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Readiness of the Philippine Coast Guard in the Surveillance and Monitoring of Radioactivity in its Maritime Jurisdiction

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Abstract

Aim: This thesis examined the readiness of the Philippine Coast Guard (PCG) in radiation monitoring and surveillance within the country's maritime jurisdiction. This study evaluated the current capabilities, infrastructure, and protocols of the PCG to handle radiological incidents effectively.
Methodology: To thoroughly examine the Philippine Coast Guard's (PCG) capacity building and readiness for the surveillance and monitoring of radioactivity for maritime safety and coastal environment preservation, this study employed qualitative research methods. Specifically, the study utilized interviews, document analysis, and inventory assessment.
Results: The Philippine Coast Guard (PCG) workforce mostly holds Bachelor's degrees, but lacks specialized training in radioactivity monitoring and regulatory procedures. While the PCG has received some training from the USA Defense Threat Reduction Agency, it has only been offered once. The PCG has limited yet critical equipment, including the Polimaster Gamma-Neutron Personal Radiation Detector and the RadSeeker CS Smith Detection radioisotope identifier device. However, more equipment and effective training on their use and maintenance are urgently needed. The PCG currently lacks a strategic framework for radioactivity surveillance and there is no comprehensive policy to guide radioactivity monitoring activities in alignment with international standards.
Conclusion: The analysis of the PCG's preparedness for this role reveals a mixed picture. On the one hand, the PCG boasts a workforce with a solid educational foundation, predominantly composed of individuals with Bachelor's Degrees, indicating a well-educated team. On the other hand, there are significant gaps in specialized training, particularly in radioactivity monitoring and regulatory procedures, which are essential for effective environmental protection and compliance.

Keywords: Surveillance and monitoring, Radiation, Philippine Coast Guard

INTRODUCTION

The escalating threat posed by radioactive materials to maritime safety and environmental protection has emerged as a significant global concern. This study centers on the Philippine Coast Guard (PCG), aiming to carefully evaluate its readiness in responding to radiological contaminants, such as iodine-129 (I-129) which was determined to be a prevailing radioactive contaminant in most of the maritime jurisdiction of the Philippines. The study of Cruz et al. (2020) proved that scientists found that there is a significant risk of exposure to radioactive materials in coastal areas of the Philippines, particularly in areas with high levels of shipping traffic. Another study conducted by the Philippine Nuclear Research Institute (PNRI) investigated the potential use of natural radiation as a tracer for environmental studies (Mendoza et al., 2018). The objective is to comprehensively assess the PCG's preparedness, particularly its response capabilities concerning radiological emergencies and contaminants, emphasizing the potential impact of these on the maritime environment.

The initial objective of this study is to conduct a comprehensive examination of the PCG's existing capacity for radiation surveillance in both marine and coastal areas. The emphasis here lies on understanding the PCG's level

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of preparedness for this eminent emergency. This involves a thorough assessment of the technological infrastructure, monitoring equipment, and operational protocols employed by the PCG in detecting and responding to radiological threats. Additionally, the study will delve into the training programs and initiatives implemented by the PCG to ensure the proficiency of its personnel in handling radiological emergencies. This phase of the research will involve in-depth interviews with key stakeholders within the PCG, including members of the Marine Environmental Protection Command (MEPCOM), Maritime Safety Service Command (MSSC), Deputy Chief of Coast Guard Staff for Marine Environment Protection (CG-9), and Deputy Chief of Coast Guard Staff for Maritime Safety Service (CG-8). By engaging with these personnel, the study aims to gain a nuanced understanding of the PCG's operational framework, challenges faced in radiation surveillance, and the specific measures in place to address incidents involving I-129.

The second objective is to identify and analyze specific areas of strengths and weaknesses within the PCG's readiness strategy for radiological incidents, with a particular focus on I-129 contamination. This involves a multifaceted approach, examining personnel resources, financial allocations, facilities, and equipment dedicated to radiation monitoring and surveillance. The study is scrutinized the adequacy of human resources within the PCG, evaluating the training and expertise of personnel responsible for radiation surveillance. Key personnel involved in radioactivity monitoring and response are identified, and their training records, qualifications, and experience is assessed to ensure a comprehensive understanding of the human element in the PCG's readiness strategy. The physical infrastructure supporting radiation surveillance efforts are evaluated. This includes the examination of monitoring stations, laboratories, and other facilities crucial for radiation detection and analysis. The study assessed the geographical distribution of these facilities, ensuring comprehensive coverage in areas prone to radiological threats.

The effectiveness of the PCG's readiness strategy heavily relies on the technological assets at its disposal. The study assessed the adequacy and functionality of monitoring equipment, including gamma spectrometers, radiation detectors and counters, and other specialized tools employed in the surveillance. Additionally, the study investigated the maintenance protocols and calibration practices to ensure the reliability of these instruments.

As part of this collaborative partnership, the Philippine Coast Guard (PCG) has undergone training and received technical assistance aimed at the detection and monitoring of radioactive materials.

For example, in 2017, the PCG engaged in a joint exercise with the International Atomic Energy Agency (IAEA), simulating a response to a radiological emergency in a maritime setting (International Atomic Energy Agency, 2017). This exercise involved the use of specialized equipment, such as handheld radiation detectors and gamma spectrometers, to identify and quantify radioactive materials.

