COURSE CATALOG

OBNINSK 2015

Russian methodological and tranining center on nuclear materials control and accounting,
is the first entity in Russia established for propagation of advanced technologies for nuclear material control and accounting (NMC&A), theoretical and practical training of nuclear facility personell and Rostechnadzor and Rosatom inspectors in MC&A subjects.

1 Bondarenko sq., Obninsk, Kaluga region
249033, RUSSIA
Phone: /484/ 399-56-39, 399-58-48
Fax: /484/ 399-58-13

e-mail: ryazanov@ippe.ru
www.rmtc.obninsk.ru

COURSE CATALOG

OBNINSK 2015

State Scientific Center of the Russian Federation - A.I. Leypunsky Institute for Physics and Power Engineering

Russian methodological and tranining center on nuclear materials control and accounting

RMTC

CONTENTS

COURSE CATALOG 2015

2015

RUSSIAN METHODOLOGICAL AND TRAINING CENTER ON NUCLEAR MATERIALS CONTROL AND ACCOUNTING

ROSATOM

is the first entity in Russia established for propagation of advanced technologies for nuclear material control and accounting (NMC&A), theoretical and practical training of nuclear facility personnel and Rostechnadzor and Rosatom inspectors in MC&A subjects.

Tacis

COURSE CATALOG

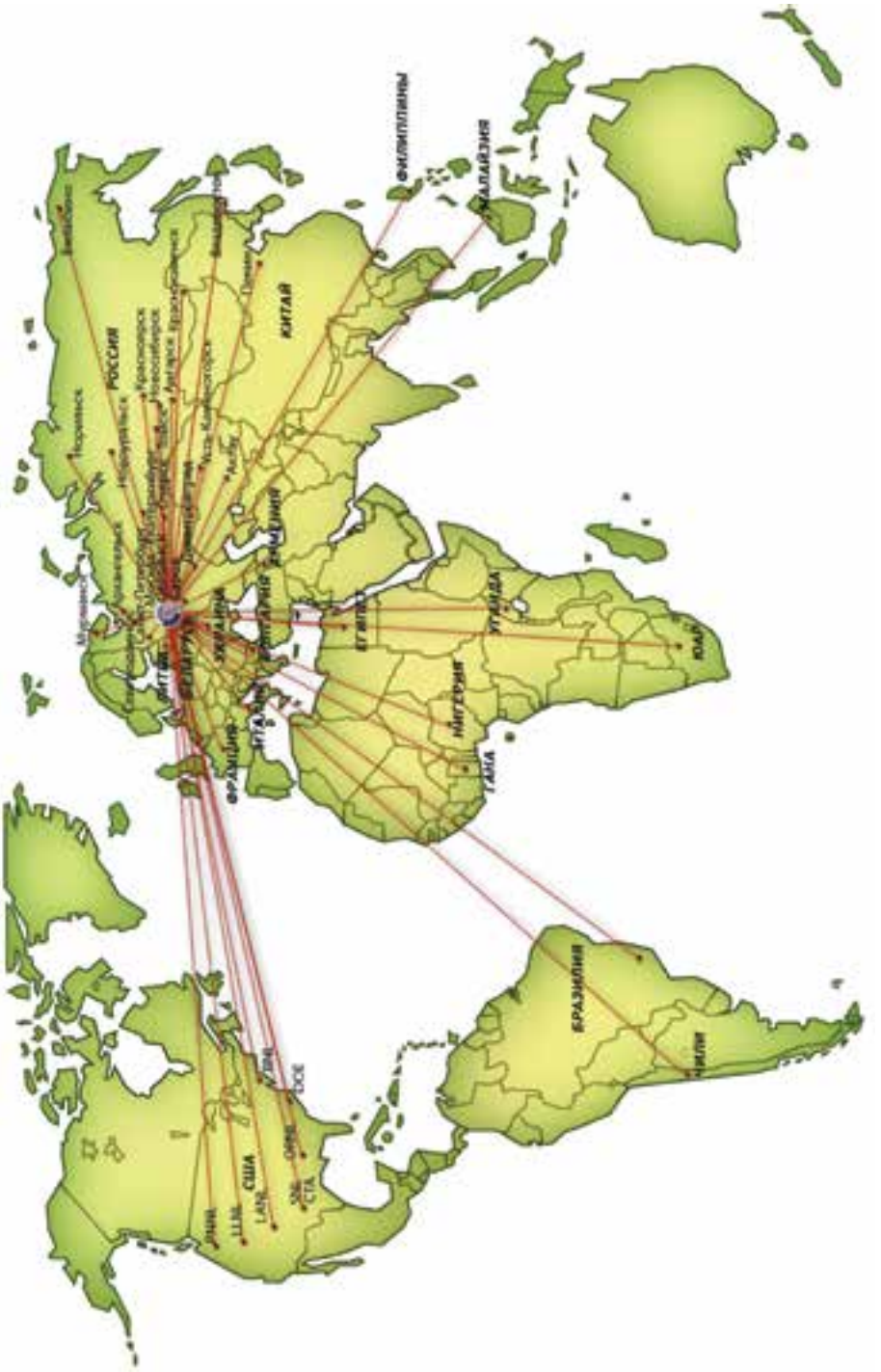
Boris G. Ryazanov

Director of the Russian Methodological and Training Center on Nuclear Materials Control and Accounting

The experience of testing and using nuclear weapons made the mankind encounter the threat of losing its immortality, a great challenge was faced to prevent nuclear wars, to avoid nuclear weapons proliferation, to provide nuclear safety and security in the general sense.

The Moscow G – 8 summit of 1996 showed that the nuclear security was integral and the nuclear sphere which for a long time had been a symbol of confrontation between West and East was being transferred into the area of new cooperation. The establishment and development of Russian Methodological and Training Center on Nuclear Materials Control and Accounting (RMTC) at the State Scientific Center of the Russian Federation – the Institute for Physics and Power Engineering (SSC RF IPPE) named after A.I. Leypunsky in Obninsk (Kaluga region) was a vivid demonstration of joining good will and efforts of Russia, the USA and Europe with the aim to solve the problem of nuclear material nonproliferation.

The decision to create a Methodological and Training Center for NMC&A in Russia was made in 1994, first by the RF Minatom, then at the federal authority level. The RMTC was established by the Minatom and Gosatom-nadzor joint decision approved by the Russian Federation Government.


РОССИЯ
КИТАЙ
ФИЛИППИНЫ
МАЛАЙЗИЯ
ЕГИПЕТ
НИГЕРИЯ
ГАНА
ЮАР
БРАЗИЛИЯ
США

The US DOE and European Commission (EC) supported the idea of creating the Center and included appropriate projects into their plans of cooperation with Russia, that envisaged training of instructors for the Center, equipping RMTC laboratories with state-of-the-art NM assay instruments, installations, systems and classroom visual aids and, at the first stage, participation of international instructors from US, European, and Russian facilities.

The importance of that collaborative effort was emphasized at the Moscow Nuclear Safety Summit on April 19-20, 1996 by the first President of the Russian Federation, B. N. Yeltsyn.

Today the RMTC is a unique center where the personnel from Russian facilities are trained in NMC&A issues. One of the main objectives of the Center is to train the attendees and to share with them the practical experience in NMC&A procedure implementation, the use of adequate instruments, tools and PC hardware and software.

The RMTC activity significantly influences and improves the Russian State NMC&A system. So the RMTC can be considered a center of NMC&A knowledge acquisition and dissemination.

RMTC ESTABLISHMENT AND EVOLUTION STAGES

Stage 1 (1994-1998)

Establishment and outfit of the main laboratories and elements of infrastructure, training of principal instructors, trainers and specialists of the Center in international laboratories.

At this stage the determinative role in developing and conducting the RMTC courses was played by the international specialists, first of all, the specialists from the US National Laboratories. That was the time when the RMTC was equipped with the most important instruments and tools for NM NDA, computerized accounting, reprographic facilities, classroom and office appliances, software.

Stage 2 (1999-2002)

Evolution of the laboratories, adaptation and development of new courses by Russian specialists, the beginning of methodological and administrative support of other projects on NMC&A upgrading in Russia, including on-site personnel training.

The main part of the equipment was supplied for the RMTC laboratories and infrastructure and, what is the most important, Russian specialists managed to adapt and develop all the courses and provided training of Russian specialists without the assistance from international trainers.

At that time the RMTC played a determinative role at the early stage of improvement and modification of the federal and Rosatom MC&A regulatory framework.

Stage 3 (2002-2004)

Evolution of the laboratories, adaptation and development of new courses by Russian specialists, the beginning of methodological and administrative support of other projects on NMC&A upgrading in Russia, including on-site personnel training.

The main part of the equipment was supplied for the RMTC laboratories and infrastructure and, what is the most important, Russian specialists managed to adapt and develop all the courses and provided training of Russian specialists without the assistance from international trainers.

At that time the RMTC played a determinative role at the early stage of improvement and modification of the federal and Rosatom MC&A regulatory framework.

In 2004 and 2009 the SSC RF IPPE got the license for condensed (72 hours) advanced training of specialists in MC&A area.

Stage 4 (2004 - nowadays)

Achievement of sustainability: modification of courses and renewal and updating of material and technical base, improvement of scientific and methodological potential, change-over to the national financial sources for training activities, introduction of computer technologies into the training process, transfer of experience and methodological materials to advanced training departments at Rosatom facilities. Assistance to facilities in NMC&A system upgrading under international and national target programs, state contracts and bilateral agreements.

THE RESULTS OF TRAINING ACTIVITY

The regular training of personnel from the facilities of Russian nuclear complex in the RMTC started in 1995. Its principal difference from training in other disciplines (criticality safety, radiation safety, physical protection) was that there had been no training of this scale and with such comprehensiveness before (see diagrams).

Today the curriculum consists of 44 courses subdivided into 7 series which cover all NMC&A subjects. The developed training courses are the result of generalization of the experience and joint work of Russian, US and European specialists in the NMC&A field.

The quality of training in the RMTC is based on the use of up-to-date methods of training. The level of students' knowledge is always checked in the beginning and at the end of each course by means of specially developed test questions, exercises and computer codes.

The RMTC training courses can be divided into three categories:

- Theoretical courses which are given without any use of nuclear materials, with the only use of conference room equipment and, to some extent, of computers, weighing and bar code equipment and dummy nuclear materials. These courses can be mobile and be held by the RMTC staff at the enterprises outside Obninsk.

These courses cover such subjects as Basic State MC&A Requirements (for top managers and leading specialists), NMC&A Fundamentals, Physical Inventory Taking (PIT) Methodology, Comprehensive NMC&A Performance Testing, NMC&A at NPPs, NM Control Methods, Tamper Indicating Devises (TID), Statistical Methods to Control Measurement Quality, Statistical Methods to Determine and Analyze the Inventory Difference, the courses for the particular categories of MC&A specialists .

- Practical courses which are given without any use of nuclear materials and held in special RMTC laboratories at the SSC RF IPPE site with the extended use of computers, bar-codes, scales and balances (such courses as "Software Engineering for Nuclear Materials Balance Analysis", "Bar Code Techniques", "Software Engineering for Scale Calibration"). These courses cannot be mobile.

- NDA courses for which NM samples, radioactive sources and special equipment are used to work with NMs and computers of special application. These courses require specially equipped rooms and access control. They cannot be mobile. Most part of the time is dedicated to practical exercises. Theoretical classes usually cover only one day of this course. Each trainee of this category has to do test exercises on the use of devices and techniques studied. The RMTC offers the written materials which include theoretic lectures and operation manuals for various measurement techniques and instruments. There is a special chapter in these manuals with the information gathered in the RMTC about failures in their operation, mistakes made by operators and recommendations for these cases.

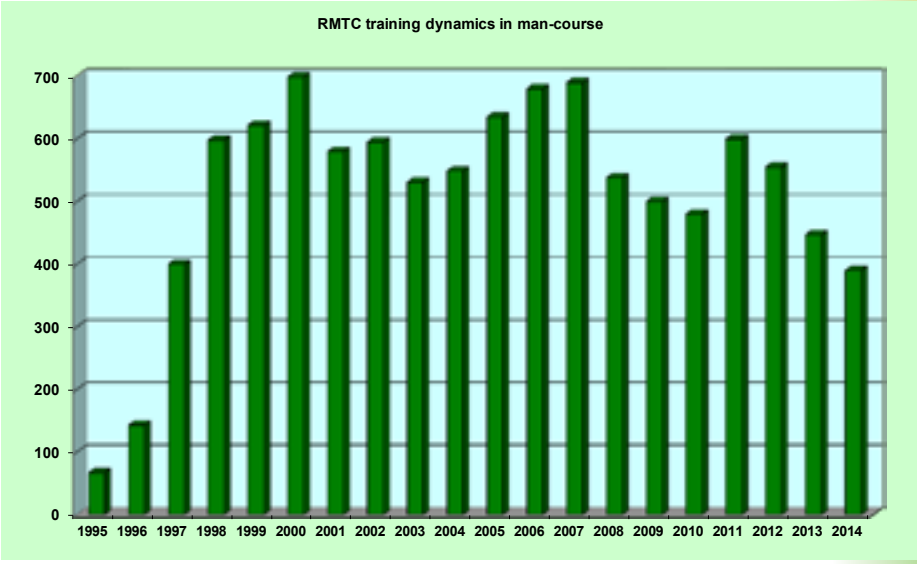
Each trainee can get electronic files with NMC&A documents (regulatory documents, guidelines, manuals) both in use and under development. A special page for these documents is developed on the RMTC web–site.

