The Surveillance of High-Risk Radiation Facilities Using Co-60 Radioactive Sources Using Central Alarm Stations in the Perspective of the Nuclear Regulatory Agency in Indonesia

Roy Candra Primarsa[1]

[1] Directorate of Inspection for Radiation Facility and Radioactive Material, Nuclear Energy Regulatory Agency of Indonesia (BAPETEN), Jakarta, Indonesia
*e-mail: r.candra@bapeten.go.id

Abstract. *The Nuclear Energy Regulatory Agency in Indonesia (BAPETEN) performs inspections to assess the level of nuclear safety and security at radiation and nuclear facilities. Since the terrorist incident of September 11, 2001 activate the requirement of source security in the use of Radioactive Sources, Indonesia has also tightened the monitoring of the life cycle of Radioactive Sources from cradle to the grave. The use of integrated visual surveillance technology in the Central Alarm Station (CAS) is needed in Indonesia, which consists of 17,000 islands with the 5 largest islands where the majority of Indonesian people live. Indonesia still having hospitals that use TeleCo-60 for cancer treatment, located between the islands. BAPETEN develops surveillance by integrating CCTV installed at the Tele Co-60 room in the hospital to the CAS that installed at BAPETEN. This system is expected to support the strengthening of Radioactive Sources monitoring. Currently, this integrated monitoring has been installed for 5 facilities that use Co-60, and in the future it will be added until all facilities using Category I High Activity Co-60 sources will be monitored by BAPETEN through the CAS also integrated with BAPETEN Inspection System.*

Keywords: Regulatory Agency, Nuclear Safety and Security, Surveillance, Central Alarm Station, Inspection, Radiation Facilites

Introduction

The utilization of Nuclear and Radiation facility in Indonesia controlled by the Nuclear Energy Regulatory Agency (BAPETEN) through Regulations, Licensing and Inspections base on Act no. 10 year 1997 [1]. Indonesia have more than 17,000 islands with the 5 largest islands where the majority of Indonesian people live. Since the terrorist incident of September 11, 2001 (9/11), regulation insert the requirement of source security in the use of Radioactive Sources [2], Indonesia has also tightened the monitoring of the life cycle of Radioactive Sources from the cradle to the grave. Lot of the utilization in radiation facility specially in the Medical and the Industrial field [3]. In this paper, we will discuss the utilization of integrated system with visual technology to supporting the Supervision of the high-risk radiation facilities that using category I source Co-60. Now, the security aspects of the use of category 1 radioactive sources are strictly and consistently enforced by the regulatory body Because the Security aspect of the utilization of radioactive sources still not yet been optimized by supervision, so the BAPETEN develops surveillance by integrating CCTV installed at the Tele Co-60 room in the hospital to the Central Alarm Station (CAS) that installed at BAPETEN. The Level of fullfilled of the security requirement identify as Index of Security of Radioactive Material (IKZR).

Materials and Methods

The research method in this paper was done in gradually from identifying problems, studying literature, determining of themes/research topics, and collecting data from the BAPETEN surveillance of the Hospital using the Category I High Activity Co-60 sources with CAS to analysis the level of compliance with the security requirements of its facilities. BAPETEN conducts direct surveillance through visual observation of the facility, checking the security indicators installed at the facility to obtain important data for analysis. Assessment and analysis result data will be using the qualitative and descriptive observation methods. Result data will be asses and analize using the Fish Bone Diagram to get the result about the vulnerability of the security event at the Facility, this is used as the Top Event on this Survailance. After establishing the results of the analysis of vulnerabilities to security events, the next step is to determine the level fulfilment of the security requirements identyfy as Index of Security of Radioactive Material (IKZR). The IKZR level obtained will be directly proportional to the level of

fulfillment of the requirements. The level of IKZR are divided into: Excellent, Best, Good, Fair, and Low. Excellent and Best level means that the level of fulfillment is high, as well as if the IKZR level is getting Low, the probability of fulfilling the requirements is certainly still far from the regulatory standards, these results will be used as supervisory findings to make improvements to the fulfillment of requirements.