In addition to collaborating with international partners, the PCG has taken independent initiatives to build its capabilities for nuclear safeguarding. Notably, the PCG established a Radiation Safety Office in 2020, tasked with overseeing the implementation of radiation safety measures and the training of personnel (Philippine Coast Guard, 2020). Furthermore, the PCG has invested in acquiring specialized equipment, including radiation detectors and dosimeters, to augment its monitoring and detection capabilities (Cruz et al., 2020).

Despite the PCG's proactive measures in capacity-building for nuclear safeguarding, evident through the establishment of the Radiation Safety Office, personnel training, and the acquisition of advanced equipment, there is an essential need to assess the current state of readiness. This evaluation is imperative to determine the relevance and effectiveness of the PCG's preparation in light of evolving challenges and emerging threats related to radiation monitoring. While commendable progress has been made, there remains a critical requirement to further enhance skills in radiation monitoring to ensure the PCG's continuous preparedness in the face of dynamic and evolving radiological scenarios.

Objectives

This study sought to evaluate the readiness of the PCG in radiation monitoring, identifying gaps and proposing enhancements to ensure the agency can effectively fulfill its mandate in protecting public health and maritime security.

Specifically, this study answered the following:

1. How prepared is the PCG in the surveillance and monitoring of radioactivity in the Philippine maritime jurisdiction in terms of:
    1.1 Human resource
    1.2 Physical resources and Logistics
2. What are the current initiatives in the surveillance and monitoring of radioactivity in terms of:
    2.1 Policies

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2.2 Strategies

3. What are the challenges in the surveillance and monitoring of radioactivity in terms of:
   3.1 Policies
   3.2 Strategies
4. Based on the findings, what can be recommended to ensure the readiness of the Philippine Coast Guard in the surveillance and monitoring of radioactivity in the Philippine maritime jurisdiction?

METHODS

Research Design

This study employed qualitative research methods. Specifically, the study utilized interviews, document analysis, and inventory assessment.

Population and Sampling

Ten (10) participants hailed from various PCG ranks and units, including senior officers, technical experts, maritime safety officers, and environmental officers. This diversity ensured a comprehensive understanding of capacity-building requirements and challenges across all levels and areas of PCG activities. They possessed significant expertise in environmental protection and maritime safety, contributing valuable insights into the real-world implications of radiation monitoring and surveillance. Many had technical knowledge in data interpretation, radiation safety protocols, and radiological monitoring, enhancing the precision and reliability of data gathered during monitoring activities

Instrument

Interview guide was used to collect the necessary data in this study. Said instrumnet was validated by experts in the field.

Data Collection

The data were gathered and read following the objective of the study and in adherence to all protocols in the conduct of research**.** The interview protocol underwent validation to enhance its reliability. This process involved two key steps. First, an expert review was conducted, where feedback was sought from professionals experienced in qualitative research, radiation monitoring, and maritime safety. This step ensured that the protocol was both comprehensive and relevant to the study's objectives. Second, pilot interviews were conducted with a small group of participants. These initial interviews helped assess the clarity and effectiveness of the interview guide, allowing for adjustments to be made before the full-scale interviews commenced.

The interview guide was developed based on the research goals and insights gleaned from the quantitative survey. This guide was structured to facilitate in-depth exploration of participants' perspectives and experiences. It included several open-ended questions designed to invite participants to share detailed viewpoints, challenges, achievements, and suggestions for improving radiation monitoring capacity. These questions aimed to elicit comprehensive responses that would provide a deeper understanding of the issues at hand.

Additionally, the guide encouraged narrative exploration, prompting participants to provide rich, qualitative insights through their personal stories and experiences. This approach allowed the research to capture the nuanced and contextual factors influencing the PCG's capacity-building initiatives in radiation monitoring. By incorporating both structured and open-ended elements, the interview guide aimed to gather detailed, meaningful data that would complement the quantitative findings and contribute to a holistic understanding of the subject.

Participants shared qualitative narratives and insights, offering a deeper understanding of the PCG's capacity-building initiatives. The data collected through interviews complemented and enriched the quantitative findings, providing a holistic view of the PCG's readiness for radiation monitoring and surveillance.

Data Analysis

Thematic analysis was conducted to extract common themes and patterns from the qualitative interview data after transcription and initial analysis. Codes and themes were processed using Dedoose®, a free web-based qualitative analytic software.

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Ethical Considerations

The researcher ensured that all research protocols involving ethics in research were complied with for the protection of all people and institutions involved in the conduct of the study.

