

Assessment of knowledge, skills, attitudes, and practices on radioactive waste management among local stakeholders in the Philippines

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ABSTRACT

The Philippines has been generating radioactive waste for almost seven decades. The management of these wastes has been consistently and carefully undertaken by experts to ensure the protection of human health and the environment. Although established, these processes remain little known beyond technical practitioners. Hence, this study assessed the knowledge, skills, attitudes, and practices related to radioactive waste management among local stakeholders in the Philippines. A quantitative descriptive research design was employed to guide the investigation. Using purposive sampling, data were gathered from 222 respondents through a survey questionnaire. The findings revealed generally favorable outcomes in the knowledge, skills, attitudes, and practices of the respondents regarding radioactive waste management. However, several foundational aspects, such as definition, categories, regulations, and responsible agencies, were unfamiliar to some respondents. Moreover, related skills, attitudes, and practices concerning emergency and contact procedures, and the handling, storage, and disposal of radioactive waste require clarification and further upskilling. Also, a significant proportion of the respondents had not yet undergone training (90%) or encountered media campaigns (82%) on radioactive waste management, suggesting the need to further strengthen the knowledge, skills, attitude, and practices of the stakeholders despite the overall positive outcomes. Many respondents expressed their willingness to learn more (95%) and support community awareness and educational efforts on radioactive waste management (94%). These results are significant for developing an evidence-based communication plan that can

foster meaningful conversations and dialogues among local stakeholders of radioactive waste management.

INTRODUCTION

Radioactive waste management is significant in ensuring the sustained application of nuclear science and technology. Nuclear technologies are extensively utilized not only in energy production but also in medicine, industry, research, and agriculture (IAEA n.d.a). Notably, radioactive materials are used for medical treatment and diagnosis, disinfection and sterilization of industrial equipment and tools, identification of material properties, laboratory research, and even in enhancing crop yields (IAEA 2023). Hence, the generation of radioactive waste as a by-product of these applications is inevitable. At present, nearly all countries have been generating radioactive waste (IAEA n.d.b). The need for responsible management of radioactive waste is then crucial. As the international nuclear cooperating agency, the International Atomic Energy Agency (IAEA) has been making efforts to ensure effective and efficient management of radioactive waste around the world. Member states of the IAEA continuously implement solutions shared among each other, aiming to optimize their progress and activities. These collective knowledge-sharing efforts are reflected in the international Code of Conduct and IAEA Safety Standards Series, which have long supported Member States in advancing radioactive waste management programmes (IAEA 2022). Furthermore, nuclear technology users acknowledge the importance of responsible waste management for society and adopt practices that align with the Sustainable Development Goals (IAEA 2023).

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Radioactive waste management, radioactive waste, stakeholder engagement, communication, KSAP

The main objective of radioactive waste management is to control and account for radioactive waste generated to protect both humans and the environment. This is achieved through the concentration and containment of waste and eventual isolation from the environment. The concept also underscores its intergenerational dimension, emphasizing that management must meet the present needs without compromising the ability of future generations to meet theirs (IAEA 2023). The systemized processing of the technical and engineered management of waste follows: (a) pre-treatment, (b) treatment, (c) conditioning, (d) storage, (e) retrieval, and (f) disposal, where, for some countries without a final disposal site, the process temporarily ends in storage (ONR, Environment Agency, SEPA, and NRW 2015).

As the use of nuclear technologies gains recognition and becomes more prevalent, more countries, including the Philippines, are advancing their waste management efforts. The Philippines has been generating radioactive waste primarily from non-power applications, including medical, industrial, agricultural, and research activities, for almost seven decades already. These wastes are managed and stored at the Radioactive Waste Management Facility (RWMF), the country's centralized waste management facility, located at the Philippine Nuclear Research Institute (PNRI) in Quezon City. Current management activities emphasize predisposal management, conditioning, and secure storage of radioactive waste. The development of the country's radioactive waste management facility has been strengthened through sustained cooperation with the IAEA, collaborations with other national government agencies (NGAs), and the pursuit of significant radioactive waste management projects. The operations of the facility also adhere to the PNRI Regulations and align with the IAEA's international safety principles (Lim et al., 2026a). The Code of PNRI Regulations Part 28, particularly, provides the licensing requirements for predisposal management of radioactive waste facilities and activities, covering radioactive waste management activities prior to disposal.

While radioactive waste management is evidently practiced in the Philippines under the supervision of PNRI-RWMF, further development is necessary for the long-term management of radioactive waste. Developing a disposal facility is among the future efforts that the institution envisioned for the long-term management of radioactive waste in the country (Lim et al. 2026a). The initiative is supported by the recently enacted Republic Act No. 12305 or the Philippine National Nuclear Energy Safety Act, in which radioactive waste management oversight, principles, national policy and strategy, and disposal plans were properly addressed.

The planning and implementation are complex as various factors must be considered, such as research, siting, geological investigation, technology selection, safety studies, systemizing processes, and construction. While available scientific and technological solutions exist, there remains stakeholder involvement that shapes the decisions and the feasibility of advancing radioactive waste management in countries. According to the IAEA, social and political acceptance is as important as science and engineering required for safe management solutions (Lim et al. 2026a). Moreover, interested parties and the public are both crucial stakeholders who must be involved in planning and developing disposal sites. The IAEA mentioned that acceptance among stakeholders is one of the reasons that slows down progress in the efforts. Gaining mutual trust and support is necessary in the process (IAEA 2023).

At present, most available studies on the social and stakeholders' perspectives on radioactive waste management are largely concentrated in North American and European countries. Hietala

and Geysmans (2022) reviewed 275 articles focusing on the social aspect of radioactive waste management (RWM). The study revealed that there has been a divide between the social and technical aspects of RWM in the past two decades. The nuclear industry, including radioactive waste management processes, has traditionally relied on a top-down, technocratic governance approach in decision-making in countries such as the UK, Germany, Belgium, and the US (Augustine 2018; Simmons and Bickerstaff n.d.). But strong public and political protests against radioactive waste management projects challenged this practice, prompting a shift from the traditional top-down approach toward a bottom-up governance approach. This new orientation introduced public involvement and stakeholder participation in the decision-making process, which have since become increasingly popular in radioactive waste management initiatives (Bergmans et al. 2015).

In terms of communication efforts, countries such as the UK, France, Japan, Russia, Belgium, and Spain have already been engaging children and youth on radioactive waste management by producing tailored communications materials and utilizing appropriate content and channels. These initiatives seek to promote intergenerational equity by equipping younger demographics with knowledge necessary for logical and critical decision-making on radioactive waste management. (NEA, 2021).

Despite ongoing initiatives, communication and engagement remain difficult and multifaceted challenges within the industry. Previous studies revealed that risk perceptions and the acceptance of radioactive waste management are shaped by different factors, including socio-demographic factors such as gender, income bracket, educational attainment, and location. Studies indicate that women, lower income groups, and non-white respondents tend to perceive higher risks and show lower acceptance of waste facilities (Jenkins-Smith et al. 2011; Seidl et al. 2013; Hietala and Geysmans 2022). Likewise, authorities in communities without pre-existing nuclear facilities report higher risk perceptions and low acceptance (Gallardo, Matsuzaki, and Aoki 2014; Kim and Kim 2014; Hietala and Geysmans 2022). Although groups outside these demographics generally exhibit lower risk perceptions and greater acceptance, further investigation remains essential.

Meanwhile, the study by Trontl et al. (2020) investigated public opinion, the legal framework, policy, and expert involvement in radioactive waste management in Croatia. The study showed that there is a poor information-sharing process in the country. The study also revealed that the public has a low level of knowledge about radioactive waste management and its status in the country. The study then recommended that other countries explore similar studies to avoid similar mistakes.