Activity

The surveillance by BAPETEN officer every day to assess the security indicator at the facility with visual observation with CCTV, but analysis of data from periodic surveillance or if there are indications of suspicious indicators or alerts from systems at the facility that flag suspicious activity. Step of the surveillance will be doing with this process:

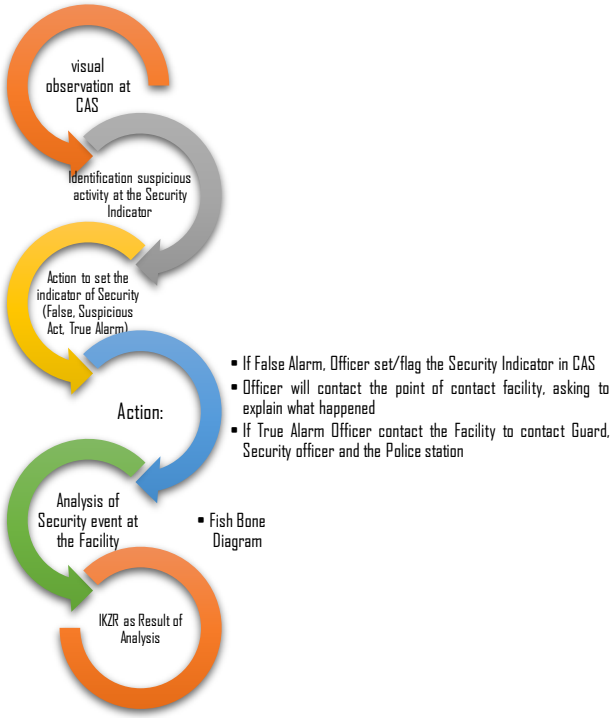


Figure 1. Step of the surveillance

Inspection unit at BAPETEN will conduct the Criteria of the Security Surveillance with the availability of the fulfilment requirements [4] below:

a. Licensing and Condition with 25 % grade – maximum point is 30
b. Human Resources (Security Officer, Guards) - with 25 % grade – maximum point is 25
c. Security Equipment - with 10 % grade – maximum point is 10
d. Radiation Exposure Monitoring - with 10 % grade – maximum point is 10
e. Security Event Monitoring - with 20 % grade – maximum point is 20
f. Documents and Records - with 5 % grade – maximum point is 5

All off maximum points in the above Criteria are still subdivided by weighting as follows:

i. 100% maximum points if all condition is eligible
ii. 75% maximum points if most condition is eligible
iii. 50% maximum points if half condition is eligible
iv. 25% maximum points if less condition is eligible
v. 0% maximum points if none condition is eligible

All of the above Criteria will become indicators to determine the IKZR. The value of IKZR is also divided into criteria of fulfilment:

A. 0 - 49.9 - Low
B. 50 - 69.9 - Fair
C. 70 - 79.9 - Good
D. 80 – 89.9 – Best
E. 90 – 100 - Excellent

Step by Step of the surveillance will be explained as follows:

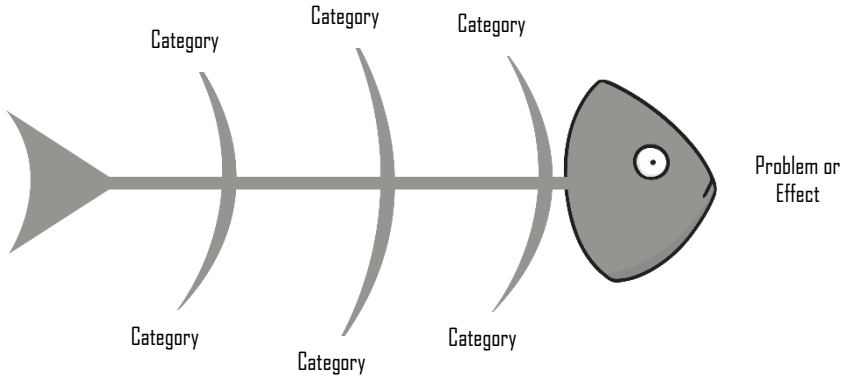
A. Visual Observations (with CCTV)
Every day officers who have been scheduled to conduct surveillance will be on duty in the CAS room to monitor the condition of facilities that use category-1 Cobalt-60 sources where the visual monitoring system or CCTV has been integrated with CAS at BAPETEN. The activity of surveillance is shown as in the figure below:

Figure 2. Activity of the surveillance

B. Identification suspicious activity at the Security Indicator
Every morning in every Days, the Officer will identify the event if there is some suspicious indicator of alarm, identification of alarm system divided into 3 (three) situations: False, Suspicious or True alarm

C. Action to set the indicator of Security (False, Suspicious Act, True Alarm)
   a. If the False alarm, Officer will set/flag the indicator that is the False alarm
   b. If Suspicious act, Officer will contact the point of contact facility (Security officer), asking to explain what happened
   c. If True alarm, Officer will contact point of contact facility (Security officer) to contact Guard, and the Police station

D. Analysis of the Vulnerability of the Facility (Fish Bone Diagram)
After collecting data from the Action of the Security indicator, from 5 (five) facility which is has been integrated visual observation (CCTV), BAPETEN conduct the analysis of Security event for each facility with the Fish Bone Diagram.