RESULTS and DISCUSSION

1. How prepared is the PCG in the surveillance and monitoring of radioactivity in the Philippine maritime jurisdiction in terms of:
   1.1 Human resources

Figure 1
Distribution of Higher Educational Attainment of the Participants

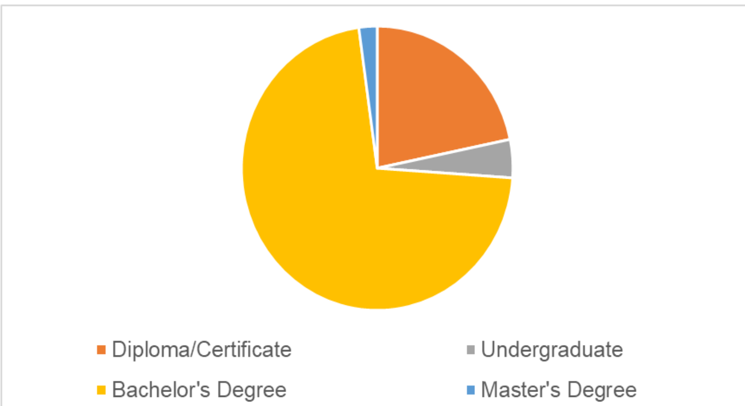

Figure 1 illustrates the educational background of the participants. Understanding their education levels is crucial for evaluating their qualifications and potential for performing specialized tasks within the organization.

The data shows that out of the total participants, 10 hold a Diploma/Certificate, 2 are undergraduates, 33 possess a Bachelor's Degree, and 1 holds a Master's Degree. This indicates a range of educational achievements among the participants.

The data reveals that the majority of participants (33) have completed a bachelor's degree, indicating a well-educated workforce. The presence of 10 individuals with Diplomas/Certificates suggests that a portion of the team has received technical or vocational training, which can be valuable for specific operational tasks. The single respondent with a Master's Degree points to a limited number of highly specialized or advanced academic qualifications within the group.

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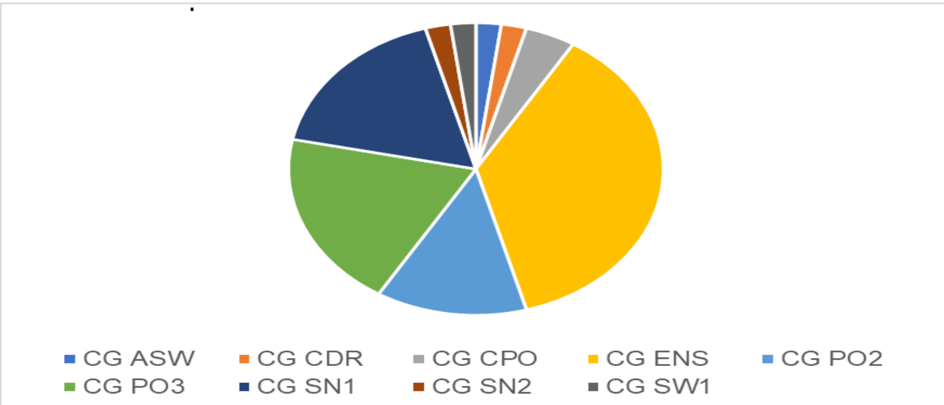
Figure 2 provides an overview of the ranks held by the participants. This information helps in understanding the hierarchical structure and distribution of responsibilities within the organization. The ranks are diverse, with 1 CG ASW, 1 CG CDR, 2 CG CPO, 17 CG ENS, 6 CG PO2, 9 CG PO3, 8 CG SN1, 1 CG SN2, and 1 CG SW1. This distribution highlights the range of positions from junior to mid-level roles within the organization.

Figure 2
Distribution of rank of the Participants.



The majority of participants are CG ENS (17) and CG PO3 (9), indicating a significant presence of personnel at the Ensign and Petty Officer Third Class levels. This suggests a workforce primarily composed of junior to mid-level officers who are likely involved in both operational and support roles. The smaller numbers in higher ranks such as CG ASW and CG CDR imply fewer high-ranking officers, which could indicate a more streamlined command structure.

Figure 3
Distribution of position/ designation of the Participants.

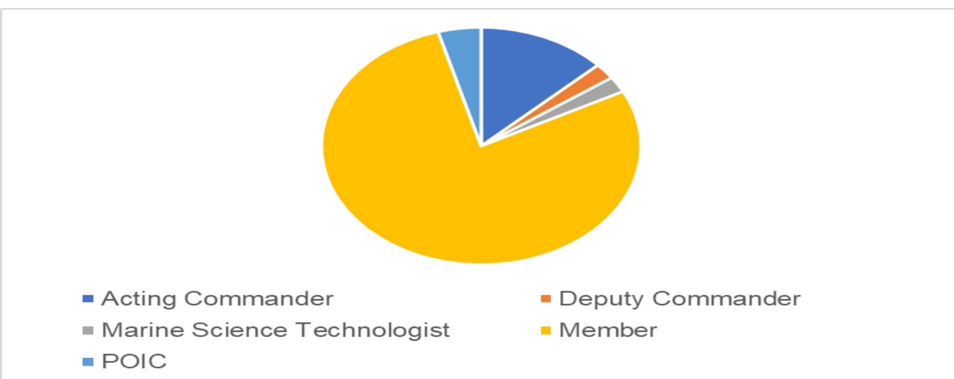


Figure 3 details the various positions or designations held by the participants, shedding light on the specific roles and responsibilities within the organization. The positions include 6 Acting Commanders, 1 Deputy Commander, 1 Marine Science Technologist, 36 Members, and 2 POICs. This distribution highlights the roles from leadership to specialized technical positions.

The majority of participants (36) are Members, indicating that most personnel are involved in regular operational roles. The presence of 6 Acting Commanders and 1 Deputy Commander suggests a small but essential leadership group overseeing operations. The Marine Science Technologist position indicates specialized roles that require specific technical expertise. The 2 POICs represent a small number of individuals responsible for oversight and management of specific operational areas.