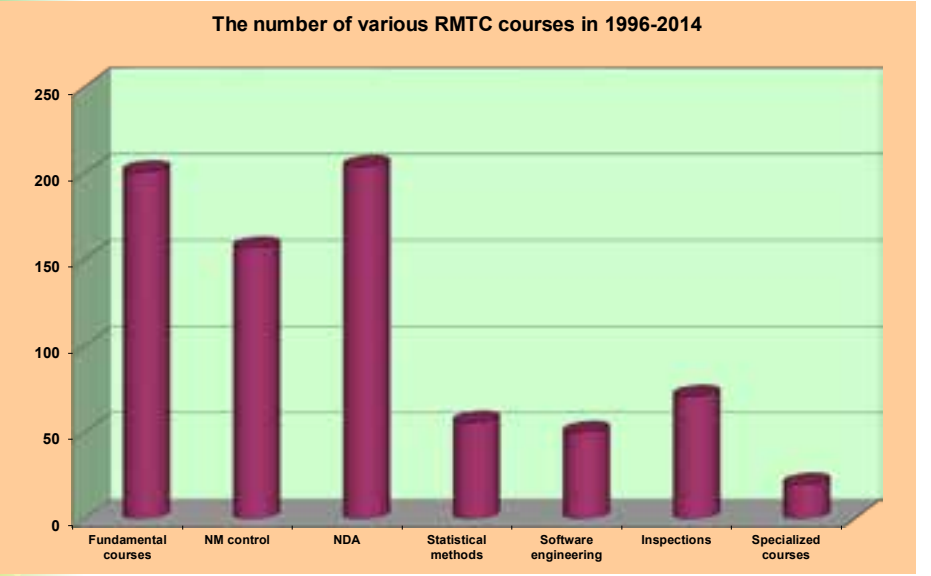
THE RESULTS OF RMTC TRAINING ACTIVITY BY THE BEGINNING OF 2015

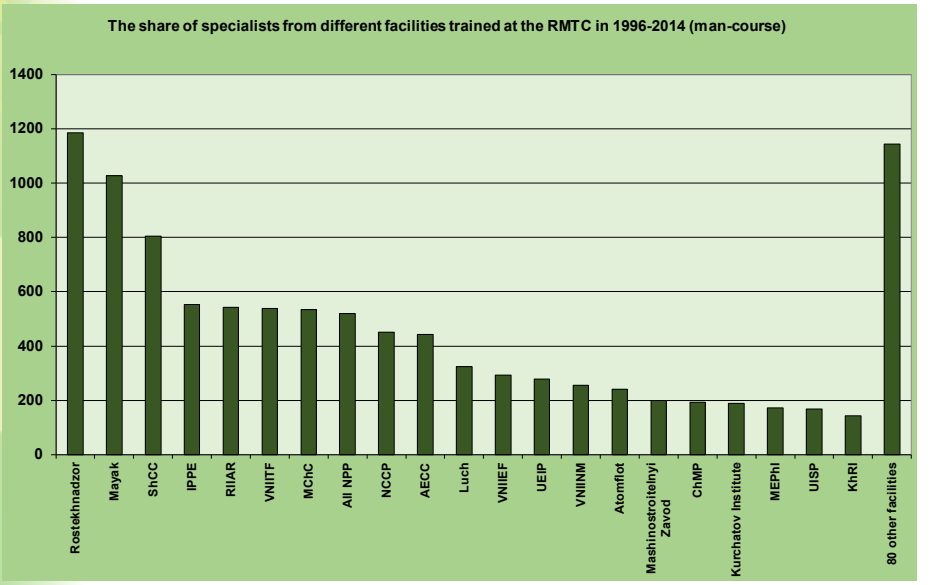
- As of January 1, 2015, 788 training courses have been held
- 4950 attendees participated in the courses,
  - out of them 410 Rostechnadzor inspectors and 4540 operators
- The scope of training covered 10204 man-courses
  - out of them 1184 for Rostechnadzor inspectors and 9020 for operators
- The significant part of specialists attended several courses, the average number of courses attended
  - by Rostechnadzor inspectors was 1184 : 410 = 2,89;
    by operators 9020 : 4540 = 1,99.
- The curriculum contained 52 different courses.

The specialists from over 100 facilities of Russia, Ukraine, Kazakhstan, Lithuania, Armenia, Malaysia, the RSA, France participated in the RMTC courses and workshops.

Five training courses on Pu NDA were organized at the RMTC for IAEA inspectors. 32 inspectors were trained at these courses. These inspectors came from Bulgaria, France, Italy, China, the Philippines, Egypt, Ghana, Nigeria, Uganda, Brasil, the RSA, Chile, the USA.




The number of various RMTC courses in 1996-2014
250
200
150
100
50
0
Fundamental courses
NM control
NDA
Statistical methods
Software engineering
Inspections
Specialized courses


The share of specialists from different facilities trained at the RMTC in 1996-2014 (man-course)
1400
1200
1000
800
600
400
200
0
Rostekhnadzor
Mayak
ShCC
IPPE
RIIAR
VNIITF
MChC
All NPP
NCCP
AECC
Luch
VNIIEF
UEIP
VNIINM
Atomflot
Mashinostroitelnyi Zavod
ChMP
Kurchatov Institute
MEPhI
UISP
KhRI
80 other facilities

WORKSHOPS AND MEETINGS

The RMTC arranges workshops and meetings of nuclear experts and inspectors to share the experience and technologies.

- In June 1996 a bilateral (European Commission/Russian Federation) NMC&A Seminar was held at the RMTC, with the participation of the JRC and the Euratom Safeguards Directorate.

Since 1997 these Seminars have become tripartite (US/EC/RF):

- April 1997 "NMC&A at Uranium Fuel Fabrication Facilities".
- November 1998 "NMC&A at Radiochemical Facilities".
- October 2000 "Nuclear Material Measurement and Evaluation for Physical Inventory".
- October 2002 "Assessment of Nuclear Materials Content and Inventory in By-products Streams".
- October 2006 "Control and Accountability Measures Applied to Nuclear Material Transfer Processes".
- October 2008 "Nuclear Materials Control and Accounting. Status and Challenges".
- November 2013 "Results and Plans for Support of Long-Term Effective Sustainability of the Russian NMC&A System".

US and European specialists made a significant contribution into the organization of these seminars and participation in them.

More than 500 Russian and international specialists participated in all the workshops. The RMTC specialists and scientists also participate in other Russian and international conferences and workshops where they present their papers. In 2009 these were international MPC&A conferences in Russia and the USA (INMM). Besides they are actively involved with the work of the Russian - US groups on personnel training, hardware and methodological support.

RMTC INSTRUCTORS

A team of teachers and instructors has been formed at the RMTC, representing the IPPE and other Rosatom facilities; besides, among the instructors there are specialists from various Rostechnadzor regional inspection offices and Rostechnadzor Headquarters.

Within the whole period of training the RMTC involved over 150 specialists from 31 Russian facilities as instructors:

- AEIP
- VNIIA
- VNIINM
- VNIITF
- VNIIEF
- SSC RF IPPE
- Mining and Chemical Combine
- Strazh
- Kalinin NPP
- Rosenergoatom Concern
- Kursk NPP
- Moscow State University
- MEPhI
- Moscow Canberra Office
- Novosibirsk Chemical Concentrates Plant
- RIIAR
- Luch
- Khlopin Radium Institute
- POMZ, Elektrostal
- UISP
- JSC CHP
- JINR, Dubna
- Mayak
- Kurchatov Institute
- State Corporation "Rosatom"
- Rostechnadzor
- Situation and Crisis Center
- Smolensk NPP
- Siberian Chemical Combine
- Urals Electrochemical Integrated Plant
- SCI

The number of instructors from the SSC RF IPPE is the highest and runs to 56 people.

Significant support was provided by the colleagues from the US National Laboratories (PNNL, LLNL, LANL, SNL, ORNL, BNL) and from the Institutes of the European Commission: Joint Research Center (IPSC, Ispra; ITU, Karlsruhe), especially at the initial stage of the work in the Center.

By now, the number of Russian and international specialists involved in the RMTC training activities totals 250 people (179 of them from Russia and 71 from the US and EC). If at the initial stage the most part of the instructors were international specialists, by the year of 2003 more than 93% of instructors were Russian. The list of Russian RMTC instructors recently participated in the courses is given in the end of the catalog.

One quarter of Russian instructors have a doctoral degree; over 50% of them have been specifically trained at the Institutes of the Joint Research Center of the European Commission and the US National Laboratories.

CAPABILITIES

Now the RMTC has developed a substantial infrastructure, including comfortable auditoria of the Conference Center, SSC RF IPPE, and laboratories located at the IPPE site.

Theoretical classes are held at the IPPE Conference Center equipped with up-to-date classroom and visual aids (local computer network, video and digital projectors, VCRs, equipment for simultaneous translation, etc.). The instructors' working places are equipped with a branched local network, access to Internet and state-of-the-art communication means.

Six RMTC laboratories have been established and equipped with state-of-the-art instruments, hardware and software for hands-on training:

THE LABORATORY OF NON-DESTRUCTIVE ASSAY (NDA) TECHNIQUES AND INSTRUMENTS

is equipped with reference materials, radioactive sources, various gamma-spectrometers, including the Russian ones, for measurement of U and Pu isotopic composition, active and passive neutron coincidence counters for measurement of U-235 and Pu mass in containers, waste drum monitors to measure Pu and U-235 mass in containers with waste, active collar counters, HKE densitometer and calorimeter.

The NDA lab has a wide spectrum of State Reference Materials (SRM) of UO_2 and PuO_2 mass and isotopic composition; the SRMs of BN-600, VVER-440 and RBMK fuel elements and fuel assemblies (FA) have been fabricated and certified. The NDA lab has equipment models and special uranium samples to conduct courses on measuring U-235 and Pu mass in hold-up in the process equipment.

THE BAR-CODING TECHNIQUES LABORATORY

is equipped with devices manufactured by Intermec company and software required for the bar code application, reading and code information processing. A local computer network has been developed to train attendees in the skills of using bar code equipment, electric scales in computer networks.

THE TANK CALIBRATION LABORATORY

has all the engineering systems in place, and the lab special equipment has been installed to provide training in large volume tank calibration and development of related methodology for solution level and density measurements.

TRAINING GROUPS

Theoretical training groups consist of 12 - 16 people, training groups with the use of real nuclear materials in the NDA lab involve 9 - 12 people, thus making it possible to maintain an appropriate feedback with the trainees during the course and help better master the program subjects.

MANUALS AND TRAINING MATERIALS

Each trainee is given a complete set of methodological materials for the course which assist in training and further practical work. Also provided are regulatory documents, the latest versions of the regulatory draft documents and other types of useful information in electronic format.

CERTIFICATES

To check the trainees' level of knowledge both in the beginning and at the end of courses, computerized tests and practical exercises are used.

A special computer code called "EXAMINER" was developed to test the level of knowledge. Its implementation made it possible: to simplify and speed up the procedure of setting up the given number of nonrecurring test questions; to speed up the procedure of checking the answers to test questions and assessing the knowledge as well as to make it more objective; to provide RMTC teachers, instructors or methodologists with the generalized results of attendees' testing in an easy – to – use graphic form.

The "EXAMINER" code was installed at all the big Rosatom facilities where it is used to test MC&A specialists' knowledge.

The students who successfully pass them get state certificates of condesed advanced training.

MOBILE TRAINING COURSES

These courses are held to adapt them to site-specific MC&A technologies and procedures at the facilities, to provide the required conditions for personnel certification. The exception is the courses, which envisage the use of NM, radioactive substances and sources, as well as complex engineering devices and systems. Three of four mobile courses are held every year.

FACILITIES' DEMAND FOR TRAINING AND METHODOLOGICAL ASSISTANCE

The basic NMC&A rules came in force in 2001. This fact became determinant in planning and conducting RMTC courses for the following years.

The annual estimation of demands for training specialists in the issues of NMC&A is based on the data submitted by the facilities in response to the RMTC inquiry circulated at the end of each year together with the course schedule and catalog. The recent statistical data about the demand for training testify to stabilization of this demand actually for all the subjects.

While the current techniques and instruments are being actively introduced into the NMC&A practice at the facilities, the demand for the methodological assistance for the NMC&A specialists at the facilities is also growing. Today this assistance consists in fabrication of state reference materials, development of federal norms and rules, regulatory documents at the Rosatom level, and adaptation and implementation of the NM gamma-control procedures.

RMTC IN THE NEAR FUTURE

The main RMTC activity that consists in training personnel from nuclear facilities in the MC&A field is carried out in accordance with the current validity of the license for condensed training activity, on the basis of the system approach.

The performed assessment of Russian facilities' demand for MC&A training has revealed new directions in educational activities but has not shown any tendency towards decreasing the required volume of training for the next five years (about 500 man-courses a year). Mobile courses and computer training technologies (CBT-technologies: CD-courses, computerized video-materials, etc.) will make it possible to increase the number of trainees and to optimize the training cost.

The share of mobile courses has increased in the annual training. Each mobile course is developed on the basis of advance application in view of site-specific NM management technologies for particular sites. The program for these courses actually consists of the modules from two or three existing RMTC courses depending on requests of the facilities. Besides, they are complemented with special modules that reflect the site-specific features of NM management technologies and MC&A procedures at these facilities. These modules are developed and given by the specialists from these facilities. This approach allows the course to be completely adapted to the demands for MC&A training of specialists at particular facilities.

SERIES OF COURSES ON MC&A STATUS MONITORING

The ROSATOM facility specialists from on-site MC&A monitoring teams are trained at the RMTC. For this purpose, special courses on procedures of monitoring of MC&A system and its separate elements have been developed. For the first time the demands for training of these specialists were determined in 2005. Now new information is being collected. The basic course for Rosatom inspectors, the courses on NM control inspection, NM accounting inspection and a course on MC&A status monitoring by the facility specialists are conducted.

COURSES FOR MC&A SPECIALISTS WITH DIFFERENT FUNCTIONAL RESPONSIBILITIES

In order to ensure the effective and reliable MC&A system operation it is necessary to organize site-specific personnel training at the facility in view of the established structure of MC&A system, NM management technologies existing in MBAs and functional responsibilities of different specialists. The MC&A specialists from Rosatom facilities were categorized in order to develop functional characteristics and model training programs aimed at relevant categories.

In compliance with the functional responsibilities introduced, the RMTC is currently in the process of development of the courses for the categories of MC&A specialists set up in 2009 [series 7].

DEVELOPMENT OF NEW COURSES

The following courses have been modified, updated and newly developed:

- The facility MC&A status monitoring procedures for Rosatom commission members and the specialists, involved in the site level monitoring.
- Application of a segmented gamma-scanner to measure U-233 and Pu in solid waste
- Seals (TID) Application
- MC&A requirements and procedures for specialists, involved in measurments.
- MC&A data statistical analysis.
- Basic MC&A requirements for managerial personnel.

DEVELOPMENT OF NEW MODULES

Most part of RMTC courses is to some extend updated after their completion on the basis of trainees' responses and feedback. During four or five years the courses are changed by 30-50%, thus the trainees who attend the course for the second time in five years gain new knowledge there.

PUBLISHING ACTIVITY

The publishing group regularly prepares the materials for training courses, workshops, working group meetings and conferences held at the RMTC. The available technical and personnel resources are sufficient to ensure the use of new technologies in preparation of training materials. In the near future it is planned to provide the trainees with the CD sets of topical materials, including lectures, graphs, training videos for the courses, etc.

INFORMATION ACTIVITY

Currently the RMTC homepage contains the information about training and methodological activity of the Center, primarily of the advertising nature. It has the sections which help the readers get technical and regulatory information on NMC&A issues.

