

# **SELF-ASSESSMENT OF NUCLEAR SECURITY CULTURE OF RADIOACTIVE SOURCE USERS IN BATAN: SURVEY AND INTERVIEW**

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## **Abstract**

A self-assessment on nuclear security culture of radioactive source users have been conducted by CSCA in Pasar Jumat Nuclear Area, Indonesia, following a trial assessment that was conducted on February 2018. There are 5 (five) centers in the area with activities that are mainly using radioactive sources. This activity is based on the BATAN Chairman Directive Letter on April 2018 and currently two methods were performed, namely survey and interview methods. The CSCA deployed a survey team with 17 members to survey 353 employees. Meanwhile, the interviewer were 12 persons to interview 60 employees. These team members are experienced and well-trained on each method. The survey statements were developed in reference to a model of radioactive source security culture (CRPJO2007). A number of characteristics were selected from management system group, leadership behaviour group and personnel behaviour group within the model. The survey results were analyzed and categorized as follows: statements with highest score, statements with lowest score, and statements that are contradictory. There were also a number of written comments from survey respondents. Some survey results includes: different personnel behaviour in different centers, management system are not well implemented, and different behaviour between management level and staff level. Following the survey, positive hypotheses from highest score statements and negative hypotheses from lowest score statements were then developed. Subsequently, negative hypotheses were used as interview topics within the interview guideline, while positive hypotheses will be assessed by document review method. Some findings from the interview stage includes lack of security SOPs and lack of interaction or team work in problem solving. It is recommended that these findings need to be examined further by document review and observation methods.

## **1. BACKGROUND**

World community has put substantial efforts to control the radioactive sources effectively. In 2004, the IAEA published Code of Conduct on the Safety and Security of Radioactive Sources [1] to encourage all its member states to strengthen controls on radioactive sources. Each member state should establish a system of regulatory control of radioactive sources from initial production to the final disposal. Global nuclear security regime has been developed under several instruments, such as United Nation Security Council Resolution no 1373 and 1540, Convention on the Physical Protection of Nuclear Material and its Amendment in 2006 [2] and Recommendations on Physical Protection of Nuclear Material and Nuclear Facility in 2011 [3]. Efforts to control radioactive sources have been conducted by many entities, such as EU efforts in strengthening nuclear security, reported in 2016 [4]. Concurrently, in 2015 Indonesia established a BAPETEN Chairman Regulation on the security of radioactive sources [5].

In the Code of conduct, IAEA provides a basic principle that every member state should promote safety culture and security culture with respect to radioactive sources [1]. To develop a clear concept and its relationships with nuclear security, IAEA published an implementation guide on nuclear security culture in 2008 [6]. Nuclear security culture plays an important role in strengthening nuclear security, including radioactive sources as defined in the Guide, “nuclear security culture is defined as the assembly of characteristics, attitudes and behaviour of individuals, organizations and institutions which serves as a means to support and enhance nuclear security”[6]. Furthermore, IAEA provides technical guidance on conducting a self-assessment on nuclear security culture[7].

There are other similar concepts of security culture, such as 3S culture or CBRN security culture[4]. The concept of 3S culture emphasizes on human resources and training, while CBRN security culture combines

chemical, biology, radioactive material and nuclear security culture. However, the nuclear security culture gained its momentum after the World Trade Center incident in 2001. Nuclear security culture was highlighted by high level political leaders during a Nuclear Security Summit in Washington in 2010. At the consecutive Nuclear Security Summits in Seoul 2012 and the Hague 2014, the international community recognizes further the importance of building and sustaining a strong nuclear security culture. These summit emphasized strong international and regional cooperation on awareness-raising, training and education on nuclear security.

Implementation of nuclear security culture is not limited to national or international levels. Several programs in developing nuclear security culture at organizational level are also conducted. Yankov et.al in 2014 have performed a self-assessment in a Nuclear Power Plant in Bulgaria[8]. József in 2015 has conducted self-assessment of security culture in radioactive material associated facility in Hungaria[9], and consecutively Máté in 2017 has conducted assessment of security culture in small facilities handling radioactive materials in Hungaria[10]. Multilateral community also discussed the nuclear security culture, such as in Singapore in 2017 [11]. Private sectors are also recognized to have an important role in improving radiological security by practicing security culture[12].

Indonesia has been conducting self-assessment on nuclear security culture periodically since 2012[13]. The 2<sup>nd</sup> self-assessment of nuclear security culture was conducted in 2015 for nuclear facilities[14]. For conducting the self-assessment, Indonesia has established a center of excellence, namely Center for Security Culture and Assessment (CSCA)[15]. The importance of the security culture on radioactive sources is recognized, and the threats are highly possible. In Pasar Jumat Nuclear Area, BATAN has a research facility complex with 5 research centers that mostly handling radioactive sources. The facility also provides training, irradiation services, non-destructive testing, test and calibration services, and exhibition for public. Visitors and customers are frequently visiting the area. Therefore in 2018, to extend the scope of works, CSCA has commenced a program for self-assessment in security culture of radioactive sources users in the facility.

