

**ABSTRACT****Challenges of Nuclear Personnel Certification as the Impact of The National Research Innovation Agency (BRIN) Establishment**

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**Abstract.** Nuclear applications in various sectors have many benefits, but it has potential risks for workers and the environment. The risk must be controlled, which is one of the controls by means of competency certification. Apart from regulatory requirements, nuclear personnel competency certification has a large market. More than 2000 certified personnel work in the inspection and preservation industries, hospitals, government, and even work abroad. Certification of nuclear personnel has operated for more than 10 years. Its doing by Personnel Certification Bodies (LSP BATAN), accredited by National Accreditation Body (KAN) since 2017. The establishment of the National Research and Innovation Agency (BRIN) impacted LSP BATAN services, where BRIN plans to combine all certification functions within the Professional Certification Institute (LSP BRIN) licensed by National Professional Certification Agency (BNSP). KAN and BNSP use SNI ISO/IEC 17024:2012 as a reference, but there are different requirements in the implementation. KAN liberated LSP to determine procedures in implementing standards, while the BNSP regulates its, including forming of competency standards. It becomes a challenge when the certification service must continue, but LSP BATAN has not fulfilled the requirements to be licensed by the BNSP. It needs efforts to change the structure of the certification body through a study that maps the current condition of the LSP BATAN and identifies the requirements for a BNSP license. In preparing competency standards, technically adapted from SNI and BATAN Standards, there are several paradigm changes, including the passing grade indicators from quantitative to qualitative and the scope of the certification scheme, which could be some competencies into one certification scheme for one competency. Competency standards as a reference for certification schemes and other assessment tools. The results of this study serve as input to prepare the works program LSP BRIN to be licensed by BNSP.

*Keywords: nuclear, certification, standard*

## INTRODUCTION

Nuclear utilization has a high potential for hazard and risk, so it is necessary to control it to eliminate the danger or reduce the risk. One of the efforts to control it is through certification of nuclear personnel as required in Law of the Republic of Indonesia No. 10 of 1997, Government Regulation No. 33 of 2007, and Regulation of the Head of Nuclear Energy Regulatory Agency (BAPETEN) No. 16 of 2014 [1]–[3]. In addition, personnel certification is also an effort to improve the competence and competitiveness of workers, both nationally and internationally.

Nuclear personnel certification has been running for more than 10 years, its implementation is carried out by the Person Certification Body of the National Nuclear Energy Agency (LSP BATAN), which has been accredited by KAN since 2017. LSP BATAN is tasked with carrying out personnel certification in the field of nuclear energy, such as Radiography levels I, II, and III, Irradiator Personnel, Radioisotopes Radiopharmaceuticals Production Personnel [4], [5]. The establishment of the National Research and Innovation Agency (BRIN) has an impact on the implementation of nuclear personnel certification carried out by LSP BATAN, where there are policies related to implementing tasks at BRIN. BRIN separates the task executors into Science and Technology HR in the Research Organization and Science and Technology Supporting HR in the Secretariat and Deputy. This separation has a very large impact on the implementation of certification. BRIN plans to combine all existing certification functions in the former BATAN, Indonesian Institute of Science (LIPI), and Agency for the Assessment and Application of Technology (BPPT), in the LSP (Professional Certification Body) BRIN licensed by BNSP.

To be accredited by KAN, LSP must meet the requirements of SNI ISO/IEC 17024:2012 Conformity assessment – General requirements for bodies operating certification of persons [6], KAN U-01 Terms and Rules for Accreditation of Conformity Assessment Agencies [7], and KAN K-09 Special Requirements for Accreditation of Person Certification Bodies [8]. Meanwhile, to be licensed by BNSP, LSP must meet the requirements in BNSP Regulation No. 1/BNSP/III/2014 concerning Guidelines for Conformity Assessment - General Requirements for Professional Certification Bodies [9], where this regulation refers to ISO/IEC 17024:2012. Although the reference for implementing accreditation by KAN and licensing by BNSP is ISO/IEC 17024:2012, the implementation is different. One of them is related to the establishment of a certification scheme. KAN gives freedom to LSPs in forming certification schemes if the requirements in SNI ISO/IEC 17024:2012 are met. Meanwhile, BNSP requires the establishment of Work Competency Standards (SKK) which are a reference in the formation of certification schemes and other certification assessment tools.