On the other hand, the study of Geysmans, Turcanu, and Eeckhout (2025) also investigated youth engagement in radioactive waste management in Belgium. The study highlights the significance of youth involvement given the extensive timeframe of radioactive waste management, underscoring their vital roles in ensuring sustainability in the future. It identified the perceptions and awareness of the youth regarding RWM, revealing that those without prior engagement expressed negative perceptions of radioactive waste, while those with engagement placed less emphasis on it. Significantly, youth without existing engagement demonstrated limited knowledge and awareness of RWM, indicating the need for more targeted information and education. This finding suggests that strengthening youth engagement early on is essential to bridging knowledge gaps and fostering long-term acceptance and participation in the process.

Lastly, both studies on stakeholders' dialogue on waste management in the Czech Republic and Spain (Yokoyama et al.

2023) and stakeholders' needs on nuclear waste disposal in the UK (Pemberton 2024) acknowledge secondary resources as a basis of understanding the respective social research landscape and recommend further exploration of primary data.

In the Philippines, studies on radioactive waste management remain limited and have primarily focused on technical aspects. Recto, Inocencio, and Lobo (2023) examined the feasibility of radioactive waste disposal in the country by assessing factors such as waste classification, management options, and disposal strategies. Their study outlined a roadmap for developing a disposal site, which includes: (1) technical requirement, (2) site selection, (3) financial capability, (4) regulatory requirements, and (5) disposal operations. Moreover, the study concluded that the effective course of action for establishing geological disposal sites would be through the administration of the Philippine government, particularly the DOST-PNRI and legislative body, with technical support from international agencies.

On the other hand, the study of Lim et al. (2026b) projected the annual amounts of radioactive waste for each classification once a ~1200 MWe light-water reactor (LWR) is deployed in the country. The projections serve as a reference for infrastructure planning, regulatory readiness, and long-term waste management, particularly in designing storage, treatment and conditioning, transport, and disposal systems. Ultimately, these projections aim to safeguard public and environment health and support developing effective policies and regulations and sustainable funding mechanisms. While these studies advance the introduction of radioactive waste management concepts in the Philippines, the lack of empirical data establishing the social dimensions of RWM, particularly stakeholder engagement and communication, is viewed as critical in this study. Such data can not only enrich the global understanding of the social landscape of radioactive waste management but, more importantly, serve as essential baseline data for future RWM initiatives in the country.

This study specifically aims to assess the existing knowledge, skills, attitudes, and practices (KSAP) of radioactive waste management (RWM) stakeholders in the Philippines. This framework originally emerged to measure family planning and population studies, later extending to health, environment, and risk communication studies (FAO, n.d.). Applying this framework in communication and behavioral studies is essential for planning, implementing, and evaluating advocacy, communication, and social mobilization (ACSM) activities, with the goal of fostering sustainable and behavioral change among selected stakeholders (WHO, 2008).

In the study of Manalo et al. (2024), the KSAP framework was vital in evaluating the needs and gaps among local stakeholders regarding their current engagement in ecotourism, ecotourism entrepreneurship, and environmental conservation in Iloilo. The study found that while the stakeholders demonstrate favorable technical skills in ecotourism and a positive attitude towards sustainable ecotourism, their knowledge of environmental conversation principles and their practical engagement in ecotourism activities remained at a moderate level. The researchers therefore recommended stronger institutional support and the development of a policy framework to promote sustainable ecotourism in the municipality. Additionally, the study suggested the implementation of participatory community extension programs to help translate their knowledge into effective sustainable actions on ecotourism.

Similarly, the KSAP framework was integrated in a study to assess the effectiveness of a training series on biodiversity and

environmental conservation being conducted among teachers in Mindoro. The study found a significant difference in the skills of the trained participating teachers compared to those of the untrained participants and non-participating teachers, highlighting the importance of providing different communication and teaching strategies and methods for training. Further, the study also revealed that the teachers' training has resulted in a positive impact on students' knowledge, attitude, and practices on the topic. The study then supported sustaining the training, while integrating monitoring and evaluation strategies in the process (Cielo et al. 2022). The KSAP framework has also been used in other fields of study, such as disaster risk management, waste management, agriculture, and health, indicating its wide acceptance as a framework for investigating learning gaps of various stakeholders (Apocay 2026; Paigalan et al. 2025; Cacao et al. 2024; Red et al, 2021).

Given the existing studies on stakeholders' engagement regarding RWM, which have highlighted limited knowledge and awareness, high risks perceptions, and low acceptance as among the common social concerns, this research emphasizes the importance of assessing the KSAP of stakeholders to contextualize the identified factors in the Philippine context. The framework provides a comprehensive understanding of stakeholder readiness and capacity to participate in RWM programs by identifying knowledge gaps, cultural beliefs, existing competencies, or behavioral patterns. In addition, understanding the socio-demographic profiles and media consumption habits of stakeholders is considered significant, as these variables provide deeper insights into behavioral and communication influences KSAP outcomes (Figure 1).

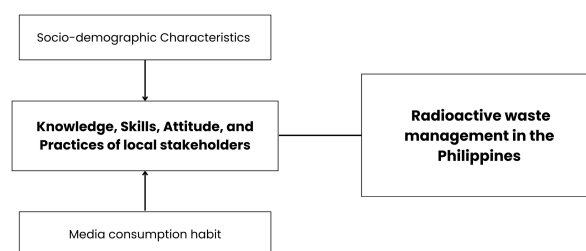


Figure 1: Conceptual Framework of the Study

The study particularly focuses on university students, teachers, academic staff, and local government (LGU) representatives from selected areas of the country. University students, especially those in science, technology, engineering, and mathematics (STEM), represent the younger demographics of society. They play a crucial intergenerational role in sustaining practices, introducing RWM innovations, and making long-term decisions, given the long timeframe of RWM planning, development, and operation (Geysmans, Turcanu, and Eeckhout 2025). They also potentially practice and demonstrate skills necessary for responsible handling of radioactive materials and managing radioactive waste. Meanwhile, both the academic faculty/staff and LGUs directly affect the lives of the students and community they govern. For academic faculty and staff, they are capable of holding certain authority and control within the university policies. They also have the capacity to influence their students' knowledge and behaviors on RWM. On the other hand, LGUs' ability to regulate land use, enforce local laws, and ensure the safety and health of their residents mean that they must be managed closely and actively engaged in any decisions regarding radioactive waste. Their role makes them essential stakeholders in the management of radioactive waste (Figure 2).

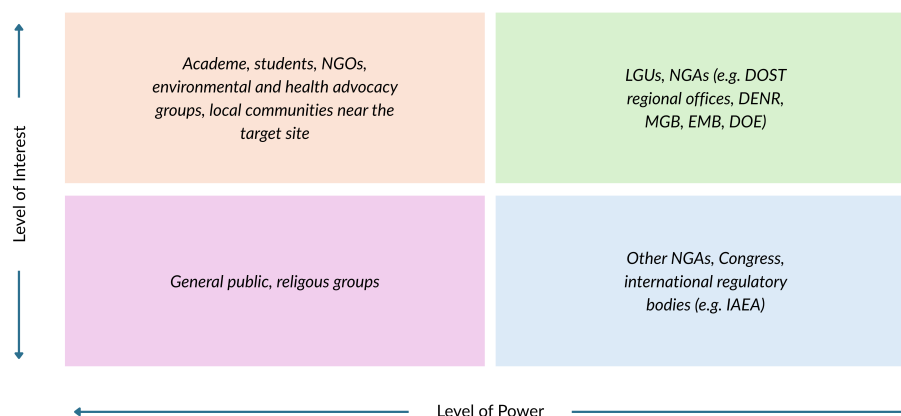


Figure 2: Stakeholder map of radioactive waste management in the country.

