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The Challenges of Safety and Security of Radioactive Sources in Albania

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The paper presents an overview of the results of investigation and study of inalienable of radioactive sources and some aspects of their safety and security based at the actual legislation and regulations that are in operation. In the framework of the General Order Agreement (RTR GOA-A1), Albanian institutions, have undertaken the study of the sealed radiation sources for 1960-2008. During the investigations of worker's group on site at the users, some spend radiation sources were discovered. Important outputs of this study was the listing and putting in evidence of the orphan / lost / found sources and their conditioning in accordance with internationally accepted practices.

The evaluation of sealed radiation sources situation

Radioactive sources were used in Albania since '60 years, mainly in geological research and military units for instrument's calibration. In the mid of '60 years begun in General Hospital, Tirana the first tele-therapy cobalt source unit with activity 150 TBq.

In 1970 the Institute of Nuclear Physics (INP now CANP) was established and the use of radioactive sources in medicine, industry, agriculture and researches was expanded. A large number of alpha, beta, gamma and neutron radioactive sources were imported. For 1970-1992, INP has been in charge to import-export, transport and inventory of radioactive materials. INP had created also the register and inventory of all radioactive materials.

In 1995, the Albanian Parliament approved the Radiation Protection Act No. 8025, establishing the Radiation Protection Commission as national regulatory body and Radiation Protection Office as executive body.

A set of regulations for licensing and inspection, safe use of radiation sources, safe waste management, safe transport of radioactive material were issued. Last years Albanian government through a special ordinance has provided implementation of the IAEA Code of Conduct on the Safety and Security of radioactive sources.

Based at Minister Council Ordinance No. 158 (2008) and IAEA documents, is formulated the draft of Regulation for Physical Protection of Radioactive Materials, which will enter in force 1 January 2009. In accordance with this regulation exist 4 groups of securities to the radioactive sources as below:

group A- include the radioactive sources of the category one;

group B- include the radioactive sources of the categories two and three;

group C- include the radioactive sources of the category four;

group D- include the radioactive sources of the category five.

The situation of radiation sources during transition period

For 1992-2000 period in the country was applied a decentralized policy for the import-export of radioactive materials. After that period and especially after the Minister Council Ordinance (No. 56, date 27.02.2000)) for the control of import and export of radioactive materials by the licensed institutions, the RPO has under control the radioactive materials procedures.

Therefore during the transition period (1990-2000), when the license and inspection control were not well established, probably some radioactive sources were out of the control of regulatory body, and actually are transformed in lost or orphan sources. In the same period a number of state companies, which have used radioactive sources, were closed and therefore the radioactive materials were lost or are in unidentified situation. In some companies the sources may be are stored in safety places, but this fact needs to be verified carefully under the investigation process by INP and RPO.

Regarding the radioactive sources used by military divisions, after the agreement between the Ministry of Defense and CANP (2003), was confirmed that spent radioactive sources were transported for conditioning and interim storage in CANP.

During the control of radioactivity contamination in the metallic scrap at the customs entry / exit points, were found radioactive sources mainly used by army and industrial applications. Recently (2004) three cobalt sources, which belonged to military units, were found in the north of Albania by state police officers. By custom office in Tirana (2006) were found 4 pieces 241Am/Be emitter neutron sources (A»0.4 GBq) each of them, and 1 piece of 137Cs (A» 750 MBq), used for industrial applications. We evaluate that other radioactive sources (60Co, 90Sr), may be are lost or stolen during 1997 unrest events. The 137Cs source was found by INP staff, which not included at the inventory list of the radioactive sources used for 1960- 2008. As seems, these sources have penetrated by neighbor countries in illicit manner. The database of radioactive materials entered Albania through legal procedures is located in INP and a copy is in RPO.

Investigation of the present situation

A working group was established with participants from INP, RPO and Geophysical Center to carry out the tasks, examining carefully the most important documents related with: import-export and turned back radioactive sources at suppliers, invoices, reports, contracts, registers, all radioactive sources in use/storage, conditioned, lost, suspected for 1960 - 2008.

Based in the inventory registers in INP and RPO, conditioned spent radioactive sources and total number of existing radioactive sources used in the public-private sectors, were verified. Based in documents the responsible persons that have in charge radioactive sources in respective facilities, their addresses, in order to contact during the next steps for localization, identification and recovery, were identified.

In fundamental register in INP are recorded all nuclides, total activities, owner companies, towns, regions, where the radioactive sources are in use/storage. The presentation of the data is based in the registers of INP (1970-1992) and RPO licensing documents (1997-2008), which are recorded in RAIS program.

An important output of this study was the listing and to putting in evidence of all orphan and lost radiation sources in Albanian territory.

Based at the studies documents and at the data of SRS/RAIS programs, for 94 items of the radiation sources, their investigation situation is under control. 26 items of the radiation sources are conditioned, while 42 items are in use/storage. 10 items are turned back to suppliers, while 16 items are suspected and need to be investigated in future. The financial support of this investigation of the suspected / lost / found radiation sources needs to be ensured by Albanian governmental institutions and from other resources.

Transport Security of Radioactive Material

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Abstract

Radioactive material transport safety is highly regulated and the transport safety regulations have been in effect for decades. Transport security recommendations for many types of radioactive material have just been developed and are now being applied, and the potential impact on transport operations is significant.

While the security measures and definition of high consequence radioactive material added to the United Nations Model Regulations for Transport of Dangerous Goods were recognized as a very positive step, the IAEA initiated a review of these provisions to ensure they were technically sound and consistent with other approaches used in nuclear and radioactive material security.

Several significant steps have been taken in further defining appropriate security measures to apply during transport and these are reflected in the IAEA guide "Security in the Transport of Radioactive Material". These measures can be adopted by countries and international transport modal organizations to provide a consistent approach in security requirements for these materials. However, there is still much to be accomplished before transport security is on par with transport safety.

This poster briefly describes the implementation of the IAEA security recommendations.

The poster will also present information on the training course "Security in Transport of Radioactive Material" that has been given at a number of occasions in different parts of the world. This training course, developed cooperatively by the IAEA, the U.S. National Nuclear Security Administration and The Australian Radiation Protection and Nuclear Safety Agency (ARPANSA), is based on the guidance and is intended to educate Member States in how to apply the Recommendations.

The poster also will present information on transport security upgrade assistance programs that are now getting started.

Security of Radioactive Sources and Nuclear Materials in Bangladesh

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Like other countries in the world, in Bangladesh, different type s of radioactive sources and nuclear materials are being used in various fields, such as medicine, industry, agriculture, industrial gauges and well logging, construction works, research, irradiation of medical products and food etc. Bangladesh Atomic Energy Commission (BAEC) has been operating 14 Nuclear Medical institutes and 04 research centers , in addition to other research and educational institutes. There is one 3MW TRIGA Mark-II research reactor for production of radioisotopes and research activities. There are also 12 Nuclear Medical/Radiotherapy centers working in Govenunent and 2 in private sectors. Several other users are using sealed radioactive sources for industrial purposes as well. Planning is in progress for a much larger irradiator for material processing plant of BAEC. The country is also considering building a nuclear power plant.

The safety and security of radioactive and nuclear materi als have long been a matter of national and international concern. The security issues have became paramount importance. Particularly so after the terrorist incident of 11 September 2001. Like many other countries of the world Bangladesh has already established its national infrastructure for nuclear safety, security, safegu ards and radiation control in practices and facilities. The country has also on overwhelming interest in seeing that all radioactive and nuclear materials are secured and accounted for by establishing and upgrading the radiological and nuclear security system to deal with the problems of theft, unauthori zed removal, attemp t of threaten to cause property/environment damage with radioactive contamination or creating social and economic disruption, illicit trafficking or trading. In order to protect individuals, society and environment, the Government of Bangladesh is committed to take the appropriate measures necessary to ensure that the radioactive and nuclear material s within its territory or under its ju risdiction or control are safely managed and securely protec ted during the useful lives and at the end of their useful lives. BAEC is only the responsible organization in the country for all promotional and regulatory activities of atomic energy; it has the responsibility to take initiatives of all possible technical and lawful measures for safety and security of radioactive and nuclear materials of the country . To regulate and control the safe use of these activities. Govenunent of Bangladesh has authorized regulatory authority for the implementation and enforcement of Nuelear Safety and Radiation Control (NSRC) Rules-97 and other regulatory requirements under NSRC Act-93 [I, 2]. The rules builds the legal basis of national radioactive and nuclear material control and set forth rules to ensure the security in lawful use of radioactive and nuclear material and to prevent theft, sabotage, loss, illegal use and removal nuclear material. The NSRC rule has defined some sanction provi sions of warning, fining or ordering operator to rectify within a certain time or termination of license for violations of regulations. Inspection is an important measure in nationa l nuclear material control system. SAEC is the competent autho rity in charge of implementation of nuclear security system and physical protection measures. has the responsibilities of:

- Establishing a national system on physical protection/nuclear security of radioactive/nuclear materials and nuclear facilitie s;
- Radioactive/nuclear material license application review, approval and management;
- Organizing the inspection to verify the compliance ofl icensee;
- Establishing rules, standards and technical guides on nuclear safety. Radiation protection and radioactive waste management;
- Investigations and legal action against the theft, illegal removal, sabotage and illicit trafficking of nuclear and radioactive materials, etc.

