitute important national information dissemination windows, making safe broadcasting extraordinarily significant. First, maintaining normal broadcasting is essential for ensuring content effectiveness and improving overall program quality. Broadcasting forms can be broadly categorized as audio or video, both aiming to ensure that the public receives accurate radio and television information promptly and that high-quality services are provided. Only by guaranteeing safe broadcasting can party-mass relations be strengthened, providing a solid public foundation for implementing party policies and achieving harmonious social development. Through broadcasting media, party and government organs can transmit the latest party news and national policies to the public in various formats, helping them understand policy directions and priorities. Therefore, ensuring safe broadcasting is crucial for party and government publicity work. Finally, actively maintaining safe broadcasting enables radio and television media to fulfill their positive role in guiding public opinion, establishing them as opinion leaders that promote harmonious and stable social development. For the broadcasting industry, transmitted content typically guides audience cognition and influences ideological development to varying degrees. Consequently, information content must be strictly filtered during program broadcasting to ensure safe transmission.

2. Types of TV Station Machine Room Safety Broadcasting Technologies

2.1 Machine Room Hardware System Safety Technology

2.1.1 Power Supply Safety Technology Support Generally, actively maintaining power supply line safety in TV station machine rooms is the prerequisite for ensuring normal and orderly program broadcasting. In practice, most TV station machine room power systems use dual-circuit municipal power supply lines, as both circuits are dedicated lines powered by independently operating multiple substation equipment. Therefore, to maintain machine room power safety, corresponding transformers can be installed in both municipal circuits, with the power supply unit converted to single-bus dual-power segmented supply. Key locations such as studios and broadcast rooms should adopt dual-power automatic switching supply. Additionally, besides external power supply lines, broadcast rooms should be equipped with a small number of uninterruptible power supply (UPS) systems. Through UPS automatic switching functions, backup power can be provided during sudden power outages.[1]

2.1.2 Video Server Technology Support Video server failure is a common hardware issue in TV machine rooms. To maintain safe broadcasting, high-quality video servers must be introduced, with multi-level backup of data information in node servers. Distributed storage technology can also be employed for rapid data dispersion, reducing storage pressure and improving storage rates and access efficiency for various data types. Additionally, leveraging distributed storage technology optimizes the overall data information sharing workflow. Using a single node server' s decryption channel within the server to compile all internal information can further optimize program broadcast content while improving information sharing efficiency. It should be noted that television programs are inevitably affected by manual operations during recording, editing, or broadcasting states, with various system operations occupying system resources and increasing bandwidth load. In severe cases, this may cause server crashes, affecting decoding units in the machine room system and impacting normal video server operation, creating considerable difficulties for maintenance personnel. However, with the promotion and use of tiered storage architecture, maintenance, repair, and reconstruction work can avoid direct impact on safe broadcasting. Moreover, such safety architecture can effectively prevent major failures, ensuring stable and orderly overall program broadcasting processes and helping machine room staff quickly inspect server failures while gradually improving the tiered storage architecture.[2]

2.2 Machine Room Software System Safety Technology

2.2.1 Backup System Technology Support Currently, leveraging the advantages of information technology, rational use of information transmission media such as digital microwave, fiber optics, and communication satellites can

provide high-quality signal transmission channels for stable radio and television program broadcasting and offer more options for information backup. For machine room information backup system protection measures, a "one-to-many" backup server construction scheme can be adopted. By building signal backup servers for dual-source backup of uniformly uploaded program signals, broadcast television programs are always equipped with backup signal sources. This ensures seamless switching to backup signal sources when the main signal source experiences broadcast failures, guaranteeing normal program signal output from the TV machine room and adding a "safety lock" to normal program broadcasting.