This study is significant in identifying the particular stakeholders' learning needs and communication gaps concerning the basic principles of radioactive waste management. Significantly, the result of the study can serve as a reference for developing an evidence-based and responsive communication plan that will foster an authentic participatory approach among stakeholders of radioactive waste management in the country. This will then contribute to the improvement of policies and regulations on radioactive waste management, guide the planning of RWM strategies and development, and strengthen social acceptance of RWM initiatives in the country.

RESEARCH DESIGN AND METHODS

Research Design

This quantitative study employed a descriptive, cross-sectional research design, analyzing data collected within a defined period from the target respondents (Wang and Cheng 2020). The research design offered valuable preliminary insights that described the significant variables of the study, such as the socio-demographic, media consumption habits, knowledge, skills, attitude, and practices of the stakeholders.

Variables of the Study

The study examined the socio-demographic characteristics and media consumption habits of Filipino respondents in relation to their knowledge, skills, attitudes, and practices (KSAP) regarding radioactive waste management. These variables were measured using a structured survey questionnaire and were operationalized as follows:

- A. Socio-demographic characteristics refer to the personal and household attributes of the respondents that may influence their knowledge, skills, attitudes, and practices regarding radioactive waste management. The variables collected include age, gender, highest educational attainment, occupation, household monthly income, place of residence (urban or rural), marital status, and household size.
 - a. Age was measured as a continuous variable and recorded in completed years.
 - b. Gender was measured as a categorical variable with response options of male, female, prefer to self-describe, and prefer not to disclose.
 - c. Highest educational attainment was measured as a categorical variable representing the

respondent's highest level of completed education.

- d. Occupation was measured based on the respondent's current employment status or primary occupation.
- e. Place of residence was categorized as urban or rural based on the respondent's self-reported location.
- f. Training experience on radioactive waste management was measured dichotomously (Yes or No).
- g. Language or medium of instruction preference for the communication materials was inferred from the frequency with which each language appeared, as no explicit choices were provided.

- B. Media consumption habits refer to the respondents' patterns of accessing, utilizing, and engaging with various media sources for information, particularly on environmental issues and radioactive waste management. This variable was measured using nine indicators that capture media accessibility, usage patterns, information preferences, and levels of engagement with media content.

- a. Media access was measured as a nominal variable by asking respondents to indicate which media devices or platforms they have access to (e.g., cellphone/smartphone, tablet, radio, television, computer/laptop, and newspaper).
- b. Frequency of media consumption was measured using a four-point ordinal scale (1 = Never, 2 = Rarely, 3 = Weekly, and 4 = Daily) across four information sources: television, radio, internet/social media, and newspapers.
- c. Duration of media consumption was measured using four time categories (Less than 1 hour, 1–2 hours, 3–4 hours, and More than 4 hours) for each media source.
- d. Trust in media sources for information on the basic principles of radioactive waste management was measured using a four-point ordinal scale (1 = None, 2 = Low, 3 = Moderate, and 4 = High) across television, radio, internet/social media, and newspapers.
- e. Primary source of information on environmental issues was measured as a nominal variable in which respondents selected their main source of information.
- f. Internet accessibility was measured by identifying the type of internet access available

- to respondents (e.g., home broadband, mobile data, public Wi-Fi, free data, or no access).
- g. Engagement with media content related to environmental issues was measured using a five-point ordinal scale ranging from Never to Always.
 - h. Exposure to media campaigns on the basic principles of radioactive waste management was measured dichotomously (Yes or No), with respondents who answered "Yes" asked to specify the source of the media campaign.
 - i. Preferred media format for learning about the basic principles of radioactive waste management was measured as a nominal variable with response options including video, audio, text-based materials, and interactive content.
- C. Knowledge on radioactive waste management refers to the respondents' understanding of the fundamental concepts, hazards, safety measures, and regulatory aspects of radioactive waste management. This variable was measured using two dimensions: factual knowledge and self-perceived knowledge.
- a. Factual knowledge was assessed through ten (10) True-or-False statements covering the definition, sources, health and environmental impacts, disposal practices, safety requirements, and international guidelines related to radioactive waste management. Each correct response was assigned a score of one (1), while incorrect responses received a score of zero (0). Total scores ranged from 0 to 10, with higher scores indicating greater factual knowledge of radioactive waste management.
 - b. Self-perceived knowledge was measured using four (4) statements assessing respondents' awareness of the hazards of radioactive waste, their ability to differentiate types of radioactive waste, and their familiarity with relevant government regulations and responsible agencies in the Philippines. Responses were measured using a five-point Likert scale ranging from 1 = Strongly Disagree to 5 = Strongly Agree. Higher scores indicate higher levels of perceived knowledge and familiarity with radioactive waste management principles and regulations.
- D. Skills related to radioactive waste management refer to the respondents' self-perceived abilities and competencies in recognizing, understanding, and appropriately responding to situations involving radioactive waste management. This variable encompasses respondents' familiarity with emergency procedures, proper disposal practices, safety measures, relevant regulations, and their readiness to support and engage in activities that promote safe radioactive waste management. The variable was measured using ten (10) statements rated on a five-point Likert scale ranging from 1 = Strongly Disagree to 5 = Strongly Agree. The items assessed respondents' perceived competencies in identifying appropriate actions during radioactive contamination incidents, reporting improper disposal practices, following proper disposal procedures, understanding the potential hazards and sources of radioactive waste, recognizing applicable safety guidelines, and expressing willingness to learn more about and support educational initiatives related to radioactive waste management. Higher scores indicate greater perceived skills and competencies related to radioactive waste management.
- E. Attitudes toward radioactive waste management refer to the respondents' beliefs, perceptions, and dispositions regarding the importance of safe radioactive waste management practices, government policies and initiatives, and community engagement in promoting environmental and public safety. This variable reflects the extent to which respondents value and support efforts related to the proper management and disposal of radioactive waste. The variable was measured using nine (9) statements rated on a five-point Likert scale ranging from 1 = Strongly Disagree to 5 = Strongly Agree. The items assessed respondents' attitudes toward environmental protection, willingness to learn about safe disposal practices, support for stricter government regulations and educational initiatives, confidence in following safety protocols, perceptions regarding barriers to proper radioactive waste management, and support for community awareness programs. Higher scores indicate more favorable attitudes toward radioactive waste management and greater support for policies and practices that promote its safe and responsible implementation.
- F. Practices related to radioactive waste management refer to the respondents' self-reported behaviors and participation in activities that promote safe handling, disposal, and management of radioactive waste. These practices encompass adherence to established safety protocols, participation in educational activities, and engagement in actions that contribute to public awareness and environmental protection. The variable was measured using seven (7) statements rated on a five-point frequency scale ranging from 1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Often, and 5 = Always. The items assessed respondents' practices concerning the proper labeling, storage, handling, and disposal of radioactive materials, the use of protective equipment, reporting improper disposal practices, participation in training or seminars related to radioactive waste management, and efforts to educate others about its safe management. Higher scores indicate greater engagement in practices that support the safe and responsible management of radioactive waste.

Research Instrument design

To gather the necessary data from these respondents, a face-to-face Knowledge, Skills, Attitudes, and Practices (KSAP) survey was employed among the participants through survey questionnaires. Survey questionnaires are used to gather statistical information about the characteristics, attitudes, and practices of a sample or population using standardized questions (Preston 2009). For this study, a total of six (6) sections were utilized for the questionnaires. The sections include socio-demographic profiles, media consumption habits, knowledge about basic facts, knowledge awareness level, attitude, and practices. The questionnaire was provided to the respondents in English, as this is the primary medium of instruction in education in the country (Santos et al. 2022).