For instance, databases on scientific and technical information, data on MBAs and measu-rement instruments, results (documents, articles) of studies, on-site implementation of MC&A system elements, workshop proceedings, materials of the meetings held at the RMTC.

METHODOLOGICAL SUPPORT OF THE FACILITIES

Besides conducting training courses the Center performs studies and development, testing and evaluation of new MC&A methods; renders its assistance to facilities in development and implementation of MC&A measures, technological tools and techniques; participates in development of MC&A regulatory documents.

Under the contracts with the facilities, the RMTC experts participate in development and implementation of modern MC&A system elements at the JSC "POMZ", "Mining and Chemical Combine", in testing NDA techniques and instruments during Rostechnadzor inspections, in development and implementation of methods and instruments to control U-235 and Pu mass in hold-up in nuclear systems.

METHODOLOGICAL SUPPORT OF THE FACILITIES IN THEIR ON–SITE MC&A PERSONNEL TRAINING

Besides conducting mobile courses the RMTC develops course curricula and materials, trains the trainers who are the specialists of these facilities, so that they could train the personnel in their bureaus (divisions) responsible for advanced training and at working places.

It is planned to develop a library of MC&A regulatory documents on laser discs to be distributed among the facilities.

Within the "Plan of MC&A subjects for qualification upgrading of managerial personnel from nuclear facilities" the RMTC participates in advanced training rendered for NPP MC&A service managers and deputy chief engineers at the advanced training department of the Obninsk State Technical University for Nuclear Power Engineering (now the MEPhI branch).

METHODOLOGICAL SUPPORT OF ROSATOM MONITORING PROJECT

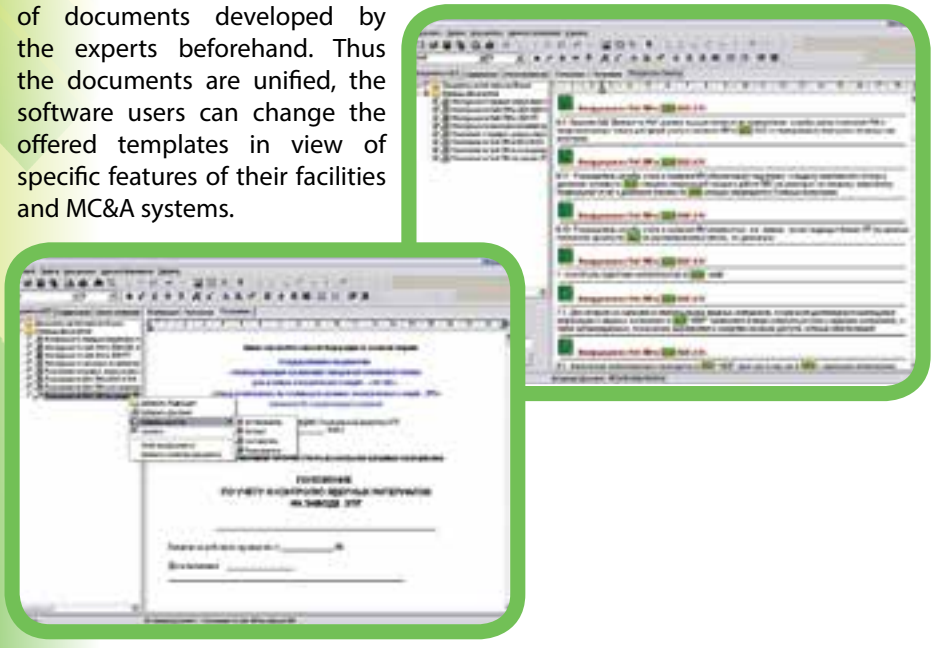
The RMTC has developed and conducts the courses for the specialists involved in Rosatom MC&A monitoring at sites, participates in working out the regulatory framework for Rosatom monitoring procedures and in inspections of MC&A systems at Rosatom facilities.

DEVELOPMENT OF REGULATORY DOCUMENTS AT THE FEDERAL, AGENCY AND OPERATOR LEVELS

The RMTC has accomplished the review of "Basic MC&A Rules" and development of "Provision on procedures for releasing NM products to the category of radioactive substances and radioactive waste". The development of "Methodological Guidelines on Detection, Investigation and Recording of MC&A Anomalies and Violations" and "NM PIT Working Manuales" are almost competed. Besides, the RMTC participates in developing many documents of federal and Rosatom levels, such as "Recommendations and Comments on the Use of Basic MC&A Rules".

DEVELOPMENT OF SPECIALIZED SOFTWARE TO SUPPORT THE DEVELOPMENT OF MC&A DOCUMENTS AT FACILITIES AND MBAS

In cooperation with the Virginia Technology University programmers (Blacksburg, USA) the RMTC specialists have developed the software that significantly helps the specialists from the facilities work out MC&A provisions, instructions and guidelines by means of model sections of documents developed by the experts beforehand. Thus the documents are unified, the software users can change the offered templates in view of specific features of their facilities and MC&A systems.



DEVELOPMENT OF NM NDA REFERENCE MATERIALS

NDA techniques used for MC&A confirmatory measurements require development and fabrication of various reference materials (RF), first of all, at the facility level. The RMTC has state RMs that allow this task to be solved much easier by recalibration of instruments and traceability of values of state and other types of RMs. The RMTC specialists help the facilities develop documents and fabricate NM NDA reference materials.

NDA TECHNIQUES DEVELOPMENT AND TESTING

With a wide scope of NDA instruments, state and working RMs available, the RMTC carries out and plans to extend in the future the work on development and testing of NDA measurement techniques primarily with the purpose to determine the area of their applicability and measurement errors under various conditions. Great progress has been achieved in methods and techniques to control U-235 and Pu mass in hold-up. The procedures to measure U-235 mass in hold-up were developed for the JSC "POMZ" and those to measure Pu mass in hold-up were developed for the Mining and Chemical Combine.

NDA INSTRUMENT CALIBRATION AND TESTING WITH THE USE OF STATE RM

First of all, it refers to neutron coincidence counters of different types and drum monitors to control U-235 and Pu mass in solid radioactive waste, as well as to gamma-spectrometers used to measure NM mass in hold-up. Calibration and testing of measurement instruments and measurement procedures with the state RMs available at the RMTC cover the important part of this activity.

FEEDBACK FROM FACILITIES AND AGENCIES

The main tool and data source to manage the RMTC activities was and still will be the feedback from the facilities and specialists that enjoy the RMTC services, first of all, in the field of advanced training. This feedback is implemented by the following measures:

- Plans of checking how training requirements are implemented and specified
- Annual inquiries about MC&A training needs at the facilities
- Questionnaires filled in by course trainees and participants of other RMTC events
- Workshops for MC&A training managers at the facilities. These workshops are held on a regular basis, once a year or every other year.
- Acquisition and analysis of the information about the level of MC&A specialists training, that is submitted by the facilities to the State Corporation "Rosatom" in their annual reports.

IMPROVEMENT OF TEACHERS', INSTRUCTORS', ASSISTANTS' KNOWLEDGE

There is a traditional way to upgrade the RMTC personnel's qualification level. It consists in sharing the experience and participation in joint work and workshops with leading specialists from Russian and international institutions, in conducting their own R&D work on MC&A issues, defending theses, etc.

MAIN TRENDS IN RMTC EVOLUTION

The RMTC plans for the near future are, first of all, related to significant updating of a number of fundamental courses and developing the new ones primarily due to the fact that the new Basic MC&A Rules have come into force. Besides the plans include rendering methodological support to the facilities both in their on-site personnel training and in development and implementation of modern MC&A elements and procedures, the system approach to MC&A personnel training. Implementation and mastering of computer technologies and training tools as well as the use of the engineering and intellectual base created with the aim to provide methodological support to the facilities in their MC&A system upgrading, especially in development of MC&A regulations and implementation of MC&A devices and procedures in practice, play the principal role in realization of these plans. Improvement of on-site personnel training is also of great importance. In particular, this work concerns the development of training and methodological materials for specialized courses for each category of MC&A specialists and their transfer to the facilities.

SERIES 1. FUNDAMENTAL COURSE

1.1 FUNDAMENTALS OF NUCLEAR MATERIALS CONTROL&ACCOUNTING 31

The general course on the principles and basic requirements of the advanced NMC&A systems - the US system, international system (IAEA), and current Russian NMC&A system.

1.2 NUCLEAR MATERIAL CONTROL AND ACCOUNTING IN MBAS WITH NM ITEMS 32

The course objective is to give the trainess information about the MC&A requirements and procedures in MBAs with NM in the form of items only.

1.3 PHYSICAL INVENTORY TAKING (PIT) METHODOLOGY 33

The course is intended for studying the key MC&A element – PIT procedure.

1.3.1 PIT PLANNING AND PERFORMANCE WITH THE USE OF NDA METHODS AT FACILITIES WITH ITEMS CONTAINING U AND PU 34

The course objective is to train the personnel of various nuclear fuel cycle facilities how to perform PIT procedures in practice by means of NM confirmatory measurements with gamma-spectrometric and neutron techniques.

1.4 COMPREHENSIVE NMC&A PERFORMANCE TESTING 35

The objective of this course is to demonstrate how to assess performance and effectiveness of the NMC&A system and its components.

1.5 NUCLEAR MATERIAL ACCOUNTING, FIS REPORTS 36

The course objective is to give the trainees the detailed information about and practical skills in management of NM accounting, first of all, for generation of FIS reports: NM characteristics description; generation of reporting documents for different organizations; the use of AWS in generation of reports; in particular: preparation of electronic files, introducion of FIS classifiers and handbooks and handling of item; entry of reporting information, control, generation of reports, correction procedures, loading of xml-files with reports.

SERIES 2. NUCLEAR MATERIALS CONTROL

2.1 NUCLEAR MATERIALS CONTROL TECHNIQUES 38

The course will give the knowledge about NM access control systems, including administrative control, access control and surveillance systems. The course is dedicated to the methods of integration of the physical protection system and control and accounting system.

2.2 SEALS (TID) APPLICATION 39

Training the facility staff authorized to implement seals (TID) Programs.

2.4 BAR CODE TECHNIQUES 40

Training in bar code system application for NMC&A.

SERIES 3. NONDESTRUCTIVE ASSAY

3.1 GAMMA ASSAY TECHNIQUES AND INSTRUMENTS 42

The course considers theoretical background of gamma-spectrometric measurements, measurement techniques and practical skills in appropriate equipment operation and measurement of a wide spectrum of NM samples.

3.1.1 URANIUM HOLD-UP MEASUREMENT IN PROCESS EQUIPMENT 43

Theoretical and practical aspects of NM measurement in hold-up. The course is aimed at gaining practical skills in running hand-held gamma-spectrometers, in carrying out measurements to estimate U-235 mass in process equipment hold-up with the use of «generalized» geometry method.

3.1.2 MEASUREMENT OF U AND PU ISOTOPIC COMPOSITION 44

The course considers the specific features in U and Pu isotopic composition measurements and analysis by means of the MGA, MGA-U and FRAM codes.

3.1.3 NDA MEASUREMENT OF PLUTONIUM MASS IN HOLD-UP 45

Theoretical and practical aspects of Pu mass measurement in hold up. Gaining practical skills in the use of measurement techniques, hand-held gamma-spectrometers applicable for these measurements. Practical measurement of Pu mass in hold-up in process equipment models.

3.2 GAMMA ASSAY TECHNIQUES AND INSTRUMENTS (FOR INSPECTORS) 46

The course is aimed at gaining practical experience and skills in the work with hand-held gamma-spectrometers suitable for verification measurements during inspections. Rostechnadzor inspectors will gain the experience in NM identification and determination of NM quantitative characteristics by state-of-the-art gamma-spectrometric methods.

3.3 NEUTRON ASSAY TECHNIQUES AND INSTRUMENTS 47

Theoretical and practical aspects of NM measurement by neutron techniques. Specifics of neutron coincidence analysis. Pu and U-235 mass measurement procedures with passive and active neutron coincidence methods and practical skills in operation of passive and active neutron coincidence counters.

3.3.2 NEUTRON NDA TO CONTROL PU IN WASTE 48

Theoretical and practical aspects of Pu mass measurement in waste. The neutron coincidence method to measure Pu mass in containers with solid waste. Measurement system calibration and measurement of Pu mass in containers with Pu waste of various composition.

3.4 NEUTRON ASSAY TECHNIQUES AND INSTRUMENTS (FOR INSPECTORS) 49

Theoretical and practical aspects of NM mass measurement by neutron techniques. Calibration of passive and active neutron coincidence counters. Practical skills in the use of measurement techniques to measure NM mass with passive and active neutron coincidence method in the course of inspections.

3.6 DIP TUBE TECHNIQUE TO CONTROL NM SOLUTION MASS/VOLUME IN PROCESS EQUIPMENT 50

The course considers the methods and principles of near-real-time control of NM mass in solutions in the process equipment. Measurement technique, applied software, practical skill in tank calibration.

3.7 NDA MEASUREMENTS OF PU MASS AND ISOTOPIC COMPOSITION 51

The course considers NDA techniques to measure Pu mass based on the results of Pu isotopic composition measurements by means of high-resolution gamma-spectrometry. Practical skills in measurements with a passive neutron coincidence counter and a gamma-spectrometer with a germanium detector.

3.8 MEASUREMENT OF U MASS IN WASTE DRUMS 52

Theoretical studies of gamma-spectrometric methods to analyze NMs. Design and principles of operation of the gamma-spectrometric channel meant to measure of U isotopic composition. Genie – 2000 software.

Theoretical aspects of passive and active neutron analysis of nuclear materials. Design and operation principles of neutron coincidence analyzers and multiplicity counters. INCC software. Measurements for active and passive U analysis in waste.

3.9 MEASUREMENT OF U AND PU CONCENTRATIONS IN SOLUTION SAMPLES BY THE HYBRID K-EDGE DENSITOMETER 53

Hybrid K-Edge densitometer design and operation principles to measure U and Pu concentration in solution samples. Application software. X-ray fluorescence analysis and K-Edge gamma-spectrometric methods to measure NM concentration in solutions. Practical skills in conducting measurements of U concentrations in solution samples with the hybrid K-Edge densitometer.

3.10. URANIUM AND PLUTONIUM ISOTOPIC COMPOSITION AND MASS MEASUREMENTS FOR SPECIALISTS RESPONSIBLE FOR NM MEASUREMENTS 54

The course is developed in compliance with the model training program aimed at training and improving qualification of the specialists who are involved in and are responsible for NM measurements and measurement quality control for the MC&A purposes. At this course the trainees will get knowledge of the NDA theory, gain skills in operation of high-resolution spectrometers and neutron coincidence.