## 2. SELF-ASSESSMENT METHODOLOGY

The methodology for conducting self-assessment for security culture within radioactive sources users is adopted from the IAEA Guidance[7]. The guide describes 4 tools for self-assessment, namely survey, interview, document review and observation. However, at the time of this report is written, CSCA has selected to conduct only two tools, which are survey and interview. An project to modify and adjust the IAEA methodology to be more focused and user friendly has been reported by Khripunov et.al, known as CRPJO2007[16]. Full descriptions on the characteristics on the security culture model is listed below.

Management Systems characteristics:

- a) Visible security management of radioactive sources
- b) Safety-security interface
- c) Clear roles and responsibility
- d) Work management
- e) Training and qualifications
- f) Transportation security
- g) Personnel reliability
- h) Information security
- i) Change management
- j) Contingency plans and drills
- k) Interface with regulators and other off-site organizations
- l) Record keeping

Leadership Behavior characteristics:

- a) Expectations and role modeling
- b) Decision-making and management
- c) Involvement of staff and feedback
- d) Effective communications
- e) Motivation

Personnel Behavior characteristics:

- a) Professionalism and security awareness
- b) Compliance
- c) Personal accountability

- d) Mutual respect and cooperation
- e) Vigilance and reporting

Therefore, the report applies the modified security culture model and uses survey and interview for the assessment. Since the model is relatively new, a trial assessment and preliminary analysis was conducted in February 2018 in cooperation with undergraduate students from Gadjah Mada University at the same facility[17].

Using the IAEA guidance, and applying results of the trial assessment above, then a survey form consists of 30 statements with 7 level answers were developed in reference to the radioactive security model, and then analyzed by means of statistical charts. The answer start from no.1 to 7 (strongly disagree, disagree, somewhat disagree, neither, somewhat agree, agree, and strongly agree). The respondent may put comments if selecting 4 (neither). The interview uses semi-structured approach, with questions developed based on the survey hypotheses. An interview guidance sheet is provided for interview team members. Finally, after the two tools applied, some findings will be reported along with the recommendations for high level leadership in BATAN.

### 3. SURVEY CONDUCT AND ANALYSIS

The activity started with Directive Letter from BATAN Chairman in April 2018 to conduct self-assessment on security culture at Pasar Jumat Nuclear Area. It shows that the activity is strongly supported by the leader of the organization. A survey team consists of 17 members from various backgrounds with relevant competences and trainings was deployed by CSCA. The initial step in developing self-assessment tools was to select a topic based on personnel behaviour, which represent current concerns, threats, and importance. Hence, the topic “**vigilance**” was selected. The next step was selecting a number of characteristics from management system component, leadership behaviour component, and personnel behaviour component that were considered related to the topic. To prepare for and to improve the knowledge of the survey team, a workshop on security culture of radioactive source users was conducted. At the end of the workshop, a survey form consists of 30 statements was produced. The selected characteristics are, among others: expectation and role modelling, decision making and management oversight, involvement of staff and their feedback, and effective communication from leadership behaviour component; safety-security interface, and work management from management system component; compliance, personal accountability, mutual respect and cooperation, and vigilance and reporting from personnel behaviour component. To get a better survey form, the team conducted survey statement validation by means of inviting volunteers from the facility to try out and give comments on the survey form. The survey statements were revised accordingly. The survey form allows respondent to provide comments. The survey form also asks for respondent details such as position and his / her Center, while maintaining anonymity.

The survey was aimed at 353 persons (60% of total employees in the facility) in one time, however, actually there were 359 responses. These results were then analyzed by means of statistical chart in the form of histograms. To get a better view, each statement was averaged by the following equation:

$$Average_i = \frac{\sum A_1 \times 1 + \sum A_2 \times 2 + \sum A_3 \times 3 + \sum A_4 \times 4 + \sum A_5 \times 5 + \sum A_6 \times 6 + \sum A_7 \times 7}{\sum Respondent_i}$$

Where,

Average<sub>i</sub> = average value of statement i

ΣRespondent<sub>i</sub> = number of respondents on statement i

ΣA<sub>1</sub>, an so on = number of responses that answered 1, and so on

The total average for overall statements was also calculated similarly.

The results of the survey show that all histograms have a bi-modal shape, for example as shown in Fig. 2, while the overall average is 5,36 out of 7 scale. Analysis shows that the two-peaks histograms are obtained since most of respondents avoid giving comment if they selected “neither”. Some comments from respondents are also collected, however they will not be analyzed and presented in this paper. Since there are respondents from 5 different centers within the facility, the survey results are also analyzed based on their centers.