The research questionnaires employed in the study were developed by the researchers. Its content was referenced from the handout entitled "*Basic principles of radioactive waste management*," which was jointly published by international regulatory authorities, including the Office for Nuclear Regulation (ONR), the Environment Agency, the Scottish Environment Protection Agency (SEPA), and Natural Resources Wales (NRW). The handout serves as a foundational guide

covering the following key areas: (a) definition of radioactive waste, (b) management of radioactive waste, (c) stakeholders involved in radioactive waste management, (d) roles and responsibilities of these stakeholders, and (e) regulatory approaches governing radioactive waste management. Hence, the document provides essential information that any user must understand regarding radioactive waste management.

Ensuring the validity of the questionnaire, the researchers administered a content review among experts in radioactive waste management. This filtered the information in the survey, confirming that the contents are credible. Further, the survey questionnaire also underwent pretesting to ensure clarity and ease of understanding, thereby enabling respondents to answer the questionnaire effectively.

Locale and Respondents of the Study

Respondents of the study were science, technology, engineering, and mathematics (STEM) students, and teachers, academic staff, and local government representatives who participated in the nuclear science and technology awareness forum conducted under the Project StRAW: Strategies for Radioactive Waste Management in the country, specifically at: (a) Palawan State University (PSU) at Puerto Princesa City, (b) Siquijor State College (SSC) at Siquijor, and (c) Western Mindanao State University (WMSU) at Zamboanga City. Sites were selected for being provincial capitals near the proposed nuclear facility sites and for having recent power crisis experiences. Participants were selected from the high-interest categories of the radioactive waste management stakeholder map (Figure 2). Invitation letters were sent to the university, local government units, and the respective regional offices of national government agencies in advance.

Sampling, Data Collection, and Data Analysis Procedure

The study utilized purposive sampling to gather a sufficient number of respondents for this research. Purposive sampling is a type of non-probability sampling method that entails the intentional selection of participants based on predetermined criteria or characteristics that are relevant to the study (Memon et al. 2024). For this study, the established criteria included the following: (a) being a university student, faculty, academic staff and LGU employee from the Philippines; (b) affiliated with a STEM-related degree program or industry; and (c) having attended the Nuclear Science and Technology Forum. Voluntary participation was also solicited when gathering data from the stakeholders.

The selection of this sampling method is positioned as providing exploratory baseline data rather than nationally representative findings. This approach also allows for efficient use of resources by targeting respondents who meet the criteria of study, particularly given that radioactive waste management is a specialized topic.

The data collection occurred on October 8, 2024 (PSU), March 25, 2025 (WMSU), and May 27, 2025 (SSC). In total, 222 individuals responded to the survey. The collected data were then analyzed using descriptive statistics to identify patterns and characterize the study landscape (Loeb et al. 2017). Moreover, mode, as the measure of central tendency, was used to analyze each section of the questionnaire and identify the score that occurred most often in the dataset (Laerd Statistics n.d.).

Ethical Consideration

In view of ethical considerations, several procedures were applied by the researchers to this study. This survey was conducted through a forum-dependent setup; hence, the conduct

was properly coordinated with the school administrations and local government representatives through letters seeking permission to conduct the survey. The request to conduct the activities was later approved and was essential to the proper administration of the survey with the respondents. In terms of the survey, a consent statement can be found at the preface of the questionnaire. The consent statement indicated that participation in the survey was voluntary and that completing the survey signified approval to the use of the data provided. Moreover, in accordance with Republic Act No. 10173, or the Data Privacy Act of 2012, the information collected was handled confidentially, and survey responses were anonymized to protect respondents. The respondents were also given the right to access, correct, and delete their personal data at any time. Essentially, researchers’ contact details were provided for any further questions or concerns from the survey respondents.

RESULTS AND DISCUSSION

Demographics Profile

This study collected a total of 222 survey respondents, as shown in Table 1. The majority were aged 18-24, comprising 174 individuals, or approximately 78% of the total respondents. The remaining respondents were distributed as follows: 38 (17%) were aged 25-34, 6 (3%) were aged 35-44, and 4 (2%) were aged 45 and above. The data revealed a clear concentration of responses among younger demographics, particularly those under 35 years old. This trend can be attributed to the fact that surveys took place in university settings.

Table 1: Socio-demographic profile of the respondents

Characteristics	Category	Frequency N=222	Percentage (%)
Age groups	18-24 years old	174	78.38
	25-34 years old	38	17.12
	35-44 years old	6	2.70
	45-54 years old	3	1.35
	55-64 years old	1	0.45
Gender	Male	92	41.44
	Female	117	52.70
	Prefer not so to say	13	5.86
Educational Background	No formal education	2	0.90
	Elementary graduate	0	0
	Highschool graduate	15	6.76
	Vocational/Technical graduate	0	0
	College undergraduate	157	70.72
	College graduate	30	13.51
	Postgraduate	18	8.11
Occupation	Student	172	77.48
	Government Employee (academic faculty and staff and LGU representatives)	36	16.22
	Others	14	6.31
Place of residence	Urban	115	51.80
	Rural	61	27.48
	Semi-urban	46	20.72
Radioactive waste management training experience	Trained participants	21	9.46
	Untrained participants	201	90.54
Media campaign exposure	Exposed	40	18.02
	Not exposed	182	81.98

In terms of occupational affiliation, the majority of respondents were students (77%), followed by government employees

(16%), primarily faculty and staff members and LGU representatives. The remaining 7% comprised stakeholders from other sectors who expressed interest in the study. This occupational breakdown further supports the age distribution, as the predominance of students naturally corresponds with the younger demographic observed, highlighting the youth-centered nature of the respondents.

Accordingly, it is also noteworthy that the majority, 157 individuals or approximately 71%, were identified as college undergraduates. This was followed by college graduates, who accounted for 30 respondents (14%), and postgraduate degree holders, comprising 18 respondents (8%). The remaining respondents comprised 15 high school graduates and 2 individuals with no formal education. Overall, these data reflect a group of participants with a strong academic profile.

In terms of gender distribution, a slight majority identified as female, comprising 117 individuals (53% of the total), while male respondents followed closely with 92 (41% of the total). The remaining 13 individuals (6%) decided not to disclose their gender. The data show a relatively balanced gender representation. Further, this data reflects an awareness of and sensitivity toward gender diversity.

Moreover, the largest proportion of respondents reside in urban areas, comprising 115 individuals (52% of the total). In contrast, 61 respondents (27%) live in rural areas, while those in semi-urban areas comprise the smallest group, with 46 respondents (21%).

Regarding training experience in radioactive waste management, only 21 individuals (9%) reported having received such training, while the majority, 201 individuals (91%), have not yet undergone any training in this area. Similarly, when asked whether they had encountered any such media campaigns on radioactive waste management, 182 individuals (approximately 82% of respondents) answered “No,” while only 40 (18%) answered “Yes” or indicated exposure to such campaigns. These data highlight a significant gap in awareness

of the fundamental principles of radioactive waste management. The limited number of trained individuals in this field suggests deficiencies in the safe handling and disposal of radioactive waste, raising concerns about human and environmental health. Further, the lack of exposure to media campaigns related to radioactive waste management highlights the limited reach of current outreach and education efforts on this topic.