SERIES 4. STATISTICAL METHODS

4.1 STATISTICAL METHODS FOR NM CONTROL & ACCOUNTING (INTRODUCTORY COURSE) 56

The trainees are given general knowledge of statistics applications for MC&A – from terminology and basic definitions to specific statistical approaches to MC&A problems.

4.2 STATISTICAL METHODS FOR MEASUREMENT QUALITY CONTROL 57

The course covers the detailed information about the application of statistical methods for MC&A measurement quality control.

4.3 STATISTICAL METHODS FOR INVENTORY DIFFERENCE (ID) CALCULATION AND ANALYSIS 58

The trainees will acquire skills in the use of statistical methods and computer codes for ID calculation and analysis.

4.4 STATISTICAL METHODS FOR ACCOUNTANCY PERFORMANCE ASSESSMENT (ADVANCED COURSE FOR EXPERTS AND INSTRUCTORS) 59

The course considers the detailed information about the application of statistical methods for MC&A system quality control – from the theory of sampling for final populations up to accountancy effectiveness assessment in quantitative terms.

SERIES 5. SOFTWARE ENGINEERING

5.1 NMC&A SOFTWARE ENGINEERING 61

5.2 SOFTWARE ENGINEERING FOR NUCLEAR MATERIALS BALANCE ANALYSIS 62

The trainees are given the detailed information about the software developed at JRC (Ispra, Italy) and RMTC for the analysis of NM balance including calculation methods.

SERIES 6. INSPECTIONS

6.1 MPC&A FUNDAMENTAL INSPECTION COURSE 64

Training in conducting effective MPC&A inspections. The course forms the basis for the next courses in this series.

6.1.1 FUNDAMENTAL COURSE FOR ROSATOM MC&A MONITORING SPECIALISTS 56

Rosatom specialists will get the basic knowledge and practical skills in Rosatom MC&A status monitoring. The course forms the basis for the next training courses for Rosatom spesialists involved in MC&A status monitoring.

7.3 NM CONTROL AND ACCOUNTABILITY PROCEDURES AND REQUIREMENTS (FOR MATERIALLY RESPONSIBLE OFFICIALS AND CUSTODIANS) 75

The trainees acquire knowledge and skills in NM accountability procedures and control methods required for the given category of specialists with the aim to adequately perform their functions and duties.

7.4 PIT PERFORMANCE (FOR PIT GROUP MEMBERS) 76

The course gives detailed information about the requirements to the given category of specialists and PIT procedures, from PIT planning to balance closing and documentation of results.

7.5 NMC&A REQUIREMENTS AND PROCEDURES (FOR SPECIALISTS INVOLVED IN AND RESPONSIBLE FOR NM TRANSFER PROCEDURES) 77

The traines will acquaire MC&A knowlege and skills required to perform the pcodures during NM transfers.

7.6 NMC&A REQUIREMENTS AND PROCEDURES (FOR SPECIALISTS RESPONSIBLE FOR NM ACCOUNTANCY IN MBAS) 78

The traines will acquaire MC&A knowlege and skills required for specialists responsible for NM accounting in MBAs.

7.7 NMC&A REQUIREMENTS AND PROCEDURES (FOR SPECIALISTS) 79

NMC&A Requirements and Procedures (for specialists responsible for statistical analysis of MC&A results).

SERIES 1

FUNDAMENTAL COURSES

1.1 Fundamentals of Nuclear Materials Control & Accounting

1.2 Nuclear Material control and accounting in MBAs with NM in items

1.3 Physical Inventory Taking (PIT) Methodology

1.3.1 PIT planning and performance with the use of NDA methods at facilities with items containing U and Pu

1.4 Comprehensive NMC&A Performance Testing

1.5 Nuclear Material Accounting

1.1 FUNDAMENTAL COURSES

5 days

THEORETICAL LESSONS

The role of MC&A system, personnel competence and discipline in nonproliferation safeguards.Current Russian MC&A regulatory framework.
The state MC&A structure and principles at the nuclear facilities with NM in items.
MC&A system arrangement at the facility level. Presentation of a training video about MC&A arrangement at the Novosibirsk Chemical Concentrates Plant.
MC&A requirements to NM transfer. Specific features of NM item transfer.
MC&A requirements to PIT performance in MBAs. Specific features of PITs for NM in items. Presentation of the training video "PIT performance at the IPPE storage facility with NM in items".
Basic aspects of NDA of NM in items.
The experience of NDA use in the course of NM items transfer and PIT procedure at the RMTC NDA laboratory.
MC&A bar-code technologies.
Statistical methods used in NM items transfer and PIT procedures.
TID application for MC&A purposes.
NM balance closing in MBAs with NM in items.
Accounting and reporting documents processing.
Monitoring of MC&A system functioning with NM in items and the methods of its elements performance testing.

PRACTICAL EXERCISES

MBA arrangement: selection of the optimum number of MBAs and MBA boundaries at a hypothetical facility.
Development of MC&A, PIT and NM transfer instructions at a hypothetic facility.
Application of bar-code technologies in the course of PIT of NM in items.
Statistical methods used in the course of transfer and PIT of NM in items.
TIDs used for MC&A purposes.
MC&A elements performance testing, if NM is in items.

POTENTIAL AUDIENCE

Specialists from nuclear facilities with MBAs with NM in items.

PRELIMINARY TRAINING

CD-ROM course "Introduction into MC&A issues".

5 days

1.2 NUCLEAR MATERIAL CONTROL AND ACCOUNTING IN MBAS WITH NM IN ITEMS

THEORETICAL LESSONS

The role of MC&A system, personnel competence and discipline in nonproliferation safeguards.
Current Russian MC&A regulatory framework.
The state MC&A structure and principles at the nuclear facilities with NM in items.
MC&A system arrangement at the facility level. Presentation of a training video about MC&A arrangement at the Novosibirsk Chemical Concentrates Plant.
MC&A requirements to NM transfer. Specific features of NM item transfer.
MC&A requirements to PIT performance in MBAs. Specific features of PITs for NM in items. Presentation of the training video "PIT performance at the IPPE storage facility with NM in items".
Basic aspects of NDA of NM in items.
The experience of NDA use in the course of NM items transfer and PIT procedure at the RMTC NDA laboratory.
MC&A bar-code technologies.
Statistical methods used in NM items transfer and PIT procedures.
TID application for MC&A purposes.
NM balance closing in MBAs with NM in items.
Accounting and reporting documents processing.
Monitoring of MC&A system functioning with NM in items and the methods of its elements performance testing.

PRACTICAL EXERCISES

MBA arrangement: selection of the optimum number of MBAs and MBA boundaries at a hypothetical facility.

Development of MC&A, PIT and NM transfer instructions at a hypothetic facility.

Application of bar-code technologies in the course of PIT of NM in items.

Statistical methods used in the course of transfer and PIT of NM in items.

TIDs used for MC&A purposes.

MC&A elements performance testing, if NM is in items.

POTENTIAL AUDIENCE

Specialists from nuclear facilities with MBAs with NM in items.

PRELIMINARY TRAINING

CD-ROM course "Introduction into MC&A issues".

1.3 PHYSICAL INVENTORY TAKING (PIT) METHODOLOGY

5 days

THEORETICAL LESSONS

Survey of MC&A fundamentals, MC&A requirements in domestic regulatory documents, PIT status in MC&A, assessment criteria of MPCA& system effectiveness.Initial PIT performance and MC&A records.
PIT planning: starting with the work organization and assignment of responsibilities through the use of computer codes for statistical sampling when planning measurements and processing PIT results.
Strategy of NM parameters measurements which reveals total or partial defects.
PIT procedures and their implementation in practice.
Reconciliation of MC&A records data and PIT results.
MC&A specific features at facilities with nuclear materials in bulk-form and items.

PRACTICAL EXERCISES

Development of PIT and NM transfer procedures for a hypothetical facility; initial PIT of conventional nuclear material with the use of weighing equipment, reference materials, computer equipment and TIDs.

Periodical PITs of NMs subjected to technological processes.

Detection of NM losses and thefts against measurement uncertainties.

The course comprises a technical tour to the IPPE with the aim to get familiarized with PIT procedures at BFS facility, videos about MC&A arrangement at Y-12 Plant (Oak Ridge) and PIT performance at Russian nuclear facilities.

Examples of PIT program and instructions on PIT performance are given.

POTENTIAL AUDIENCE

Specialists involved in practical MC&A activity or development of MC&A systems and/or their elements, instructions, procedures.

PRELIMINARY TRAINING

It is desirable to know the courses:

1.1 Fundamentals of Nuclear Materials Control & Accounting.

CD-ROM course «Introduction into NMC&A issues».

5 days

1.3.1 PIT PLANNING AND PERFORMANCE WITH THE USE OF NDA METHODS AT FACILITIES WITH ITEMS CONTAINING U AND PU

THEORETICAL LESSONS

Topicality of MC&A issues in Russia.
Introduction into PIT methodology.
PIT planning and performance.
Adequate procedures and practice, statistical sampling, sequence of actions, anomaly notification, survey of software use to calculate statistical sampling.

PRACTICAL EXERCISES

1

Practical classes are performed in the NDA Laboratories.

Performance testing of measurement devices with the use of reference materials.

PIT performance (statistical sampling, TID verification, U & Pu identification, weighing, measurement of isotopic composition and mass).

Estimation of measurement result confidence, comparison with item passport data.

Simulation of defects (NM substitution, partial or total removal, etc.)

PIT summarizing.

POTENTIAL AUDIENCE

NDA specialists with the knowledge of materials given in courses 1.3, 3.1, 3.3.

PRELIMINARY TRAINING

It is desirable to know: PIT methodology, NM NDA measurements for MC&A purposes.

1.4 COMPREHENSIVE NMC&A PERFORMANCE TESTING

5 days

THEORETICAL LESSONS

Survey of MPC&A fundamentals, vulnerability assessment, MPC&A requirements in international and domestic regulatory documents.
Goal and objectives of comprehensive NMC&A system performance testing.
Criteria of MPC&A effectiveness assessment.
Performance testing plans.
Performance testing implementation.
Documentary recording of results.

PRACTICAL EXERCISES

Development of performance testing plans for a hypothetical facility.

Development of performance testing procedures.

Performance testing.

Staff exercises on performance testing.

Recording of results.

Methodological materials available for the students comprise excerpts from DOE Regulatory Documents on MPC&A quality evaluation.

POTENTIAL AUDIENCE

Specialists involved in practical MC&A activity or in developing state and facility MC&A systems.

Specialists from state authorities and operating organizations who are involved in inspections or upgrading of the Russian MC&A system.

PRELIMINARY TRAINING

It is desirable to be acquainted with the courses:
1.1 Fundamentals of Nuclear Materials Control & Accounting.

1.3 PIT Methodology.

5 days

1.5 NUCLEAR MATERIAL ACCOUNTING

THEORETICAL LESSONS

Introduction into NMC&A aspects.
NM accounting role in NM and NW nonproliferation safeguards.
MC&A elements and principles.
Regulatory framework of SNMC&A system information support.
The accounting system structure at the federal, Rosatom and operator levels.
NM accounting at the facility level.
Computerization of accounting and reporting documentation system at the facility.
Accounting system quality assurance at the facility.
NMC&A Federal Information System. History of development.
Description of NM characteristics.
Universal NM reporting system.
Generation of reporting documents.
FIS and MC&A systems performance testing at facilities.
Demonstration and practical exercises of work with AWSs for report generation.
Information protection and security in computerized and noncomputerized MC&A systems at facilities.

PRACTICAL EXERCISES

Performance testing of facility NM accounting systems in exercises. Exercises to develop skills in NM description. Examples of how to prepare reporting document for various facilities. Preparation of regular and correction reports. Practical training in how to work with AWSs for report generation.

POTENTIAL AUDIENCE

The specialists involved in practical MC&A activities, first of all those who are responsible for generation of FIS reports.

PRELIMINARY TRAINING

It is recommended to be acquainted with the course:
1.1 Fundamentals of Nuclear Materials Control and Accounting.

NUCLEAR MATERIALS CONTROL

SERIES 2

5 days

2.1 NUCLEAR MATERIALS CONTROL TECHNIQUES

THEORETICAL LESSONS

Basic elements of NM control including nuclear material containment measures:
– localization,
– access control,
– surveillance,
– detection and response measures.
Enhancement of MPC&A system effectiveness by means of integration of system elements.

PRACTICAL EXERCISES

NM control in process areas.

NM control during transportation.

NM transfer with the use of computerized MC&A system.

NM control at storage areas.

The course is accompanied with videos about TIDs application, PITs at real nuclear facilities, the boundary between nuclear materials control and accountability.

POTENTIAL AUDIENCE

Specialists directly involved in NMPC&A activity as well as in its inspection.

PRELIMINARY TRAINING

It is desirable to be acquainted with the course:
1.1 Fundamentals of Nuclear Materials Control & Accounting.

2.2 Seals (TID) Application

5 days

THEORETICAL LESSONS

Seals (TID) application in MC&A.
Federal and Rosatom Seals (TID) regulatory documents.
Seals (TID) program elements.
Implementation of Seals (TID) program at a facility.
Seals (TID) types.
Seals (TID) selection.
Verification of seals (TID) integrity, visual inspection techniques.
Inspections and testing of seals (TID) programs.

PRACTICAL EXERCISES

Seals (TID) documentation.

Procedures of seals (TID) application, removal and destruction.

Procedures of E-cup seals (TID) verification.

Detection of seals (TID) anomalies and seals (TID) documentation inconsistencies.

POTENTIAL AUDIENCE

Personnel responsible for seals (TID) accountancy, storage, application and control, as well as for MC&A issues.

PRELIMINARY TRAINING

It is desirable to be acquainted with thr courses:
1.1 Fundamentals of Nuclear Materials Control & Accounting;
1.3 Physical Inventory Taking Methodology.

5 days

2.4 BAR–CODE TECHNIQUES

THEORETICAL LESSONS

Bar-coding as part of computerized MC&A systems.
Symbolics characteristics.
Printing of bar-symbols.
Basic principles of bar-code reading.
Bar-symbols printing quality assessment.
Technology of data acquisition by «Intermec» readers.
Information exchange in computerized data acquisition systems.
Interfaces and codes for data transfer.
Use of EasyBuilder for programming terminals (
Trakker Antares 2420/2480).
Intermec reader programming by EasySet.
ICW applications for data exchange in «computer – bar-code reader» system.