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Figure 4
Distribution of tenure/ years in service of the Participants.

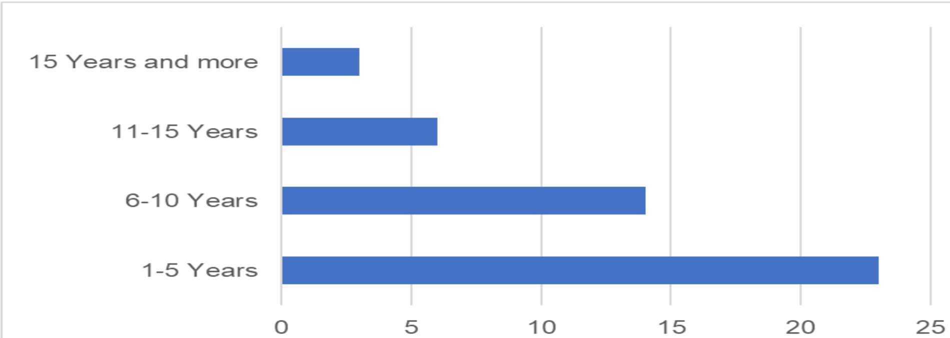

Figure 4 shows the participants' years of service, providing insight into their experience levels within the organization. The data indicates that 23 participants have 1-5 years of service, 14 have 6-10 years, 6 have 11-15 years, and none have more than 15 years of service.

The majority of participants (23) are relatively new, with 1-5 years of service, suggesting a youthful and potentially adaptable workforce. The 14 participants with 6-10 years of service indicate a substantial mid-level experience base, while the 6 participants with 11-15 years show that there is a smaller, more seasoned group within the organization. The absence of personnel with over 15 years of service may point to high turnover or a young organization.

Figure 5
Distribution of training status of participants in environmental monitoring and surveillance.

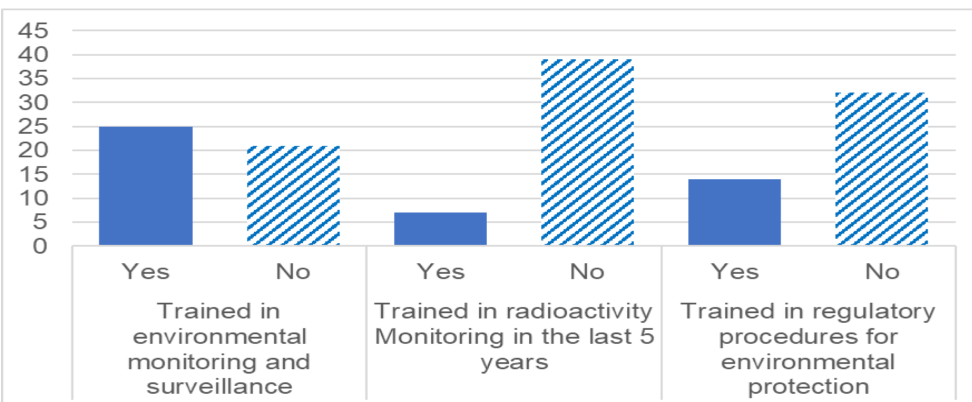

Figure 5 examines the training status of participants in environmental monitoring and surveillance, providing an understanding of their preparedness for specific environmental tasks. The data reveals that 25 participants have received training in environmental monitoring and surveillance, while 21 have not. Additionally, 7 participants have been trained in radioactivity monitoring in the last five years, and 39 have not. Furthermore, 14 participants have been trained in regulatory procedures for environmental protection, while 32 have not.

The majority of participants are not trained in radioactivity monitoring (39), indicating weak preparation in this critical area. However, the split in environmental monitoring and surveillance training (25 trained vs. 21 not trained) suggests a need for more comprehensive training programs. The lower number of participants trained in regulatory procedures (14) compared to those not trained (32) highlights a significant gap in regulatory knowledge, which could impact compliance and procedural adherence.

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Document analysis reports the training manuals and modules provided for capacity building in radiological/nuclear (RN) emergency response preparedness of the Philippine Coast Guard (PCG). The key documents reviewed include two comprehensive training courses designed and implemented by the USA Defense Threat Reduction Agency (DTRA) under the cooperative program on Weapons of Mass Destruction (WMD) Philippine Maritime Proliferation Prevention of the Philippine National Coast Watch System. Both courses were held in February 2019 and aimed to equip the PCG with the necessary skills and knowledge to handle RN emergencies effectively. The training manuals and modules analyzed offer a robust framework for building capacity in radiological/nuclear emergency response within the Philippine Coast Guard. The one-day CBRN course provides essential introductory knowledge and skills for entry-level Coast Guards, equipping them to perform their roles as competent WMD inspectors. The more intensive five-day WMD Inspectors Training course offers a comprehensive curriculum that covers both theoretical and practical aspects of RN emergency response, ensuring that inspectors are well-prepared to handle a wide range of scenarios.

The CBRN Course designed and implemented by the USA Defense Threat Reduction Agency is a one-day, in-person training program targeted at entry-level Coast Guards. The course focuses on radiation control and detection, emergency response, and prevention. It introduces the basic principles of radiological and nuclear safety, providing foundational knowledge essential for Coast Guards. Trainees acquire initial skills in radiation detection and control, crucial for their role in preventing the proliferation of weapons of mass destruction (WMDs).

