

VLORA RADIATION PORTAL MONITOR FAILURE ANALYSIS AND REPAIR IN ALBANIA.

DRITAN PRIFTI¹, GANI DEMIRAJ¹, KOZETA TUSHE¹
¹University of Tirana, Institute of Applied Nuclear Physics

INTRODUCTION

Radiation Portal Monitors (RPMs) are critical components of nuclear security infrastructure worldwide, playing a critical role in detecting and preventing the illicit trafficking of radioactive materials across international borders, ports, and key strategic facilities.

In Albania, the deployment of RPMs at major entry points including land border crossings, seaports, and airports forms a key element of the national nuclear security framework [1],[4]. The Vlora Port, one of Albania's primary maritime hubs, houses a RPM installation at its Border Crossing Point (BCP), strategically positioned to screen vehicular traffic and cargo moving through the terminal. This installation not only strengthens Albania's internal security but also supports global efforts to combat nuclear smuggling and radiological terrorism [2],[10].

However, the sustained effectiveness of RPM systems is vulnerable to a range of challenges, including environmental exposure, technical aging, resource constraints, and inadequate maintenance practices. Particularly in coastal areas like Vlora, harsh environmental conditions — such as high salinity, humidity, and temperature fluctuations affect equipment degradation over time.

This article presents a comprehensive analysis of a failure incident involving the Vlora Radiation Portal Monitor, the investigative methods employed, the repair process undertaken, and recommendations to enhance long-term system reliability.

METHODS AND MATERIALS

The RPM installation at Vlora Port is situated at the exit lane of the terminal, designed to cover the full width of traffic flow to ensure comprehensive scanning of vehicles. Under standard conditions, the system is expected to maintain continuous operation, 24 hours a day, 7 days a week, supervised by Customs Front-Line Officers (FLOs). These officers, while responsible for RPM operation, are simultaneously tasked with broader customs and security duties [5],[7],[9],[11].

The RPM system has been non-functional due to prolonged discontinuation of routine maintenance. The following main components comprised the Vlora RPM installation:

- RPM master and slave detection pillars
- Telecommunication wallbox
- Video monitoring system
- Operator's workstation
- Thermal printer for alarm reporting
- Initial Inspection Findings:

The system's primary power switch connecting to the 220V/50Hz mains was found in the "OFF" position, and internal MAINS and BATTERY switches within each detection pillar were also turned off, indicating prior intervention. Diagnostic Approach: A step-by-step technical assessment was conducted, including visual inspection, cable integrity testing, power supply verification, and module-level diagnostics. Restoration efforts focused initially on reestablishing power and communication links among system modules. Following extensive maintenance interventions, several key subsystems were repaired, and one detection pillar was fully restored to its intended operational state.

RESULTS

The technical investigation revealed several critical failures and points of degradation across the system:

Communication and Control Subsystem Failures:

- Power supply and processing unit (BPO-04) failure at the master pillar.
- Power supply and processing unit (BPO-04-01) failure at the slave pillar.
- Data communication link between the master and slave terminal boxes.
- Broken data connection between the master terminal box and the telecommunications junction box (Krone plinth).

Contributing Technical Issues:

- Faulty connections with occupancy sensors possibly cause repeated overloads.
- Unstable and fluctuating main power supply, resulting to internal power module failures.
- Significant degradation of the data cable linking the slave pillar to the operator's workstation, particularly at the junction point.

Restoration Actions Taken:

- Repaired the communication link between the master and slave terminal boxes.
- Restored the data connection between the master terminal box ,the telecommunications wallbox inside the operator's cabin.
- Temporarily replaced the slave pillar's defective power supply and processing unit with a functional spare.
- Restored temporary communication between the operator control panel (PVC-01) and the detection system.
- Replacement of Master and Slave Pillars battery.

Upon completion of the repair works, the RPM underwent a functionality tests, using NORM [3],[6],[8]. The system demonstrated accurate alarm triggering, reliable data transmission, and proper visual/auditory alert functions, confirming its return to full operational capability.