PRACTICAL EXERCISES

Practical training is conducted in the computer class using special equipment, hardware and software to print bar-code labels and to read the information applied.

Printing bar-code labels with Zebra S500, EasyCoder 4420 printers and support codes.

Practical scanning.

Practical use of bar-code readers.

Development and testing of training codes for readers.

Use of terminals (Trakker Antares2420/2480), use of data input, MicroBar 9730, programming and practical use.

Ethernet <-> Rs232 converter produced by Lantronix: CoBox E2, programming and use in the systems of bar code data acquisition.

POTENTIAL AUDIENCE

Specialists responsible for development and application of methods and means of NMC&A bar-coding.

PRELIMINARY TRAINING

Knowledge of MS Windows and the following courses:

1.1 Fundamentals of Nuclear Materials Control & Accounting;

1.3 Physical Inventory Taking Methodology.

NONDESTRUCTIVE ASSAY

SERIES 3

- 3.1 Gamma Assay Techniques and Instruments
- 3.1.1 Uranium Hold-up Measurement in Process Equipment
- 3.1.2 Measurement of U and Pu Isotopic Composition
- 3.1.3 NDA Measurement of Plutonium Mass in Hold-up
- 3.2 Gamma Assay Techniques and Instruments (for inspectors)
- 3.3 Neutron Assay Techniques and Instruments
- 3.3.2 Neutron NDA to Control Pu in Waste
- 3.4 Neutron Assay Techniques and Instruments (for inspectors)
- 3.6 Dip Tube Technique to Control NM Solution Mass/ Volume in Process Equipment
- 3.7 NDA Measurements of Pu Mass and Isotopic Composition
- 3.8 Measurement of U Mass in Waste Drums
- 3.9 Measurement of U and PU concentrations in solution samples by the Hybrid K-Edge Densitometer
- 3.10 Uranium and Plutonium Isotopic Composition and Mass Measurements for Specialists Responsible for NM Measurements.

5 days

3.1 GAMMA ASSAY TECHNIQUES AND INSTRUMENTS

THEORETICAL LESSONS

Theory and methods of nuclear material gamma-spectrometry analysis. Design and operation principles of gamma-spectrometric equipment. Uranium enrichment and uranium and plutonium isotopic composition measurement procedures.
Software.

PRACTICAL EXERCISES

Lessons are conducted at the NDA Laboratory.

They include practical exercises in uranium enrichment measurements, plutonium and uranium isotopic composition measurements with advanced gamma-spectrometric methods and high and low resolution detectors.

Measurements are performed with the following devices: mMCA-430, Coupol, Kolibri, IMCA InSpector, InSpector-2000, InSpector-1000.

Exercises in NM identification, uranium enrichment measurements and uranium and plutonium isotopic composition measurements are conducted with uranium and plutonium samples of different isotopic and chemical composition and geometry to gain practical skills.

"Do-it-yourself" and test measurements are performed with the aim to determine isotopic compositions of "unknown" nuclear material samples and evaluate the knowledge gained.

POTENTIAL AUDIENCE

Specialists engaged in NDA measurements of nuclear materials.

PRELIMINARY TRAINING

Knowledge in the field of gamma radiation measurement.

3.1.1 URANIUM HOLD-UP MEASUREMENT IN PROCESS EQUIPMENT

5 days

THEORETICAL LESSONS

Theory and methods of NM gamma-spectrometry analysis.
Design and specifications of the instruments to detect uranium location, to identify it and to measure uranium mass in hold-up.
"Generalized" geometry method to measure hold-up uranium in the process equipment.
Methods to calculate and introduce corrections.

PRACTICAL EXERCISES

Lessons are conducted at the NDA laboratory.

Preparation of Russian handheld instruments (Coupol, Kolibri) for measurements.

Calibration of the measurement equipment.

Measurement of U-235 mass in hold-up in process equipment models.

POTENTIAL AUDIENCE

Specialists involved in NDA measurements.

PRELIMINARY TRAINING

Knowledge in the field of gamma-radiation measurements.

5 days

3.1.2 MEASUREMENT OF U AND PU ISOTOPIC COMPOSITION

THEORETICAL LESSONS

Theory and methods of NM gamma spectrometry analysis.
Design and operation functions of gamma-spectrometric equipment to measure isotopic composition.
Specific features of MGA, MGA-U and FRAM codes.

PRACTICAL EXERCISES

Lessons are conducted in the NDA Laboratory.

Measurement and analysis of U and Pu gamma-spectra with the use of detectors of high resolution and MGA, MGA-U and FRAM software.

Exercises to measure and analyze isotopics of U and Pu samples with various isotopic and chemical composition, geometric shape and in various containers.

"Do-it-yourself" and test measurements are performed with the aim to determine the isotopic composition of «unknown» nuclear material samples.

3

POTENTIAL AUDIENCE

Specialists involved in NDA.

PRELIMINARY TRAINING

Knowledge of the course:
3.1. Gamma Assay Techniques and Instruments.

3.1.3 NDA MEASUREMENT OF PLUTONIUM MASS IN HOLD–UP

5 days

THEORETICAL LESSONS

Theory and methods of NM gamma-spectrometry analysis.
Design and specifications of the instruments to detect plutonium location, to identify it and to measure plutonium mass in hold-up.
"Generalized" geometry method and upgraded approach with spectrometer calibration to measure plutonium in hold-up in the process equipment.

PRACTICAL EXERCISES

Lessons are conducted at the NDA laboratory.

Preparation of the Russian handheld instrument Kolibri and γ-spectrometers of high resolution for measurements.

Calibration of the measurement equipment.

Measurement of Pu-239 mass in hold-up in process equipment models.

POTENTIAL AUDIENCE

Specialists involved in NDA measurements.

PRELIMINARY TRAINING

Knowledge in the field of gamma-radiation measurements.

5 days

3.2 GAMMA ASSAY TECHNIQUES AND INSTRUMENTS (FOR INSPECTORS)

THEORETICAL LESSONS

NM gamma-spectrometry fundamentals, theory and methods.
Design and operation principles of portable devices for NM identification, uranium enrichment measurements, uranium and plutonium isotopic composition measurements by means of mMCA-430, InSpector, InSpector-2000, Kolibri.
Appropriate computer software applications.

PRACTICAL EXERCISES

Lessons are conducted at the NDA Laboratory.

The classes include:

- Exercises in NM identification, uranium enrichment measurements and uranium and plutonium isotopic composition measurements conducted with uranium and plutonium samples of various isotopic and chemical composition, geometry and in various containers.
- "Do-it-yourself" and test measurements of isotopic composition of "unknown" nuclear material samples.

POTENTIAL AUDIENCE

Inspectors experienced in safeguards programs, involved in NM analysis in MC&A systems.

PRELIMINARY TRAINING

Knowledge in the field of gamma-radiation measurements.

3.3 NEUTRON ASSAY TECHNIQUES AND INSTRUMENTS

5 days

THEORETICAL LESSONS

NM passive and active neutron assay theory.
Design and operation principles of shift register, high level neutron coincidence counter (HLNCC) for passive analysis of Pu samples, active well neutron coincidence counter (AWCC) for active analysis of uranium samples.
Safety principles in the course of measurements.

PRACTICAL EXERCISES

Lessons are conducted at the NDA Laboratory.

The use of the INCC software is trained in the computer classroom

The classes include:

- Calibration of passive and active neutron coincidence counters with reference materials (RMs) of uranium and plutonium.
- NDA measurements of uranium and plutonium mass in these RMs, measurement quality control, test measurements of uranium and plutonium mass in samples.

POTENTIAL AUDIENCE

Specialists engaged in NDA measurements.

PRELIMINARY TRAINING

Knowledge in the field of neutron radiation measurements.

5 days

3.3.2 NEUTRON NDA TO CONTROL PU IN WASTE

THEORETICAL LESSONS

Pu passive neutron assay theory.
Fundamentals of fission count rate methods based on fission neutron multiplicity distribution.
Design and operation principles of a neutron coincidence analyzer, detection units made by Eurisys Measures and Canberra to measure Pu mass in solid radioactive waste.

PRACTICAL EXERCISES

Practical training is conducted at the NDA laboratory.

The classes include:

- Practical use of applied software (INCC codes).
- Laboratory exercises with the aim to determine operating parameters of the instrument designed for measuring containers with Pu waste.
- Measurements with Pu reference materials of waste drum models that simulate Pu waste with various matrices.

3

POTENTIAL AUDIENCE

Specialists involved in NM NDA.

PRELIMINARY TRAINING

It is desirable to know the course:
3.3 Neutron Assay Techniques and Instruments.

3.4 NEUTRON ASSAY TECHNIQUES AND INSTRUMENTS (FOR INSPECTORS)

5 days

THEORETICAL LESSONS

NM passive and active neutron analysis theory.
Design and operation principles of a shift register, high level neutron coincidence counters (HLNCC II) for passive analysis of plutonium samples, active well coincidence counter (AWCC) for active analysis of uranium samples.
Safety principles in the course of measurements.

PRACTICAL EXERCISES

Lessons are conducted at the NDA Laboratory.

The classes include:

- Practical use of applied software (INCC codes).
- Calibration of passive and active neutron coincidence counters with working RMs of uranium and plutonium.
- NDA measurements of uranium and plutonium mass in samples, measurement quality control. Test measurements of uranium and plutonium mass in samples.

POTENTIAL AUDIENCE

Inspectors experienced in safeguards programs and involved in NM analysis in MC&A systems.

PRELIMINARY TRAINING

Knowledge in the field of neutron radiation measurements.

5 days

3.6 DIP TUBE TECHNIQUE TO CONTROL NM SOLUTION MASS/VOLUME IN PROCESS EQUIPMENT

THEORETICAL LESSONS

Solution mass/volume measurement by the dip tube technique, measurement system components.
Tank calibration technique, measurement system testing, introduced corrections.
Software.

PRACTICAL EXERCISES

Lessons are conducted at the Tank Calibration Laboratory.

The classes include:

- Calibration of process equipment models with the use of laboratory measurement system and applied software:
  - cylindrical tank,
  - conic-annular tank,
  - tubular tank.
- Calibration verification, water mass/volume measurements in process equipment models with the use of near-real-time mode.

POTENTIAL AUDIENCE

Specialists involved in control of NM in solutions in process equipment.

PRELIMINARY TRAINING

Knowledge of the course:

1.1 Fundamentals of Nuclear Materials Control & Accounting.

3.7 NDA MEASUREMENTS OF PU MASS AND ISOTOPIC COMPOSITION

5 days

THEORETICAL LESSONS

Theoretical aspects of gamma and neutron radiation measurements.
Instruments for measurement and analysis of gamma spectra, gamma ray identification, software.
Instruments for neutron coincidence measurements, software.

PRACTICAL EXERCISES

The lessons are conducted at the NDA Laboratory.

During the lessons the trainees measure:

- gamma spectra of Pu samples of various isotopic composition with the U-Pu InSpector system with the HPGe detector
- Pu mass in samples based on the results of gamma-spectrometric analysis
- Based on the measurement results the causes that impact the accuracy of Pu mass measurement in the sample are analyzed.

POTENTIAL AUDIENCE

Specialists involved in NDA analysis with the knowledge of courses 3.1, 3.3.

PRELIMINARY TRAINING

Knowledge of gamma and neutron measurements.

5 days

3.8. MEASUREMENT OF U MASS IN WASTE DRUMS

THEORETICAL LESSONS

Theory and methods of NM gamma-spectrometry analysis. Design and operation principles of gamma-spectrometric systems to measure U isotopic composition.
Theoretical aspects of passive and active neutron analysis of nuclear materials. Design and operation principles of the neutron coincidence analyzer based on the shift register, multiplicity counter for active and passive analysis of U in waste.

PRACTICAL EXERCISES

Lessons are conducted at the NDA laboratory.

The procedures of measurements and analysis of gamma-spectra with the use of the MGAU code to determine U isotopic composition in the waste drum models.

Then the trainees determine the neutron analysis parameters, perform passive and active measurements of U mass in waste drum models.

POTENTIAL AUDIENCE

3

Specialists involved in NM NDA.

PRELIMINARY TRAINING

It is desirable to know the following courses:

3.1 Gamma Assay Techniques and Instruments;

3.3 Neutron Assay Techniques and Instruments.

3.9 MEASUREMENT OF U AND Pu CONCENTRATIONS IN SOLUTION SAMPLES BY THE HYBRID K–EDGE DENSITOMETER

5 days

THEORETICAL LESSONS

Theory and methods of NM gamma-spectrometric analysis.
"X-ray fluorescence analysis" and "K-Edge" gamma-spectrometric methods to measure NM concentration in solution samples.
K-Edge densitometer design and operation principles to measure U and Pu concentration in solution samples.
Application software.

PRACTICAL EXERCISES

Lessons are conducted at the NDA Laboratory.

The trainees gain skills in the use of devices and software to measure NM concentration in solution samples. They learn:

- Hybrid K-Edge densitometer design. Specific features of turning it on and adjusting.
- Procedures for calibration measurements with NM solution samples; determination of applicability area for "X-ray fluorescence analysis" and "K-Edge" methods.
- Verification measurements, estimation of factors that impact the analysis accuracy.

POTENTIAL AUDIENCE

Specialists involved in NM NDA.

PRELIMINARY TRAINING

Knowlege of course 3.1.

3.10 URANIUM AND PLUTONIUM ISOTOPIC COMPOSITION AND MASS MEASUREMENTS FOR SPECIALISTS RESPONSIBLE FOR NM MEASUREMENTS.

THEORETICAL LESSONS

Theory and methods of NM gamma-spectrometric analysis.
"X-ray fluorescence analysis" and "K-Edge" gamma-spectrometric methods to measure NM concentration in solution samples.
K-Edge densitometer design and operation principles to measure U and Pu concentration in solution samples.
Application software.

PRACTICAL EXERCISES

Lessons are conducted at the NDA Laboratory.

The trainees gain skills in the use of devices and software to measure NM concentration in solution samples. They learn:

- Hybrid K-Edge densitometer design. Specific features of turning it on and adjusting.
- Procedures for calibration measurements with NM solution samples; determination of applicability area for "X-ray fluorescence analysis" and "K-Edge" methods.
- Verification measurements, estimation of factors that impact the analysis accuracy.

POTENTIAL AUDIENCE

Specialists involved in NM NDA.

PRELIMINARY TRAINING

Knowlege of course 3.1.