2.2.2 Database Safety Support During the initial planning stage of radio and television broadcast systems, relevant personnel should focus on database resource backup design. Effectively improving database resource backup design not only enhances recovery capabilities for various data types but also greatly benefits maintaining broadcast stability and improving overall broadcast effects. Therefore, during database software deployment, staff should actively perform installation, regulation, and configuration work to ensure the database operates efficiently. Complete server operation and maintenance regulations should be established, requiring staff to conduct periodic inspections according to these regulations to ensure the machine room database remains under safety monitoring. Daily management should be strictly standardized while comprehensively improving machine room database staff's capabilities in database software maintenance. Combining existing database maintenance experience to deeply analyze background operation data and check operation status monitoring logs ensures rapid fault location when database failures occur, enabling early detection and handling to prevent problem escalation.[3]

2.2.3 Broadcast Control System Safety Support Currently, the main security control measures for TV station machine room broadcast control systems in various regions involve daily control and maintenance through two-level control units. The control process is as follows: First, program broadcast schedules are organized and sorted, with content divided from broadcast control work areas to avoid duplication. This assists the program arrangement area in autonomously organizing broadcast programs in an orderly manner and adjusting corresponding broadcast equipment, while the broadcast control work area concentrates resources on unified monitoring of equipment status, monitoring data, and alarm information. After overall planning, this helps various work areas in the broadcast control system operate efficiently without mutual interference, both maintaining stable television program broadcasting and enabling rapid location of various broadcast failure points. Second, dual-machine hot standby technology is applied to regulate and manage broadcast control equipment. If the main control work area of the broadcast control system fails during operation, the standby control workstation can be converted into the system' s main control workstation through a transfer switch, enabling the standby workstation

to directly take over the main control workstation' s tasks and maximize protection of normal program broadcasting. In summary, functional equipment such as main-standby switching workbenches and broadcast video recorders applied in broadcast control systems can all be rapidly switched and controlled through dual-machine hot standby technology.

Environmental conditions constitute another critical aspect of system safety. When indoor temperatures are too high, they affect normal equipment operation and staff work efficiency. Therefore, real-time monitoring units must be established for machine room temperature control to ensure broadcast equipment remains in optimal operating condition. In practice, monitoring data mainly includes electromagnetic fields, humidity, corrosive harmful gases, and shock vibration. However, temperature and humidity values have the most obvious impact on facility operation during long-term environmental monitoring. When machine room equipment operates in high-temperature environments for extended periods, some electronic components' internal cooling systems cannot effectively dissipate heat, causing excessive internal temperatures that may loosen circuit board solder joints and cause equipment failures. Generally, the stable operating temperature for most broadcast control equipment should be maintained around 25°C. Accordingly, management personnel should use temperature sensors and background monitoring systems to monitor machine room temperature. When the temperature exceeds 25°C, air conditioning and liquid cooling equipment should be used to help cool machine room equipment and maintain a cooled state. It should be noted that when adjusting machine room operating temperature, staff should simultaneously monitor indoor humidity values. Typically, when external conditions remain unchanged, reduced humidity in the machine room can cause indoor dryness, leading to continuously rising static voltage in internal circuits of various power supply equipment. When humidity increases significantly, it may also cause short-circuit failures in internal machine room equipment. Therefore, maintaining normal indoor humidity indices is crucial for stable broadcast equipment operation. With the assistance of humidity monitoring systems, staff can use humidifiers and other equipment to control machine room humidity at 70%-80%. Additionally, staff should monitor current and voltage values on some main lines. Due to the complex arrangement of various cables in the machine room, voltage and current fluctuations are prone to occur. Therefore, if ammeter current and voltage fluctuations exceed the standard range of 1.0-2.0A or 6V-7V, targeted maintenance should be performed on the target equipment. Finally, during daily operation and maintenance procedures, staff must also regularly clean dead corners in the machine room, performing cleaning work to avoid indoor impurity accumulation.[4]

2.4 Television Broadcast Signal Monitoring

In all stages of television program broadcasting, signal monitoring status is crucial for program monitoring, broadcast effects, and signal flow optimization. Therefore, machine room staff must monitor television broadcast signals con-

