



STRATEGIC BUSINESS PLAN (SBP)

IEC/TC OR SC:	SECRETARIAT:	DATE:
TC45/SC45A/SC45B	Russian Federation	2019-05-12

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**A. STATE TITLE AND SCOPE OF TC**

**TC 45** “Nuclear instrumentation”.

**Scope:** To prepare international standards relating to electrical and electronic equipment and systems for instrumentation specific to nuclear applications.

**SC 45A:** “Instrumentation, control and electrical power systems of nuclear facilities”.

**Scope:** To prepare standards applicable to the electronic and electrical functions and associated systems and equipment used in nuclear energy generation facilities (nuclear power plants, fuel handling and processing plants, interim and final repositories for spent fuel and nuclear waste) to improve the efficiency, safety and security of nuclear energy generation.

Our standards cover the entire lifecycle of these instrumentation, control and electrical power systems, from conception, through design, manufacture, test, installation, commissioning, operation, maintenance, aging management, modernization and decommissioning.

Our core domain is instrumentation, control and electrical power systems important to safety in nuclear energy generation facilities. The nuclear sector has its own well-developed safety philosophy and methodology, hence our safety publications address the differences from the generic approach and provide directives specific to nuclear energy related facilities with an all-encompassing approach to safety. According to the TC 45/IAEA agreement our nuclear sector safety and security standards implement principles and terminology of the IAEA safety and security guides. The core domain includes the radiation monitoring instrumentation used for monitoring, control and safety actuation functions.

Our domain includes instrumentation, control and electrical power systems used in nuclear energy generation facilities to manage and control nuclear materials in the frame of international agreements and to safeguard nuclear material and prevent its illicit trafficking. Joint work and/or liaison will be undertaken in case of overlapping functions with radiological and environmental monitoring.

An aspect of our charter is the application of emerging electronic techniques in order to meet nuclear instrumentation and control requirements, particularly computer systems and advances in information processing and control, including artificial intelligence. In this context, one of our strategic tasks is to review and comment on drafts of IAEA safety and security codes in order to maintain consistency between IAEA and IEC documents and identify detailed technical aspects for which IEC standard developments are appropriate and responsive to the market needs.

**SC 45B** “Radiation protection instrumentation”

**Scope:** To prepare standards that address instrumentation used for:

- the measurement of ionizing radiation in the workplace, to the public, and in the environment for

- radiation protection purposes;
- illicit trafficking detection and identification of radionuclides;
  - radiation-based security screening.

There are two factors that have impacted the work activities of SC 45A: 1) Fukushima Daiichi nuclear disaster in 2011 forced the experts to pay a special attention to electrical power systems used in nuclear energy generation facilities; 2) The increased use of information technology continues to influence trends in international standardization, in particular such its aspect as cyber security. These factors resulted in the modification of both titles and scopes of SC 45A and its working groups.

These changes will not impact other TCs scopes.

## B. MANAGEMENT STRUCTURE OF THE TC

**Technical Committee 45**, established in 1959, produces and maintains standards for instrumentation, systems and equipment for many nuclear applications including nuclear energy and the nuclear fuel cycle, industrial and commercial uses of ionizing radiation, safeguarding special nuclear materials, and environmental and radiation protection.

The structure of TC 45 is as follows

Label	Title
<b>Subcommittees</b>	
SC 45A	Instrumentation, control and electrical power systems of nuclear facilities
SC 45B	Radiation protection instrumentation
<b>Working Groups</b>	
TC45/WG 1	Classification - Terminology
TC45/WG 9	Detectors and systems
TC45/WG 18	Mobile unmanned automated systems for nuclear and radiological applications
<b>Project Team</b>	
TC45/ PT 63XXX	Nuclear instrumentation - Fixed high intensity proton cyclotron within the energy range of 10 ~ 20 MeV
<b>Advisory Group</b>	
TC45/AG 15	CAG - Chairman's advisory group
<b>Joint Working Group</b>	
JWG 16	Cogeneration Combined Heat and Power (CHP) (Managed by TC 5)

As seen from the structure, the committee includes two subcommittees. Besides, three working groups, a project team, an advisory group and a joint working group are directly included into TC 45.