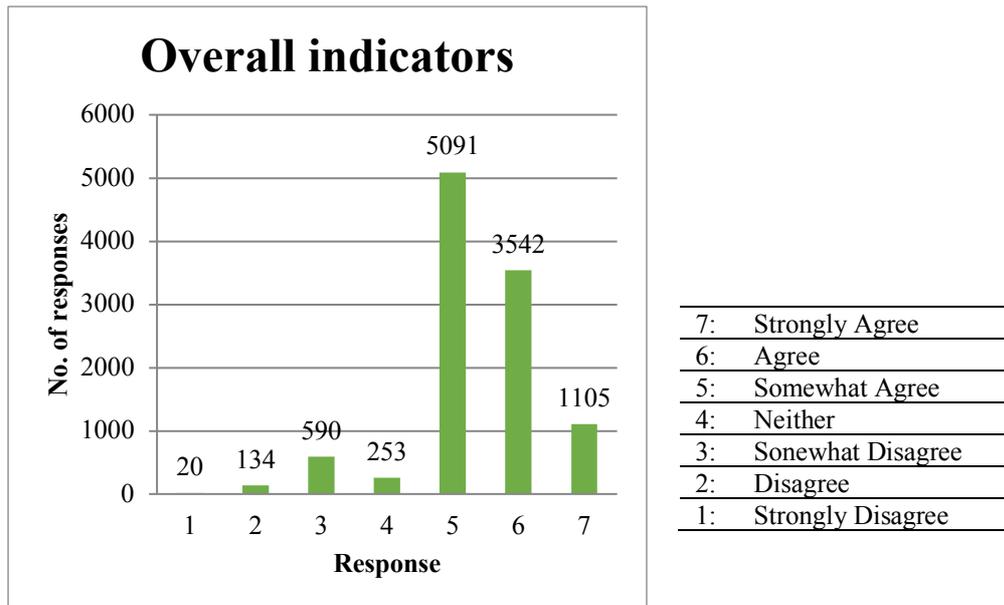


Fig. 2. Overall Indicators Shows Bi-modal Histogram

All charts are categorized as lowest, highest, and average based on the overall average calculated above. Contradictory results are also observed. Some indicators with lowest results are:

- My superior shares security procedure of radioactive sources;
- My organization has a mechanism to handle employee disgruntlements that may have impact on security system of radioactive sources;
- Information related to safety and security issues on radioactive sources is available to all levels in my organization;
- My organization provides information on security procedure to visitors, contractors, and suppliers;
- I solve problems together with superiors / subordinates and personnel from other competence areas; and
- I feel safe from reprisal when reporting any potential security breach on radioactive sources.

Meanwhile, Some indicators with highest results are:

- Radioactive source security personnel ensures radioactive sources are stored in accordance to procedure;
- My superior communicates the importance of maintaining security;
- My organization involves competent employees in decision-making with regard to safety and security of radioactive sources;
- My organization conducts radioactive source inventory periodically;
- I trust my co-worker mutually; and
- I am encouraged to prioritize teamwork in all level.

Further analysis based on the research centers shows that behaviour and attitude of employees are different between centers. Analysis on management system characteristics shows that security management system is not well implemented within the facility or any center. Analysis of behaviour and attitude according to the position of respondents shows that management level personnel have different behaviour compared to staff level personnel.

By comparing these highest and lowest results, some contradictory results are apparent. For example, positive attitude on the indicator “my superior communicates the importance of maintaining security” is somewhat in contradiction with negative result on the indicator “My superior shares security procedure of radioactive sources”.

Based on the lowest and highest results of the survey, some negative hypotheses from lowest score statements and positive hypotheses from highest score statements were then developed. Subsequently, negative hypotheses were used as interview topics within the interview guideline, while positive hypotheses will be

assessed by document review method. Contradictory results cannot be developed into hypotheses, however those results will be included as interview topics.

#### 4. INTERVIEW CONDUCT AND ANALYSIS

Following the analysis on survey results, an interview guidance sheet was developed, consisting of 12 hypotheses derived from lowest survey results. However, considering the given time for interviews are estimated for one hour, the number of hypotheses were reduced to 6, those are: Managers shares security procedure of radioactive sources; There is a mechanism to handle employee disgruntlements that may have impact on security system of radioactive sources; Information on security procedures is available for visitors, contractors, and suppliers; Information related to safety and security issues on radioactive sources is available to all levels; Problems are solved together with superiors / subordinates and personnel from other competence areas; and Employees feel safe from reprisal when reporting any potential security breach on radioactive sources.