STATISTICAL METHODS

SERIES 4

4.1 Statistical Methods for NM Control & Accounting (introductory course)

4.2 Statistical Methods for Measurement Quality Control

4.3 Statistical Methods for Inventory Difference (ID) Calculation and Analysis

4.4 Statistical Methods for Accountancy Performance Assessment (advanced course for experts and instructors)

5 days

4.1 STATISTICAL METHODS FOR NM CONTROL & ACCOUNTING (INTRODUCTORY COURSE)

THEORETICAL LESSONS

Role of statistics in MC&A. Statistical approaches in regulatory documents of national MC&A systems and that of IAEA; in reporting documents.
Statistical terminology and basic notions.
Statistical principles and methods of measurement quality control, of inventory difference variation, detection of NM losses/no losses/excess inventory under conditions of data uncertainty due to measurement errors.
Algorithms and computer codes for statistical sampling calculation and random sampling planning.
Plans of NM parameter measurements to reveal total and partial defects.

PRACTICAL EXERCISES

Calculation and analysis of inventory difference for a hypothetical facility which fabricates nuclear fuel.

Exercises with conventional nuclear material in application of statistical methods for initial and periodical PITs. The weighing equipment and RMs of mass are widely used.

The methodological material includes excerpts from the IAEA guidelines on MC&A statistical principles.

4

The course is accompanied with demonstration of computer software for statistical sampling, videos about different MC&A issues (prepared by US specialists) and PIT performance at Russian nuclear facilities.

POTENTIAL AUDIENCE

Technologists, metrologists, engineers, scientists engaged in MC&A field.

Specialists of state bodies and operators involved in inspection activity.

PRELIMINARY TRAINING

Higher technical education, University degree.

It is desirable to be acquainted with the courses:

1.1 Fundamentals of Nuclear Materials Control & Accounting or the CD-ROM course "Introduction into NMC&A issues",

1.3 Physical Inventory Taking (PIT) methodology.

4.2 STATISTICAL METHODS FOR MEASUREMENT QUALITY CONTROL

5 days

THEORETICAL LESSONS

Application of statistics in MC&A systems.
Statistical terminology and basic notions.
Statistical approaches in regulatory documents of national MC&A systems and those of the IAEA; Russian regulatory documents.
Models of measurement. Theory of measurement errors.
Systems of control and measurement quality assurance, statistical analysis of measurements of weight, mass, volume, statistical models for NDA and DA in MC&A.
Sharing the experience in statistical methods in MC&A measurement quality control among representatives of Russian facilities.

PRACTICAL EXERCISES

Exercises with NM item models in application of statistical methods for measurement quality control in case of NM shipment/receipt, PIT performance at a hypothetical facility with the use of weighing equipment, reference materials, computers and special software.

Practical exercises at the Laboratory for scale and volume calibration.

Methodological materials available for the students comprise excerpts from the IAEA guidelines on MC&A statistical principles for measurement quality control.

4

POTENTIAL AUDIENCE

Technologists, metrologists, engineers, scientists engaged in MC&A field.

Specialists of state bodies and operators involved in inspection activity.

The course was significantly updated in 2005, it is meant for the specialists trained in this subject several years ago.

PRELIMINARY TRAINING

Higher technical education, University degree.

It is desirable to be acquainted with the courses:

1.1 Fundamentals of Nuclear Materials Control & Accounting or the CD-ROM course "Introduction into NMC&A issues",

1.3 Physical Inventory Taking (PIT) methodology and

4.1 Statistical methods for NM Control & Accounting (introductory course).

5 days

4.3 STATISTICAL METHODS FOR INVENTORY DIFFERENCE (ID) CALCULATION AND ANALYSIS

THEORETICAL LESSONS

Application of statistics in MC&A area.
Terminology and basic concepts.
Statistical approaches to ID determination and analysis in regulatory documents of national MC&A systems and those of the IAEA.
Russian regulatory documents.
Measurement uncertainty propagation.
Detailed consideration of measurement errors, ID dispersion analysis for the cases with averaged and non-averaged data flows.
Defect detectability, MUF-D method being used by IAEA inspectors, software to determine and analyze ID and its components.
Statistical analysis of NM balance at the Siberian Chemical Plant (Seversk) and the Machine Building Plant (Electrostal).

PRACTICAL EXERCISES

Modeling of measurements and calculation of ID variance.

Use of statistic methods during PIT performance at a hypothetical facility with NM item models, with the use of weighing equipment, reference materials, computers and specific software.

4

Planning of NM parameters measurements to determine total and partial defects.

Methodological materials available for the students comprise excerpts from the IAEA guideline on MC&A statistical principles for ID analysis.

The course is accompanied with demonstration of videos about different MC&A issues prepared by US specialists.

POTENTIAL AUDIENCE

Technologists, metrologists, engineers, scientists engaged in MC&A activity field.

Specialists of state bodies and operators involved in inspection activity.

PRELIMINARY TRAINING

Higher technical education, University degree.

It is desirable to be acquainted with the following courses

1.1 Fundamentals of Nuclear Materials Control & Accounting or the CD-ROM course "Introduction into NMC&A issues",

1.3 Physical Inventory Taking (PIT) methodology and

4.1 Statistical Methods for NM Control & Accounting (introductory course).

4.4 STATISTICAL METHODS FOR ACCOUNTANCY PERFORMANCE ASSESSMENT (ADVANCED COURSE FOR EXPERTS AND INSTRUCTORS)

5 days

THEORETICAL LESSONS

Sampling theory for final population.
Plans of sampling for verification measurements, specific features of processing the results of measurements performed with the HLNCC.
MUF-D procedure which can be used by inspectors (from a facility, Rosatom, Rostechnadzor).
Error models, measurement co-variation for the HLNCC, mathematical equation for actual balance assessment and accountancy effectiveness assessment.
How "International Performance Values. IPV - 2000" can be used for accountancy quality assessment.
Lectures are accompanied with demonstration of the software for statistical sampling.

PRACTICAL EXERCISES

Preparation of statistical sampling for verification.

Planning of NM parameter measurements with rough and precise instruments to determine total and partial defects.

Processing of the given results measured by the HLNCC.

POTENTIAL AUDIENCE

Technologists, metrologists, engineers, scientists engaged in MC&A field or those involved in development of MC&A elements, instructions, procedures or in MC&A inspection activity. Instructors.

PRELIMINARY TRAINING

Higher technical education, University degree.

It is desirable to be acquainted with the following courses:

1.1 Fundamentals of Nuclear Materials Control & Accounting or the CD-ROM course "Introduction into NMC&A issues",

1.3 Physical Inventory Taking (PIT) Methodology and

4.1 Statistical Methods for NM Control & Accounting (introductory course).

SERIES 5

SOFTWEARE ENGINEERING

5.1 MC&A SOFTWARE ENGINEERING

5 days

THEORETICAL LESSONS

Introductory lecture on software requirements analysis.
Determination of the initial scope of the design.
Current situation analysis.
Development of working processes in the future system.
NMC&A system function analysis; definition of objects, entity analysis, methods and principles.
Development of technical requirements.
Solution selection.
SRS document creation, SRS approval.
Development of implementation plan.
Functional point analysis.
CASE tools demonstration.

PRACTICAL EXERCISES

Stages in developing software requirements to NMC&A for a hypothetical reactor laboratory (functions and processes, development of process hierarchy diagram, determination of types of entities, attributes and identifiers, development of requirement specifications). Exercises.

The course is accompanied with demonstration of videos prepared by US specialists on different issues of software requirements development.

POTENTIAL AUDIENCE

Programmers, software engineers and other personnel involved in development of computerized MC&A systems and its elements, instructions, procedures as well as in inspection of MC&A systems.

PRELIMINARY TRAINING

It is desirable to be acquainted with the courses:
1.1 Fundamentals of Nuclear Materials Control & Accounting or the CD-ROM course "Introduction into NMC&A issues".

5 days

5.2 SOFTWARE ENGINEERING FOR NUCLEAR MATERIALS. BALANCE ANALYSIS

THEORETICAL LESSONS

Methods of Inventory Difference variance calculations, description of the software developed for training purposes in the JRC, ISPRA (Italy) and RMTC.

PRACTICAL EXERCISES

Lessons are conducted at the MC&A Computerized Laboratory.

Software demonstration and exercises in the use of software for a hypothetical facility.

POTENTIAL AUDIENCE

Technologists, metrologists, engineers, programmers, scientists engaged in MC&A activity and development of MC&A system elements, instructions, procedures.

Specialists of state agencies involved in inspection activity.

PRELIMINARY TRAINING

Higher technical education, University degree.

It is desirable to be acquainted with the following courses:

1.1 Fundamentals of Nuclear Materials Control & Accounting,

1.3 Physical Inventory Taking (PIT) Methodology,

4.1 Statistical Methods for NM Control & Accounting (introductory course),

4.3 Statistical methods for Inventory Difference (ID) Calculation and Analysis.

INSPECTIONS

SERIES 6

6.1 MPC&A Fundamental Inspection Course

6.1.1 Fundamental Course for Rosatom NMC&A Monitoring Specialists

6.1.2 Procedures for Rosatom NM Accountability Status Monitoring at Nuclear Sites

6.1.3 Procedures for Rosatom NM Control Status Monitoring at Nuclar Sites

6.1.4 Control and Self-Assessment of the NMC&A Status at the Facility

6.2 MC&A Inspection Practice at Facilities with NM in Items and Bulk Form

6.4 Statistical Methods for NMC&A Inspections

6.5 Seals (TID) Use in NMC&A Inspections

5 days

6.1 MPC&A FUNDAMENTAL INSPECTION COURSE

THEORETICAL LESSONS

MPC&A legal regulations in the Russian Federation.
MPC&A regulatory activity.
Inspection planning.
Effective communication skills.
Preparation of reports about inspection results and support in elimination of detected violations and drawbacks.
Inspection of MC&A systems.
Inspection of Physical Protection Systems.

PRACTICAL EXERCISES

Data analysis based on technical characteristics of a nuclear facility.

Organization of inspections at facilities and analysis of inspection results.

The course is accompanied with demonstration of videos about different issues of inspections.

POTENTIAL AUDIENCE

Specialists of state bodies and operators involved in inspection activity.

PRELIMINARY TRAINING

It is desirable to be acquainted with the course

1.1 Fundamentals of Nuclear Materials Control & Accounting.

6

6.1.1 FUNDAMENTAL COURSE FOR ROSATOM NMC&A MONITORING SPECIALISTS

5 days

THEORETICAL LESSONS

Current legislative framework and regulatory documents (concepts and provisions) to monitor the Rosatom MC&A systems. Goals and objectives of Rosatom MC&A monitoring.

Procedures and inspections of:

- State NMC&A system arrangement and NM management;
- NM access control measures and accounting and reporting document management;
- MC&A measurement system;
- PIT performance;
- NM transfer procedures and expeditious process accounting.

Psychological aspects and factors that impact inspection effectiveness.

PRACTICAL EXERCISES

Development of inspection plans for a nuclear fuel fabrication plants, radio-chemical plants and R&I Institutes.

Inspection of:

- reporting and accounting documents at the MBA and facility level;
- NM transfer documents and correctness of shipper/receiver data consistency evaluation;
- statistical criteria used for NM confirmatory measurements.

Business game: "Which behavior rules should be chosen and followed by the inspector in specific cases".

POTENTIAL AUDIENCE

Specialists from Rosatom directorates, facilities, operators who will be involved in MC&A monitoring activity.

PRELIMINARY TRAINING

Higher technical education, University degree.

It is desirable to know the following courses:

1.1 Fundamentals of Nuclear Material Control & Accounting;

1.3 PIT Methodology.

5 days

6.1.2 PROCEDURES FOR ROSATOM NM ACCOUNTABILITY STATUS MONITORING AT NUCLEAR SITES (FOR ROSATOM MC&A MONITORING SPECIALISTS)

THEORETICAL LESSONS

Current legislative and regulatory framework for Rosatom MC&A system monitoring.
Goals and objectives of Rosatom monitoring.
Inspection of NM accountability element structure and arrangement at the facility.

Model program and procedures to inspect:

- accounting and reporting document management and measurement systems;
- PIT and expeditious accounting;
- NM transfer;
- NM accounting computerization;

PRACTICAL EXERCISES

Development of inspection plans to check NM accountability at the site (radio-chemical plants, nuclear fuel fabrication plants, R&D Institutes).

Detection of anomalies/mistakes in:

- NM transfer documents and confirmatory measurement protocols;
- reporting and accounting documents (MBA and facility level);
- PIT documents.

POTENTIAL AUDIENCE

Specialists from Rosatom directorates, facilities, operators who will be involved in MC&A monitoring activity.

PRELIMINARY TRAINING

Higher technical education, University degree.

It is desirable to know the following courses:
1.1 Fundamentals of Nuclear Material Control & Accounting; 1.3 PIT Methodology.

6.1.3 PROCEDURES FOR ROSATOM NM CONTROL STATUS MONITORING AT NUCLAR SITES (FOR ROSATOM MC&A MONITORING SPECIALISTS)

5 days

THEORETICAL LESSONS

Current legislative and regulatory framework.
Goals, objectives and procedures; role of Rosatom monitoring of MC&A system status at the sites.
Inspection of access control arrangement in terms of NMs and control system components.
Model program and procedures to inspect:

- TID use at the facility and in MBAs;
- access control for MC&A documents and data;
- access control for measurement instruments and NM management equipment;
- the use of results of NM control systems and access control during PIT procedures;
- control procedures during NM transfer between MBAs, facilities, sites;
- expeditious accounting and administrative control.

PRACTICAL EXERCISES

Development of inspection plans to check NM control at the facility (radiochemical plants, nuclear fuel fabrication plants, R&D institutes).

Detection of:

- defects/drawbacks when TIDs are applied, verified, removed and disposed;
- inconsistency between the scope of confirmatory measurements and control measures during NM transfer;
- inconsistency between the scope of confirmatory measurements and control measures during NM PIT procedures (documents with PIT results and protocols with confirmatory measurement results).

POTENTIAL AUDIENCE

Specialists from Rosatom directorates, facilities, operators who will be involved in MC&A monitoring activity.

PRELIMINARY TRAINING

Higher technical education, University degree.