Certification of nuclear personnel plays an important role in ensuring the safe and secure use of nuclear and ionizing radiation sources. This activity cannot be stopped, apart from legal requirements, certification also improves worker competence. It becomes a challenge when the implementation of certification must continue and there is a program to combine all existing LSPs at BRIN and licensed by BNSP, but LSP BATAN has not met the requirements to be licensed by BNSP. It is necessary to conduct a study to map the current condition of the LSP BATAN, identify the requirements for a BNSP license, and perform a gap analysis of these two things. The results of the gap analysis will be used as input in the preparation of the LSP licensing work program by BNSP.

## LITERATURE REVIEW

Law of the Republic of Indonesia No. 10 of the Year Article 19 requires permits for officers who operate nuclear reactors and certain officers in other nuclear installations and in installations that utilize ionizing radiation sources [1]. This rule is to ensure that the use of nuclear and ionizing radiation sources pays attention to the safety, the health of workers and the public, security, and protection of the environment. It is further described in Government Regulation No. 33 of 2007 and BAPETEN Regulation No. 16 of 2014 where those who must have a Work Permit (SIB) are Level I, Level II Radiographers, Irradiator officers, officers at radioisotope and radiopharmaceutical production facilities and protection officers. Radiation [2], [3]. For officers to obtain SIB from BAPETEN, they must attend training and be certified by a Professional Certification Agency licensed by BNSP or recognized by international institutions. To fulfill the mandate of the Act, Government Regulation, and Regulation of the Head of BAPETEN, certification of nuclear personnel is carried out by LSP BATAN. Since 2017 LSP BATAN has been accredited by KAN. The existence of a work program that will combine all LSPs

in BRIN, under the name LSP BRIN, which is licensed by BNSP must be followed up by LSP BATAN. This is in accordance with the requirements in the Regulation of the Head of BAPETEN No. 16 of 2014 regarding LSPs licensed by BNSP.

The scope of the LSP BATAN certification includes Level I, II, and III radiographers, supervisors and irradiator officers, radioisotope and radiopharmaceutical production officers, and nuclear activation analysis officers. More than 1400 certificates are currently managed by LSP BATAN. Most of the certificate holders work in the inspection industry, preservation industry, hospitals, and a small number work in government, including internal BATAN. There are even some radiographic certificate holders who work outside Indonesia. The number of certificate holders and the scope of work can be seen in Figure 1. Not limited to fulfilling legal requirements, and increasing competence, nuclear personnel certification also has a fairly good market.