E. Determining the IKZR
After result analysis of the weaknesses facility and the fulfilment of the criteria of the Security Surveillance. BAPETEN conduct the IKZR rating know what the improvements and developments still need to be made to the facility to keep the Source safe from irresponsible parties.

Results and Discussion

1.1 Result

1.2.1 Based on the visual surveillance with CCTV controlled at CAS BAPETEN, Author have some following results for the vulnerabilities issue that may affect the performance of Radioactive Source Security requirements. Authors divide into the 6 (six) vulnerability factors:

A. Insufficient of compliance with Standard Procedures (SOP)
   1. Personnel's non-compliance with Security SOPs resulting in frequent False Alarms
   2. The 2 Person Rule mechanism not running properly, because the keys that should be held by 2 people are in fact held by 1 person holding 2 keys.
   3. Cleaning Officers are allowed to enter without an escort from the Security Officer.

B. Insufficient of compliance with Worker Availability
   1. In one of the hospitals, the inspector found that personnel who were not listed in the permit were allowed to enter the irradiation room (the janitor entered the irradiation room to pick up trash and clean some equipment) and without escort.
   2. The Security Officers are not performing their daily duties.

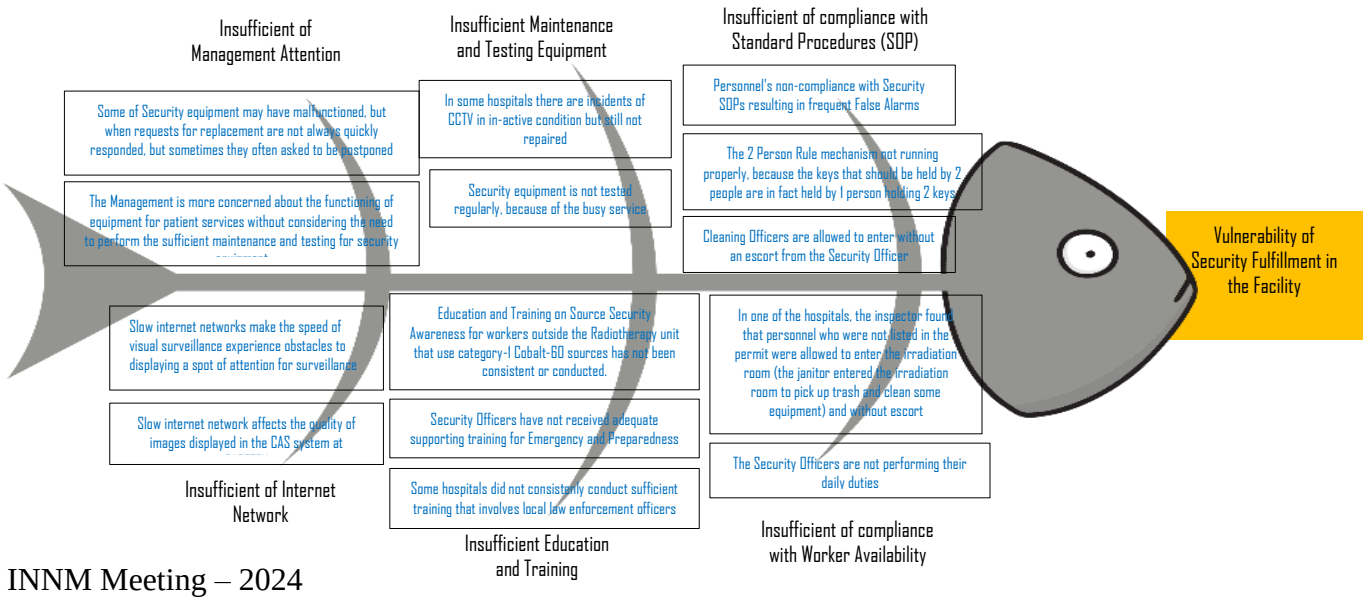
C. Insufficient Maintenance and Testing on the Equipment
   1. In some hospitals there are incidents of CCTV in in-active condition but still not repaired
   2. Security equipment is not tested regularly, because of the busy service to patients.

