Improvement of Nuclear Science Standards (SNI) to Meet Market Needs and Harmonization

J. Sutanto, P. Sulisworo

Center for Nuclear Standardization and Quality (PSMN)-BATAN

Email: jepri@batan.go.id; psulisworo@batan.go.id

Abstract. Standards are technical or standardized requirements, including procedures and methods developed based on the consensus of all stakeholders with due observance of safety, security, health, environmental and scientific and technological developments, experience, and current developments and the future to gain the greatest benefit. Nuclear science and technology standards are needed in the present time in addition to competitiveness in various industrial sectors also improve the quality, both from the process, methods and nuclear science and technology products. Currently the established nuclear science and technology standard amounts to 171 Indonesia National Standards (SNI) and 19 BATAN Standards based on competencies. The method used is statistical and monitoring method using stages according to National Standardization Body (BSN) guideline. That is through study, evaluation, technical guidance, drafting, technical meeting, consensus meeting, public hearing, polling, proposal of determination, and stipulation. The formulated and defined standards have been harmonized with existing international standards without altering the meaning of the substance and even some of the standards are the results of research and development itself (non- adoption), The objective of improving the standards of nuclear science and technology is to improve the protection of society and the environment related to the utilization of products and/or nuclear technology, enhanced quality assurance, production efficiency, national and international competitiveness and enhanced nuclear technology innovation capability as well as one part of the Clearing House of Nuclear Technology. National standard contribution at the national level is currently 1.75% of the nationally accepted standards issued by BSN.

Keywords: standards, nuclear science and technology, stakeholders, harmonization

1. Introduction

Nuclear technology has become a part of modern human life. Nuclear technology is widely used in all fields/sectors such as agriculture, industry, medical, energy, information [1]. In agriculture, nuclear technology can be used to produce superior seeds, optimize critical land, as well as preservation of crops [2]. In the field of industry, nuclear technology is widely used in the field of inspection of non-destructive testing, petroleum drilling, QC (quality control) paper mill, tracer, testing the content of a material element and so on. For medical purposes, nuclear also plays an important role in diagnostics, radiotherapy and nuclear medicine [3]. As for the energy sector, up to now there are 450 Nuclear Power Plants [4], 400 nuclear reactors for research and no less than 150 nuclear reactors for military purposes and currently Indonesia is developing detailed designs of experimental power plants RDE),
as well as the information sector related to the management and development of information technology related to nuclear power [5].

One of Indonesia's greatest challenges in this era of globalization is facing the entry of foreign products and services into the country [6], not to mention nuclear science and technology products. There has been a lot of nuclear technology coming into Indonesia especially related to the medical and industrial sectors. Some of them include camera gamma, radiology machine, Computed Tomography (CT) Scan, mammography, nuclear medicine (PET/CT; SPECT/CT) [7] and various other new nuclear technologies. Many products that have a very short lifetime, are not supported by the presence of adequate parts and also no less important may potentially compromise safety, security and the environment. Another mechanism that also needs to be considered in the issue of invasion of nuclear technology from abroad is how the arrangement for nuclear technology produced by domestic industry can compete with the onslaught of nuclear technology from abroad.

Development of standards in accordance with enactment No. 20 of 2014 on Standardization and Conformity Assessment, is conducted through testing, inspection and certification activities. If referring to Regulation of Head of BATAN No. 21 of 2014 which was later changed to Regulation of BATAN No. 8 of 2016 concerning the duties and functions of work units in BATAN, the nuclear standardization function is attached to the Center for Nuclear Standardization and Quality (PSMN-BATAN). It is therefore reasonable that there is a discourse from the BATAN leadership stating that Clearing House Nuclear Technology will be run by PSMN from standard development, standard application and conformity assessment (accreditation and certification).

Improvement of nuclear science and technology standards to meet market needs and harmonization of international standards already exist for various sectors, especially in the energy sector which has generated enough standards related to nuclear energy engineering and radiation measurement, currently research reactors have been built and operated in Indonesia i.e. GA Siwabessy reactor (Serpong - South Tangerang), Triga 2000 (Bandung), Kartini (Yogyakarta) and will be developed experimental power plant (RDE) to generate energy for electricity. To undergo and optimal operation requires standardized reference that is with national standard or BATAN standard. PSMN with coordination to National Standardization Body (BSN) will raise the standard of nuclear science and technology continuously. The improvement of nuclear science and technology standards is managed by Technical Committee (TC) consisting of stakeholders, stakeholders in standard development (SNI/SB) covering experts, manufacturers, consumers and governments.

2. Methodology
The method used for the development of the standard is to use statistical methods (from year ≤ 2013 to 2017) and monitoring by using the stages in accordance with the guidelines of the National Standardization Body (BSN), through review, evaluation, technical guidance, drafting, technical meetings, consensus meetings, public hearings, proposed settlements, and stipulations [8]. The development secretariat for the improvement of nuclear science and technology standards is centralized in the Center for Nuclear Standardization and Quality (PSMN-BATAN).