DISCUSSION

One of the main failure root causes of Vlora RPM failure was the lack of maintenance throughout the years, lack of financial resources to cover the maintenance and also the lack of a trained and specialized team in Albania which can regularly maintain the RPMs. In addition, unstable power supply and some issues with the conformal coating are identified as reasons which results in the failure of the BPO-04 and BPO-04-01 units.

This failure underscores the vulnerability of radiation detection systems to cumulative mechanical, electrical, and software degradation, especially in challenging coastal environments such as Vlora.

Salt air corrosion, fluctuating temperatures, and intermittent maintenance all contributed to the system's decline. Notably, the failure analysis highlighted the critical need for regular preventive maintenance, firmware management protocols and environmental protection measures.

Scheduled inspections and component testing could have identified failure issues earlier.

Improved sealing and corrosion-resistant materials could mitigate environmental impacts on sensitive electronics.

Moreover, this analysis emphasizes the importance of maintaining a trained technical response team capable of both diagnosing complex electronic failures and executing precise repairs.

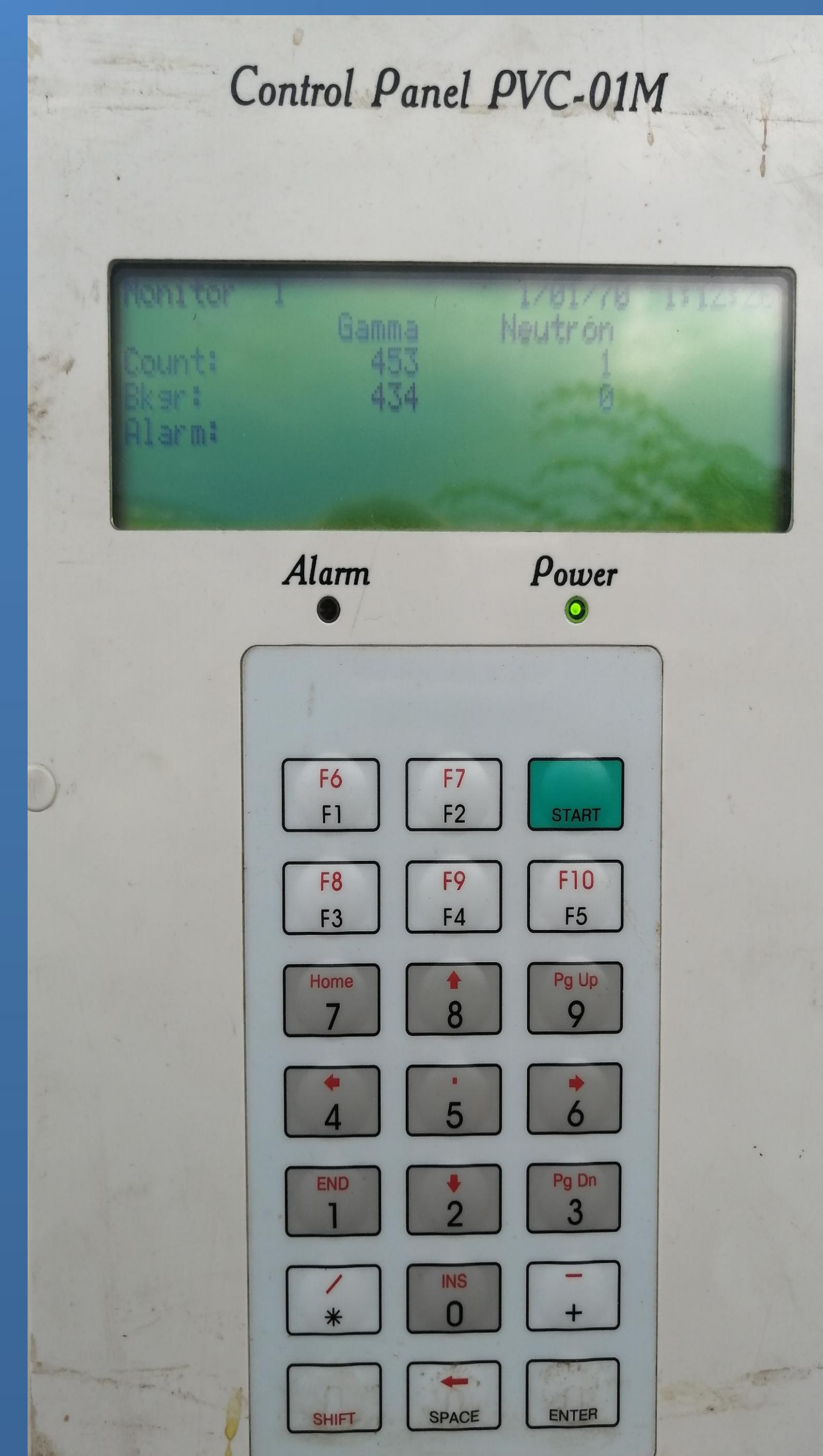
CONCLUSIONS

Based on the current technical status described above, the Radiation Portal Monitor (RPM) is fully operational. The failure and subsequent successful repair of the Vlora RPM system serve as a valuable case study for the operational risks and technical vulnerabilities inherent to radiation detection infrastructure, especially in environmentally challenging locations.

This RPM failure underlines the critical need for continuous investment in technical maintenance, capacity building, and infrastructural resilience to ensure that Albania's RPM systems can continue to protect the nation and by extension, the global community from radiological and nuclear threats. By applying the lessons learned from the Vlora experience, Albania can strengthen the long-term sustainability and reliability of its nuclear security architecture. Through systematic analysis and targeted interventions, full system functionality was successfully restored. To enhance future operational resilience, it is recommended to implement stricter preventive maintenance regimes, improve environmental shielding, and ensure continual training for technical personnel. Strengthening these areas will be vital in maintaining Albania's preparedness against radiological threats at critical points of entry.