**SC45A** is responsible for the standardization of activities related to electronic and electrical functions and associated systems and equipment used in instrumentation, control and electrical systems of nuclear facilities. These activities include nuclear power plants, the entire nuclear fuel cycle from mining to processing, reprocessing, and interim and final repositories for spent fuel and nuclear waste.

The structure of SC 45A is as follows:

<b>Label Working Groups</b>	<b>Title</b>
TC45/SC45A/ WG 2	Sensors and measurement Techniques
TC45/SC45A/ WG 3	Instrumentation and control systems: architecture and system specific aspects
TC45/SC45A/ WG 5	Special process measurement and radiation monitoring
TC45/SC45A/ WG 7	Functional and safety fundamentals of instrumentation, control and electrical power systems
TC45/SC45A/ WG 8	Control rooms
TC45/SC45A/ WG 9	System performance and robustness toward external stress
TC45/SC45A/ WG 10	Ageing management of instrumentation, control and electrical power systems in NPP
TC45/SC45A/ WG 11	Electrical power systems: architecture and system specific aspects

**SC 45B** is responsible for standardization activities covering all aspects of radiation protection instrumentation and dosimetry systems, including for the measurement under both normal and accident conditions of external and internal individual exposure and exposure rates, radioactive contamination and radiation characteristics in the workplace, in effluents, the environment and foodstuffs. SC45B is also responsible for the development of standards that are applicable to the detection and identification of illicit trafficking of radioactive and nuclear material, as well as security inspection systems using radiation.

The structure of SC 45B is as follows:

<b>Label Working Groups</b>	<b>Title</b>
TC45/SC45B/ WG 5	Measurements of Environmental Radiation
TC45/SC45B/ WG 8	Active pocket and portable dose (rate) meters and monitors and passive dosimetry systems
TC45/SC45B/ WG 9	Installed equipment for radiation and activity monitoring in nuclear facilities
TC45/SC45B/ WG 10	Radon and radon daughter measuring instruments
TC45/SC45B/ WG 15	Illicit trafficking control instrumentation using spectrometry, personal electronic dosimeter and portable dose rate instrumentation
TC45/SC45B/ WG 16	Contamination meters and monitors
TC45/SC45B/ WG 17	Security inspection systems using active interrogation with radiation
TC45/SC45B/MT 18	Radiation protection instrumentation - Environmental, electromagnetic and mechanical performance requirements

In addition, SC45A and SC45B are together responsible for standards related to the safeguarding of special nuclear materials, SC45A by the safe use of instrumentation and controls throughout the nuclear fuel cycle, and SC45B with standards for monitoring the management, storage and movement of special nuclear materials in all forms.

**AG 15** is the Chairman's Advisory Group (CAG), a TC 45 consultative body. It has been

set up with First National Delegates, TC/SC officers and Working Group Conveners and Project Leaders in order to improve the committee's activity coordination and the liaison strategy. The CAG reviews the SBP at each meeting. The CAG also advises WGs on NWIPs and shares common management issues in order to have a better overall alignment of the activities.

### C. BUSINESS ENVIRONMENT

Requirements of industrial standards should be minimal and sufficient. They should not limit the development of new products. We continuously need to ensure that our standards are not just developed for a limited group of specialists but for a wide circle of experts.

The activity of TC45 can be presented in several segments:

- instrumentation, control and electrical power systems for the safe and secure generation of electricity from nuclear energy;
- radiation protection instrumentation for personnel and for the environment;
- instrumentation for industrial and commercial uses of nuclear technology, and
- instrumentation for the safeguarding of special nuclear materials, as well as instrumentation used during nuclear fuel manufacture, storage and processing.
- instrumentation for monitoring the illicit trafficking of radioactive and nuclear material and radionuclide identification.