In addition to imparting foundational knowledge, the CBRN course emphasizes emergency response preparedness. The training ensures that Coast Guards can act swiftly and efficiently in the event of a radiological or nuclear incident. By the end of the training, participants are expected to become competent inspectors capable of identifying and managing potential WMD threats. This competency-building aspect is central to the course, as it prepares participants for real-world scenarios.

The WMD Inspectors Training, also provided by the USA Defense Threat Reduction Agency, is a more intensive five-day course with 28 hours of classroom discussions and 12 hours of practical exercises. This course is designed for WMD inspectors and aims to ensure they master the procedures and equipment used in WMD inspections. The curriculum is comprehensive, with 13 out of 20 lessons specifically focused on radio nuclear awareness, technical fundamentals, detection, response, and management.

The course's detailed discussions on technical concepts significantly enhance the inspectors' ability to detect, respond to, and manage radiological/nuclear threats. Practical exercises included in the training ensure that inspectors can apply theoretical knowledge to real-world scenarios, increasing their effectiveness in the field. The course also covers routine and standard inspection procedures, promoting consistency and thoroughness in WMD inspections. Additionally, a case study on radionuclear interdictions provides practical insights into managing real-life RN interdiction scenarios, helping inspectors understand the complexities and nuances of such operations.

Since their implementation in February 2019, the CBRN Course and the WMD Inspectors Training by the USA Defense Threat Reduction Agency have only been offered once. Despite their critical importance in equipping Coast Guards and WMD inspectors with essential skills in radiation detection, control, and emergency response, these comprehensive training programs have not been repeated. This limited offering highlights a gap in ongoing training and continuous capacity building for radiological and nuclear emergency preparedness within the Philippine Coast Guard.

1.2. Physical resources and Logistics

The Philippine Coast Guard (PCG) has a limited yet critical inventory of physical resources and logistics to ensure radionuclear emergency response readiness. A key piece of equipment in their arsenal is the Polimaster Gamma-Neutron Personal Radiation Detector (PRD), specifically the PM1703GNA-II model. This active detector is equipped with a high-sensitive scintillator capable of measuring personal dose rates up to 300 µSv/h. The PRD provides continuous monitoring and ensures high-performance detection in various scenarios. It offers users peace of mind by alerting them through visual, audible, and vibration alarms when preset radiation thresholds are exceeded, thereby enhancing personal safety during radiation exposure events.

Another essential device in the PCG's inventory is the RadSeeker CS Smith Detection radioisotope identifier device. This next-generation portable and handheld system excels in identifying and locating sources of suspicious substances, even in shielded or concealed conditions. The RadSeeker displays detection results in real-time on a high-contrast OLED colour display, ensuring clear visibility of data with a screen resolution of 428px x 272px. The device also features high-sensitivity detection alarms for both gamma and neutron radiation, providing audio, visual,

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earphone, vibrator, and discrete ultra-bright LED alarm indications, with adjustable audio alarm thresholds. This versatility and precision make the RadSeeker an invaluable tool for accurate radiation detection and identification.

These critical pieces of equipment were provided to the PCG during the 2019 Weapons of Mass Destruction (WMD) Inspectors Training. This training was a collaborative effort between the USA Defense Threat Reduction Agency and the Philippine National Coast Watch System. The provision of these devices underscores the importance of equipping the PCG with state-of-the-art technology to enhance their capability to detect, respond to, and manage radio-nuclear threats effectively. These resources are fundamental to maintaining a high level of readiness and operational efficiency in the face of potential radiological or nuclear incidents.

Despite the advanced capabilities of the Polimaster PRD and RadSeeker, the infrequency of training sessions and the limited inventory pose significant challenges to the PCG's overall preparedness. Continuous training and an expanded inventory are essential to ensuring that the PCG can effectively utilize these resources and respond swiftly to any radiological or nuclear emergency. Therefore, it is crucial to address these gaps to bolster the PCG's capacity for sustained readiness and robust emergency response in the face of evolving radio-nuclear threats.

Figure 6
Polimaster Personal Radiation Detector PM1703GNA; (R) RadSeeker CS Smith Detection radioisotope identifier

2. What are the current initiatives in the surveillance and monitoring of radioactivity in terms of:

2.1. Policies

Insufficient and Inadequate Training Programs and Expertise Driven by the available PCG Policies

Participants consistently highlighted the inadequacy and novice status of current personnel, underscoring a pervasive lack of expertise. This deficiency is compounded by the absence of a robust, established training program within the PCG, with training efforts largely outsourced to external agencies such as the DOE and PNRI. Moreover, past training initiatives have not been sustained or regularly updated, leading to a stagnation in skills development. The analysis indicates a critical need for comprehensive, in-house capacity-building initiatives to equip PCG personnel with the necessary knowledge and practical skills. Addressing these issues through structured training programs and continuous professional development is essential for enhancing the PCG's operational readiness and effectiveness in radioactivity surveillance and monitoring. Most personnel lack adequate training, with some describing their expertise as "novice" or non-existent. Training that has been provided is primarily at an awareness and operational level, with only a few individuals receiving more specialized instruction.