Using the interview guidance sheet, 60 employees were interviewed by interview team of 12 persons. The interview took approximately one hour per employee by two interviewers. The interviewer may ask additional questions to gain deeper information on a given topic. This type of interview using a guidance and allowing probing questions is called semi-structured interview. The resulting information is qualitative but contains more accurate information, such as:

- Information on security issues should be displayed in running text or monitors;
- Tighter security may cause employee’s complaint, so to reduce it the internalization of security procedures is desirable;
- Daily paging shall also mention about security, and today’s events should be displayed on monitors at security gate;
- Any safety or security incidents and the lesson learned need to be distributed among employees; e) Standard operating procedures for security aspect are inadequate; and
- interaction or team work between employees for problem solving is somewhat weak.

The abovementioned interview results reflect the employee’s expectations and feedbacks for current security status in Pasar Jumat Nuclear Area. It is also apparent from the interviews that harmonization of safety and security is important in enhancing security culture of radioactive sources. It is worth to note that some of interview results are anecdotal information, hence other tools of self-assessment such as document review and observation will be helpful in gaining insight of the topics. A better interview results may be obtained by improving the skill and knowledge of interviewers.

Overall structure of the methodology is shown in Fig 3.

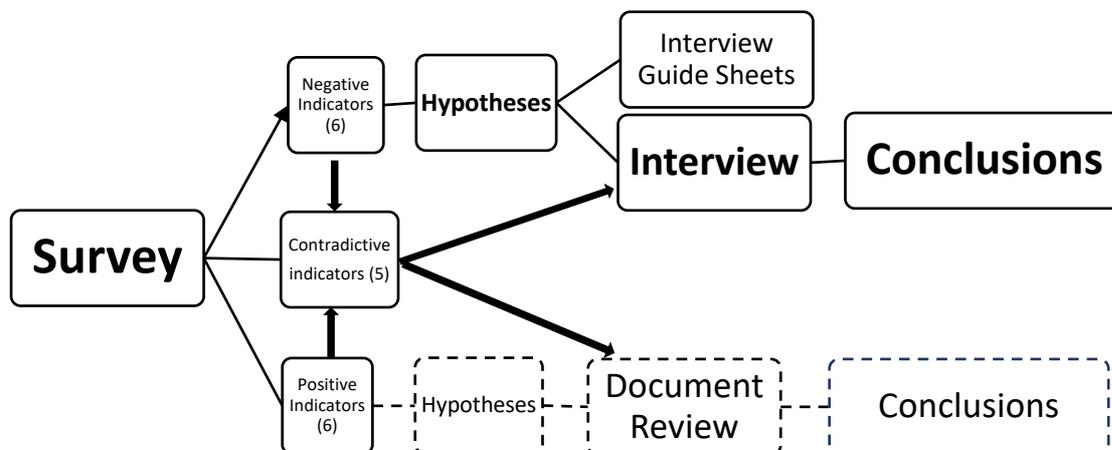


Fig. 3. Structure of Self-assessment Methodology

## 5. DISCUSSION

The finding on differences in employee's behaviour and attitude may be corrected by internalization of security procedures to all levels. Differences in security culture is also found between management level and staff level. The internalization may be in the form of security trainings, which is also reported in a similar activity conducted at academic institution and medical facilities using radioactive sources[18]. The findings during interview related to the lack of information on security issues and the necessity of daily paging to all personnel within the facility may be improved by conducting safety and security induction for employees periodically, and specifically to customers, visitors, contractors, and suppliers. Information on security issues sometimes contain sensitive matters, hence confidentiality is an important factor. However, lessons learned need to be disseminated among personnel, which is quite common in safety culture. Therefore, harmonization of nuclear safety culture and security culture is necessary. Before this self-assessment, Indonesia has conducted the workshop on this topic[19]. The workshop highlighted the differences and similarities of safety and security culture. Some action plans were also proposed, and some are in-line with the findings in this paper. One example is the implementation of an integrated management system in the facility, which integrate quality, safety, health, security, and environmental elements. The implementation of such management system is in fact the biggest component in the radioactive source security culture model.

Action plans discussed above to improve radioactive source security culture are based on only two tools of self-assessment. However, better and focused recommendations may be submitted to leadership after the other two methods and their analysis are completed.

## 6. CONCLUSIONS

Self-assessment of radioactive source users in Pasar Jumat Nuclear Area has been conducted by CSCA, and some findings that lead to improvement action plan are analyzed. A report to top management includes the following recommendations:

- Internalization of security procedures to all levels, including security trainings
- Harmonization of safety culture and security culture
- Conduct of safety and security induction periodically to employees and specifically for customers, visitors, contractors and suppliers, and
- Implementation of integrated management system consists of quality, safety, health, security, and environmental elements.

A more detailed recommendation may be proposed after the completion of document review and observation of security culture.

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