Instrumentation and control for nuclear energy generation:

The business environment for nuclear power generation is currently changing and imposes some challenges:

- The resurgence of nuclear power worldwide has been tempered and even delayed by two factors: the nuclear accident at Fukushima in March 2011 and by the exploration and production of abundant natural gas by "fracking" or horizontal drilling at least in the United States. For example, Japan is reevaluating their use of nuclear power. After the earthquake in 2011, all nuclear power plants were stopped in Japan, however, several units are currently in operation. Germany appears to be shutting down their nuclear power plants in favour of solar, wind and imported nuclear power. Local politics will play a major role for nuclear power in Germany over the next ten years.
- new nuclear power reactor designs must be reviewed and approved before licensing;
- nuclear utilities must have the assets and regulatory approvals in order to proceed with the construction of new power plants;
- expanded new energy needs are connected to the economies of established nuclear countries (such as China, India, Brazil, Russia, Argentina, Pakistan and others) as well as new countries including Belarus, Uzbekistan, Vietnam, Lithuania, United Arab Emirates and Egypt.
- management and refurbishment of aging reactors that are reaching their initial design life and are subjected to life extension programmes determined by routine safety reviews, lessons learned and the implementation of new technical standards;
- decommissioning, where some older reactors will be entirely dismantled;
- the management, transportation and storage of nuclear fuel and special nuclear material, and

-safe management of spent nuclear fuel that includes transportation from power reactor sites to nuclear storage and repository facilities;

- additionally, new aspects (i.e. "loss of infrastructure") are being discussed after the Fukushima accident in March 2011, and the need for additional standards might arise from that throughout the nuclear fuel cycle;

- security and cyber security standards are being developed.

Radiation protection instrumentation for personnel and environment:

The increased use of nuclear and radiation technologies for meeting industrial and social needs causes the rise of safety expectations to protect people and the environment, in particular:

- safety or ecology related events may have wide repercussions transcending international boundaries (e.g. the Chernobyl and Fukushima events). Nations must combine their efforts to raise the safety of their nuclear facilities to consistent levels;

- credible radiological measurements using appropriate radiation instrumentation are addressed.

Instrumentation for the safe commercial uses of ionizing radiation and nuclear technology including accelerators of charged particles:

-Ionizing radiation is finding more widespread uses in the fields of non-destructive testing for materials and structures, for gauging moisture, liquid levels and other material thickness and density, flaw and void detection, for industrial imaging, in the irradiation of a variety of foods, in the sterilization of all types of medical supplies. The Technical Committee through the Subcommittees emphasize the safe applications of radiation and nuclear technology.

Instrumentation for safeguarding of special nuclear materials such as Plutonium and Uranium:

- SC45A incorporates safeguarding of special nuclear materials in the standards on nuclear fuel cycle that are developed in this subcommittee.

-SC45B develops instrumentation standards for the detection of illicit trafficking activities that helps prevent radioactive material being used by potential terrorists.

- SC 45B continues to develop and maintain contemporary standards for airborne and environmental monitoring; for portable radiation detection instruments; for monitoring radon and radon progeny; and for radiation dosimeters used by personnel and in the environment.

- SC45B also develops standards for radiation detection systems used for the screening of persons and cargo/vehicles for security and transporting any kind of illicit items through airports, seaports and other border control check points.

There are many companies dealing with the aforesaid businesses, including many major international companies as well as a large number of system and equipment manufacturers and suppliers from around the world.

#### D. MARKET DEMAND

- Who are the customers of the existing and future publications developed by the TC/SC?

The customers are typically designers and manufacturers of instruments, control and protection systems and equipment, users, nuclear operators, government and state/provincial regulators, legislators, and testing organisations, the many commercial and industrial users of radionuclides (many users of non-destructive testing (NDT) or non-

destructive examination (NDE)).