The formulated and defined standards are expected to harmonize with existing international standards without altering the meaning of the substance even some standards are the result of their own research and development (non-adoption). The nuclear science and technology standard is stipulated in the national standard (SNI) and BATAN standard. The development of standards outside the MoU Nasional Standardization Body (BSN) is set forth in BATAN standards that are tailored to the competence of expertise in BATAN [8]. The process or flow of the formulation of national standards and BATAN standards are almost identical with the study until the initial draft, followed by technical meetings and consensus meetings, finalization and determination.

The stages of SNI formulation, review and evaluation are needed at the beginning to start the program proposal by preparing the draft standard that is standard design (RSNI / RSB), followed by technical meeting and consensus meeting by technical committee/standard formulation team of BATAN (TC/TPSB) after completion of the consensus and reaching the final edition of quorum by the
secretariat of the Center for Standardization and Nuclear Quality (PSMN) and proposed for standard setting (SNI/SB). An example of the SNI formulation stage is shown in Figure 1.

![Figure 1](http://www.bsn.go.id/main/bsn/isi_bsn/20169/perumusan-sni)

**Figure 1** – (a) SNI formulation stage, (b) SB formulation stage
*Source: http://www.bsn.go.id/main/bsn/isi_bsn/20169/perumusan-sni*

In the development of standards can be done by identical adoption method that is the same method of translation/substance with the original standard or international standard (harmonic), can also be done by modification method that is the method that can be changed the content of the substance adapted to the country adopting it and can be done by non-adoption of the method resulting from the research and development of researchers with reference from various sources of reference and existing regulations. Identical adoption methods, modification methods and non-adoption methods have been developed in nuclear standards both from the general requirements, vocabulary, test methods, personnel processes and competencies as well as technical requirements.
The transformation of the policy of SNI formulation of nuclear science and technology [9] is the acceleration of the implementation of the formulation of Standards, strengthening the monitoring of each standard formulation, supporting the synergy of industry needs with government programs and identifying potential Conformity Assessment Institute (LPK) since the standard will be formulated. There are 256 LPK institutions in Indonesia and 1187 testing laboratories and 252 calibration laboratories (Table 1). The management system of nuclear science and technology may use IAEA publications and regulations from BAPETEN regarding the responsibilities of management, resources, process implementation, measurement, assessment and improvement [10].

Table 1. Laboratory and inspection body

| No. | LPK               | Amount |
|-----|-------------------|--------|
| 1   | Testing laboratories | 1187   |
| 2   | Calibration laboratories | 252   |
| 3   | Inspection bodies  | 119    |
| 4   | Proficiency test organizer | 15    |
| 5   | Medical laboratories | 59    |
|     | **Jumlah**        | **1632** |

Source: SNI development workshop - BSN, May 2, 2018 (update January 2018)

Technical Committee (TC) SNI formulation managed by National Standardization Body amounted to 145 technical committees spread from Sabang to Marauke, for technical committee related to nuclear science and technology there are 5 technical committee with secretariat in PSMN - BATAN (TC 19-01: Non-destructive testing [11]; TC 17-01: Radiation Measurement; TC 27-01: Nuclear Energy Engineering; TC 11-05: Nuclear science-based medical equipment; TC 67-05: Food irradiation). In the internal sphere of BATAN, there are BATAN standard formulation teams (TPSB) in 7 (seven) areas of competence in BATAN consisting of Application of isotope and radiation technology (TPSB-ATIR); making of isotope and compound marked (TPSB-PLS); Management and organizational administration (TPSB-AMO), engineering and manufacture of nuclear devices (TPSB-RPPN), power reactor (TPSB-RD); Nuclear fuel cycle (TPSB-DBBN) and radioactive waste management (TPSB-PLR).

Table 2. Number of SNIs in Figures in Indonesia

| No | SNI Per Sector                          | SNI Applies | SNI Abolition/Not applicable | Total SNI once determined |
|----|----------------------------------------|-------------|-----------------------------|--------------------------|
| 1  | Agriculture and food technology        | 1.985       | 437                         | 2.422                    |
| 2  | Construction                           | 865         | 180                         | 1.045                    |
| 3  | Electronics, information and communication technology | 418         | 4                            | 422                      |
| 4  | Engineering technology                 | 1.536       | 282                         | 1.818                    |
| 5  | General, infrastructure and science    | 642         | 60                          | 702                      |
| 6  | Health, safety and environment         | 815         | 128                         | 943                      |
| 7  | Material Technology                    | 2.734       | 546                         | 3.280                    |
| 8  | Special technology                     | 256         | 68                          | 324                      |
| 9  | Transportation and distribution of food | 508         | 206                         | 714                      |
|    | **Total**                              | **9.759**   | **1.911**                   | **11.670**               |

Source: SNI development workshop - BSN, May 2, 2018 (update January 2018)
The current SNI is 9759 standards managed by the National Standardization Body through 145 technical committees divided into 9 sectors contained in Table 2. SNI that is no longer valid is in abolition status. The number of compulsory SNIs applied by the Indonesian government through institutions is 207 standards (Table 3).