D. Insufficient Education and Training
   1. Education and Training on Source Security Awareness for workers outside the Radiotherapy unit that use category-1 Cobalt-60 sources has not been consistent or conducted.
   2. Security Officers have not received adequate supporting training for Emergency and Preparedness in Source Security issues.
   3. Some hospitals did not consistenly conduct sufficient training that involves local law enforcement officers.

E. Insufficient of Management Attention about Fulfilment of Source Security Requirements
   1. Some of Security equipment may have malfunctioned, but when requests for replacement are not always quickly responded, but sometimes they often asked to be postponed.
   2. The Management is more concerned about the functioning of equipment for patient services without considering the need to perform the sufficient maintenance and testing for security equipment.

F. Insufficient of Internet Network
   1. Slow internet network affects the quality of images displayed in the CAS system at BAPETEN
   2. Slow internet networks make the speed of visual surveillance experience obstacles to displaying a spot of attention for surveillance

1.2.2. Analysis of the Vulnerability of Security Fulfillment in the Facility (Fish Bone Diagram)
As explained in point 1.2.1 above, the author makes a vulnerability analysis of the fulfilment of general security requirements obtained from 5 (five) facilities under surveillance.



1.2.3 Based on qualitative and descriptive observations, the author observed the implementation of surveillence for 5 (five) Hospital with the following results:

1. Licensing
   a. All the Hospital have a license from Nuclear Energy Regulatory Agency (BAPETEN)
   b. License condition for the Security criteria fulfilled the requirement of the regulation
2. Human Resources
   a. All the Hospital have the Security personel that fulfilled the requirement of the regulation
   b. One of the hospitals committed a violation by allowing Officers who were not listed in the permit to be given access to the irradiation room where there was a Source (Cleaning Officer) and not accompanied by a Security Officer.
3. Security Equipment
   a. All Hospital fulfilled the requirement of the regulation about the Security Equipment
   b. Some Hospital do not perform test and maintenance of the Equipment properly
4. Radiation Exposure Monitoring
   a. All Hospital fulfilled the Radiation Exposure Monitoring
   b. Inspector was provided with periodic reports of radiation exposure from all hospitals, none of which showed significantly high exposure levels.
5. Security Event Monitoring
   a. The CAS provided the Security event are recorded, always monitored and followed up
6. Documents and Records
   a. All Hospital have documents and records about the Security Source
   b. Some hospitals did not update the document due to changes in Director
   c. One hospital has not authorised the document signed by the new Director

The Result of the IKZR for Five Hospital after assess by remote Surveillence can desribe as follow:

No.	Hospital	Licensing and Conditions	Human Resources Availability	Security Equipment	Radiation exposure Manitoring	Security Event Monitoring	Documents and Records	IKZR	Grade
1.	A	30	12.5	10	10	10	5	77.5	Good
2.	B	30	18.75	7.5	10	15	5	86.25	Best
3.	C	30	25	10	10	15	2.5	92.5	Excellent
4.	D	30	25	7.5	10	15	2.5	90	Excellent
5.	E	30	18.75	15	10	15	5	93.75	Excellent

Conclusion

From the results of the supervision carried out on the 5 hospitals mentioned above, it can be concluded that all hospitals are still in regulatory compliance. Although there are still potential vulnerabilities that can affect the performance of the radioactive source security system and potential violations committed by users due to inadvertence. The IKZR score range is still in the Good until Excellent. For now, development on surveillance still limited for the facilities using Category I High Activity Co-60 sources wich already integrating CCTV to the CAS that installed at BAPETEN, In the future it will be added until all facilities using Category I High Activity Co-60 sources will be monitored by BAPETEN through the CAS also integrated with BAPETEN Inspection System.

Acknowledgments

The author wishes would like to acknowledge for the publication support to God Almighty, my Parents, Family, and my Friends in the Inspection Unit with help and discussion

References

[1] Act 10 Year 1997, Ketenaganukliran
[2] Vaz, Pedro *Radiological protection, safety and security issues in the industrial and medical applications of radiation source, Instituto Superior Técnico, Universidade de Lisboa, Campus Tecnológico e Nuclear, Bobadela LRS 2695-066, Portugal*
[3] Tom Bielefeld[1], Helmut W. Fischer[2], *The Security of Medical and Industrial Radioactive Sources*, Belfer Center for Science and International Affairs, Harvard Kennedy School, USA[1], University of Bremen, Postfach, Bremen, Germany[2].
[4] Technical Guidelines for the Assessment of the Security Level of Radioactive Sources of BAPETEN in the Implementation of Radioactive Source Security Inspections, DIFRZR – BAPETEN