- Are the TC/SC publications widely used at the regional/national level?

The published IEC standards are widely used as a basis for national or regional standards and in procurement efforts.

Discussion and efforts are underway to improve conformance between IEC standards, national and regional standards and operational measures or practices.

European Committee for Electrotechnical Standardization (CENELEC) has set up Technical Committees CLC/SR 45, CLC/TC 45AX and CLC/TC 45B for monitoring the work of TC45 and its SCs and endorsing IEC standards produced by TC45 and its SCs as European standards (EN). All those EN are implemented as national standards in more than 30 European countries - members of CENELEC.

Japanese industrial standards are coordinated with IEC TC 45/45A/45B standards on request of the authorities.

IEC Standards may be adopted as British (BS IEC) Standards if they have not been implemented as BS EN Standards.

Russia has directly implemented some IEC standards.

Rep. of Korea has translated about 60 IEC standards published by TC45 and its subcommittees into Korean national standards (KS).

- Are they supporting regulation or used as the basis for contracts?

In Europe, at national level, at least fifteen IEC/SC45A standards are referenced through their EN endorsement by different European countries in the licensing documents and procedures.

Korea Institute of Nuclear Safety (KINS), the regulation research institute of Rep. of Korea, has started to incorporate IEC TC45 standards into Korean nuclear regulatory standards.

Some IEC standards are used by reference in American National Standards Institute (ANSI) N42 in the development of US instrument standards. Conversely some ANSI N42 standards are referenced in some IEC standards.

Export contracts from the USA use IEC standards. In addition, an increasing number of IEC standards are referenced by the US Department of Energy, US Nuclear Regulatory Commission and US Department of Homeland Security.

IEC standards are specifically used as reference and technical basis for documents published by the IAEA related to the detection of illicit trafficking of radioactive materials.

- Which are the competing standards developed by other organizations?

TC 45 and its Subcommittees develop standards for the design, construction, performance, testing and calibration of radiation detection instrumentation for all applications. These standards are complementary to ISO/TC 85 standards for the use of such instrumentation. Other relevant organisations, such as the IAEA, are concerned with the establishment and regulation of safety principles and the IAEA also publishes reports on engineering practice.

Given below are brief characterizations of relationships between IEC/TC45 and other

international organisations working in related areas.

IAEA: Close liaison has always been maintained between TC 45 and the IAEA. IEC/SC45A standards use terms of the IAEA safety and security glossaries. Representatives of IEC/SC45A are participating to the NUSC (Nuclear Safety Standards Committee) and NSGC (Nuclear Security Guidance Committee) and are participating to the I&C Technical Working Group of the Nuclear Division of the IAEA . Recently the IAEA and SC45B have reactivated their liaison A status and are now fully reporting and harmonising their work. SC45B is now an official member of the IAEA Radiation Safety Standards Committee (RASSC), which is responsible for the revision of the Basic Safety Standard.

ISO: TC45 has a liaison relationship with ISO/TC85 “Nuclear energy”. This cooperation covers terminology and classification in the nuclear field and some other fields of standardization. IEC/TC45/SC45B has started to regularly attend ISO/TC85/SC2 meetings to address any potential overlapping or contradictory issues related to radiation protection standards that are common for both SCs.

IEEE: A better use of IEEE nuclear power standards, and generic software engineering standards from IEEE or IEC/ISO JTG1 should be considered. To that end, a liaison of D category has been established between WGA9 and IEEE/NPEC (Nuclear Power Engineering Committee).

CENELEC: TC45, SC45A and SC45B standards endorsement as EN standards is considered by CENELEC after a case by case review of each standard. The TC45 and SC45B standards can be endorsed with modifications. These modifications are supplied as comments for the next revision of IEC standards. The SC45A standards are endorsed without modifications.

ISA: a category D liaison between ISA67 “International Society of Automation/Nuclear power standards” and IEC/SC45A/WG9 “Instrumentation and control of nuclear facilities/Instrumentation systems” has been established.