Table 3. Number of mandatory SNI

| No | Technical Institution Regulating SNI Compulsory | Number of SNI |
|----|-----------------------------------------------|---------------|
| 1  | Ministry of Industry                          | 105           |
| 2  | Ministry of Energy & Mineral Resources         | 27            |
| 3  | Ministry of Agriculture                        | 3             |
| 4  | BPOM                                          | 1             |
| 5  | Ministry of Transportation                     | 14            |
| 6  | Ministry of Public Works                      | 55            |
| 7  | Ministry of Maritime and Fisheries Affairs     | 2             |
|    | Total                                         | 207           |

Source: SNI development workshop - BSN, May 2, 2018 (update January 2018)

Table 4. Number of nuclear science and technology standards

| No. | Technical Committee (TC) | Amount (year) | ≤ 2013 | 2014 | 2015 | 2016 | 2017 |
|-----|--------------------------|---------------|--------|------|------|------|------|
| 1   | TC 19-01, Non-destructive testing |               | 30     | 14   | 1    | 3    | 0    |
| 2   | TC 17-01, Radiation measurement       |               | 24     | 9    | 15   | 2    | 0    |
| 3   | TC 27-01, Nuclear energy engineering |               | 30     | 0    | 1    | 0    | 0    |
| 4   | TC 11-05, Nuclear science-based medical equipment | | 11     | 12   | 6    | 2    | 3    |
| 5   | TC 67-05, Food irradiation           |               | 1      | 2    | 1    | 4    | 0    |
| 6   | BATAN Standard                     |               | 12     | 2    | 2    | 3    | 0    |

The number of nuclear science and technology standards consists of 5 technical committees authorized to formulate standards consisting of stakeholders, i.e. experts, manufacturers, consumers and the governments. The nuclear science and technology standard is divided into 5 major sections related to non-destructive testing, radiation measurements, nuclear energy engineering, nuclear science-based medical equipment, and food irradiation. Beyond the scope of the 5 technical committees of BSN is also supported by the competence of BATAN personnel to formulate the standards formulated by the BATAN standard drafting team outside the scope of the Technical Committee. Nuclear science and technology standards are widely adopted from international standards such as ISO, IEC, ASTM, ASME, JIS, EN and so forth.

Enactment No. 20 of 2014 on standardization and conformity assessment is to improve quality assurance, production efficiency, national competitiveness, fair and transparent business competition in trade, business certainty and ability of business actors and technological innovation capabilities, improve protection to consumers, perpetrators efforts and other societies, as well as the State both from the aspects of safety, security, health and the preservation of environmental functions [12] and enhance the certainty, fluency and efficiency of trade transactions of goods and / or services domestically and abroad. [13]

3. Results and Discussion
National Standard of nuclear science and technology, namely SNI and BATAN standards. SNI related to nuclear science and technology there are 171 standards that apply nationally consist of SNI technical committee 11-05 Nuclear science-based medical equipment 34 SNI, SNI technical committee 19-01
Non-destructive testing 48 SNI, SNI technical committee 67-05 food irradiation 8 SNI, SNI technical committee 17-01 Field of radiation measurement 50 SNI, SNI technical committee 27-01 Nuclear energy engineering 31 SNI. For BATAN standards in accordance with the competence of personnel and internal needs of BATAN has been formulated as many as 19 BATAN Standards.

From the data obtained there are 207 compulsory standards applicable nationally, for nuclear science and technology standards there is no mandatory standard, currently still voluntary. There are 1632 laboratories and inspection bodies in Indonesia. The continuous improvement of nuclear standards was developed to focus more on experimental power reactors (RDEs) in this case the energy sector. National standard contribution at the national level is currently 1.75% of the nationally accepted standards issued by the National Standardization Body.

The need for continuous improvement of national standards in accordance with the needs of stakeholders and national interests, especially for the needs of the industrial sector that is RDE/NPP. Passive safety systems are carried out on the RDE / NPP to reduce the number of active components and minimize construction costs [14]. In addition to the active participation of technical committee members and/or BATAN standard drafting teams, there is a need for budget support for continuous improvement. In the year 2018 is being done standard formulation in the field of nondestructive testing as much as 5 standards and the field of food irradiation 6 standards. As well as being drafted early related to the national program of Experimental Reactor (RDE).

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