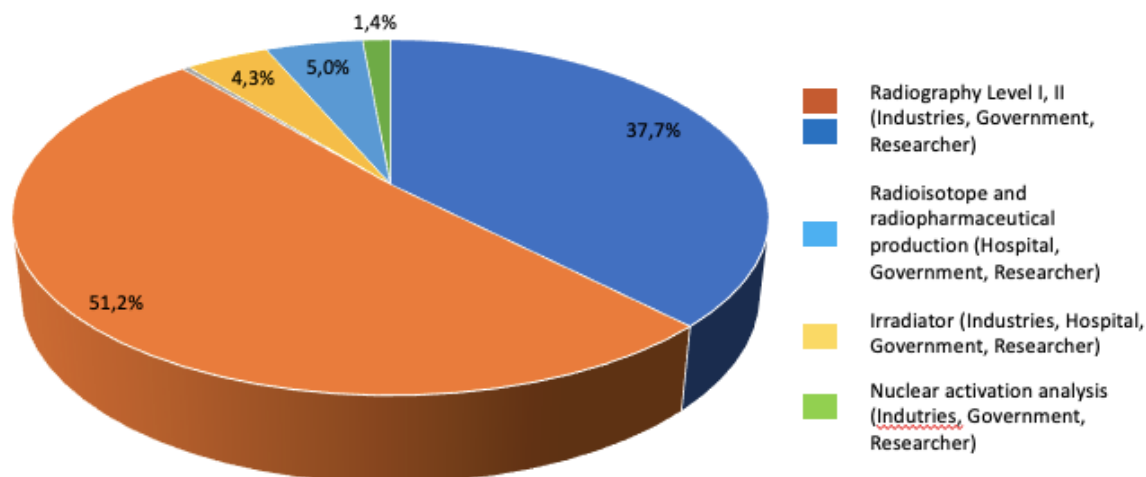


Fig 1. The Number of certificate holders and the scope of work

In the implementation of certification, the certification scheme implemented by LSP BATAN is compiled referring to SNI ISO 9712:2014 Non-destructive test – Qualification and certification of UTR personnel [6], Standard BATAN (SB) 002 BATAN:2016 Qualification and certification of irradiator officers and supervisors [10], and BATAN Standard 010 -BATAN:2011 Guidelines on the Qualification and Certification of Officers and Supervisors of Radioisotope and Marked Compounds Processes [11] and Standards BATAN-007-BATAN:2009 concerning Qualifications and Certification of Neutron Activation Analysts [12]. SNI and SB have a paradigm that stipulates graduation criteria by using the minimum score method so that the certification scheme also sets a minimum score as a passing criterion.

The process of granting competency certificates by LSPs licensed by BNSP is carried out systematically and objectively through competency tests that refer to work competency standards (SKK), which are divided into Indonesian national work competency standards (SKKNI), special work competency standards (SKKK), and work competency standards. international work competence (SKKKI). SKKNI is a formulation of workability covering aspects of knowledge, skills, expertise, and attitudes determined in accordance with the provisions of the legislation by the Minister of Manpower. SKKK is a competency standard that is developed and used by the organization, which is determined by the leadership of the organization. SKKKI is a work competency standard developed and determined by a multinational organization and used internationally. An SNI can be used as SKKKI after being registered by the Ministry of Manpower. The SKK will be a reference in the preparation of the certification scheme. Where the assessment of competency/graduation criteria uses the method of competency level (competent or not yet competent) based on competency units/elements.

## METHOD

The first step of the LSP license program is to identify the current condition of the LSP BATAN which describes the hierarchy and number of documents in the implementation of certification activities. Then identify the requirements for a BNSP license, and perform a gap analysis of the two

things. Since the standard is the top reference for the formation of other instruments, a more detailed gap analysis will be carried out between SNI and SKK and how to transform SNI into SKK. To get a gap analysis of the requirement of a BNSP license, this study is providing desk-based research and analysis from the primary data of LSP BATAN, book, journal, or other references. The results of the study will be used for the recommendation of the developing work program for the LSP license of BNSP.

## RESULT AND DISCUSSION

LSP BATAN has 2 certification schemes, namely the Radiography Non-Destructive Test Certification Scheme and the Nuclear Engineering Application Certification Scheme. The Radiography Non-Destructive Test Certification Scheme is prepared to refer to SNI ISO 9712:2014 for 3 scopes of certification, namely Radiography Level I, Level II, and Level III. Meanwhile, the Nuclear Engineering Application Certification Scheme is based on 3 BATAN Standards, namely SB 002 BATAN: 2016, SB 010-BATAN: 2011, and SB-007-BATAN: 2009 for 12 scopes of certification which can be seen in detail in Figure 2 [6], [10]–[12].