tinuously during program broadcasting. (1) Output monitoring helps staff understand the overall status of master and sub-control rooms in real time and locate and adjust sudden interference signals. (2) Video monitoring focuses on signal issues such as signal interruption, black field, and mosaic in video images. Static frame monitoring can monitor the duration of a single video frame during program broadcasting; if the video frame duration exceeds the specified standard, it can be identified as a static frame requiring technical processing. Black field monitoring is similar to the above monitoring scheme, determining whether a black field problem exists by monitoring the duration of black screen video frames during broadcasting. Color bar monitoring works by detecting whether special images appear in video images, or by subdividing image frames and color bar frames and combining preset color bar standards for image judgment to determine whether the current frame is a color bar frame. If images remain in color bar frames for an extended period, the monitoring system can issue color bar alarms based on the video monitoring system. Monochrome monitoring involves statistical comparison of the three primary color block ratios in images; if the quantity of two color blocks is close to 0 while the third is close to 255, the image frame can be directly identified as monochrome. Audio monitoring uses a 100-millisecond baseline with audio sliding window monitoring, performing multiple comparative analyses between monitored high-level values and volume anomaly level values; when TRUE time exceeds the limited standard, audio problems can be determined. Mosaic monitoring primarily detects whether complete continuity is maintained between frames; if no gradient appears but obvious edges exist, and the module matching coefficient value rises to the threshold, mosaic can be determined.

3. Auxiliary Measures for Broadcast Safety Technologies

3.1 Improving Machine Room Staff Management Systems

Due to the relatively complex working environment in most radio and television station machine rooms and the stringent operating requirements of large broadcast control systems, internal staff management must be strengthened to build a strict and standardized management system, ensuring machine room staff remain in an orderly working state. First, strict regulations should be established for machine room personnel access, prohibiting unauthorized personnel other than broadcast maintenance and equipment monitoring staff from entering the machine room. A complete "Machine Room Personnel Access" management system should be established to prevent human-caused damage to machine room equipment and ensure smooth program broadcasting. Second, comprehensive quality training for machine room staff should be enhanced to improve proficiency in daily management and maintenance work, ensuring all work content meets relevant standards. Additionally, corresponding systems should be established for machine room equipment usage, prohibiting staff from moving equipment, switching connection cables, or connecting external mobile storage devices to machine room computers without authorization, thereby re-

ducing external factors' impact on program broadcasting equipment. Finally, when early warning systems locate fault signals, staff should be required to follow manual regulations to troubleshoot faults according to standards, determine fault causes based on data feedback, and perform standardized fault handling to minimize adverse effects on equipment operation.[5]

3.2 Continuously Improving Radio and Television Transmission Network Security

With the rapid development of information technology, actively strengthening radio and television transmission network security has become an important means of maintaining stable program operation and improving overall broadcast quality. First, data encryption technology should be introduced. Encrypting digital signal channels during broadcasting can prevent criminals from hijacking or tampering with signal data during transmission, thereby strengthening data information security. Second, digital signature technology should be promoted. Using data signatures at the information sending end while verifying the digital signal receiving end can efficiently verify both parties' identities and prevent information forgery. Third, digital fingerprinting technology can also be introduced. Using digital fingerprinting' s marking function to uniquely mark data can prevent data information from being modified by criminals. Finally, adding monitoring modules to relevant network equipment can also enhance network security. In this process, network monitoring bandwidth should be actively expanded, and router and firewall equipment should be reconfigured according to relevant requirements to improve radio and television transmission network security.

As domestic spiritual civilization construction enters a new era, the public' s demand for spiritual culture is growing daily, with increasing attention to various television programs. Accordingly, television stations at all levels must focus on strengthening program quality and broadcast safety performance, deeply recognizing the important significance of machine rooms as media for transmitting program signals to the outside world, scientifically and rationally applying safe broadcasting technologies, and strengthening personnel and network signal management.

References: [1] Xu Hualong. Implementation Plan for Lightning Protection Technology in Radio and Television Station Wireless Transmission Machine Rooms[J]. China Media Technology, 2017(10): 97-98.
[2] Wang Yongmei. Exploration of Emergency Response in TV Hard Disk Broadcasting Construction and Operation[J]. China Media Technology, 2012(24): 120-121.
[3] Tan Wenling. Application of Safe Broadcasting Monitoring Systems in Grassroots TV Broadcast Control Rooms[J]. Satellite TV & Broadband Multimedia, 2020(15): 22-24.
[4] Liu Yin. Overview of Integrated Design of Signal Source Broadcasting Monitoring System for Radio and Television Transmission Machine Rooms[J]. Science

and Information Technology, 2020(1): 27, 31.
[5] Liu Hua. Analysis on Management and Maintenance Countermeasures for UPS Power Supply in Broadcasting and Television Machine Rooms[J]. China Media Technology, 2020(11): 122-124.

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Note: Figure translations are in progress. See original paper for figures.