It is desirable to know the following courses:

1.1 Fundamentals of Nuclear Material Control & Accounting;

1.3 PIT Methodology.

5 days

6.1.4 CONTROL AND SELF–ASSESSMENT OF THE NMC&A STATUS AT THE FACILITY

THEORETICAL LESSONS

NMC&A in terms of "safety and security culture".
Legislative framework and regulatory documents on the on site arrangement of NMC&A monitoring by the facility.
Goals and objectives of facility monitoring.
Planning of facility monitoring.
Brief information about the methods of MC&A system element performance testing.
Inspection of the system of accounting and reporting documents.
Inspection of NM accounting computerization.
Brief information about the use of NMC&A statistical methods.
Inspection of measurement systems and MC&A quality control.
Inspection of access control for NMs, MC&A documents and data, measurement systems and equipment for NM management, NM control system components.
Inspection of TID use.
Inspection of PIT procedures, NM balance closing, presence of NMs in proper places.
Inspection of NM transfer procedures between MBAs, facilities.
Inspection of expeditious accounting and administrative control.
Inspection of introduction of corrective measures and MC&A system modification plans.
Documentation of facility monitoring results and MC&A assessment in MBAs/divisions, at the facility on the whole.

PRACTICAL EXERCISES

The trainees will be split into groups with three or four people in each.

6

The objectives and conditions of practical exercises will be specific for each group. Each module of the course will consist of lectures and practical exercises or lectures and exercises on performance testing of an element of the facility MC&A system.

POTENTIAL AUDIENCE

Rosatom nuclear facility experts involved or to be involved in the MC&A status monitoring at nuclear facilities, in particular, specialists from MC&A services or the services that are not directly related to the NMC&A system but provide operation of the NMC&A system elements (for example, metrologists can assess the status of measurement quality control), facility administration and management.

PRELIMINARY TRAINING

It is recommended to know the following courses:
6.1.1 Fundamental Course for Rosatom NMC&A Monitoring Specialists.
One or two courses from the Fundamental Courses Series.

6.2 MC&A INSPECTION PRACTICE AT FACILITIES WITH NM IN ITEMS AND BULK FORM

5 days

THEORETICAL LESSONS

Facility NMC&A system and its components.
Nuclear facilities with NM in items.
Nuclear facilities with NM in the bulk form.
Accounting, confirmatory and verification measurements.
State NMC&A system inspection.
Inspection preparation, performance and documentation of results.
Specific features of inspections of the facilities with NMs in items and bulk form.
Sanctions imposed in the course of inspections.
Inspection of PIT procedures, PIT performance and results.

PRACTICAL EXERCISES

Exercises in working out inspection reports and protocols of administrative violations.

POTENTIAL AUDIENCE

Specialists of state bodies and operators engaged in inspection activity.

PRELIMINARY TRAINING

It is desirable to be acquainted with the course:

6.1 MPC&A Fundamental Inspection Course.

5 days

6.4 STATISTICAL METHODS FOR NMC&A INSPECTIONS

THEORETICAL LESSONS

Introduction into MC&A. Statistical criteria in regulatory documents of Russia, US, IAEA.
Basic notions of probability theory, statistics. Statistical principles and methods used in NMC&A inspections.
Statistical methods used in MC&A system quality inspections, in verification measurements, in the analysis of PIT results and shipper/receiver differences.
ID analysis.
MUF-D methods.
MC&A inspections at fuel cycle facilities, NPPs and research facilities.
Advanced ideas in the field of MC&A statistical methods application.

PRACTICAL EXERCISES

Development of measurement models.

Determination of electronic scale errors.

Calculation of random sampling sizes.

Calculation of ID and confidence intervals.

PIT procedures.

Measurements and measurement control in the procedures of conventional NM movements.

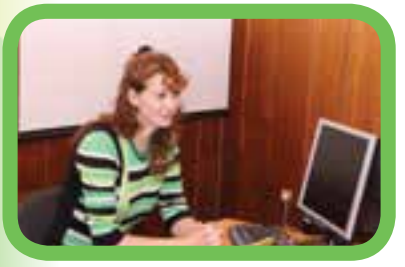
POTENTIAL AUDIENCE

Specialists of state bodies and operators involved in inspection.

PRELIMINARY TRAINING

It is desirable to know the course:

6.1 MPC&A Fundamental Inspection Course.



6.5 SEALS (TID) USE IN NMC&A INSPECTIONS

5 days

THEORETICAL LESSONS

Topical NMC&A tasks.
Federal and Rosatom guidelines on seals (TID) management.
Elements of seals (TID) use program.
Seals (TID) types, design, principles of operation.
Seals (TID) use in NMC&A inspections.
Selection of TIDs for inspection.
Seals (TID) integrity verification techniques.
Seals (TID) accounting and reporting documentation.

PRACTICAL EXERCISES

Seals (TID) documentation.

The procedures of seals (TID) application, removal and destruction.

Verification of seals (TID) of the small "E-cup" type.

Inspection of seals (TID) documentation and integrity.

Inspector's actions in response to detection of violations and inconsistencies.

POTENTIAL AUDIENCE

Rostechnadzor specialists and inspectors.

PRELIMINARY TRAINING

It is desirable to be aquatinted with the course:

6.1 MPC&A Fundamental Inspection Course.

SERIES 7 SPECIALIZED COURSES

7.1 Basic State MC&A Requirements (for Managers and Leading Specialists)

7.2 NM Control and Accountability Procedures and Requirements (for MBA Managers and their Deputies)

7.3 NM Control and Accountability Procedures and Requirements (for Materially Responsible Officials and Custodians)

7.4 PIT Performance (for PIT Group Members)

7.5 NMC&A Requirements and Procedures (for specialists involved in and responsible for NM transfer procedures)

7.6 NMC&A Requirements and Procedures (for specialists responsible for NM accountancy in MBAs)

7.7 NMC&A Requirements and Procedures (for specialists responsible for statistical analysis of MC&A results)

7.1 BASIC STATE NMC&A REQUIREMENTS (FOR MANAGERS AND LEADING SPECIALISTS)

5 days

THEORETICAL LESSONS

Topicality of MC&A tasks in terms of NM and NW nonproliferation and nuclear culture sustainability.
Criminal liability for inadequate NM management at facilities.
Three state NMC&A systems: for civil application (SNMC&A system), for military application and for radioactive substances and radioactive waste.
Current NM&A regulatory framework.
NP-030-05 Document in comments.
NMC&A system structure (subsystems and elements). Requirements to NMC&A systems, subsystems and elements at facilities.
Rosatom and site-specific monitoring of the facility MC&A status.
NMC&A elements performance testing techniques at facilities.
Survey of Rostechnadzor NMC&A guiding and regulatory documents. Current experience of inspecting NMC&A systems at facilities.
Comparative analysis of Russian and foreign NMC&A systems.
Problems in Russian NMC&A system upgrading.
Future development of NMC&A regulatory framework.
Information for managerial personnel about the scope of disciplines offered by the RMTC and other training centers, that is useful for making decisions about NMC&A training of specialists from different facilities.

PRACTICAL EXERCISES

Organization of NMC&A subsystems at a hypothetic facility.

The course is supported with the video about the solution of "plutonium problems" at Handford site (USA).

POTENTIAL AUDIENCE

Managers from facilities, production sites, NMC&A divisions, services and leading specialists involved in development of site-specific NMC&A systems or their elements at facilities.

PRELIMINARY TRAINING

CD-ROM course "Introduction into NMC&A issues".

NMC&A regulatory documents from the list.

It is desirable to know the courses:

1.1 Fundamentals of Nuclear Materials Control & Accounting.

5 days

7.2 NM CONTROL AND ACCOUNTABILITY PROCEDURES AND REQUIREMENTS (FOR MBA MANAGERS AND THEIR DEPUTIES)

THEORETICAL LESSONS

Interaction of control and accounting systems for NM, radioactive substances and radioactive waste.
The MC&A and human factor role in nonproliferation safeguards.
Current Russian MC&A regulatory framework.
The facility-level MC&A system structure, elements and principles.
Accounting system arrangement at the facility.
MC&A measurement system at the facility.
Planning and performance of scheduled and unscheduled PITs at the facility.
NM balance closing in MBAs.
Technologies of collecting and processing the data for FIS reporting.
MC&A computerization.
TID application for MC&A purposes.
Typical drawbacks in the state MC&A system. Experience of agency- and facility-level inspections.

PRACTICAL EXERCISES

MC&A Culture.

MC&A arrangement at the facility.

NM balance closing.

TID application in the MC&A system.

POTENTIAL AUDIENCE

MBA managers and their deputies.

PRELIMINARY TRAINING

Basic knowledge of: MC&A systems, PIT methodology, NDA measurements, document management.

7.3 NM CONTROL AND ACCOUNTABILITY PROCEDURES AND REQUIREMENTS (FOR MATERIALLY RESPONSIBLE OFFICIALS AND CUSTODIANS)

5 days

THEORETICAL LESSONS

Interaction of control and accounting systems for NM, radioactive substances and radioactive waste.The MC&A and human factor role in nonproliferation safeguards. Current Russian MC&A regulatory framework.
The facility-level MC&A system structure, elements and principles.
PIT preparation at the facility.
Accounting system arrangement at the facility and introduction into computerized accounting. Accounting document management.
Technologies of collecting and processing the data for FIS reporting.
Bar-code technologies.
The role of materially responsible officials in MC&A processes at the MBA level.
Control over NM transfer. TID application for MC&A purposes.
Typical violations of responsible officials and custodians in NM control and accounting.

PRACTICAL EXERCISES

The procedures of NM receiving, shipping, entry into and removal from the account.

Maintenance of data accounting, collection and processing.

Bar-code technologies in the MC&A system.

TID application for MC&A purposes.

POTENTIAL AUDIENCE

Materially responsible officials, NM custodians.

PRELIMINARY TRAINING

Basic knowledge of MC&A systems, PIT methodology, access control systems.

7.4 PIT PERFORMANCE (FOR PIT GROUP MEMBERS)

THEORETICAL LESSONS

Interaction of control and accounting systems for NM, radioactive substances and radioactive waste.
The MC&A and human factor role in nonproliferation safeguards.
Current Russian MC&A regulatory framework.
The PIT role in the MC&A system. MC&A system arrangement at the facility level.
Facility-level regulatory document requirements to PIT procedures in MBAs.
Periodical (scheduled) PIT plans at the facility. Presentation of the training video "NM PIT performance at the IPPE storage facility".
Scheduled and unscheduled PIT performance at the facility. DA and NDA used in the course of PIT procedures (through the examples of a radio-chemical production site with NM in its bulk form and the RMTC NDA laboratory with NM in items). Presentation of the training video "NM PIT performance at the Novosibirsk Chemical Concentrates Plant".
Bar-code technologies in the MC&A systems.
Statistical methods used for PIT procedures.
TID application for PIT procedures.
NM balance closing in MBAs of various facilities.
Basic analysis of inventory difference (ID) statistical significance.
Documentation of PIT results.
Typical PIT drawbacks.

PRACTICAL EXERCISES

Application of bar-code technologies in the course of PIT procedures.

MBA arrangement: selection of the optimum number of MBAs and MBA boundaries at a hypothetical facility.

Development of PIT instructions for MBAs at a hypothetical facility.

Application of TIDs in the course of PIT procedures.

Statistical methods used in the course of PIT procedures.

Material balance closing and analysis of ID statistical significance.

Maintenance of accounting and reporting documents.

The trainees will be divided into groups, with three-four people in each. Exercises and practical tasks will be formulated for each group individually.

POTENTIAL AUDIENCE

PIT group members, specialists participating in PIT preparation and performance.

PRELIMINARY TRAINING

Knowledge of the courses:
1.1 Fundamentals of NM Control and Accounting.
1.3. PIT Methodology.
NM NDA measurements in the MC&A system.

7.5 NMC&A REQUIREMENTS AND PROCEDURES (FOR SPECIALISTS INVOLVED IN AND RESPONSIBLE FOR NM TRANSFER PROCEDURES)

THEORETICAL LESSONS

The role of NM control and accountancy, the facility personnel competence and discipline in nonproliferation safeguards. The role of the workers involved in and responsible for NM transfer procedures; the list of their main functions, skills and scope of knowledge required to perform their duties. The current Russian MC&A regulatory framework. NMC&A arrangement at nuclear facilities. Characteristics of MC&A anomalies and violations that may happen in the course of NM transfer procedures and the ways to detect them.

The facility-level NMC&A information protection requirements. Authorization procedures for personnel access to NM management in the rooms with nuclear materials, to transport vehicles with nuclear materials.

Statistical methods in NM item transfer procedures. Confirmatory measurements. Reconciliation of accounting (book) and actual (physical) data. NMC&A procedures to be used in the course of NM transfer. Requirements to accounting documents package, their contents and formats. Seals application and verification of their states during items transfer procedures. Bar-code technologies in the NMC&A field (computerized NMC&A system operation principles with the use of bar-code technologies).

Procedures for releasing NM to the category of radioactive substances and RAW. The experience of agency-level and facility-level inspections.

PRACTICAL EXERCISES

MBA arrangement at a hypothetical facility.

Development of the facility-level instructions for NM transfer procedures between MBAs at the facility with NM in the form of items.

Detection of various violations with various typed of seals (TIDs).

Application of bar-code technologies for NM PIT and transfer procedures.

NM preparation for shipment. NM transfer procedures.

Demonstration of NDA use in the course of NM transfer in the NDA laboratory.

POTENTIAL AUDIENCE

Specialists involved in and responsible for NM transfer procedures.

PRELIMINARY TRAINING

Knowledge of the courses:

1.1 Fundamentals of NM Control and Accounting.
1.3. PIT Methodology. NM NDA measurements in the MC&A system.

7.6 NMC&A REQUIREMENTS AND PROCEDURES (FOR SPECIALISTS RESPONSIBLE FOR NM ACCOUNTANCY IN MBAS)

THEORETICAL LESSONS

Topicality of NMC&A tasks and importance of NMC&A personnel awareness and discipline for nonproliferation safeguards. .The role of authorized specialists (engineers) responsible for accounting, the list of their main functions, skills and scope of knowledge required to perform their duties. The current Russian NMC&A regulatory framework. NMC&A arrangement at nuclear facilities. NM inventory control procedures. Characteristics of MC&A anomalies and violations and the ways to detect them. The facility-level principal requirements to MC&A computerization and NMC&A information protection. Principal requirements to NM physical protection. Maintenance of MBA-level reporting and accounting documents. Procedures of NM entry into and removal from account. Procedures for releasing NM to the category of radioactive substances and RAW.

Computerized MC&A system operation principles with the use of bar-code technologies. Application of MC&A seals (TIDs). Statistical methods in NM item transfer procedures Reconciliation of accounting (book) and actual (physical) data.

NMC&A procedures to be used during NM transfer. NM batching requirements. Process accounting control. NM transfer procedures. NM balance closing and ID statistical significance analysis. Preparation of PIT results and statements. Main procedures of MC&A status inspections. Typical deficiencies of the MC&A system functioning at the facilities. The experience of agency-level and facility-level inspections.