According to the NSRC Rules·93, licensing is the basic requirement of national nuclear control system to ensure lawful and safe use of radioactive and nuclear materials [3]. Any organization or individual s intending to use, produce or store nuclear materials must apply the licenses and get the approval from the competent authority. The necessary information about types, characterizations and quantities of nuclear material, operation location, the management system of nuclear material control and security at facilities is required to be described in the license application documents. The owners/licensee of radioactive/nuclear materials are responsible to ensure security of radioactive/nuclear materials by keeping the materials sources under lock and key and maintain movement records about location so that unauthorized removal of the materials from their locations could be minimized. Any premises in which nuclear facility, radioactive/nuclear material is to be used/stored/manufactured etc. require license from the BAEC.

Presently, BAEC is working with the USDOE for upgrading the physical/nuclear security system for different radioactive and nuclear facilities in the country to prevent the possibility of radiological threats. We apply the same principles of physical prolection to the security management of nuclear material, radioactive sources and the facilities. The physical protection system consists of three elements of detection, delay and response. In order to protect the security of nuclear material, radioactive sources and nuclear facilities effectively, BAEC set up several protection layers for different locations. The detection is the first line of defense technical measures of perimeter detection, access control , video camera assessment, personnel identification are applied. Physical barriers is the second line of defense to delay adversary to reach the targets effectively, the technical measures such as fences, hardened doors, meshed windows, locks, fixed devices, intruder alarm system, balance magnetic switch, etc. arc installed . This report is aimed to briefly discuss the status of physical protection and nuclear security system for radioactive and nuclear facilities in Bangladesh.

References

[1] Nuclear Safet y and Radiation Control Act (Act No. 21 of 1993), Bangladesh Gazette, 22 July, (1993).

[2] Nuclear Safety and Radiation Control Rules-97 (SRO-205/Law/97), Bangladesh Gazette, 4 September, (1997).

[3] MOLLAH, A. S., Regulatory Contro l ofRadiation Sources in Bangladesh, Proc. of the Int. Conf. on Measures to Prevent, Intercept, and respond to illicit uses of Nuclear Material and Radioactive Sources, IAEA-CN-86, IAEA, Vienna, (2002) 521-524.

Some Lessons Learned from Developing, Testing and Using Border Monitoring Equipment for the Last Decade

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An experience gained by several countries in creating systems of border (customs) radiation control for the last decade since the beginning of the well-known ITRAP program provides a possibility to learn definite lessons and to assess the promising progress of international efforts aimed to combat illicit trafficking in nuclear and other radioactive materials across the state borders and territories.

The main result and lesson of this program is obvious conclusion : the specialized equipment is required to solve tasks of border (customs) radiation control. At the same time, developers and manufacturers of equipment, on one hand, and developers of standards and recommendations, on the other hand, are much concerned with the only technical part of radiation control. The main efforts are made to search new technical solutions, detectors, electronics, etc. New and very expensive equipment has appeared (spectroscopic portal monitors, radiation scanners, etc).

Note the very important issue: according to the recent researc h, the effectiveness of using such equipment significantly depends on the operation procedures. For example, according to developed concept of "two-tier approach" [I]. the plastic based portal monitors are used for the primary control in the 'pass-through' mode at the first tier, and the spectroscopic portal monitor is used at the second tier in the 'stand-in' mode. The recent tests of this approach showed promising results.

Previous research made by the authors for gamma-neutron personal radiation detectors and backpacks [2, 3] also showed that, without properly elaborated operation procedures, the use of these instruments in the real field conditions is very questionable and, sometimes, even not possible.

Saying "operation procedures" we mean the following : (i) definition of scenarios of radiation control; (ii) analysis of possible places of installation or application of equipment; (iii) definition of the maximum distance between a detector and the probable worst case of appearance of a radioactive source; (iv) definition of the minimum measurement time interval.

In this paper, the authors have investigated one more aspect of the discussed problem based on an example of pedestrian radiation portal monitors (PRPM) that are widely used (e.g. in airports). As a reference point, a PRPM was taken that can detect 0.3 g of Pu by its gamma radiation (e.g. the PM-700 of TSA Systems [4]). Fig. I presents results of calculations of the minimum detectable mass (MDA) of Pu in dependence on the thickness of Ph shielding. Calculations were perfonncd both for gamma radiation only and with corrections for the additional count rate due to neutrons. As seen, at 5 ern Pb shielding and corrections for neutrons, MDA of Pu is about 120 g. In other words, the PRPM which detects OJ g of unshielded Pu can detect (using the same plastic detectors as a gamma channel) about 120 g of Pu in 5 cm Pb shielding. Let's emphasize that it is usually considered that for the detection of shielded Pu an additional neutron channel based on He-3 tubes is needed which increases significantly the cost of the monitor.

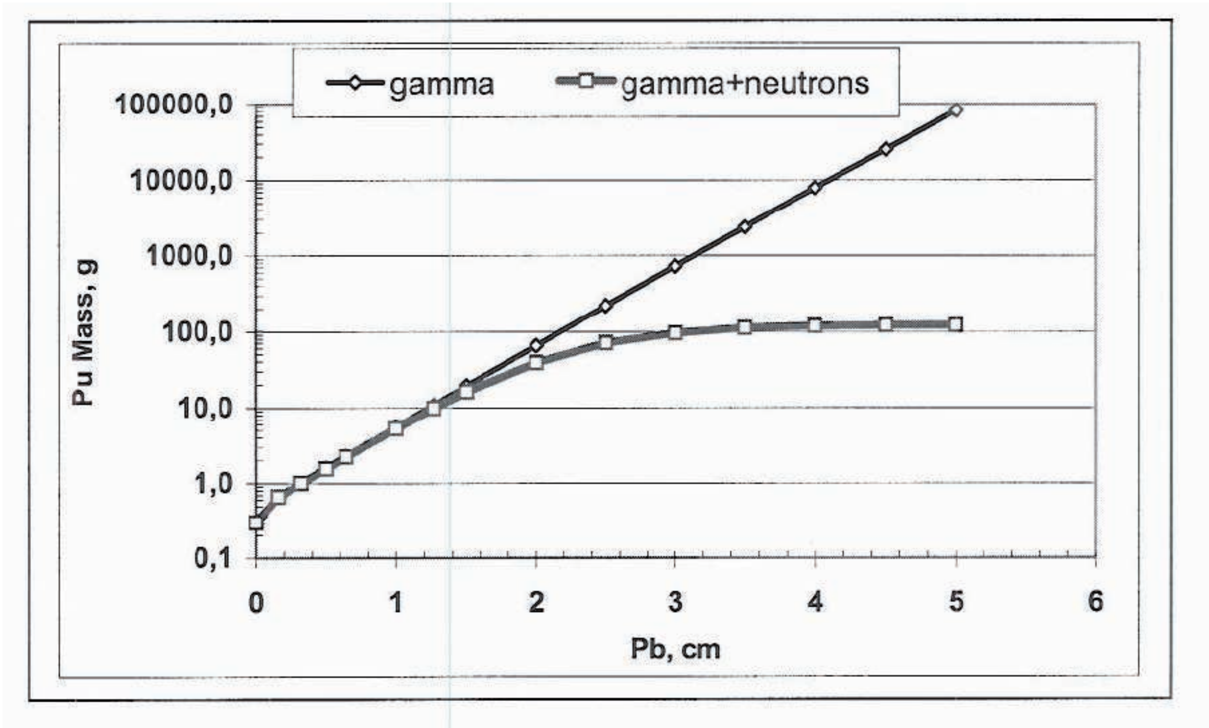

Fig.1 Dependence of Minimum Detectable Pu Mass on Pb shielding

On the other hand, the simple estimations show that for Pu mass of 30-300 g, mass of 5 em Pb shielding ranges approx. from 10 to 15 kg. It means that if a PRPM is used at the pedestrian check point in conjunction with ametal detector or an X-ray machine, this can allow (in some cases) not using the neutron channel in monitor, which significantly simplifies the monitor design and decreases its cost.

Based on the results of calculations and measurements, the following factors that influence the PRPM parameters of are also considered in the paper:

- measurement time(within the range from 1 second to several minutes)
- distance between pillars (from 0.8m - standard doorway up to 105m);
- availability of additional equipment for the personnel who is operating PRPMs (personal radiation detectors and handhelds).

Results of research evidently testify that the elaboration and optimization of the operation procedures of radiation control will increase the effectiveness of such control and simplify the design of equipment, thus making it less expensive and more widely used.

References

[1] Frymire, A., A Total Solution for Radiological Security. www.tsasys tems.comJIibrary/ articles/article_Ol .pdf

[2] Kagan, L., Stavrov, A., Personal Radiation Detectors: expectations and actual capabilities, INMM 47" Annual Meeting (Final program) , Tucson (2007) 60.

[3] Kagan, L., Stavrov, A., Strategy of development of new instruments to combat illicit trafficking: from applications towards specifications. International Conference on Illicit Trafficking: Collective Experience and the Way Forward (Book of Extended Synopses), Edinburgh (2007) 111-112.

[4] www.tsasystcms.comlproductsiportal]M-700A.html

A New Regulatory Authority for the Control of Nuclear Security and Radiation Protection in Burkina Faso

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Burkina Faso is a State with Small Quantity Protocol. It's additional Protocol interred into force on the 17 of April 2003; but the International Atomic Energy Agency (IAEA)"s statutes have been ratified in 1998. Burkina Faso is involved in several AFRA research activities relating to the nuclear security. In order to better control the activities of structures that use ionizing radiations, the National Assembly voted a law for the control of the radiation protection and nuclear safety, law N° 010-2005/AN, on the 26 of April 2005 ; and the nation al regulatory authority for radiation protection and nuclear security (ARSN) was created in July 2007. This structure is under the Ministry of Environment but with independent authority and resources, Plans are far advanced to give it a fully independent status. For the ARSN to be effective in its responsibilities, all activities involving radiation exposure are subjected to regulatory control by a system of notification, authorization by registration or licensing, and inspection. ARSN works closely with the IAEA national liaison officer through the national technical secretary of atomic energy (STEA) that has in charge the promotion of nuclear energy in Burkina Faso . Also collaboration is established with the individual dosimeter service located in the National public health laboratory. The mandate of the Burkina Faso National Regulatory Authority is also to advise the government on matters relating to radiation protection and disposal of radioactive sources (including wastes) and nuclear material s, and, of cause, to provide an effective national framework for safety and security of radioactive sources and radiological installations.