Lack of Comprehensive and Sustained Capacity-Building Effort Driven by the available PCG Policies.

The ongoing capacity-building initiatives aimed at enhancing the skills and knowledge of Philippine Coast Guard (PCG) staff in radioactivity monitoring highlights several significant challenges and gaps. The primary issues identified include a lack of budget, inadequate prioritization, and an absence of long-term or continuous training programs. Several participants pointed out that there are no established policies or regulations mandating the development of capabilities in responding to radioactive materials or Weapons of Mass Destruction (WMD), resulting in this area not being a priority. Additionally, there are logistical challenges such as insufficient funding, political will, and a clear implementation plan. While there are proposals for establishing a Chemical, Biological, Radiological, and Nuclear (CBRN) Unit and procuring relevant equipment, these efforts have not been fully realized.

The need for updating and refreshing training, especially for new personnel, was also mentioned, underscoring the critical gap in ongoing capacity-building efforts. To address these challenges, a structured and well-

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funded long-term plan, backed by strong leadership commitment and clear policies, is essential to ensure the continuous development of PCG personnel's skills and knowledge in radioactivity monitoring.

Inadequate and Insufficient Equipment for Radioactivity Surveillance Driven by the available PCG Policies.

The equipment and technology currently in use for radioactivity surveillance within the Philippine Coast Guard (PCG) reveals a significant disparity and inadequacy in available resources. The majority of participants indicated that the PCG primarily relies on Personal Radiation Detectors (PRDs) and, to a lesser extent, Radio Isotope Identifier Devices. While some mention the presence of protective equipment such as HAZMAT suits, it is evident that the overall procurement and availability of specialized equipment are severely lacking. Several participants explicitly stated that there is no established equipment for comprehensive radioactivity surveillance, highlighting an urgent need for substantial investment in technology and resources. The absence of subunits equipped with the necessary tools further underscores the critical gaps in the PCG's capability to effectively monitor and respond to radioactive threats. This analysis points to a pressing requirement for a systematic approach to equip the PCG with advanced, reliable technology and equipment to enhance their operational readiness and effectiveness in managing radioactivity surveillance.

2.2. Strategies

Need for Establishment and Regular Review of Strategic Framework for Radioactivity Surveillance.

A unanimous recognition of its absence and a strong consensus on the need for its establishment. Most of the participants explicitly stated that there is currently no strategic framework in place. They emphasized the importance of developing such a framework to guide and enhance the PCG's capabilities. They have pointed out the necessity of having a comprehensive contingency plan and legal mandates to bolster the country's readiness against threats like Weapons of Mass Destruction (WMD). There is also a suggestion for collaboration with other government agencies such as the Department of Science and Technology (DOST) and the Philippine Nuclear Research Institute (PNRI) to establish this framework. Overall, the responses highlight a critical gap in policy and strategic planning that needs to be addressed to ensure the PCG is adequately prepared for radioactivity surveillance and monitoring. In terms of reviewing and updating strategies for radioactivity surveillance to align with international standards indicate that there are currently no established policies or strategies in place.

Limited and Fragmented Networking and Partnerships for Radiological Preparedness

The existence of an established networking and collaborations framework for the PCG in determining prospect institutions for radioactivity surveillance and monitoring indicate a minimal presence of formal frameworks. National Coast Watch System (NCWS) through the National Maritime Center (NM Center) as a potential model for determining these prospect institutions. This suggests that while there might be some foundational structures in place, such as the NCWS, there is no explicit, well-established framework dedicated specifically to radioactivity surveillance and monitoring collaborations. The lack of additional detailed responses highlights a gap in structured networking and collaboration efforts in this specific area, suggesting a need for the development of a more robust and dedicated framework.

Joint initiatives or partnerships aimed at strengthening the overall network for radiological preparedness reveal limited engagement in such activities. AJD recalls the establishment of the NCW Center (now NM Center) with funding from the Defense Threat Reduction Agency (DTRA) as part of efforts to enhance the country's Maritime Domain Awareness and its Weapons of Mass Destruction Proliferation Prevention Program (WMD-PPP). This indicates a significant, albeit historical, partnership aimed at improving radiological preparedness. While B mentions individual training through a partnership with the Japan International Cooperation Agency (JICA). The overall responses highlight sporadic and limited joint initiatives, indicating the need for more comprehensive and ongoing partnerships to enhance the PCG's radiological preparedness.

3. What are the challenges in the surveillance and monitoring of radioactivity in terms of:

3.1 Policies

The consistent message from the participants is that the PCG has not yet developed a policy to guide its radioactivity monitoring activities, and therefore, there are no existing strategies to review or update. This lack of an established framework suggests that the PCG is not in alignment with international standards and best practices,

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highlighting an area that requires immediate attention. Establishing a policy and regular review process is essential for the PCG to stay current with global standards and ensure effective radioactivity surveillance and response capabilities. The feedback underscores the necessity for initiating policy development and setting up a system for continuous evaluation and improvement.