PRACTICAL EXERCISES

MBA arrangement, determination of the optimum number of MBAs and KMP, and their boundaries.

Application of bar-code technologies for NM PIT and transfer procedures.
Application of NMC&A seals (TIDs).
NM transfer procedures at the hypothetical facility.
PIT performance. NM balance closing and analysis of ID statistical significance.

POTENTIAL AUDIENCE

Specialists responsible for NM accountancy in MBAs

PRELIMINARY TRAINING

Knowledge of the courses:
1.1 Fundamentals of NM Control and Accounting. 1.3. PIT Methodology.
NM NDA measurements in the MC&A system.

7.7 NMC&A REQUIREMENTS AND PROCEDURES (FOR SPECIALISTS RESPONSIBLE FOR STATISTICAL ANALYSIS OF MC&A RESULTS)

THEORETICAL LESSONS

Topicality of MC&A tasks and importance of MC&A personnel awareness and discipline for nonproliferation safeguards.

The role of MC&A specialists responsible for statistical analysis of MC&A measurement results. MC&A statistics requirements.

Theory of errors and the elements of measurement results statistical processing, Statistics terminology and main notions that are used in the MC&A tasks. Random and bias errors in MC&A. Planning of random sampling, including the ones of big sizes. Statistical methods to control measurement quality.

MC&A destructive and nondestructive assay methods; the principle of liquid solution volume measurements by means of the bubbling technique.

The inventory difference as a target value of NM security in the course of PIT performance. The uncertainty propagation method to calculate the ID variance.

The CUSUM graphs and analysis of time series applied to IDs.

PRACTICAL EXERCISES

Methods of mathematical statistics for initial processing of MC&A data

Calculation of random value parameters with the use of STADIA package and their interpretation. Selection of measurement error model.

Derivation of the formula to determine NM parameter measurement variances.

Determination of shipper/receiver difference, discrepancies in accounting and confirmatory measurement data.

Determination of systematic and random error components of instruments and measurement methodologies with the use of reference material measurement results.

Planning of accounting, confirmatory measurements and measurement control quality.

Calculation of anomaly criteria parameters in MC&A field.

Planning of random sampling.

Calculation and analysis of ID in terms of elements and isotopes.

Detection of indicators and anomalies in MC&A.

POTENTIAL AUDIENCE

Specialists responsible for statistical analysis of MC&A results.

PRELIMINARY TRAINING

Knowledge of the courses:

1.1 Fundamentals of NM Control and Accounting.

1.3. PIT Methodology.

NM NDA measurements in the MC&A system.

RUSSIAN RMTC INSTRUCTORS

NMC&A FUNDAMENTALS

Elena P. Agafonova
SCC, Moscow
Chief Specialist

Valery I. Bulanenko
SSC RF IPPE, Obninsk
Senior Researcher

Valery N. Bogomolov
SSC RF IPPE, Obninsk
Chief Engineer, Ph. D.

Vadim V. Bondarenko
SSC RF IPPE, Obninsk
Leading Engineer

Vladimir G. Dvukhsherstnov
SSC RF IPPE, Obninsk
Head of the BFS facility

Alexander I. Erygin
SCC, Moscow
Head of the Service

Vladimir F. Efimenko
VNIIA, Moscow
Leading Specialist, Ph. D.

Larisa N. Fyodorova
SCC, Moscow
Head of Laboratory

Victor K. Gorunov
SSC RF IPPE, Obninsk
Leading Researcher, Ph. D.

Vladimir V. Goryunov
Konstant Ltd., Obninsk
Group leader

Sergey S. Kargin
SSC RF IPPE, Obninsk
Engineer

Alexander P. Klukov
"Atombezopasnost", Moscow
Head of Division

Tatyana P. Kurakina
SCC, Moscow
Leading Engineer

Vyacheslav A. Luppov
«Rosenergo» Concern, Moscow
Head of MC&A Department

Sergey N. Mironov
SCC, Moscow
Deputy Head of Division

Yuri V. Molchanov
SSC RF IPPE, Obninsk
Chief Engineer – Head of the Operation Service

Anastasiya A. Osokina
SCC, Moscow
Engineer

Gennady M. Pshakin
SSC RF IPPE, Obninsk
Leading Researcher, Ph. D.

Victor I. Regushevsky
SSC RF IPPE, Obninsk
Leading Researcher, Ph. D.

Boris G. Ryazanov
SSC RF IPPE, Obninsk
Head of Nuclear Safety Department, RMTC Director, Ph. D.

Irina Yu. Voloshina
Atombezopasnost, Moscow
Leading Engineer

Irina V. Zubairova
NCCP, Novosibirsk
Engineer

NUCLEAR MATERIALS CONTROL

Vadim V. Bondarenko
SSC RF IPPE, Obninsk
Leading Engineer

Vladimir G. Dvukhsherstnov
SSC RF IPPE, Obninsk
Head of the BFS facility

Aleksey N. Ermakov
SSC RF IPPE, Obninsk
Head of Bureau

Gennady M. Pshakin
SSC RF IPPE, Obninsk
Leading Researcher, Ph. D.

Boris G. Ryazanov
SSC RF IPPE, Obninsk
Head of Nuclear Safety Department,
RMTC Director, Ph. D.

Vladimir S. Serdechnyi
SSC RF IPPE, Obninsk
Senior Researcher

Dmitry V. Volnistov
SSC RF IPPE, Obninsk
Researcher

NONDESRUCTIVE ASSAY

Gennady M. Bezhunov
SSC RF IPPE, Obninsk
Leading Researcher, Ph. D.

Sergey A. Bogdanov
SSC RF IPPE, Obninsk
Deputy Head of Department, Ph. D.

Dmitry A. Bokov
Rostechnadzor, Headquarters
Head of Division

Valery I. Bulanenko
SSC RF IPPE, Obninsk
Senior Researcher

Vyacheslav I. Gorbachev
SSC RF IPPE, Obninsk
Leading Engineer

Alexander A. Krivolapov
Rostechnadzor, SITD
Chief State Inspector

Nikita S. Rykov
SSC RF IPPE, Obninsk
Engineer

Vladimir V. Talanov
SSC RF IPPE, Obninsk
Head of NDA Laboratory

Dmitry V. Volnistov
SSC RF IPPE, Obninsk
Researcher

Ivan V. Zakharchyuk
Rostechnadzor, UITD
Deputy Head of Division

STATISTICAL METHODS

Valery N. Bogomolov
SSC RF IPPE, Obninsk
Chief Engineer, Ph. D.

Vladimir F. Efimenko
VNIIA, Moscow
Leading Specialisr, Ph. D.

Victor K. Gorunov
SSC RF IPPE, Obninsk
Leading Researcher, Ph. D.

Vladimir V. Gorunov
Konstant Ltd., Obninsk
Group leader

Alexander Ya. Karpenko
SCI, Obninsk
Senior Instructor, Ph. D.

Boris G. Ryazanov
SSC RF IPPE, Obninsk
Head of Nuclear Safety Department,
RMTC Director, Ph. D.

Alexander A. Tumanov
Head of Laboratory, Ph. D.

Anatoly M. Zlobin
VNIIEF, Sarov
Head of Laboratory

SOFTWARE ENGINEERING

Kseniya A. Bobrova
SCC, Moscow
Specialist

Vladimir F. Efimenko
VNIIA, Moscow
Leading Specialisr, Ph. D.

Victor K. Gorunov
SSC RF IPPE, Obninsk
Leading Researcher, Ph. D.

Vladimir V. Gorunov
Konstant Ltd., Obninsk
Group leader

Alexander N. Rumyantsev
Kurchatov Institute, Moscow
STC «Electronika», deputy Director

Boris G. Ryazanov
SSC RF IPPE, Obninsk
Head of Nuclear Safety Department,
RMTC Director, Ph. D.

Galina V. Shporta
Rostechnadzor, CITD
State Inspector

NMC&A SYSTEM INSPECTIONS

Vadim V. Bondarenko
SSC RF IPPE, Obninsk
Leading Engineer

Evgeny A. Boyko
NCCP, Novosibirsk
Engineer

Dmitry A. Bokov
Rostechnadzor, Headquarters
Head of Division

Anatoly V. Bushlya
Rosatom, Moscow
Chief Specialist

Nikolay V. Chernov
Rostechnadzor, UITD
Consultant

Vladimir G. Dvukhsherstnov
SSC RF IPPE, Obninsk
Head of the BFS facility

Vladimir F. Efimenko
VNIIA, Moscow
Leading Specialisr, Ph. D.

Victor K. Gorunov
SSC RF IPPE, Obninsk
Leading Researcher, Ph. D.

Vladimir V. Gorunov
Konstant Ltd., Obninsk
Group leader

Alexander A. Krivolapov
Rostechnadzor, SITD
Chief State Inspector

Valeri N. Krokhin
Rostechnadzor, CITD
Head of Division

Galina V. Lavrentyeva
Luch, Podolsk
Head of Division

Valentin I. Mamonov
«Strazh», Moscow
Deputy Director

Grigory Ye. Novikov
VNIINM, Moscow
Leading Researcher

Boris G. Ryazanov
SSC RF IPPE, Obninsk
Head of Nuclear Safety Department,
RMTC Director, Ph. D.

Igor N. Sazonov
VNIIA, Moscow
Head of the Group

Vladimir I. Seredkin
UEIP, Novouralsk
Head of the Group, Ph. D.

Andrei V. Stepashko
Rosatom, Moscow
Adviser

Victor V. Tsybin
VNIITF, Snezhinsk
Deputy Head of Department

Ivan V. Zakharchyuk
Rostechnadzor, UITD
Deputy Head of Division

Marius M. Zubairov
Rostechnadzor, SITD
Head of Division

Irina V. Zubairova
NCCP, Novosibirsk
Engineer

HOW TO PARTICIPATE IN TRAINING COURSES

1. In the beginning of the year the facilities are to submit preliminary applications to the RMTC indicating the number of trainees and course titles.

2. One or two months before the course on the basis of the previous applications the Center sends invitation letters to the facilities and organizations with the detailed information about the forthcoming course.

3. A facility has 3 weeks to respond and submit the application form, which indicates the names and positions of its specialists to be received at RMTC for the course. The information about trainees is accepted by phone, e-mail, or fax.

4. Telephone confirmation is desirable before departure for the course.

Detailed information about the Center, its schedule for the next courses can be found in Internet on the website http://rmtc.obninsk.ru.

REQUIREMENTS TO TRAINEES

In order to be a success in mastering the course it is necessary to have a certain background level of knowledge and skills. Pay attention to the recommendations on the required level of trainees' background indicated in each course summary.

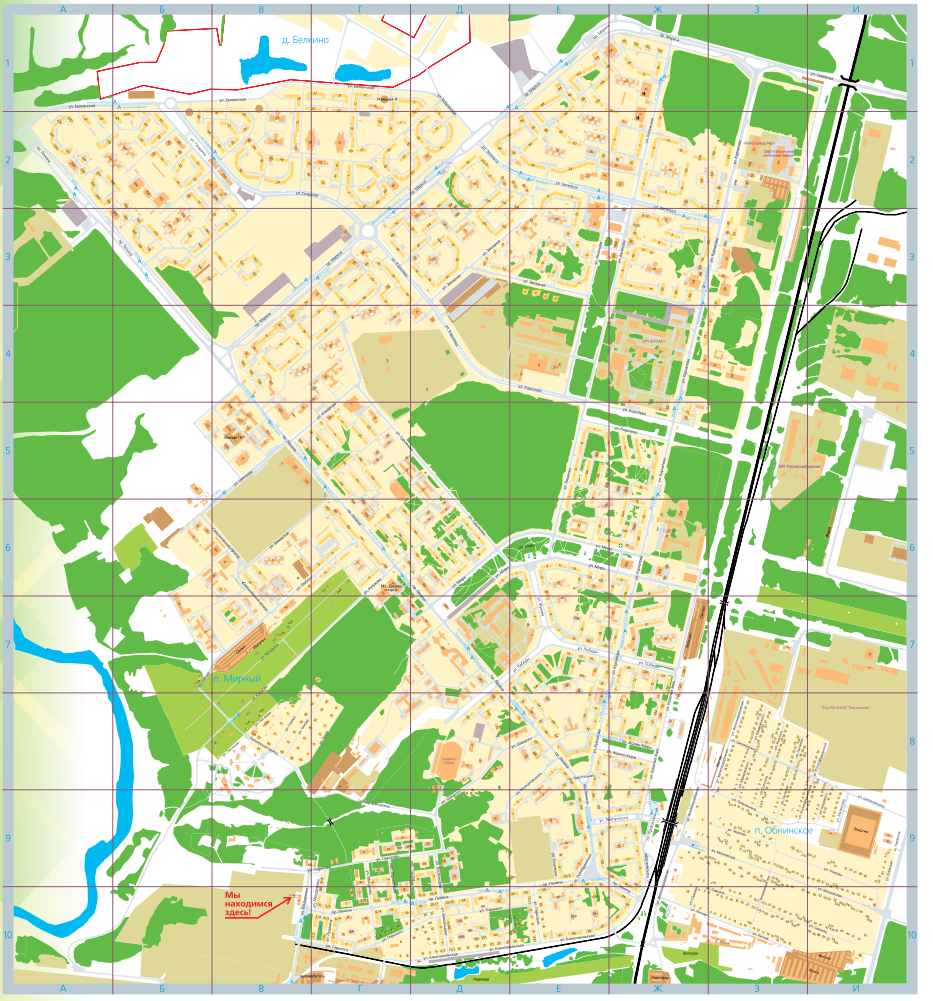
ACCOMMODATION AND MEALS

Accommodation and meals for training course participants are organized at the IPPE guest-house located in the green zone on the bank of Protva river. The hotel has a large conference and lecture hall, a restaurant, sauna and swimming pool. The TSIPK hotel is used if necessary.

VENUE

You may go from Moscow by electric train from Kievsky railway station (Kaluga or Maloyaroslavets as final stations) to "Obninskoye" station. There are inter-city buses from "Tyoply Stan" Moscow underground station to Obninskoye (about a 2 h trip).

ОБНИНСК
ПЕРВЫЙ НАУКОГРАД РОССИИ



RUSSIAN METHODOLOGICAL AND TRAINING CENTER

State Scientific Center of the Russian Federation – Institute for Physics and Power Engineering named after A.I. Leypunsky

1, Bondarenko sq., Obninsk, Kaluga region,
249033, Russia
Fax: (48439) 95813.
Phone: (48439) 95639, 95848, 98590.
E-mail: ryazanov@ippe.ru
http://rmtc.obninsk.ru