Media Consumption Habits
Media accessibility, frequency of consumption, and level of trust

The data revealed that almost all surveyed individuals (220 out of 222) have access to cellphones and smartphones, making these the most widely accessible media. Additionally, a large proportion of respondents (162) also reported having access to a computer/laptop. These results indicate a clear dominance of digital technology in respondents’ daily lives. These also reflect the growing accessibility and widespread presence of digital technologies for educational, professional, and personal purposes in contemporary society (Parveen and Ramzan 2024; Wang et al. 2024; Sandblad 2023). Notably, more than half of the respondents (127) also have access to television, suggesting that it remains a relevant medium among the respondents.

In terms of frequency of usage and time spent daily across the four main communication channels – television, radio, internet/social media, and newspapers, Table 2 shows that the majority of respondents overwhelmingly relied on internet and social media, with nearly all (215 out of 222 or 97%) of the respondents consuming information from this source daily. Most of the respondents (168 or 76%) are also spending more than four (4) hours daily using the said source (Table 3). This highlights the significant role of digital platforms in everyday activities, particularly for accessing news, updates, and entertainment (Garzon 2025; Zhang 2023). In contrast, traditional media sources such as Television, Radio, and Newspapers are consumed far less frequently and less than an hour daily by most respondents (Tables 2 and 3).

Table 2: Frequency of use across the four main communication channels

ASPECT	SCALE		
	CATEGORY	F (n=222)	%
1. Television	Daily	49	22
	Weekly	39	18
	Rarely	110	49
	Never	24	11
	TOTAL	222	100%
2. Radio	Daily	17	8
	Weekly	12	5
	Rarely	109	49
	Never	84	38
	TOTAL	222	100%
3. Internet/Social Media	Daily	215	97
	Weekly	4	1
	Rarely	2	1
	Never	1	1
	TOTAL	222	100%
4. Newspapers	Daily	4	2
	Weekly	9	4

	Rarely Never	116 93	52 42
	TOTAL	222	100%

Table 3: Time spent daily across the four main communication channels

ASPECT	SCALE		
	CATEGORY	F (n=222)	%
1. Television	Less than 1 hour	146	66
	1-2 hours	59	26
	3-4 hours	8	4
	More than 4 hours	9	4
	TOTAL	222	100%
2. Radio	Less than 1 hour	203	91
	1-2 hours	9	4
	3-4 hours	6	3
	More than 4 hours	4	2
	TOTAL	222	100%
3. Internet/Social Media	Less than 1 hour	3	1
	1-2 hours	10	5
	3-4 hours	41	18
	More than 4 hours	168	76
	TOTAL	222	100%
4. Newspapers	Less than 1 hour	213	96
	1-2 hours	8	3
	3-4 hours	1	1
	More than 4 hours	0	0
	TOTAL	222	100%

While traditional media is less frequently consumed, the respondents still recognize the credibility of these sources compared to the internet and social media. Most of the respondents have a moderate to high level of trust in Television,

Radio, and Newspaper as sources of accurate information on the basic principles of radioactive waste management (Table 4).

Table 4: Level of trust in media communication channels

ASPECT	SCALE		
	CATEGORY	F (n=222)	%
1. Television	High	76	34
	Moderate	110	50
	Low	27	12
	None	9	4
	TOTAL	222	100%
2. Radio	High	34	15
	Moderate	124	56
	Low	41	19
	None	23	10
	TOTAL	222	100%
3. Internet/Social Media	High	28	13
	Moderate	130	58
	Low	62	28
	None	2	1
	TOTAL	222	100%
4. Newspapers	High	67	30
	Moderate	101	45

	Low None	28 26	13 12
	TOTAL	222	100%

Information sources and media engagement on environmental issues

Another important aspect examined in the study was the respondents' information-seeking behavior of the respondents regarding environmental issues. A large proportion of the respondents, 214 or 96%, identified internet/social media as their primary source of information about environmental issues, despite the moderate level of trust in this source. This is consistent with respondents' identification of the internet/social media as the most frequently used communication channels. Television ranked second with 63 respondents (20%), while other traditional media, such as newspapers and radio, were each selected by less than 5% of respondents. This suggests that traditional media are relatively less utilized for environmental communication. Other information sources identified by some respondents include interpersonal and institutional communication (friends, school, barangay, workplace, and seminar) and printed/digital materials (books and journals/articles). On the other hand, in terms of the frequency of engagement, results show that respondents often (41%) to always (32%) engage themselves with media content related to environmental issues (Table 5). Hence, a discussion of the relevance of radioactive waste management may pique respondents' interest.

Table 5: Information sources and media engagement on environmental issues

Indicators	Category	Frequency	Percentage (%)
Primary information sources on environmental issues	Television	61	27
	Radio	8	4
	Internet/Social media	214	96
	Newspapers	11	5
Frequency of media content engagement related to environmental issue	Others	9	4
	Always	72	32
	Often	91	41
	Sometimes	48	22
	Rarely	8	4
	Never	3	1

Language and media format preferences

Survey results also revealed the significance of English as the preferred medium of instruction for most respondents (164 or 74%). Given the demographic profile of the respondents, the result is expected, as the language is widely used in professional and university settings (Santos et al. 2022). Meanwhile, a

portion of the respondents (25%) have also expressed their interest in Filipino and Tagalog as means of communication. A combination of both languages has also appeared to be relevant, indicating a preference for bilingual formats, commonly observed in informal and semi-formal communication across the Philippines (GPI n.d.). Local dialects in the country, such as Bisaya, Cebuano, Chavacano, Tausug, and Ibanag, also appeared to be relevant to some respondents, reflecting their diverse linguistic backgrounds.

Meanwhile, in terms of the preferred medium format for learning about radioactive waste management, interests were divided among the options. Video formats (TV, vlog, audiovisual plug) emerged as the most preferred format among respondents (37%), followed by interactive contents (webinars and online courses) (33%), and visual formats (24%). This result suggests that mixed media is an effective strategy for facilitating communication on radioactive waste management. Effective mixed media among respondents should consider audio-visual storytelling and an interactive approach (Table 6).

Table 6: Media format preferences

Media formats	Frequency	Percentage (%)
Video (TV, vlog, audiovisual plugs)		
Audio (radio, podcast)	135	61
Visual (articles, newspapers, online vlogs, infographics)	20	9
	89	40
Interactive content (webinar, online courses)	122	55

*Percentages reflect the total format selections, since respondents could select multiple formats.

Knowledge, skills, attitudes, and practices on radioactive waste management

The results of the Knowledge, Skills, Attitudes, and Practices (KSAP) survey revealed favorable outcomes, reflecting high knowledge, positive attitudes, and favorable self-assessed skills in basic principles of radioactive waste management, while self-assessed practices may still be improved. There are also salient findings in each aspect that need further focus. Table 7 summarizes stakeholders' knowledge, skills, attitudes, and practices. The results for each section are discussed below.

Table 7: Summary of stakeholders' knowledge, skills, attitudes, and practices

ASPECT	SCALE		
	CATEGORY	Frequency	%
1. Knowledge	High	195	88
	Moderate	26	12
	Low	1	0
	TOTAL	222	100%
2. Level of awareness	High	534	60
	Moderate	246	28
	Low	108	12
	TOTAL*	888	100%

3.	Skills	High	1638	74
		Moderate	376	17
		Low	206	9
		TOTAL*	2220	100%
4.	Attitude	Favorable	1795	90
		Ambivalent	148	7
		Unfavorable	55	3
		TOTAL*	1998	100%
5.	Practices	Consistent	861	56
		Occasional	346	22
		Infrequent	346	22
		TOTAL*	1553	100%

*Reflects percentage/frequency of responses—not respondents

Knowledge assessment about basic radioactive waste management

Overall, 88% of the respondents demonstrated a high level of knowledge regarding basic radioactive waste management, as shown in Table 7. More specifically, Table 8 presents a detailed assessment of the respondents' knowledge level.