Some preliminary investigations have been conducted (still going on!) with a number of research centers and hospitals, using RAIS, RWMR and/or Protocol reporter software for record and keeping data (functional and/or disused sources arc inventoried, nuclear materials are accounted) and various declarations (SQP initial report, AP declarations, implementing an SSAC, etc.), The primary objective of these activities is to establish background data for further studies in order to suggest guidelines for drawing up regulations for the better control of nuclear security in Burkina Faso. During the coming years ARSN plans:

- to continue the inventory analysis of radioactive sources and radioactive waste (medical and research sectors agriculture and industrial productions) and the accounting for and the control of nuclear materials within the country;
- the Promulgation of laws and decrees relating to radioprotection and radioactive waste management;
- the control of import *I* export, holding and use of radioactive sources;
- the sensitization of stakeholder and user of radioactive sources;

For the time being, ARSN is focusing its activities in writing different complete regulatory texts in order to make functional programs related to the accountancy and the control of nuclear materials, Additional Protocol declarations and waste management in the country.

Cooperative Projects in the Nuclear Security Area with CIS Countries

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Following the breakdown of the former Soviet Union, the European Commission (EC) initiated a Technical Assistance to the Commonwealth of Independent States, the ACIS support programme. In the initial phase, essentially, nuclear safety projects were funded under the TACIS programme. From 1994, projects related to nuclear safeguards were included in the TACIS programme.

Since then, nine projects have been implemented in three recipient countries (Russian Federation, Kazakhstan and Ukraine) within the Commonwealth of Independent States (CIS) by two institutes of the Joint Research Centre of the European Commission: the Institute for the Protection and Security of the Citizen (IPSC) – Ispra (Italy) and the Institute for Transuranium Elements (lTU) - Karlsruhe (Germany).

After 10 years, the successful EC-CIS cooperation has evolved from a demand-driven to a discussion-driven relationship in areas of mutual interest and benefit. The new programme, taking into account new international threats, includes combating of illicit trafficking while sustaining past initiatives within an enlarged international cooperation. This new programme deploys 14projects in 7 countries.

This paper analyses the results of past collaboration, presents the status of the follow up programme being implemented and gives an overview of the JRC expertise which can be utilized in a new nuclear safeguards and security programme.

International Joint Efforts to Address Training Needs in Nuclear Security

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Abstract

Working within the framework of coordinated international efforts to combat nuclear and radiological illicit trafficking, three main donor organizations have recognized the training needs of the recipient institutions and in particular the Front Line Officers (FLO's). Given the tremendous demand for training and the limited resources available to each organization, a pilot joint training session was held in Ukraine whereby the United States' Second Line of Defense (SLD) program, the International Atomic Energy Agency (IAEA) and the European Commission's Joint Research Centre (JRC) brought their complementary expertise.

The synergy of the individual training programs paved the way to a successful session, as reflected in the satisfaction of the participants. The evaluation showed that these courses can be brought closer together to become more effective. A clear strength of the joint approach was in allowing the participants to address the three organizations at the same time. Additional joint training sessions will be planned, based on the success of this coordinated approach.

The first part of the paper will report on the content of the training activity hold in the Ukraine in 2008. A range of topics on detection and response based on the competences of the three supporting organizations have been covered. The follow-up and future efforts will subsequently be discussed in the second part of the paper, building on the successful Ukrainian experience. In particular, expanding the available training and strengthening the coordination and cooperation at an international level will be addressed, given that the increasing need for a wide range of training will continue to be a key issue worldwide .

Safety, Security and Safeguards on a Joint Mission

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Production of nuclear energy and use of radiation in industry, medicine and research provide for environmentally sustainable energy, means of carrying out and controlling various industrial processes, improving health care and promoting technological and scientific advances, among other things. They can only do so by being justifiable against the risks involved, resulting in radiation exposure as low as reasonably achievable, being guarded against malicious or otherwise unauthorised acts and by remaining exclusively in peaceful use. This state of affair s is achieved by a system of control measures for safety. security and safeguards- the 3S. The responsibility of applying the controls is shared by the whole society: international community, national legislators, competent authorities and perhaps most importantly, the users of nuclear and radiological technology.

Reliable 3S is a prerequisite for using nuclear energy . Nuclear renaissance may seem an attractive option as a means to reduce carbon dioxide emissions and so to decelerate the climate change. The global political climate, at the same time , requires that such renaissance be effectively safeguarded to prevent the technology from expanding beyond peaceful purposes. The decisions taken by society to build new nuclear power can only be taken if people have trust in the state taking care of the 3S. Credible 3S, therefore, must not only be effective and efficient but also visible. Similar reasoning applies to the use of radiation in general.

Our mission as the state authority is to protect people, society, the environment and future generation s from the harmful effects of radiation. This cannot be accomplished without the 3S: safety, security and safeguards, wherein also lies the rationale for the title of the paper. Despite the joint mission, the requirements of the 3S sometimes conflict with each other. For example, safety may entail dissemination of information about radioactive sources-their type, activity, location and purpose-as extensively as possible. Security, on the other hand, may require that information be restricted on a need-to-know basis. Similarly, where safety would call for unobstructed entrance and exit, for the sake of security more complex structures to restrict and delay access could be preferable. It is clear that without coordination the regulatory control measures may be counterproductive and so it is advisable for the parties responsible for each S to coordinate their efforts in setting the requirements and in overseeing their implementation. Presently, cooperation in this area is at times unnecessarily limited due to organisational divisions and popular preconceptions: "security is too secret to share information on" etc. It is equally clear, however, that a great proportion of the control measures for each S contributes directly to one or both of the other S' s. Or, in some cases, would, if they were allowed to. A surveillance camera, for example, could benefit all control regimes, but is in practice typically limited to one. Figure 1 presents one view of this overlap.

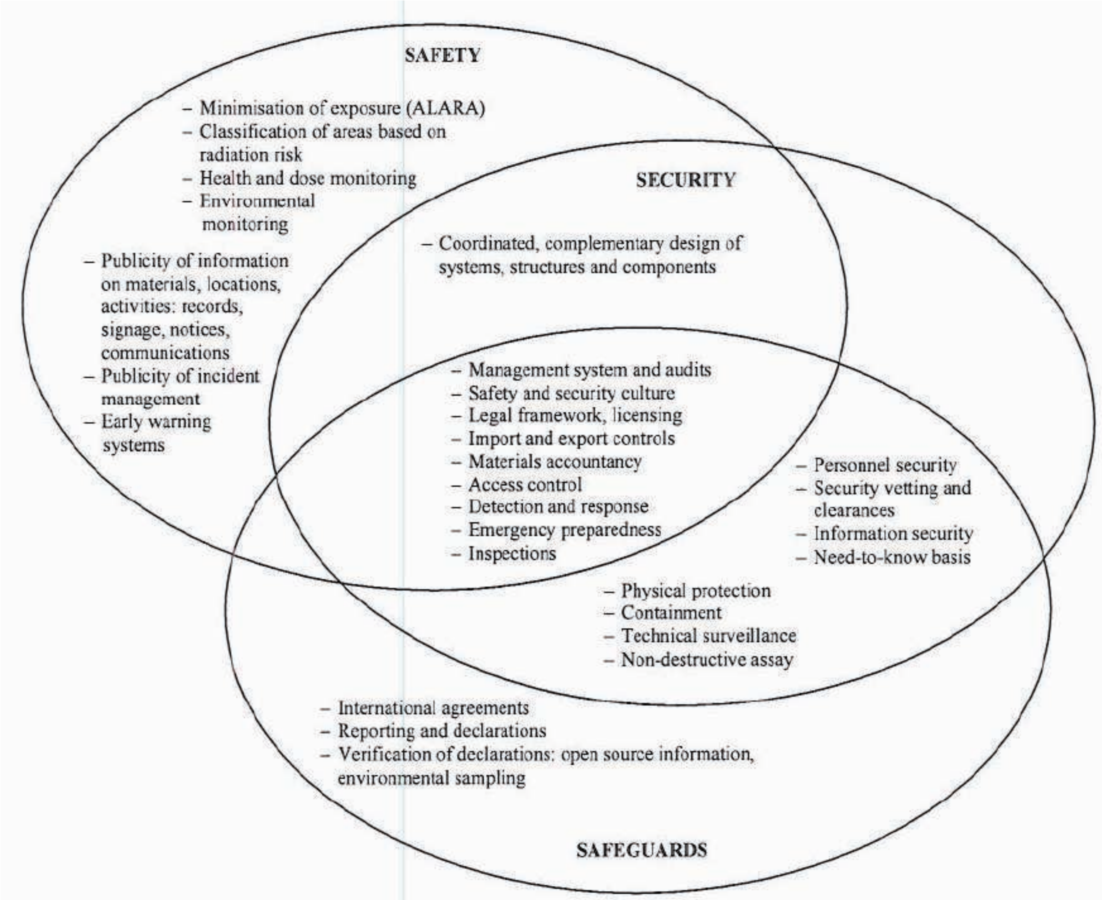

Figure1 Examples of overlapping control measures of the 3S.