3.2 Strategies

There is a heavy reliance on international training opportunities, which highlights a gap in domestic training infrastructure. Some participants pointed out that the PCG lacks comprehensive training programs and established policies or regulations mandating the development of capabilities in responding to radioactive incidents or Weapons of Mass Destruction (WMD). This lack of prioritization reflects a broader issue within the organization, where the importance of specialized training is not fully recognized or implemented. Furthermore, there are logistical challenges, such as improper turnover of trained personnel and insufficient follow-up on initial training efforts. To address these deficiencies, the PCG must develop and implement a thorough, in-house training program that is continuously updated and mandated by clear policies to ensure all personnel are adequately prepared to handle radioactivity surveillance and monitoring.

The majority of participants indicated that there is either a complete lack of equipment or outdated technology that has not been updated or maintained since 2020. Key issues include the absence of an established unit responsible for handling radioactivity monitoring, which results in budget allocations being directed elsewhere. Existing equipment, such as personal radiation detectors and radio isotope identifier devices, are mentioned but are not effectively utilized due to a lack of trained personnel. Furthermore, some equipment is under the custody of other entities, such as MSIF, with no clear status updates post-deployment. The responses reveal a significant deficiency in both the availability of appropriate technology and the capacity to effectively use and maintain the equipment necessary for comprehensive radioactivity surveillance and monitoring within the PCG.

4. Based on the findings, what can be recommended to ensure the readiness of the Philippine Coast Guard in the surveillance and monitoring of radioactivity in the Philippine maritime jurisdiction?

The Philippine Coast Guard (PCG) is tasked with surveillance and monitoring of radioactivity within the Philippine maritime jurisdiction. A review of their preparedness reveals several key points. In terms of human resources, the PCG presents a varied educational background among its participants, with the majority holding a Bachelor's Degree, indicating a well-educated workforce. However, there is a notable lack of personnel with advanced academic qualifications and specialized training in radioactivity monitoring, suggesting a need for more targeted training programs. The PCG's organizational structure is represented by a diverse range of ranks, with a significant number of junior to mid-level officers. This suggests a workforce primarily involved in operational and support roles, with fewer high-ranking officers. The distribution of positions within the PCG reveals a focus on regular operational roles, with a smaller number of personnel in leadership and specialized technical positions. This indicates a potential need for enhanced leadership and technical expertise development.

Regarding experience, the PCG's workforce is relatively new, with the majority having 1-5 years of service, indicating a youthful and potentially adaptable workforce. However, the absence of personnel with over 15 years of service may suggest high turnover or a young organization. The PCG's training status in environmental monitoring and surveillance shows a concerning gap, with a significant number of personnel not trained in radioactivity monitoring and regulatory procedures, which could impact their ability to comply with and adhere to necessary protocols. The PCG has received training through comprehensive courses provided by the USA Defense Threat Reduction Agency, which include a one-day CBRN course and a five-day WMD Inspectors Training course. These courses aim to equip the PCG with the necessary skills and knowledge to handle RN emergencies effectively. However, these training programs have only been offered once, highlighting a significant gap in ongoing training and continuous capacity building.

The PCG's inventory of physical resources includes the Polimaster Gamma-Neutron Personal Radiation Detector and the RadSeeker CS Smith Detection radioisotope identifier device. Despite the advanced capabilities of these devices, the infrequency of training sessions and limited inventory pose challenges to the PCG's overall preparedness. In terms of policies and strategies, the PCG lacks a strategic framework for radioactivity surveillance, and there are no established policies or regular review processes. This indicates a need for the development of a comprehensive contingency plan and legal mandates to bolster the country's readiness against threats like Weapons

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of Mass Destruction (WMD). The PCG faces challenges in networking and partnerships for radiological preparedness, with limited engagement in joint initiatives and a lack of a well-established framework for collaborations. This suggests the need for more structured and ongoing partnerships to enhance radiological preparedness.

While the PCG has received some critical training and equipment to handle radioactivity surveillance and monitoring, there are significant gaps in personnel expertise, training programs, equipment availability, and strategic planning. Addressing these gaps is essential for enhancing the PCG's operational readiness and effectiveness in managing radioactivity surveillance and monitoring within the Philippine maritime jurisdiction.

To ensure the readiness of the Philippine Coast Guard (PCG) in the surveillance and monitoring of radioactivity within the Philippine maritime jurisdiction, several key recommendations are proposed. Firstly, enhancing training and expertise is essential. Developing comprehensive, in-house training programs that are regularly updated to keep pace with evolving threats and technologies is crucial. Providing specialized training in radioactivity monitoring and regulatory procedures to all relevant personnel will ensure a skilled and knowledgeable workforce. Additionally, establishing a system for continuous professional development will maintain and enhance the expertise of PCG personnel.

Strengthening policy and strategic planning is necessary for effective radioactivity surveillance. Creating a strategic framework that includes a comprehensive contingency plan and legal mandates will guide the PCG's activities. Regularly reviewing and updating policies and strategies to align with international standards and best practices will ensure the PCG remains current and effective. Expanding equipment and technology is also vital. Investing in advanced, reliable technology and equipment will provide the PCG with the necessary tools to monitor and respond to radioactive threats effectively. Establishing a dedicated unit responsible for handling radioactivity monitoring will ensure proper budget allocation and equipment maintenance.