ACSEC: During the IEC General Meeting 2014 held in Tokyo, the IEC SMB has approved the creation of an Advisory Committee on Information security and data privacy (ACSEC). ACSEC provides a venue for exchanging information between the IEC and other standards developing organizations relevant to ACSEC’s scope. Jean-Paul Bouard, current IEC SC 45A Secretary, is nominated as member of ACSEC representing TC 45.

EC-JRC: A category A liaison agreement was recently concluded between Joint Research Centre of the European Commission (EC-JRC) and TC 45. Similar agreement already exists between EC-JRC and SC 45B. Several IEC standards are developed within TC 45 and SC 45B with the direct involvement of EC-JRC experts.

## **E. TRENDS IN TECHNOLOGY AND IN THE MARKET**

The rapid change in electronics, information and communications, and other technologies will continue to impact the future work of TC45 particularly in areas such as:

- new types of reactors including advanced gas-cooled reactors, small modular reactors and reactors with increased power capability. These types of reactors are being constructed in some countries and new types of instrumentation, control and electrical systems will be required for these reactors;
- hardware, software, systems, and COTS (Commercial Off The Shelf) items;
- an increasing need for cybersecurity for nuclear power instrumentation and control;
- information exchange (between instruments and control rooms, radio and wireless

links, exchange data formats);

- the internet impacts all industries and might need a specific approach for nuclear applications;
- the wide use of X-ray installations in different areas;
- the increased use of robotics in nuclear facilities;
- the application of digital technologies in nuclear instrumentation for data acquisition and processing.

The main trends in the market that will impact our future work are:

- the worldwide need for nuclear power with contemporary matching standards;
- the globalization of the nuclear market;
- the merging of key-players and consortia: manufacturers, utilities etc.;
- latest events, connected with the accident at Fukushima NPP in Japan, negatively impact the nuclear technologies market. Nevertheless, some decrease of the market seems to be of temporary character since the increasing worldwide need in electrical power could not be satisfied without the development of nuclear industry.

#### F. SYSTEMS APPROACH ASPECTS (REFERENCE - AC/33/2013)

TC 45 will actively continue to cooperate with other organizations both within IEC and outside this organization. A system approach to this activity is in the focus of our committee. The table shown below reflects the relationships between TC 45 and other organizations with the indication of the role of our committee in respect to these organizations (role of a customer or a supplier):

<b>Component committees</b> (IEC TC45 – role of a customer)	IEC/TC1	Terminology
	IEC/TC77	Electromagnetic compatibility
	IAEA	International Atomic Energy Agency
	ICRP	International Commission on Radiological Protection
	ICRU	International Commission on Radiation Units and Measurements
	ISO/TC85	Nuclear energy, nuclear technologies and radiological protection
<b>System committees</b> (IEC TC45 – role of a supplier)	IEC/TC1	Terminology
	CLC/SR 45	Nuclear Instrumentation
	CLC/TC45AX	Instrumentation, Control and Electrical System of nuclear Facility
	CLC/TC45B	Radiation Protection Instrumentation
	ISO/TC85	Nuclear energy, nuclear technologies and radiological protection
	IEC/TC8	Systems aspects for electrical energy supply
	IEC/TC56	Dependability
	IEC/TC65	Industrial-process measurement, control and automation
<b>Other committees</b>	IEC/TC35	Primary cells and batteries
	IEC/SC62C	Equipment for radiotherapy, nuclear medicine and radiation dosimetry



	IEC/TC112	Evaluation and qualification of electrical insulating materials and systems
	IEEE-NPEC	Institute of Electrical and Electronic Engineers - Nuclear Power Engineering Committee
	ISA67	International Society of Automation/Nuclear power standards
	ACSEC	Advisory Committee on Information security and data privacy

Liaison established:

TC45: TC 45 has internal liaisons with IEC/TC 1 and ISO/IEC JTC1.