As the trust in safe, secure and safeguarded nuclear energy and use of radiation on the global scale stands or falls on the same principle s as on the state level, the proficiency of the 3S must be demonstrated also to the international community. This brings our focus on the IAEA. Within the safeguards regime, the state system enables the IAEA to evaluate and draw conclusions on the state and to implement integrated safeguards, thus providing for assurances on control over its nuclear materials and on absence of undeclared activities. While less direct, interaction on safety and security is equally important. The IAEA leads the development of a framework of internationally accepted standards and reference documentation against which states may develop and self-assess their 3S systems. On IAEA-coordinated international advisory missions the state arrangements are assessed against these references to foster continuing improvement and peer-to-peer exchange. In further development of the documentation framework, we note the value of identifying the needs of the different 3S regimes as well as their synergies. Within the theme of security in particular we encourage further effort to complete the high-level reference s: fundamentals and requirements. The IAEA also hosts several information systems that reflect the state of the 3S on a global scale (reporting on incidents and emergencies, database on illicit trafficking, safeguards data acquisition and analysis). Contribution to and operation of these systems should improve our understanding of that state. Further, as a general measure, we should engage ourselves in raising awareness on the 3S and in demystification of some aspects of it among the authorities, the industry and the general public.

Security Problems Related to Uncontrolled Radioactive Sources in Georgia (Lessons Learned)

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1. Description of situation

As it is widely known Georgia had problem with s.c. "Orphan" radioactive sources originated due to loss of control on them. There were found and discovered 282 such radioactive sources in Georgia. It is possible to fix several ways for causing loss of control on radioactive sources [1]. Situation with orphan radioactive sources in Georgia is caused by complex of facts. At first it should be considered that as a part of former Soviet Union, Georgia was neighboured by NATO country. Therefore a huge amount of militaries were deployed on Georgian territory. The many of them use radioactive sources were not under civilian regulatory control. At the troops withdrawal from Georgia no strong regulatory control existed. There was period of time of soviet empire ruining, when old regulatory system was destroyed, but new one was not established still. Therefore no radiation monitoring of the territories of former military base were conducted. At the same time weakening control within military deployments gave the possibility to sell or even abandon (to avoid fees for transportation and disposal) radioactive sources. Simultaneously many enterprises owned teh sources due to economical difficulties stop their activities or changed the profile. As a result, in absence of regulatory control, number of sources becomes uncontrolled. So, the main aspect los of control and originating of orphan sources was **Financial Motive.** This motive was existed when some people found abandoned radioactive sources. They just tried to earn money and improve their wealth in difficult economical situation. Based on above-mentioned there is possible to identify three main causes for originating of orphan radioactive sources in Georgia:

- Temporary absence of regulatory control;
- Weakening of control in former Soviet troops;
- Difficult economical situation.

2. Problems and ways to solve

Several radiological accidents have been developed in Georgia since 1997. The first great radiological accident took place at the military base in Lilo, when 11 soldiers were irradiated by ^{137}Cs (orphan ^{60}Co and ^{226}Ra sources also were found) [2], when Georgia received support form the Agency within the project GEO/9/004. Notable cases refer to thermoelectric generators based on ^{90}Sr. Initial activity each of them was 1 295 TBq. There were found and safely stored six such sources.

To prevent occurrence of any accident connected with uncontrolled radioactive sources the corresponded regulatory control system should be established. Georgia takes necessary measures to establish legislative basement and elaborate regulations providing security for radioactive sources according to international recommendations [3].

Another way to solve problem together with establishment of strong regulatory control is conducting searching and recovery operations for missing sources. Administrative searching can be considered as a first phase for whole searching operation, which should be followed by physical searching. There are three main possibilities to conduct searching operation: Airborne survey, car survey and pedestrian survey.

The first possibility is the most effective and expensive at the same time. This type searching was carried out in Georgia within the scope of IAEA TC project GEO/9/006, when 56 hours of airborne gamma survey of a large territory of the western part of Georgia and around Tbilisi was carried out at 2000. During the operation one orphan radioactive source were found in Poti. Airborne survey is not effective for mountain relief. So, taking into account high price for this activity, car and pedestrian searching also were conducted at 2002, 2003 and 2005. All these activity were actively supported by the Agency in close collaboration with USA, France, Indian and Turkish experts.

All found orphan radioactive sources should be recovered. There is possible to distinguish to type recovery operations: recovery operation during searching activity and large scale recovery operation. Large scale recovery operation is required when powerful orphan radioactive source was found. Good example for this activity is event when three woodgazers had received serious health damages from two thermolectrogenerators found in Tsalendjikha district in December 2001. Conducted operation included three main phases: Gathering of information, situation assessment and implementation of planned activities. During the second phase is very important to elaborate plan of activity and conduct special trainings for rescuers. Only on this way can be strictly define recovery team composition, responsibility of each team member and construction of equipment and container necessary for the recovery operation. This phase also considers feedback to regulation and planning of future activity to avoid such type accident repeating.

REFERENCES

[1] INTERNATIONAL ATOMIC ENERGY AGENCY, Strengthening control over radioactive sources in authorized use and regarding control over orphan sources,IAEA-TECDOC-1388, Vienna (2004).

[2] INTERNATIONAL ATOMIC ENERGY AGENCY, The radiological accident in Lilo, Vienna (2000).

[3] INTERNATIONAL ATOMIC ENERGY AGENCY, Code of conduct on Safety and Security of Radioactive sources, Vienna (2004), p.5.

Data Interpretation in Nuclear Forensics

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Abstract

Nuclear Forensics is a key element in the response process which is initiated after detection of illicit nuclear or other radioactive material. Credible nuclear forensics relies on appropriate sampling procedures, on validated analytical methods and on thorough data analysis and interpretation. Nuclear forensics aims at providing clues on the history and the potential origin of the material. Elemental and isotopic composition of the material, as well as its macroscopic and microscopic appearance reflect the technological processes used for the fabrication of the material.

The nuclear forensic analysis first of all results in measurement data. Through appropriate processing of these data information on the nature and the history of the material can be obtained. A number of data evaluation techniques serving this purpose are conceivable and have been applied. On the one side, statistical methods like principal component analysis (PCA) or classification and regression trees (CART) can be applied for evaluating large data sets and identifying the relevant parameters. On the other side, a thorough education and experience in areas like radiochemistry, material science or nuclear physics enable a scientific-technical interpretation of the data and help establishing a plausible hypothesis. Interpretation can further be supported by comparison of the measured data against reference data, reference samples, and reference calculations or against the background of experience. Reference data and reference samples may be compiled in databases or in archives. The availability of and the accessibility to such resources is often critical for unambiguous attribution of seized nuclear material. This obviously calls for international cooperation and for establishing a framework enabling mutual support in nuclear forensics interpretation, however, without compromising on the sensitivity of the data. On the other hand, deficiencies in the structure of the data, lack of homogeneity within a data set and the handling of qualitative or semi-quantitative information limit the applicability of database queries.

The present paper illustrates the application of the methodologies described above and the experience gained at ITU in the context of actual case work and of research based evaluations.

Investigation of Selected Trace Elements as Nuclear Forensics Signatures

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Abstract

Nuclear material is either a product of technological processing of natural source material or it is entirely of anthropogenic origin. Consequently, nuclear material carries "tool-marks" or "fingerprints" of the process it was subjected to. Uranium fuels are examples of the first category, while plutonium belongs to the second category. The nature of these production processes is reflected in the elemental and isotopic composition of the material as well as in its microscopic and macroscopic appearance. All of these parameters can be determined using appropriate analytical techniques and they may result in important conclusions on the history and on the origin of the material. Therefore, they provide the most essential contribution to the prevention of future diversions of nuclear material from the same source.

So far, essentially metallic impurities or light elements have been investigated for their potential in providing clues either on the type of process they originate from or on the geolocation of the uranium. In the present investigation, signatures like lead and strontium isotopic compositions and rare earth patterns are scrutinized. Such signatures have been used in geological applications, but their usability in nuclear forensics is not yet fully exploited. The lack of adequate samples often prevents establishing clear relations between measured parameters and the origin of the sample, also the statistical significance of a parameter needs to be investigated. Careful evaluation of useful signatures and the related interpretation techniques form the basis for credible nuclear forensic conclusions.

The present study focuses on the front end of the nuclear fuel cycle, where we investigated the elemental and isotopic patterns of uranium ore concentrates (DOC). Based on this methodological development, a comprehensive set of UOC samples is being investigated. This will be a considerable step forward in establishing a reference sample archive on uranium powder samples.

Recent Improvements in On-site Detection and Identification of Radioactive/Nuclear Material

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To prevent and detect illicit trafficking of radioactive or nuclear material sensitive mobile detection systems are mandatory in addition to fixed monitors installed at border crossings, or at the gateway of nuclear and industrial facilities. A specific search can be executed when a concrete suspicion arises and often identification is possible to assess the potential risk. We there fore investigated in the characteristics of recently fielded promising instruments for out of-laboratory operation.

Recently, new detector systems with relatively good resolution gamma scintillators have become available [l], for instance the Inspector 1000 (manufactured by Canberra) system with lanthanum bromide (LaSr) scintillator. These systems offer high efficiency at reasonable cost combined with enhanced resolution compared to NaI. Scintillators of LaBr can be produced with virtually any size and are therefore comparable to the wide-spread NaI scintillators. LaBr offers a 2 to 3 times better resolution than NaI. Of course, this is still much lower than the resolution of semi-conductor detectors with high-purity Germanium, but some interesting options, like Uranium-Plutonium-Analysis, normally only feasible with high resolution Germanium detectors, come into view.