Table 8: Knowledge assessment of basic facts on radioactive waste management.

	Statement	Correct Answer	% of respondents who got the correct answer	% of respondents who got the wrong answer
1	Radioactive waste is any material that contains radioactive substances and is no longer useful.	TRUE	55% (121)	45% (101)
2	Only nuclear power plants produce radioactive waste.	FALSE	90% (200)	10% (22)
3	Exposure to high levels of radioactive waste can be harmful to human health.	TRUE	95% (212)	5% (10)
4	Radioactive waste can be safely disposed of by dumping it into regular landfills.	FALSE	85% (188)	15% (34)
5	There are international guidelines and regulations for handling and disposing of radioactive waste.	TRUE	95% (211)	5% (11)
6	Protective equipment is not necessary when handling radioactive materials.	FALSE	94% (208)	6% (14)
7	Long-term storage and containment are necessary for certain types of radioactive waste.	TRUE	93% (207)	7% (15)
8	Improper disposal of radioactive waste can lead to environmental contamination.	TRUE	97% (215)	3% (7)
9	Public awareness and education about radioactive waste management are important for safety.	TRUE	99% (219)	1% (3)
10	Radioactive wastes can be recycled.	TRUE	69% (154)	31% (68)

For the fundamental definition of radioactive waste, more than half of the respondents (55%) have correctly identified it as any material containing radioactive substances that has no further

use. While this is favorable, there remains the fact that 45% of respondents misidentified the definition, suggesting the need for further reinforcement and introduction of the concept to improve respondents' understanding.

In terms of the generation of radioactive waste, the majority (90%) correctly rejected the statement that only nuclear power plants produce radioactive waste, implying that they are aware of radioactive waste generation in other sectors such as medical, industrial, and research fields.

The respondents also demonstrated a high level of knowledge regarding health and safety concerns, with 95% acknowledging that exposure to high levels of radioactive waste can harm human health. Similarly, 94% recognized that protective equipment is necessary when handling radioactive materials, 93% understood the importance of long-term storage and containment for certain types of radioactive waste, and 85% recognized that radioactive waste should not be disposed of in regular landfills.

Moreover, a large proportion of respondents (97%) understood that improper disposal of radioactive waste can lead to environmental contamination, while nearly all (99%) recognized the importance of public awareness and education on radioactive waste management for ensuring public safety. Most respondents (95%) were also aware of the international guidelines and regulations for radioactive waste management, demonstrating strong awareness of governance and regulatory frameworks.

Lastly, regarding the recyclability of radioactive waste, while 69% of respondents were aware that certain types of radioactive waste can be recycled, the remaining 31% still need to be informed about this matter. This indicates the necessity of further improving discussions on waste treatment options.

Level of awareness regarding radioactive waste management

This subsection analyzed the level of awareness of the respondents in the following: (a) potential hazards of radioactive waste, (b) different categories of radioactive waste, (c) government regulations regarding radioactive waste disposal in the Philippines, and (d) agencies responsible for monitoring radioactive waste disposal. Overall, while more than half of the respondents (60%) expressed a high-level understanding of

these topics, 40% still expressed a moderate-to-low level of awareness (Table 7).

A closer look at the survey results (Table 9) revealed that most respondents have a high level of awareness of the potential hazards posed by radioactive waste. A combined total of 87% of respondents affirmed their awareness, with 42% strongly agreeing and 45% agreeing with the statement. The remaining 13%, however, exhibited a moderate to low level of awareness about the hazards posed by radioactive waste, indicating that some individuals still need to be better informed.

Table 9: Level of awareness of respondents regarding radioactive waste management

Statement	Frequency N=222	Percentage (%)
I am aware of the potential hazards of radioactive waste.	94	42.34
Strongly agree	99	44.59
Agree	18	8.11
Neutral	2	0.90
Disagree	9	4.05
Strong disagree		
I can differentiate between high-level and low-level radioactive waste.		
Strongly agree	37	16.67
Agree	86	38.74
Neutral	64	28.83
Disagree	26	11.71
Strong disagree	9	4.05
I am familiar with government regulations regarding radioactive waste disposal in the Philippines.		
Strongly agree		
Agree	23	10.36
Neutral	63	28.38
Disagree	101	45.50
Strong disagree	24	10.81
I know which agencies are responsible for monitoring radioactive waste disposal.	11	4.95
Strongly agree		
Agree	46	20.72
Neutral	86	38.74
Disagree	63	28.38
Strong disagree	16	7.21
	11	4.95

Meanwhile, survey results indicate that a slight majority of the respondents (55%) can differentiate between high-level and low-level radioactive waste, while 29% were neutral, and the remaining 16% lacked the ability to do so. These findings reflect a varying level of awareness among respondents. Although the majority demonstrated high knowledge, it remains critical to

highlight the technical knowledge gap among the remaining respondents.

Similarly, in terms of respondents' knowledge of the responsible agencies for monitoring radioactive waste disposal, a slight majority (59%) either strongly agreed or agreed that they are aware of these agencies. However, a considerable proportion (41%) remained neutral or expressed a lack of awareness. On the other hand, a significantly low level of familiarity with government regulations regarding radioactive waste disposal was revealed in the survey results. Only 10% of respondents strongly agreed, and 28% agreed that they are familiar with these regulations. Notably, the largest portion of respondents (46%) expressed a neutral stance, while approximately 16% indicated unfamiliarity. These findings further highlight existing knowledge and information gaps in discussions on radioactive waste management. Consequently, this recognizes the need to effectively inform and educate the public through appropriate strategies, as government regulations and monitoring agencies are not only essential to the structure of radioactive waste management processes but also critical to ensuring safety and addressing public health concerns in the country.

Skills of respondents regarding radioactive waste management

The findings revealed that most respondents (74%) expressed a high level of confidence in their ability to demonstrate radioactive waste management skills. This suggests that many respondents perceived themselves as capable of understanding or following basic radioactive waste management-related procedures. However, since most respondents were not formally trained radioactive waste workers, these results should be interpreted as self-assessed confidence rather than demonstrated operational competence.

A salient finding in this section is that respondents demonstrated a high level of confidence in understanding or following procedures related to proper handling and disposal, adherence to safety measures, and the basic principles of radioactive waste management (Table 10, Statements 3-8). However, despite this overall confidence, only 43% of respondents believe that they are highly familiar with the contact procedures in case of radioactive contamination. Likewise, only 26% of respondents expressed a high level of confidence in their ability to demonstrate emergency procedures in the event of radioactive contamination. Hence, training on contact and emergency procedures in the event of radioactive waste contamination should be considered to further enhance respondents' skill sets.