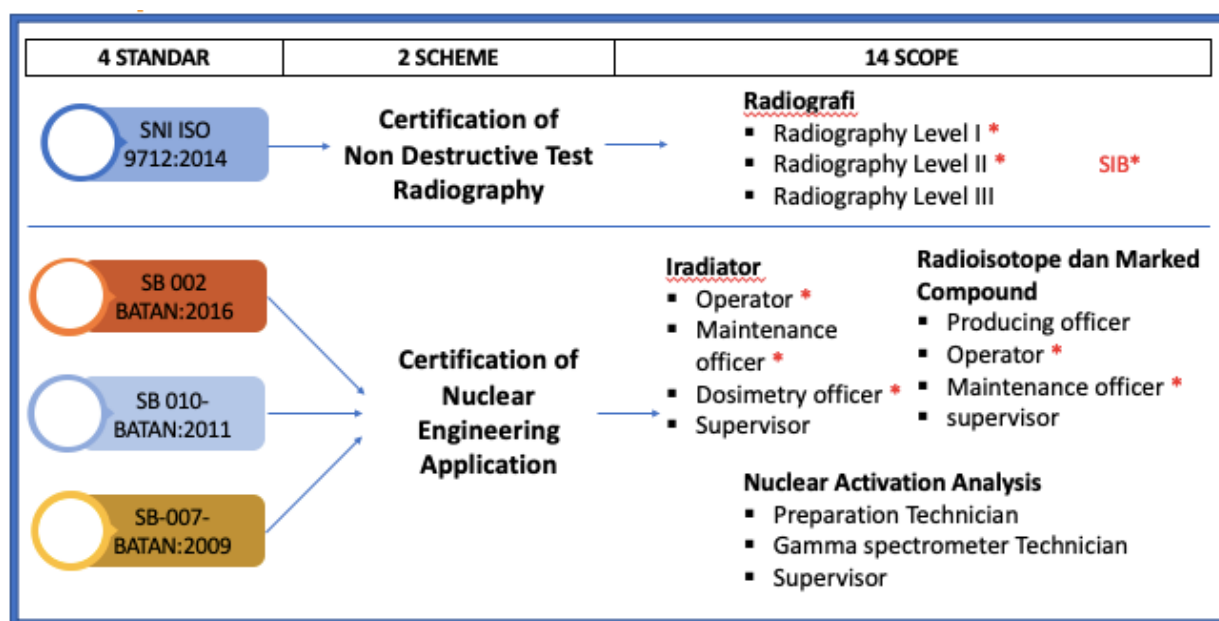


Fig. 2. Standard, Scheme dan Certification Scope of LSP BATAN

A study has been conducted that compares structurally between SKKNI, SNI ISO 9712:2014, and SB 002 BATAN:2016. The comparison of the 3 standards can be seen in Table 1. There are several differences between SKKNI and SNI/SB. The elements of Work behavior and critical aspects required by the SKKNI do not exist in SNI or SB. The number of standards, schemes, and scope of competence of LSP BATAN is not linear, in contrast to the SKKNI where 1 SKKNI is for 1 certification scheme and 1 competency. So if the LSP BATAN is to be licensed by BNSP, for the implementation of certification with 14 scopes of competence there must be 14 SKK and 14 schemes.

Table 1. Comparison of SKKNI, SNI ISO 9712:2014, and SB 002 BATAN:2016 [4], [5]

	<b>SKKNI Professional, Scientific and Technical Services Main Group Activities Headquarters Activities and Management Consultation in Manufacturing Systems Sector</b>	<b>SNI ISO 9712:2014 Non-Destructive Test - Qualification and Certification of NDT Personnel</b>	<b>SB 002 BATAN: 2016 Qualification and Certification of Irradiator Officers and Supervisors</b>
Education	Not required	Not required	High School in Science or Engineering field