There are also fairly new detection systems with high resolution gamma crystals available, which are now more compact and easier to use as for example the DetectivEX (manufactured by Ortec). A disadvantage of such systems is still there, the very high price. Since now the problems with Stirling coolers for mobile Germanium detectors appear to be solved, Stirling cooled High-Purity Germanium detectors roll up the market. Another reason may be that many users felt quite uncomfortable with Liquid Nitrogen. Modern Stirling coolers can be powered by a car battery, making them even more flexible . Figure I shows a comparison of a Plutonium spectrum taken with gamma detectors of different energy resolution.

Neutron spectroscopy now is also possible with a hand-held detection systems, e.g., the n-Probe (manufactured by BTI). This system contains a NE213 liquid scintillator and a He-3 tube and thereby covers the energy range from 0 to 18 MeV. Energy information for neutrons may be very helpful to categorize radioactive material. Though the neutron spectrum usually does not contain much structure the spectrum of commonly used industrial neutron sources as Am/Be and Cf is well known and an unknown spectrum may be compared to it. A further benefit is that the system is rather inexpensive.

Neutron coincidence and to some extent even multiplicity information also can be gained with a portable, hand pulled system, e.g., the fission meter (manufctured by Ortec) [2]. It consist of 30 He--3 tubes with a PE-moderator on one side. This system allows to categorize material in fissionable and non-fissionable. This is done by analyzing the multiplicity structure of the neutron events and comparing it to a Poisson distribution which would arise from a random source. In addition, the system can to some extent discover shielding material located between source and detector by Feynman variance plots. The presence of shielding material is often important information for the evaluation of neutron measurements. One disadvantage of such systems remains: They are very expensive.

All of the detection systems mentioned above were investigated in our institute and the results of the measurements showed their benefit. Constraints and limitations were also figured out. Mobile detection possibilities are improved greatly by these and some more other recently fielded instruments.

These types of instruments enhance the possibility to detect radioactive material out of regulatory control and to bring it into a safe and secure environment and thereby reduce the risks of this material becoming used for malicious purposes.

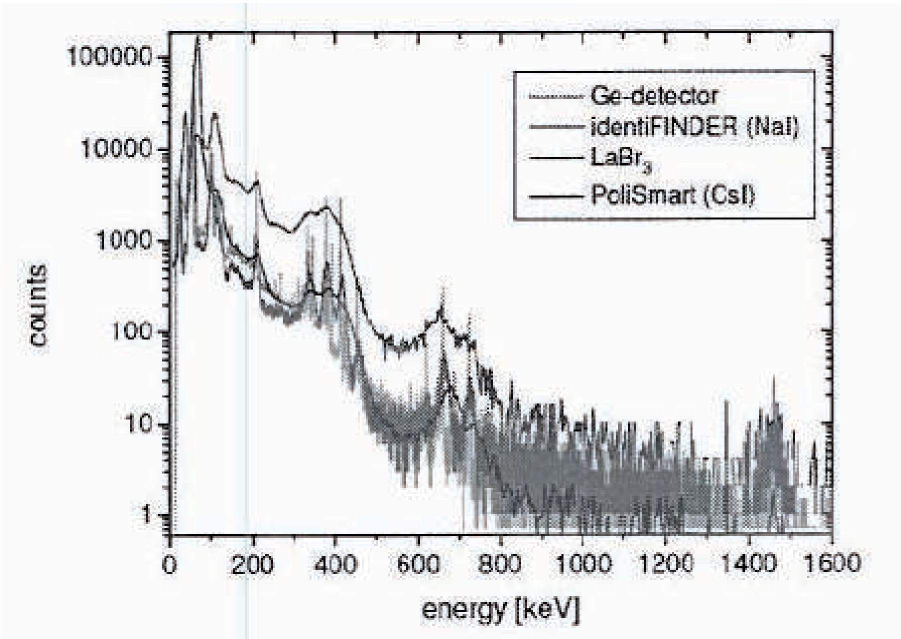

Fig. 1: Comparison of different spectra obtained with different detection systems using a plutonium source with 84 % ^{139}*Pu without shielding.*

References

[1] RISSE, M. ; BERKY, W. ; KOBLE, T. ; ROSENSTOCK, W.: Identification of nuclear material with different gamma spectroscopic devices. In: Institute of Nuclear Materials Management -INMM-: INMM 48th Annual Meeting 2007. CD-ROM : Proceedings of the Institute of Nuclear Materials Management Madison: Omnipress, 2007, 8 S.

[2] KOBLE, *T.;* RISSE, M.; BERKY, W.; CHMEL, S.; FRIEDRICH, H.; ENGELENPETER, J.; ROSENSTOCK,W.: Tracking of Fissile Material with Neutron Detector Systems. In: Institute of Nuclear Materials Management -INMM-: INMM 49th Annual Meeting 2008. CD-ROM : Proceedings of the Institute of Nuclear Materials Management (in press)

Joint Exercises and Training of Law Enforcers and Radiation Protection Advisors for the Defence against Nuclear Hazards in Germany - Experience Gathered at the Federal Level

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Joint training and exercises between law enforcers and radiation protection advisors are an essential part of any response capability that is expected to respond to incidents involving the malicious use of radioactive materials. This paper sets out some experiences and information about training and exercises in the field of the defence against nuclear hazards that has been gathered by the Federal Office for Radiation Protection over the last few years. The principle aim of this paper is for the lessons learned to contribute to international best practise in training and exercises from a radiation protection standpoint.

In Germany, the defence against nuclear hazards is normally the responsibility of the state ("Bundesland") in which an incident occurs. Each German Bundesland has its own police force, criminal police office and radiation protection authority who are all equipped to deal with small to medium-scale incidents involving radioactive materials. However, if the incident is of a serious and/or criminal nature, for instance an emergency with nuclear material or an attack with a radiological weapon, the Bundesland can call on the federal government for additional forces from a unit known as the "Central federal support group for the defence against nuclear hazards" (abbreviated to ZUB from the German). The ZUB includes specialists from the Federal Criminal Police Office (BKA), the Federal Office for Radiation Protection (BfS) and the Federal Police (BPol) [1].

When called upon, the ZUB is integrated into the local task force dealing with the threat; however, the control of the operation remains in the hands of the local Bundesland police administration. Since every Bundesland has different ways of dealing with nuclear hazards, different regulations and specialists, it is crucial for federal forces to retain a high degree of flexibility in order to work together effectively. In addition, the three institutions BfS, BKA and BPol are very different in nature, both culturally and with respect to their expertise. To ensure that the forces work well together, despite the possible difficult and varying conditions of a deployment, regularly planned exercises and training are essential. This training OCCW'S both within the ZUB itself and between the ZUB and the 16 different German Bundesländer. In the paper, an example of the recent ZUB exercise in Cologne together with the Cologne authorities in IlD1e 2008 will be taken. This example will illustrate the scope, complexity and success of the large exercises the ZUB carries out with the German Bundesländer and also serve as a basis for explaining some of the radiation protection issues that are often encountered during such exercises. These issues include: discrepancies between real and exercise radiation protection; training on a local level between police and radiation protection authorities; educating fire departments about radioactivity and the correct use of personal protective equipment during a deployment involving radioactive materials [2]; the importance of experts outside the ZUB and the Bundesland; discrepancies between the timescale expectations of the police and the radiation protection authorities during the deployment; the evaluation and importance of press reports [3] and visitor programmes; the inclusion of police academy instructors into the visitor programme; the essential nature of on call responsibilities for the field exercise and unexpected measurements in the field that have nothing to do with the planned exercise.

An important result of all the training activities within the ZUB and between the ZUB and the German Bundesländer is that the members of the ZUB and the Bundesland forces have begun to know and recognise each other and establish friendly working relationships. The importance of this cannot be underestimated, as it is much easier to work with someone during a deployment if you have met them previously and have a basic understanding of the person's job and their strengths.

Exercises and training are one of the main methods used for improving best practise in the field of the defence against nuclear hazards in Germany. Exercises undertaken in a controlled manner can highlight problems which can then be tackled in a systematic fashion to develop new operating procedures and guidelines. These guidelines and procedures are then implemented and tested in a similar fashion, yielding what is hopefully a continuous improvement in the ZUB operation. International contacts to foreign authorities are also very important in order to gain more information about best practise methods and improve the function of the ZUB further.

References

[1] EISHEH, J-T., Defence against nuclear hazards in Germany -the federalapproach, Conference contribution, International Conference on Illicit Nuclear Trafficking: Collective Experience andthe Way Forward, Edinburgh, November 2007.