Table 10: Self-assessed skills of respondents regarding radioactive waste management

Statement	SCALE		
	CATEGORY	F (n=222)	%
1. I am familiar with emergency procedures in case of radioactive contamination.	High	57	25.68
	Moderate	105	47.30
	Low	60	27.03
2. I know whom to contact if I encounter or suspect improper disposal of radioactive waste.	High	96	43.24
	Moderate	75	33.78
	Low	51	22.97
3. I can follow proper disposal procedures for radioactive waste	High	154	69.37
	Moderate	47	21.17

	Low	21	9.46
	High	189	85.14
4. I have basic understanding of what radioactive waste is.	Moderate	20	9.01
	Low	13	5.86
5. I know that improper disposal of radioactive waste can be harmful to health and the environment.	High	191	86.04
	Moderate	21	9.46
	Low	10	4.50
6. I understand the importance of using protective measures when dealing with hazardous waste.	High	193	86.94
	Moderate	18	8.11
	Low	11	4.95
7. I am aware of the different sources of radioactive waste, such as medical and industrial activities.	High	173	77.93
	Moderate	35	15.77
	Low	14	6.31
8. I know that there are specific rules and guidelines for handling radioactive waste.	High	187	84.23
	Moderate	25	11.26
	Low	10	4.50
9. I am interested in learning more about proper radioactive waste management practices.	High	197	88.74
	Moderate	17	7.66
	Low	8	3.60
10. I would support initiatives to educate communities about radioactive waste and its safe disposal.	High	201	90.54
	Moderate	13	5.86
	Low	8	3.60

Attitudes toward radioactive waste management

Generally, the respondents demonstrated a broadly positive and proactive attitudes regarding radioactive waste management, with 90% of their responses to attitudinal statements indicating a favorable perception. Particularly, the respondents have favorable attitude to the following: (a) proper radioactive waste management is essential for environmental protection (95%), (b) government should impose stricter regulations on radioactive

waste disposal (94%), (c) support initiatives aimed at improving radioactive waste management in the Philippines is essential (93%), (d) lack of knowledge is a major barrier to proper radioactive waste management (93%), (e) access to proper disposal facilities is insufficient in my area (93%), and (f) there is a need for more government initiatives (84%) (Table 11).

Table 11: Attitudes of respondents towards radioactive waste management

Statement	SCALE		
	CATEGORY	F (n=222)	%
1. I believe that proper radioactive waste management is essential for environmental protection.	Favorable	210	94.59
	Ambivalent	6	2.70
	Unfavorable	6	2.70
2. I am willing to learn more about safe radioactive waste disposal practices.	Favorable	211	95.05
	Ambivalent	6	2.70
	Unfavorable	5	2.25
3. I think the government should impose stricter regulations on radioactive waste disposal.	Favorable	208	93.69
	Ambivalent	9	4.05
	Unfavorable	5	2.25
4. I feel confident in my ability to follow safety protocols in handling radioactive materials.	Favorable	164	73.87
	Ambivalent	48	21.62
	Unfavorable	10	4.50
5. I support initiatives aimed at improving radioactive waste management in the Philippines.	Favorable	206	92.79
	Ambivalent	11	4.95
	Unfavorable	5	2.25
6. I believe that lack of knowledge is a major barrier to proper radioactive waste management.	Favorable	206	92.79
	Ambivalent	11	4.95
	Unfavorable	5	2.25
7. I think that access to proper disposal facilities is insufficient in my area.	Favorable	207	93.24
	Ambivalent	9	4.05
	Unfavorable	6	2.70
8. I feel that there is a need for more government initiatives on radioactive waste education.	Favorable	187	84.23
	Ambivalent	25	11.26
	Unfavorable	10	4.50

9.	I support community awareness programs on the risks and management of radioactive waste.	Favorable	209	94.14
		Ambivalent	8	3.60
		Unfavorable	5	2.25

Notably, nearly all (95%) expressed their willingness to learn more about safe radioactive waste disposal practices. Additionally, the respondents expressed a favorable attitude (94%) on supporting community awareness programs and educational efforts on the risks and management of radioactive waste. This finding is particularly significant, as it suggests a favorable attitude toward addressing the identified gaps in their procedural skills. Also, this means that the respondents acknowledge the importance of radioactive waste management and are supportive of ideas aimed at improving management in their community and the country.

The only concern identified in respondents' attitudes concerns their confidence in their ability to follow safety protocols. There

are still a few respondents (26%) who are ambivalent or unfavorable towards this matter.

Practices of respondents regarding radioactive waste

With regard to essential practices in radioactive waste management, more than half of the respondents (56%) reported regular adherence or willingness to adhere to such practices, although these responses should be interpreted with caution because many respondents may not routinely handle radioactive materials or radioactive waste.

Further, findings indicate that several practice-related areas still require attention, particularly the following: (a) proper labeling and storing of radioactive materials (43%), (b) following proper protocols in handling and disposing of radioactive waste (54%), and (c) reporting any improper handling or disposal of radioactive waste (53%) (Table 12).

Table 12: Self-assessed practices of respondents regarding radioactive waste management

Statement	SCALE		
	CATEGORY	F (n=222)	%
1. I properly label and store radioactive materials according to safety guidelines.	Consistent	95	42.79
	Occasional	65	29.28
	Infrequent	62	27.93
2. I follow proper protocols in handling and disposing of radioactive waste.	Consistent	120	54.05
	Occasional	59	26.58
	Infrequent	43	19.37
3. I ensure that radioactive waste is disposed of only in designated facilities.	Consistent	131	59.28
	Occasional	46	20.81
	Infrequent	44	19.91
4. I use protective equipment when handling radioactive materials.	Consistent	142	63.96
	Occasional	36	16.22
	Infrequent	44	19.82
5. I report any improper handling or disposal or radioactive waste that I observe.	Consistent	117	52.70
	Occasional	46	20.72
	Infrequent	59	26.58
6. I participate in training or seminars about radioactive waste management when available.	Consistent	124	55.86
	Occasional	48	21.62
	Infrequent	50	22.52
7. I take measures to educate others about the importance of proper radioactive waste management	Consistent	132	59.46
	Occasional	46	20.72
	Infrequent	44	19.82

In spite of this, the proportion of respondents who reported consistently participating in training or seminars about radioactive waste management (56%) and those who educate others about the importance of proper radioactive waste management (59%) reflects a positive outlook and suggests the

potential for a more inclusive dialogue on radioactive waste management within the country.

KSAP Outcomes Across Respondent Sectors

To provide more insightful data that can guide future communication initiatives on radioactive waste management (RWM), this section presents the KSAP results for the two dominant respondent groups based on their

occupation/affiliation: university students and government employees (faculty, staff, and LGU representatives).

Knowledge, skills, attitudes, and practices of university students

The KSAP survey results among university students indicated generally favorable outcomes across most variables.

Respondents demonstrate high levels of knowledge (88%), positive attitudes (90%), and favorable self-assessed skills (73%) in the basic principles of radioactive waste management. However, areas requiring improvement were observed in awareness (62%) and self-assessed practices (57%) (Table 13).

Table 13: Summary of university students' knowledge, skills, attitudes, and practices

ASPECT	SCALE		
	CATEGORY	Frequency	%
1. Knowledge	High	152	88
	Moderate	20	12
	Low	0	0
	TOTAL	172	100%
2. Level of awareness	High	425	62
	Moderate	192	28
	Low	71	10
	TOTAL*	688	100%
3. Skills	High	1263	73
	Moderate	304	18
	Low	153	9
	TOTAL*	1720	100%
4. Attitude	Favorable	1391	90
	Ambivalent	112	7
	Unfavorable	45	3
	TOTAL*	1548	100%
5. Practices	Consistent	686	57
	Occasional	294	25
	Infrequent	223	18
	TOTAL*	1203	100%

*Reflects percentage/frequency of responses—not respondents

Despite the strong knowledge scores, a notable gap remains. 47% of students incorrectly identified radioactive waste as materials containing radioactive substances that are no longer useful, highlighting the need to clarify fundamental concepts of RWM. Similarly, classifications, regulations, and responsible agencies require further clarification.