<p>Knowledge</p>	<ul style="list-style-type: none"> <li>• Techniques and processes of product design that have been made</li> <li>• Occupational Health and Safety and regulatory requirements, standards, and risk assessments for prototype design and activities</li> <li>• Criteria standards design product</li> <li>• Types of materials and components used in manufacturing</li> <li>• Tools, factories, and processes for material and special product</li> <li>• Process manufacture</li> </ul>	<ul style="list-style-type: none"> <li>• General knowledge of NDT</li> <li>• NDT equipment, including function and setting verification tools</li> <li>• Basic radiation physics and protection radiation</li> <li>• Provisions for radiation safety work procedures</li> <li>• Film radiography and digital radiography</li> <li>• Radiography quality</li> <li>• Radiation sources and radiography equipment</li> <li>• Material knowledge</li> <li>• Test method based on standards</li> <li>• Radiation technique</li> <li>• Defect ology</li> <li>• ASME</li> </ul>	<ul style="list-style-type: none"> <li>• Basic radiation physics and protection radiation</li> <li>• Irradiator related: components, safety system, operations, dosimetry, maintenance, emergency countermeasures , applications, and management facilities</li> <li>• Irradiator operators and supervisor certification systems and related standard</li> <li>• Nuclear legislation</li> <li>• Safety and security of radioactive sources</li> </ul>
<p>Skills</p>	<ul style="list-style-type: none"> <li>• Determine appropriate engineering and knowledge principles for component and product design activities</li> <li>• Evaluate alternative solutions for material and components, manufacturing processes, tooling, and component suppliers for product</li> <li>• Compile design specifications and documentation including applying graphic techniques, modeling and prototype techniques</li> <li>• Make reports and document results of investigations, application of principles and techniques, calculations, specifications, diagrams, CAD files, prototype designs</li> <li>• Use software design as needed</li> </ul>	<ul style="list-style-type: none"> <li>• Choosing techniques and determining operating conditions</li> <li>• Preparing (surface conditions) and visually inspecting the specimen</li> <li>• Arranging equipment</li> <li>• Testing with the NDT method</li> <li>• Detecting and reporting discontinuities, their characteristics, and evaluations</li> <li>• Compiling writing instruction for level one (1)</li> </ul>	<ul style="list-style-type: none"> <li>• Operating irradiator</li> <li>• Determining irradiator dosimetry</li> <li>• Maintaining irradiator</li> </ul>
<p>Work behavior</p>	<ul style="list-style-type: none"> <li>• Creative</li> <li>• Careful</li> <li>• Accuracy</li> </ul>	<ul style="list-style-type: none"> <li>• Not Required</li> </ul>	<ul style="list-style-type: none"> <li>• Not Required</li> </ul>

Critical aspects	<ul style="list-style-type: none"> <li>• Accuracy in making product design in accordance with product specifications</li> </ul>	<ul style="list-style-type: none"> <li>• Not Required</li> </ul>	<ul style="list-style-type: none"> <li>• Not Required</li> </ul>
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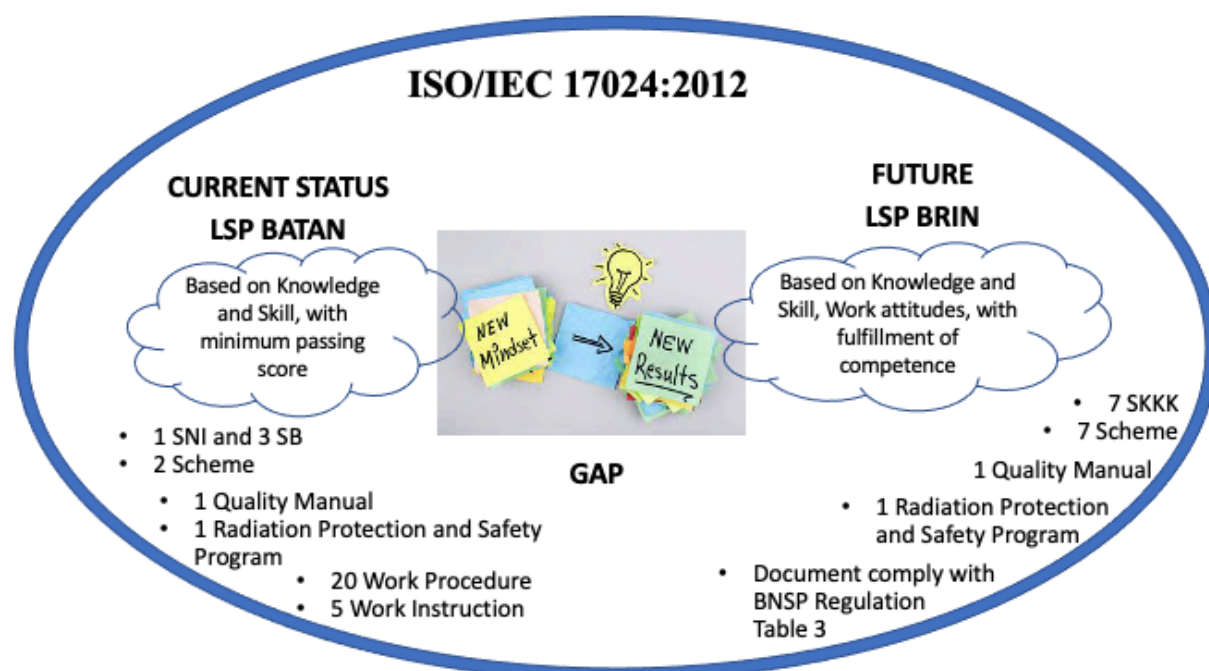
Regarding the graduation criteria for candidate certificate holders, SNI and SB use quantitative methods that require minimum scores, both for written exams and practical exams. A minimum score of 70 for officers and a minimum of 80 for supervisors. The paradigm of the assessment method from quantitative to qualitative must be changed because the competency assessment/certification criteria by BNSP use the competency level method (competent or not yet competent) based on the competency units/elements in the SKK. This may have an impact on the method of the examination carried out by LSP BATAN. The theory test which includes general and specific material in the form of multiple-choice questions must be able to be converted into another form that can show evidence that the candidate is competent or incompetent with certain units/elements of competence. The comparison between the assessments in SNI/SB and SKKNI can be seen in Table 2.