Fostering networking and partnerships and addressing logistical challenges are critical components. Developing a robust framework for networking and collaboration with other government agencies, international organizations, and industry experts will facilitate the sharing of knowledge, resources, and best practices. Engaging in joint initiatives and partnerships will strengthen the overall network for radiological preparedness. Improving the turnover and follow-up processes for trained personnel will ensure that skills and knowledge are effectively transferred and utilized within the organization. Securing adequate funding and political support will help overcome logistical challenges and implement long-term capacity-building efforts. Implementing a review and evaluation system to regularly assess the PCG's readiness and effectiveness will help identify areas for improvement and measure the impact of implemented strategies.

Summary

The Philippine Coast Guard (PCG) workforce mostly holds Bachelor's degrees, but lacks specialized training in radioactivity monitoring and regulatory procedures. While the PCG has received some training from the USA Defense Threat Reduction Agency, it has only been offered once. The PCG has limited yet critical equipment, including the Polimaster Gamma-Neutron Personal Radiation Detector and the RadSeeker CS Smith Detection radioisotope identifier device. However, more equipment and effective training on their use and maintenance are urgently needed. The PCG currently lacks a strategic framework for radioactivity surveillance and there is no comprehensive policy to guide radioactivity monitoring activities in alignment with international standards.

In addition, the PCG needs to improve networking and partnerships. Currently, it has limited engagement in joint initiatives and partnerships for radiological preparedness. More structured and ongoing partnerships are necessary to enhance radiological preparedness and ensure a collaborative approach to managing radiological threats.

To enhance training and expertise, it is crucial to develop comprehensive, in-house training programs that are regularly updated to reflect the latest advancements and methodologies. Strengthening policy and strategic planning involves creating a strategic framework that includes a comprehensive contingency plan and legal mandates to guide operations. Expanding equipment and technology requires investing in advanced tools and establishing a dedicated unit for radioactivity monitoring to ensure effective and timely responses. Fostering networking and partnerships is essential, and can be achieved by developing a robust framework for collaboration with other agencies and international organizations to share knowledge and resources. Addressing logistical challenges, such as securing adequate funding and political support, is necessary for implementing long-term capacity-building efforts. Lastly, implementing a review and evaluation system to regularly assess the PCG's readiness and effectiveness in managing radioactivity surveillance and monitoring is imperative for continuous improvement and adaptation to emerging threats.

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Conclusion

The Philippine Coast Guard (PCG) is tasked with the critical responsibility of monitoring radioactivity within the Philippine maritime jurisdiction. The analysis of the PCG's preparedness for this role reveals a mixed picture. On the one hand, the PCG boasts a workforce with a solid educational foundation, predominantly composed of individuals with Bachelor's Degrees, indicating a well-educated team. On the other hand, there are significant gaps in specialized training, particularly in radioactivity monitoring and regulatory procedures, which are essential for effective environmental protection and compliance.

The PCG's inventory of physical resources and logistics, while limited, includes advanced equipment such as personal radiation detectors and radioisotope identifier devices. However, the effectiveness of this equipment is undermined by a lack of comprehensive training and a limited number of trained personnel. This situation is exacerbated by the absence of a dedicated unit to focus on radioactivity monitoring, which could lead to inadequate maintenance and proper utilization of the equipment.

In terms of policies and strategies, the PCG lacks a strategic framework to guide its activities in radioactivity surveillance. The absence of regularly reviewed and updated policies means that the PCG's approach to this critical area does not align with international standards and best practices. This gap in strategic planning could hinder the PCG's ability to respond effectively to radiological threats.

The PCG's efforts in networking and partnerships for radiological preparedness are also found to be limited. While there have been some collaborative initiatives with other government agencies and international organizations, these appear to be sporadic and not part of a structured, ongoing engagement. This limitation could impede the PCG's ability to leverage external expertise and resources to enhance its capabilities.

Recommendations

Based on the findings and implications outlined in the study, several recommendations are proposed to enhance the preparedness and effectiveness of the Philippine Coast Guard (PCG) in radiologic surveillance and monitoring. These recommendations aim to bridge the gap between theoretical readiness and practical application, ensuring comprehensive and sustained capacity-building initiatives.

1. Develop Comprehensive Training Programs

Implement robust, continuous in-house training programs that are regularly updated. Focus on advanced and specialized training in radiologic surveillance and emergency response.

2. Enhance Policy Implementation

Strengthen the strategic policies supporting radiologic monitoring and surveillance. Ensure policies are clearly communicated and consistently enforced across all levels of the PCG.

3. Address Logistical Challenges

Secure adequate funding to support long-term training and development programs. Foster political will and commitment to sustain these initiatives. Implement proper personnel turnover procedures to maintain continuity in trained staff.

4. Establish a Dedicated CBRN Unit

Create a specialized Chemical, Biological, Radiological, and Nuclear (CBRN) Unit within the PCG. Equip this unit with the necessary tools and resources to effectively manage radiologic threats.

5. Foster International Partnerships

Strengthen collaborations with key organizations such as the Philippine Nuclear Research Institute Nuclear Regulatory Division (PNRI NRD) and the International Atomic Energy Agency (IAEA). Engage with Southeast Asian countries to share best practices and enhance regional cooperation.

6. Regular Evaluation and Feedback

Conduct regular assessments of training programs and policy implementation to identify areas for improvement. Solicit feedback from PCG personnel to ensure training programs meet their needs and address any emerging challenges

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