In terms of self-assessed skills, only 25% of respondents expressed confidence in performing emergency procedures related to radioactive waste, and just 45% reported knowing whom to contact in cases of improper disposal. The ambivalence reflected in self-assessed practices underscores the importance of introducing and strengthening basic management practices for radioactive waste among students. Despite these identified gaps, the survey results show that students consistently demonstrate openness across all attitude indicators, suggesting a strong willingness to learn and engage with communication and

educational initiatives on radioactive waste management (RWM). Although this group may not be considered immediate stakeholders in RWM operations, their openness highlights the strategic value of strengthening their knowledge base and exposing them to relevant skills and practices.

Knowledge, skills, attitudes, and practices of university faculty and staff and LGU representatives

Similar to the KSAP survey results among university students, this sector also demonstrated generally favorable outcomes across the measured variables with a high level of knowledge (86%), positive attitudes (90%), and self-assessed skills (75%). Their awareness (56%) and self-assessed practices (55%) regarding RWM were also notably lower. This suggests that this group also requires attention for learning about the topic (Table 14).

Table 14: Summary of university faculty staff and LGU representatives' knowledge, skills, attitudes, and practices

ASPECT	SCALE
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	CATEGORY	Frequency	%
1. Knowledge	High	31	86
	Moderate	4	11
	Low	1	3
	TOTAL	36	100%
2. Level of awareness	High	81	56
	Moderate	33	23
	Low	30	21
	TOTAL*	144	100%
3. Skills	High	269	75
	Moderate	47	13
	Low	44	22
	TOTAL*	360	100%
4. Attitude	Favorable	290	90
	Ambivalent	25	7
	Unfavorable	9	3
	TOTAL*	324	100%
5. Practices	Consistent	138	55
	Occasional	31	12
	Infrequent	83	33
	TOTAL*	252	100%

*Reflects percentage/frequency of responses—not respondents

Particularly, areas of learning that require further clarification for this group include the classification of radioactive waste and the regulations governing its management. As individuals holding higher roles within their respective institutions, the need for additional training is also evident, especially since their self-assessed practices show weaker demonstration compared to the university students' group. Strengthening their practices will not only enhance their own competencies but also reinforce their broader influence over policies and decision-making on the safe and effective management of radioactive waste.

Implications for stakeholder engagement and communication

Overall, the results suggest that these stakeholders possess a favorable starting point for engagement on radioactive waste management but require further development for operational readiness. The respondents generally recognized the importance of radioactive waste management for environmental protection and public safety, and many expressed willingness to learn more and support community awareness initiatives. However, understanding became less consistent as the topic shifted from general safety concepts to more specific procedural and institutional aspects, including regulations, responsible agencies, and safety protocols for handling and disposal. This pattern indicates a gap between positive attitudes and reported behavioral capacities.

These findings should be considered in future communication and stakeholder engagement plans. Awareness-raising remains a critical foundation in radioactive waste management, but fostering meaningful participation among stakeholders in systemizing processes, facility development, regulatory

processes, or community safety requires going beyond awareness alone. Communication efforts should therefore be strategically designed to deliver targeted knowledge while also incorporating practical, scenario-based, and institutionally grounded guidance. This approach helps ensure a more authentic communication and engagement process. Further, media consumption findings highlight that digital platforms offer broad reach, while traditional media channels help reinforce credibility and trust in communicating radioactive waste management.

To support these objectives, communication materials for university students should be presented in interactive and engaging formats such as audiovisual explainers and infographics to sustain interest and encourage learning while addressing concerns about why it is beneficial to learn the principles of radioactive waste management and how they can contribute to safe practices. Providing an educational engagement activity, like seminars and workshops, that highlights the identified knowledge and awareness gaps will also be beneficial for an immersive approach to learning the basic principles of radioactive waste management.

For university staff and local government units (LGUs), more formal and credible formats such as visual deck presentations and pamphlets are appropriate to respond to concerns about institutional prioritization, responsible agencies, and safety protocols about RWM. This could be disseminated through inter-agency meetings, regional conferences, or courtesy visits to different communities in the country.

CONCLUSION

This study advances the discussion on radioactive waste management by assessing the knowledge, skills, attitudes, and practices of local stakeholders in the Philippines. Notably, the findings indicated favorable outcomes in the knowledge, skills, and attitudes of the respondents regarding radioactive waste management. However, their self-assessed practices emerged as an area for improvement, as only 56% of responses revealed consistency. Further, while results indicated a generally positive outcome to the knowledge, skills, and attitudes of the respondents, there is a need to recognize and strategize for specific areas where improvement is still needed. First, it is necessary to effectively clarify the definitions of radioactive waste and radioactive waste management. Treatment, conditioning, storage, clearance, and disposal concepts should also be communicated clearly, with emphasis on the distinction between current predisposal management and future disposal pathways. Moreover, knowledge of the categories of radioactive waste, government regulations, and the agencies responsible must be communicated thoroughly. Emergency and contact procedures should be emphasized during training opportunities. Ultimately, practices such as labeling and storing radioactive materials, following proper protocols for handling and disposal, and reporting improper handling or disposal of radioactive waste are crucial for building confidence in the practice of radioactive waste management.

It is noteworthy that a deeper level of understanding across all aspects of radioactive waste management must still take place, especially since management strategies in the country are dynamic in nature, with anticipated plans for strengthening the handling, storage, and disposal of radioactive waste. Further, the significant proportions of respondents without training experience (90%) and who have not yet encountered any media campaigns (82%) on radioactive waste management also add to the argument, as training and media campaigns are necessary interventions in the process of effectively understanding radioactive waste management. Hence, credible information, appropriate skill sets, and sound practices must be instilled not only among the respondents but, more importantly, across all stakeholders involved in radioactive waste management. Respondents have expressed their willingness to learn more and are very supportive of implementing community awareness programs and educational efforts in this field. Effective communication and stakeholder engagement are then significant. As for this study, the use of English, Filipino/Taglish, or the combination of both English and Filipino is an effective medium of instruction, based on the survey results. On the other hand, various media types such as audiovisual, interactive, and visual content were identified as formats to effectively execute communication and engagement among the respondents.

This study serves as a preliminary baseline assessment of stakeholders' knowledge, skills, attitudes, and practices regarding radioactive waste management in the Philippines, with particular focus on how these are shaped through communication, information dissemination, and public engagement. The results can significantly support the development of an effective communication plan consisting of strategies, messages, and materials tailored to stakeholders in radioactive waste management. It also recommends further investigating the knowledge, skills, attitudes, and practices of more stakeholders' groups beyond the scope of this study. By examining stakeholders' perceptions and attitudes toward radioactive waste, the research highlights the critical role of effective science communication in building awareness, trust,

and informed decision-making among affected sectors. Given the current understanding of the social landscape of radioactive waste management, further efforts to communicate its fundamentals to a wider audience are necessary.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

CONTRIBUTIONS OF INDIVIDUAL AUTHORS

RMF: Writing – original draft, Writing – review & editing, Data curation, Formal analysis; **AJRY:** Writing – original draft, Conceptualization, Methodology, Formal Analysis, Investigation; **RNMQ:** Writing – review & editing, Conceptualization, Methodology, Formal Analysis, Investigation; **MCED:** Writing – review & editing, Conceptualization, Formal Analysis; **CBA:** Writing – review & editing, Conceptualization, Formal Analysis; **EMRJR:** Writing – review & editing, Conceptualization, Formal Analysis; **FRAP:** Writing – review & editing, Investigation, Data Curation; **CAPP:** Writing – review & editing, Investigation, Data Curation; **AAP:** Writing – review & editing, Investigation; **JOS:** Writing – review & editing, Formal Analysis, Supervision, **ATBVII:** Writing – review & editing, Funding acquisition, Supervision; and **REP:** Writing – review & editing, Conceptualization, Funding acquisition, Supervision, Investigation.

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