**Table 2.** Competency Assessment of Certificate Holder Candidates

Assessment based on SNI and SB	Assessment based on SKKNI
<ul style="list-style-type: none"> <li>• Assessment based on knowledge and skill</li> <li>• Passing criteria are based on a minimum passing score of 70 for officers, and 80 for supervisors for all types of examinations.</li> <li>• Assessment is carried out through written and practical exams. The written exam includes general and specific material in the form of multiple-choice questions with the number and scope of the material specified in the SNI/SB. Practice exams are carried out by demonstration and assessing the results.</li> </ul>	<ul style="list-style-type: none"> <li>• Assessment based on knowledge, skill, and work attitudes.</li> <li>• Passing criteria based on competence or not yet competent on elements of competence.</li> <li>• Assessment is by utilizing a portfolio, demonstration, written test, and/or oral.</li> </ul>

SNI, or SB, as well as SKK, is a desire to prepare certification schemes and assess other equipment. The step that must be immediately followed up by LSP BATAN in licensing the LSP BRIN program by BNSP is to prepare an SKK. If you look at the scope and market of users, for the SKK Radiography, Radioisotope, and Irradiator certification, the SKKNI that needs to be compiled is the SKKNI. However, because of the urgency, we recommend that an SKKK be drawn up for the certification of nuclear personnel. Of the 14 scopes, the priority scale can be selected according to the requirements of the SIB requirements of 7 scopes (see Figure 2), so that 7 SKKK are needed. The gap illustration of the current condition of LSP BATAN and the future of LSP BRIN is in Figure 3.

In the development of a certification scheme, experts in the appropriate field must be involved, periodically reviewed, and systematically validated. KAN provides flexibility for LSP BATAN in carrying out these requirements. Meanwhile, BNSP applies the application of levers to the certification scheme by BNSP, including its amendments. In addition, BNSP also regulates the Duties, Functions, and Authorities as well as the organizational structure of the LSP. In addition to standards, schemes, and assessment tools, LSP must also have a competency test place, competent personnel including competency assessors, and a control system according to the requirements in Table 3.