[2] KROEGER, E. A., Developing a communication strategy for illegal acts involving radioactive materials - drawing on experience obtained during the Po-210 incident in Hamburg 2006, Conference contribution, International Conference on Illicit Nuclear Trafficking: CollectiveExperience and the Way Forward, Edinburgh. November 2007

[3] http://www.wdr.de/themen/panorama/25/koeln_polizeiuebung/index.jhtml

Design and Operational Provisions for Nuclear Security in India

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Design and operational provisions for the Security for nuclear material and facilities in India have been significantly upgraded since 2002. IAEA publications on the subject and training of personnel at courses conducted by IAEA have been of good help in this effort . A manual on security for Nuclear Power Plants (N??) was prepared by Atomic Energy Regulatory Board (AERB) covering aspects such as physical protection system, training. certification of personnel, documentation and reporting. Since implementation of all the provisions of the manual would require considerable time, "Minimum Requirements of Physical Protection System (PPS)" was specified for all NPPs. These requirements include; credentials of personnel, exclusion boundary, main plant boundary, operating island, delay elements, physical barrier, central alarm station, etc. using a graded approach. Site constraints in implementing these requirements were mainly on account of problem in retrofitting in plants constructed in early 70s and 80s. To get over this problem, alternate means of meeting the requirements were worked out. The minimum requirements for PPS are now being upgraded to include aspects like back-up power supplies, security operating procedures and conduct of exercises.

Audit of PPS for all NPPs and front-end and back-end fuel cycle facilities was carried out. Based on the observations, a dedicated group is being constituted at each site for maintaining and reviewing security aspects and for conduct of security awareness program to enhance security culture. Other improvements include ensuring fail safe design of PPS elements, development of a standard concept of PPS that may be suitably modified for individual sites and training of operating personnel and security personnel including the response force.

Work on development of Design Basis Threat (DBT) has been initiated with emphasis on scenarios that can lead to unauthorized removal of nuclear material in use, storage or transport. The guiding principles are: defining unacceptable consequences and direct or indirect identification of areas to be protected. The indirect method identifies vulnerable areas such as those where components of engineered safety features are located.

The AERB guide on Consenting Process for NPPs and Research Reactors lays down the requirements of safety and security for different stages of a project and all the projects under construction will have to comply with these requirements. This also includes fulfilling the security requirements for new fuel storage area before arrival of fuel at the site. For projects being constructed near an operating plant, access control procedures for construction contractor personnel, vehicles and material have been specified .

For multi-unit projects, once the first unit comes to the fuel loading stage, the PPS requirements for plant have to be fulfilled and that unit is segregated from the unit under construction from security considerations. AERB has also prepared draft guidelines on security event reporting and for conduct of regulatory inspection of security aspects.

AERB guide on “Security of radioactive material during transport” has been issued and the draft guide on “Security of radioactive sources in radiation facilities” has been prepared and is under review.

This paper will discuss improvements brought about in security systems for nuclear facilities in India based on the changing security scenarios and threat perceptions as also the experience gained in this field both at the national and international levels.

Challenges to Implementation on Security of Radioactive Sources for Reducing The"Radiological" Threat in Indonesia by Regulation

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Security of radioactive sources is a new concept introduced in Indonesia compared to existence of the concept of safety and physical protection for nuclear material and installation that have been implemented through year. Radioactive Sources are being used all cover the world, including Indonesia for many decades to benefit the humankind for various applications, for example to diagnose and treat illness, irradiate food, non-destructive testing, well-logging, etc. Some sources contain relatively large amounts of radioactive material that could potentially be used for malevolent purposes.

With reference to Article 14 Act No 10 Year 1997, BAPETEN (Nuclear Energy Regulatory Agency) is empowered to control on the utilization of nuclear energy including the utilization of ionizing radiation through regulations, licensing utilization, and inspections. In conducting its tasks, including law enforcement with regard to security of radioactive sources as well as radiation safety. The basic principles of nuclear energy regulate on practice in Indonesia set out in the law provide that control of any nuclear energy utilization is aimed to: [1]

- Assure the welfare, the security and the peace of people;
- Assure the safety and the health of workers and public, and the environmental protection;
- Maintain the legal order in implementing the use of nuclear energy;
- Increase the legal awareness of nuclear energy user to develop a safety culture in nuclear field;
- Prevent the diversion of the purpose of the nuclear material utilization; and
- Assure for maintaining and increasing the worker discipline on the implementation of nuclear energy utilization.

The Act stipulated that any activity related to the utilization of nuclear energy is required to be conducted in a manner which observers safety, security, peace, health of workers and the public, the protection of the environment. This requirement is further implemented by Government Regulation No. 33 Year 2007 on Safety of Ionizing Radiation and Security of Radioactive Sources. The aim of the regulation is to ensure the safety, security, peace and health of the workers and people and to protect the environment [2]. The Government

Regulation No. 33 Year 2007 on Safety of Ionizing Radiation and Security of Radioactive Sources based on SSS 115 and Code of Conduct on The Safety and Security Radioactive Sources [3-4]. The national strategies to minimize the likelihood of a loss control based on the Government Regulations stated in Article 60 to article 76 [2].

As part of the nuclear regulatory control, an export-import authorization system of radioactive sources is founded in article 61 to Article 65 of the Government Regulation No. 33 Year 2007.

Article 61 states that prior to consigning radioactive sources category 1 and category 2, the importer shall ensure that domestic users already obtained license from BAPETEN as well as the exporter. Besides, the exportation requires: exporter shall have obtained licensee from BAPETEN and ensure that importer for radioactive sources category 1 and 2 also holds license from their regulatory authority [2], the provisions on categorization of Radioactive Sources shall further be stipulated in BAPETEN Chairman Decree [5]. As referred to Article 71, in case of finding lost sources, licensee shall report to BAPETEN in an immediate manner, while the responsibility of securing found sources relies on the licensee pursuant to Article 72. Based on Article 72, responsibility to secure orphan sources lies on BAPETEN [2]. Effective date to apply security requirements: 8 June 2010 [2]. The regulations have provisions for authorization for receipt, possession, use, transport, import, export and disposal of radioactive sources; to obtain a license, the user must meet certain requirements which are stipulated in Ref. [6].

Pertaining to the regulatory control of radiation safety and security, BAPETEN has successfully established an information system on licensing and inspection for radiation facilities and radioactive sources. This model is called B@LIS (BAPETEN Licensing and Inspection System). Many seminars as well as internal and external meetings have been held by BAPETEN to disseminate the regulations to all stakeholders and the public, and to promote awareness regarding the security of radioactive sources. BAPETEN plans to train the staff of customs, port authorities and other parties which are involved the security of radioactive sources.

References

[1] Act of the Republic of Indonesia Number 10 of 1997.

[2] Government Regulation No. 33 Year 2007 on Safety of Ionizing Radiation and Security of Radioactive Sources (2007)

[3] International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources, Safety Series No. 115, IAEA, Vienna, 1996

[4] Code of Conduct on the Safety and Security of Radioactive Sources, lAEA/CODEOC/2004, IAEA, Vienna, 2004

[5] Chairman Decree No.7 Year 2007 on Security of Radioactive Sources, BAPETEN, Jakarta

[6] Government Regulation No. 29 Year 2008 on Licensing of Ionization Radiation Sources and Nuclear Material (2008)

Nuclear Regulatory Policy Concept on Safety, Security, Safeguards and Emergency Preparedness (3S+EP)

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Regulatory Policy is formulated in regulations that stipulate the assurance of workers and public safety and environmental protection. Legislation and regulations on nuclear energy should consider nuclear safety, security and safeguards, as well as nuclear emergency preparedness (3S+EP) and liability for nuclear damage. Specific requirements stipulated in international conventions and agreements should also be taken into account.

The effects of regulatory policy on nuclear industry should also be noted. A country that utilises nuclear energy and yet pays little attention to 3S+EP could incite accidents, sabotage, terrorism and non-peaceful use of nuclear energy and will certainly harm nuclear industry globally. Therefore, it is the responsibility of the regulatory bodies around the world to ensure that proper oversight on the implementation of 3S+EP.

Apart from nuclear regulations, a Standard Review and Assessment (SRA) should be provided as a tool for regulatory staffs in performing evaluation on licence applications. SRA is needed to ensure that licence issuance is based on contemporary legal requirements, legal norms and international practice.

By undertaking proper regulatory oversight on Safety, Security and Emergency Preparedness (3S+EP) as an integrated and comprehensive system, safe and secure use of nuclear energy can be assured. Licence requirements and conditions should fulfil regulatory requirements pertaining to 3S+EP for nuclear installation as an integrated system. The boundaries of 3S+EP in the operation of nuclear installations cannot be burdened on the owner, yet they interact with national and international level of coordination, such that appropriate oversight on nuclear energy can be assured.

The importance of emergency preparedness is clearly shown in Chernobyl accident. An effective emergency capacity that can be immediately mobilized is important. The capacity in protecting the personnel before, during and after the disaster should also be planned. Thus, proper emergency preparedness should be supported by adequate resources.

Regulatory policy concept on safety, security, safeguards and emergency preparedness is depicted on Figure I. The interface between safety, security, safeguards and emergency preparedness has to be set forth in nuclear regulations, such as regulatory requirements; 3S+EP; components, systems and structures of nuclear installations and human resources. Licensing regulations should stipulate, among others, DIQ, installations security system, safety analysis report, emergency preparedness requirements and necessary human resources that meet the 3S+EP requirements. If 3S is not stipulated in the licensing requirements, there will be a lack of regulatory oversight that could result in unintended consequences. However, this can be anticipated with emergency preparedness system. If the integrated 3S+EP concept is thoroughly fulfilled safe and secure use of nuclear energy can be assured.