Vlora RPM Master and Slave Pillars



Control Panel PVC-01M

REFERENCES

- [1] Law no. 8025, dated 11.01.1995 "On protection against ionizing radiation" amended No. 9973, July 28-th 2008.
- [2] Decision No 877, date 30.10.2015 of Council of Minister for the approval of the regulation "On physical protection of radioactive materials in the Republic of Albania"
- [3] Decision no. 638, date 07.09.2016, of the Council of Ministers "On the approval of the regulation on the safe handling of radioactive waste in the Republic of Albania".
- [4] Cooperation Agreement between Center of Applied Nuclear Physics and the Directorate General of Customs 419 dated 14/01/2009 "On discovering and combating the illicit trafficking of radioactive materials".
- [5] Law no. 102/2014, "the Customs Code of the Republic of Albania", 22 August 2014.
- [6] Regulation No. 9, date 07.01.2010 "On the categorization of radioactive sources in the Republic of Albania", in function of the radiation protection, safety and security of ionizing radiation sources.
- [7] Guideline nr. 1526/2, dated 13.04.2012 "Over the procedures of physical movement for radioactive materials, goods and reaction in case of incident with radioactive sources in CPs".
- [8] Decision No.815, dated 16.11.2016 on the adoption of the regulation "On the safe transport of radioactive materials..
- [9] Decision No 158, date 13.02.2008 of Council of Minister over "Import-Export of Ionizing Radiation Sources."
- [10] Regulation nr.4873 / dated 17.06.2008 "On cooperation between the Customs Service and the State Police".
- [11] Regulation about Standard Operation Procedures for Recovery of Radioactive Materials date 10.05.2016.

CONTACT

Dritan Prifti
University of Tirana,
Institute of Applied Nuclear
Physics
Email:
dritan.prifti@unitir.edu.al
Phone: +355674805452
Website: www.ifbz.al

RAD CONFERENCE

THIRTEENTH INTERNATIONAL CONFERENCE ON RADIATION,
NATURAL SCIENCES, MEDICINE, ENGINEERING, TECHNOLOGY AND ECOLOGY

JUNE 16-20, 2025
HUNGUEST HOTEL SUN RESORT, HERCEG NOVI, MONTENEGRO