**Fig. 3.** Current and the future LSP

**Table 3.** BNSP and Minister of Manpower and Transmigration Regulation regarding Person Certification

References	Scope
BNSP Regulation Number:1/BNSP/III/2014 (P201) Concerning Guidelines for Conformity Assessment – General Requirements for Professional Certification Institutions	General/All
BNSP Regulation Number: 2 / BNSP / III / 2014 (P202) Regarding Guidelines for the Establishment of Professional Certification Institutions	General/All
BNSP Regulation Number: 3/BNSP/III/2014 (P208) Concerning Guidelines for General Provisions for Licenses of Professional Certification Institutions	General/All
BNSP GUIDELINES 207-2007 (P207) Requirements for Establishment of LSP's	General/All (if any)
Minister of Manpower and Transmigration Regulation Number 5 of 2012 concerning the National Work Competency Standardization System	Competency standards
Minister of Manpower and Transmigration Regulation Number 3 of 2016 concerning Procedures for Stipulating Indonesian National Work Competency Standards	Competency standards
BNSP Regulation Number: 4/ BNSP / VII / 2014 (P210) Regarding Guidelines for the Development and Maintenance of Professional Certification Schemes	Certification Scheme
BNSP Guidelines 203 - 2007 Guidelines for the Implementation of License Assessor Training	Personnel
BNSP Guidelines 204-2007 (P204) Criteria and Registration of License Assessors	Personnel
BNSP Guidelines 205-2007 (P205) Criteria for Licensee Assessor Training	Personnel
BNSP Decree Number: 10/BNSP.303/XI/2013 (P303) Regarding Guidelines for General Requirements for Assessors, Master Assessors, and Lead Assessors	Personnel
BNSP Regulation Number: 13/BNSP.218/XII/2013 (P218) concerning Guidelines for General Requirements for License Assessors, Lead Assessors, and Facilitators of LSP Quality Management Systems	Personnel
BNSP Regulation Number: 5 / BNSP / VII / 2014 (P206) Regarding Guidelines for General Requirements for Competency Test Places	Competency Test Place (TUK)

References	Scope
BNSP Regulation Number: 12/BNSP.214/XII/2013 (P214) concerning Guidelines for Verification of TUK by TUK	Competency Test Place (TUK)
BNSP Regulation Number: 09/BNSP.301/XI/2013 (P301) concerning Guidelines for the Implementation of Professional Competency Assessment	Standards, Assessment tools, Competency Test Places, Personnel, Control Systems
BNSP Regulation Number: 02/BNSP.211/X/2013 (P211) Guidelines for Reporting the Implementation of LSP Activities to BNSP	System Control
BNSP Regulation Number: 6/BNSP/VIII/2014 (P219) Concerning Guidelines for Performance Assessment of Professional Certification Agencies	System Control
BNSP Regulation Number: 03/BNSP.302/X/2013 (P302) concerning Guidelines for Issuing Competency Certificates	System Control
BNSP Guidelines 503 – 2012 (P503) regarding Online Control of BNSP Competency Certification	System Control
BNSP Regulation Number: 05/BNSP.508/X/2013 (P508) Management Guidelines for LSP and BNSP Certification Information Systems	System Control

## CONCLUSION

Personnel with certain competencies can guarantee a quality product and ensure safety in its implementation. Competency assessment can be done through certification. Nuclear is widely used in various sectors, including industry and health. Personnel certification is quite important and has a wide market. Regarding the BRIN program which will combine all existing LSPs licensed by BNPS, it is necessary to make efforts for LSP BATAN to be able to change the structure of LSPs accredited by KAN to being licensed by BNSP. The study was conducted with the current condition of the LSP BATAN and identification of the BNSP license requirements. As the main factor in the preparation of other assessment tools, LSP needs to prepare 8 SKKK whose context is by SNI and SB. The challenge for this arrangement is to change the criteria paradigm. In the LSP program license by BNSP, the preparation of the SKKK is a priority that must be followed up immediately, which is then followed by the preparation of other instruments.

## IMPLICATION/LIMITATION AND SUGGESTIONS

This paper is limited to the application of SNI ISO/IEC 17024:2012 at LSP BATAN and provides recommendations for transforming the implementation of these standards to be licensed by BNSP. In more detail, this paper reviews the standard and schema drafting paradigms.

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## AUTHOR CONTRIBUTION

All authors equally contribute to the study including the preparation and approval of the final version of the manuscript.



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