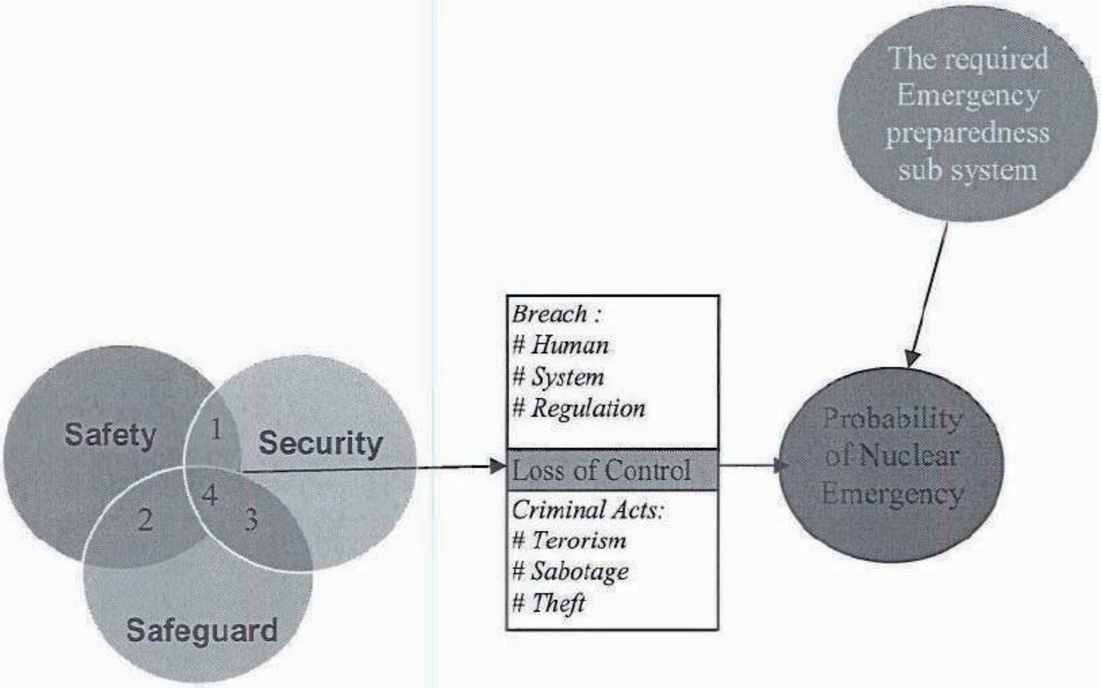

FIG 1. Regulatory control with 3S+EP concept

References

[1] Act No.1 0 Year 1997 on Nuclear Energy.

[2] Government Regulations No.5 Year 2006 on National Energy Policy Year 2005.

[3] Government Regulation No.43 Year 2006 on Licensing of Nuclear Reactor

[4] BAPETEN Regulatory Document Year 2008, Draft Government Regulation on Safety and Security of Nuclear Installation s

[5] Dodd Brian, Safety& Security of Radioactive Sources: Conflict, Commonalities & Control, BD consulting, USA

[6] Kenzo Oshima, International Conference "Fifteen Years After the Chernobyl Accident: Lessons Learned" Kiev, 18-20 April 2001

[7] G.A Klapisson et. al, An Overview of the Licensing Approach of the South African Nuclear Regulatory Authority, CNS, 2000.

[8] Mycle Schneider, The World Nuclear Industry Status Report, Brussels, 2004.

[9] Sudarto, Draft Government Regulation on National Nuclear Emergency Preparedness System, DP2IBN-BAPETEN, July 2006

[10] Zurias Ilyas, Leadership Capacity Development on the Licensing of Nuclear Power Plant, SPAMEN papers, Jakarta, 2006.

[11] Zurias Ilyas, Regulations on the establishment of Nuclear Power Plant in Indonesia, The 12th National Seminar on Safety Technology of Nuclear Power Plants and Facilities, Yogyakarta, September 2006

Regulation On Nuclear Materials In Indonesia

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Indonesia belongs to those countries which actively utilizes atomic energy for peaceful purposes. In order to prevent the deviation of the purpose of nuclear energy utilization and nuclear security, there is a need to enact governmental regulation according to the Act No. 10 Year 1997 on Nuclear Energy article 4.a.

The utilization of nuclear energy shall be controlled properly in order to comply with the safety regulations. Safety regulation consists of regulation, licensing and inspection established by regulatory body according to the Act No. 10 Year 1997 article 4.b [1]. The Presidential Decree No. 76/1998 on the regulation of the utilization of nuclear energy in Indonesia is vested to Bapeten (Badan Pengawas Tenaga Nuklir - Nuclear Energy Regulatory Agency) [2]. Any body who proposes a license to use nuclear materials shall fulfil and comply with the regulation established by Government and Regulatory Body.

According to Chapter 3 article 10 paragraph 1 of Government Regulation (GR) No. 29, Year 2008, any person or institution that will utilize nuclear energy shall posses license issued by Regulatory Body [3]. GR No. 43 Year 2006 Chapter 3 article 15 states that the utility proposing license for reactor commissioning shall have the license of nuclear material utilization [4].

Approval on certification of nuclear material, transportation licensing and export of spent fuel are regulated in GR No 26 Year 2002 on the safety of Radioactive Material Transportation. Chapter 3 article 6 of GR No 26 Year 2002 states that the transportation of radioactive material can be performed if the nuclear installation consignee and the carrier of the radioactive materials have a license of nuclear material utilization issued by regulatory body. In addition to license of nuclear material utilization, the sender shall posses transportation license.[5]

GR No. 29 Year 2008 Chapter III article 16 governs that the licensee shall posses System of Accounting for and Control of Nuclear Material and system of Physical Protection of Nuclear Material. GR No 43 year 2006 Chapter 3 article 12 and Bapeten Chainnan Regulation (BCR) No. 3 year 2006 Chapter 2 article 11 state that utilities proposing a construction license shall submit DIQ (Design Information Questionnaire for SSAC) and preliminary physical protection program. Article 15 chapter 4 of GR 43 year 2006 and article 14 of BCR year 2006 stipulate that utilities proposing the commissioning license shall has SSAC and physical protection program [4,6].

The purpose of inspection is to check that utilities fulfil and comply with the regulation. According the Act No. 10 year 1997 article 20 the inspection to the nuclear installations and installations that utilize ionizing radiation shall be performed by the regulatory body in order to ensure that the licensing requirements and nuclear safety regulations are complied with.

As the authorized institution, Bapeten has established the regulation on the State System of Accounting for and Control of Nuclear Material (SSAC) in the DBC No. 02 Year2005.

To demonstrate that Indonesia does not have undeclared facility and open to the IAEA verification, Indonesia has signed the additional protocol to safeguards based on Model INFCIR/540, meaning that Indonesia accepts the IAEA additional verification to all non-nuclear activities relating to nuclear material cycles and equipment used for nuclear activities. Related to additional protocol, Bapeten has issued the BCR No. 09 year 2006 on Conducting of Additional Protocol of SSAC[8].

To prevent nuclear material theft and sabotage to nuclear facilities, Indonesia has ratified the Convention on the Physical Protection on Nuclear Material and legitimated in the Presidential Decree No. 49/1986, and has signed its amendment. The Guidance on Physical Protection for Nuclear Materials and Facilities is established by BCR No. 02P year 1999. In addition to BCR No. 02P year 2000, the physical predication is governed by the GR No. GR No. 29 Year 2008 on Licensing of Ionization Radiation Source and Nuclear Materials UtilizationChapter3 Article 16 clause 1 letter b. It states that nuclear material utilization shall apply physical protection system of nuclear material. GR No. 26 year 2002 on Radioactive Material Transport Safety article 7 clause I stipulates that before the transport is performed, the sender have anobligation to prepare physical protection and other safety requirements [5]. This matter is also stipulated in the GR No. 27 year 2002 on Radioactive Waste Management. Moreover, the government regulation on safety and security of nuclear installations will be issued in next two years.

Article 20 GR No. 27 year 2002 establishes that spent fuel storage facilities shall fulfil the specified requirements, one of the requirements is a complete physical protection system. Article 27 and 28 GR No. 27 year 2002 requires the physical protection system and any other safety requirements for final storage oflow, intermediate and high radioactive wastes [9].

To ensure that nuclear materials in Indonesia are utilized for peace purposes, Bapeten accepts IAEA verification on safeguards and conducts the State System of Accounting for and Control of Nuclear Material, and Additional Protocol of SSAC inspections to ensure that nuclear material utilization is under control. Bapeten as nuclear energy regulatory agency has performed control to nuclear facilities in Indonesia and Bapeten conducts the inspection of physical protection on nuclear facilities/installations to prevent nuclear material theft and sabotage to nuclear facilities.

References

[1] Act No.10Year 1997 on Nuclear Energy

[2] Presidential Decree No. 76 year 1998 on Nuclear Energy Regulatory Agency

[3] [3] Government Regulation No. 29 Year 2008 on Licensing of Ionization Radiation Source and Nuclear Material Utilization

[4] Government Regulation No. 43 Year 2006 on Licensing of Nuclear Reactor

[5] Government Regulation No. 26 year 2002 on Radioactive Material Transport Safety

[6] Bapeten Chairman Regulation No. 03 Year 2006 on Licensing of Non Reactor Nuclear Installations

[7] Bapeten Chairman Regulation No. 02 Year 2005 on SSAC

[8] Bapeten Chairman Regulation No. 09 year 2006 on Conducting of Additional Protocol of SSAC

[9] Government Regulation No. 27 year 2002 on Radioactive Waste Management

[10] Bapeten Chairman Regulation No. 02PII999 on the Guidance on Physical Protection of Nuclear Materials and Facilities

ITWG – A Platform for International Cooperation in Nuclear Forensics

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Abstract

Reporting of the first nuclear trafficking incidents began in the earl y 1990's. The incidents were handled on a national level, using the resources and expertise available in the respective states. However, it soon became evident that fighting this illicit movement of nuclear material across borders would require international cooperation and a systematic and methodological approach . To this end, the G-8 states encouraged the creation of a dedicated group of experts. The Nuclear Smuggling International Technical Working Gro up (ITWG) was created in the mid 1990's under the auspices of the G-8, following the 1995 Ottawa summit and the 1996 nuclear security summit held in Moscow. The group reports regularly to the Nuclear Safety and Securi ty Group (NS SG) of the G-8.