The committee also has a liaison with ISO TC 85.

Liaisons of A category exist with the following organisations: IAEA; ICRP; ICRU; WHO; EC – JRC.

SC45A: Internal liaisons exist between SC 45A and the following committees and subcommittees: IEC/TC 65; IEC SC 65A; IEC/TC 56; IEC/TC77; IEC/SC 77C; IEC/TC 112.

Liaisons of A category has been established with the following organisations: IAEA; ICRP; ICRU; OECD/NEA; IEEE/NPEC; ACSEC; ISA67; WNA.

Liaisons of D category have been established between WGA9 and IEEE/NPEC, as well as between WGA9 and ISA67; also a liaison of D category has been established between working groups A3 and A7 and WNA.

SC45B: Internal liaison exists between SC 45B and IEC/TC 104.

Also the subcommittee has a liaison with ISO/TC 85/SC 2.

Liaisons of A category have been established with the following organizations: EFOMP; IAEA; ICRP; ICRU; OIML; WHO; EC.

#### G. CONFORMITY ASSESSMENT

The issue of conformity assessment was discussed at the TC 45 Plenary meeting in Moscow (2013). The common opinion was that there is no sense in the inclusion of IEC TC45/SC45A/SC45B standards into the IEC conformity assessment system for several reasons. The main two of them are as follows:

- 1) the procedure of the third-party conformity assessment is very expensive and is effectively applied only when a wide world market exists for products covered by IEC standards, that is not the case for TC45/SC45A/SC45B standards;
- 2) According to ISO/IEC Directives the two types of activities existing within IEC, namely standard development and conformity assessment, should be absolutely independent from each other. As TC45 and its subcommittees are involved into standard development, it is impossible for them to formally develop conformity assessment systems (45/761/RM).

#### H. HORIZONTAL ISSUES

TC 45 and its subcommittees, SC 45A and SC 45B, deal with the following horizontal issues:

TC 45 cooperates with TC 1 in a field of terminology and has a liaison agreement with it;

SC 45A has liaison agreements and cooperates with TC 65 on system aspects and with TC 112 on the evaluation and qualification of electrical insulating materials and systems;

SC 45B has liaison agreement and cooperates with TC 104 in a field of environmental conditions, classification and methods of test.

**I. 3-5 YEAR PROJECTED STRATEGIC OBJECTIVES, ACTIONS, TARGET DATES**

STRATEGIC OBJECTIVES 3-5 YEARS	ACTIONS TO SUPPORT THE STRATEGIC OBJECTIVES	TARGET DATE(S) TO COMPLETE THE ACTIONS
We should continue to be driven by technology needs and recommendations of other authorities, such as the IAEA.	The participation of IEC/SC45A Secretary in the in the activities of IAEA Nuclear Safety Standards Committee (NUSSC) and Nuclear Security Guidance Committee (NSGC) allows the IEC/SC45A to be directly informed of the development, review and revision of IAEA safety and security standards and to formulate observations on those projects.	Constantly
We should be alert to all relevant standards developed by national and regional organisations that are important and can be transformed into IEC standards.	Subcommittee 45A has included into its Work Program the development of several standards jointly with the IEEE organization. Technical committee 45 and Subcommittee 45B have included into their Work Programs the development of several standards jointly with EC-JRC.	Constantly
We shall be cognizant to standardization as connected with non-proliferation and illicit trafficking of nuclear and radioactive materials and produce standards useful for all participating countries.	The development of the corresponding standards.	2021
The Fukushima accident is to be analyzed and the experience gained should be taken into account in our publications, both new and revised ones.	Revision of some old standards and development of the new ones in order to take into account lessons learned from Fukushima accident.	2019
Work on harmonization and unification of terms used in the standards of TC 45, SC 45A, SC 45B should be continued.	A revision of the existing Part 395 of IEC will be carried out.	2021

Note: The progress on the actions should be reported in the RSMB.