The ITWG has been working towards a sustainable mechanism to help resolve the international problem surrounding combating the illicit trafficking of nuclear material . In consequence, the technical focus has been on establishing a means for identifying the origin of the nuclear material, enabling the improvement of preventive measures at the source and thus avoiding future thefts or diversions. This scientific discipline is called nuclear forensics.

The ITWG and its plenary meetings provide the forum for end users, stakeholders, and policy makers to engage with scientists to address the contextual issues involving the application of nuclear forensics. A subgroup of the ITWG, known as the ITWG Nuclear Forensic Laboratories ([NFL) is an international association of active practitioners of nuclear forensics. The objec tive of the INFL is to advance the science ofnuclear forensics for attributing nuclear

and radiological materials and to serve the needs of states and law enforcement agencies that need this type of capability.

It has always been a guiding principle of the group that credi ble nuclear forensics conclusions can only be obtained if the entire process from sample taking at the incident site to the analysis and data interpretation in the laboratory is carried out in a controlled manner. Nuclear forensics starts at the incident site (or crime scene), which is a key element of the response process.

The ITWG is a forum for practitioners in all aspects of nuclear forensics, including law enforcement, nuclear regulators and nuclear laboratories. The objective is to advance best practices in nuclear forensics through a shared commitment to improve forensic measurements and their interpretation. The annual meetings serve for exchanging experience on method developments, on recent case work and on methodological approaches. In order to advance the area of nuclear forensics and to foster technical exchange, task groups were created to address specific questions. The bulk of the work of the ITWG is done in its task groups.

The evidence collection task group deals with nuclear forensics-related actions to be taken at the incident site. To this end, the task group is drafting specific guidelines (e.g. management of contaminated crime scenes), which benefit from the experience of the task group members. Furthermore, the group is establishing a catalogue of past nuclear forensics exercises in order to share the experience gathered in different countries using different incident scenarios.

The guidelines task group establishes general descriptions and recommended approaches for nuclear forensic techniques or methodology based upon a consensus of the active practitioners. These recommendations arc intended to serve as a basis for country specific implementation and range from crime scene procedures to radiochemical separations.

The exercise task group organizes round robin exercises involving the analysis of nuclear material by participating nuclear forensic laboratories. In addition, scenario based table-top exercises are held addressing questions of response infrastructure. The goal of the exercise task group is to evaluate and improve the effectiveness of nuclear forensic techniques and methods. The group has established laboratory capability profiles summarizing the analytical capabilities as declared by the nuclear forensic laboratories.

The outreach and communication task group establishes links with other international organizations and initiatives working in the nuclear security area. By exchanging views and experience and by mutual participation in each others exercises and meetings, synergies can be exploited and developments can he accelerated. Countries and organizations so far not represented in ITWG are encouraged to participate.

The ITWG as been serving successfully as a platform for international cooperation in nuclear forensics for over a decade. The present paper illustrates the work of ITWO with particular emphasis on the current activities of the task groups. The ITWO has significantly contributed to the advancement of the nuclear forensics discipline. The group is recognized as a global leader for its collective nuclear forensic expertise and, in consequence, continues to attract attention in its pursuit of counter-terrorism and non-proliferation objectives around the world.

Overview of the Nuclear Security Infrastructure in Lebanon: Improvement and Needs

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Since two years, the Lebanese regulatory authority is pursuing a continuous effort to establish an acceptable nuclear security level in the country and on the borders, in order to satisfy and fulfil the related international conventions and resolutions, as well as to be protected against any malicious act involving nuclear terrorism or even any unintentional nuclear incident. In this perspective, combating illicit trafficking, physical protection and repatriate of the radioactive sources, nuclear materials accountancy and the installation of radiation portal monitors at different locations in Lebanon are the main tasks achieved till now. Indeed, to improve the nuclear security level in Lebanon, there different tasks will be discussed in this paper, to show progress, from one part, and to request support from other experienced countries in the framework of international collective efforts.

With the technical aid of the International Atomic Energy Agency (IAEA), the National Council for the Scientific Research of Lebanon has founded the Lebanese Atomic Energy Commission (LAEC) in 1996, in order to promote both the peaceful use of the atomic energy and to implement the infrastructure of radiation protection. In 1998, the contamination or content of radioactive sources. In addition, this surveillance was applied too to the imported iron used for building construction. The portable instruments used for radiation detection were moderately sensitive. Besides, an inventory on the number, activity, location, status, type and use of radioactive materials existing in Lebanon was established. They are mainly located in hospitals, industries and universities.

For the Physical Protection of the existing category I and II radioactive sources, some hospitals are in ongoing process to finalize a secure system of material protection against any theft or sabotage, with the aid of an IAEA mission. Some other sources will be dismantled, again within IAEA missions.

Weeks ago, a Radiation Portal Monitor was installed at the Masnaa border, a cooperation project between the Office of Nuclear Security at the IAEA, Lebanese Customs and LAEC as MEST. Another RPMs will be added in due course. For a better assessment and control of the different gates a central system located at LAEC will be established. The LAEC inspectors will be present permanently at the site with a local laboratory for more advanced measurements. Besides, the Customs and LAEC staff will be equipped with portable detectors.

Nuclear materials, mainly depleted uranium, were located in different Lebanese areas, accounted and reported to the IAEA.

Within the illicit trafficking database, more than 40 incidents were reported since 2007, they are mainly unauthorized disposal found in scarp's activities, however, one case of scum and one old case of lost RA-226 needles will be reported. As most the materials involved in the different incidents are of unknown origin, they are temporary stored in a safe location at LAEC, till the founding of a national storage. The newly established Nuclear Security and Emergency Department NSED will follow the incident during the different processing steps, from discovery to storage, and finally will report it to the IAEA Illicit Trafficking Database Office ITDB.

Nuclear Security Projects Related To Border Control in Lebanon

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For the last two years, Lebanese customs have been under increasing national and international pressure to tighten control and security at its borders. In this context, attention was brought to the uncontrolled movement of radioactive material across the borders.

In order to address this issue, and in close coordination with the Lebanese Customs, the Project Administration Office (PAO) at the Presidency of Council of Ministers initiated an EU-funded project entitled “Strengthening National Infrastructure related to Lebanese Trade and Border Control”.

This initiative led to the establishment of several other projects in 2008 between the Lebanese government and international and foreign organizations/agencies to address the related issue of control of radioactive material movement across the borders. These are more generally described as nuclear security projects that directly beneficiate Lebanese Customs and are listed as the following: the above listed EU-funded project, the IAEA-funded project for Masnaa border, the IAEA Coordinated Research Project and the US-DOE Megaport project. They are under current implementation and come as complementary to the Northern Border Pilot Project that promotes the integrated management of Lebanon’s borders, led by Germany and with contributions by the EU Commission and various countries.

This paper describes the various projects involved, their programmatic plans, and the coordination needed for reaching the common objectives.

Status of Safety and Security of Radioactive Sources in Madagascar

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Radioactive sources are widely used in medicine, mining industry, manufacturing industry, construction industry, agriculture, and education and research in Madagascar. The acquisition, possession, use, transfer and storage of radioactive material within the country are regulated. All radioactive sources used are imported. Madagascar does not have any radioactive waste disposal. There is a draft national policy on radioactive waste management which is not yet approved. An operational part of this policy today is the return of the sources to the manufacturers. This establishes the cooperation between of the Technical Body of the Regulatory Authority (Madagascar-INSTN) and the Customs Department. The safety and security of radioactive sources are two of the major statutory functions of Madagascar-INSTN, which was established in 1998 by the Law 97-041. These functions arc carried out through the process of regulations and guidance; authorization; oversight functions; and emergency planning and response. In the case of Madagascar, facing these challenges is one of the most priorities of the implementation of different measures aimed by the IAEA nuclear security project. A very effective import/export control has been established through the process of application, control and authorization. A comprehensive inventory of sources and users is in progress and has proved to be a necessary condition for an effective regulatory control of radioactive sources in the country, which in turn will enhance safety and security. In Madagascar there is awareness of the situation and determination to join efforts of world nuclear community for increasing global nuclear security, primary by improving it at the national level. This paper presents the current status of the nuclear security in Madagascar, efforts that have been made so far to implement the regulatory infrastructure that should protect nuclear and other radioactive materials, nuclear installations and transport from malicious acts, and should combat illicit trafficking.

Control and accountability of these sources was done mainly from a safety perspective. After terrorist attacks of September 2001, many countries have implemented programmes dealing with problems of nuclear terrorism, illicit trafficking and malevolent use of radioactive sources. Identifying, consolidating, and securing radioactive sources are therefore the major concern worldwide. Madagascar has been actively involved in a number of measures towards the control and accountability of Nuclear and Radioactive Materials including: training of front line officers on measures to monitor, detect, identify and respond to incidents involving nuclear and Radioactive Materials at borders; upgrading security of facilities with high-risk radiation sources of categories 1 to 3; participating in the IAEA ITDB and the AFRA project RAF/9/036 "Nuclear Security Implementation Support", Currently Madagascar's interest focus on revising the legal framework for radiation safety and the security of radioactive sources, to ensure that it is consistent with international standards, and to fulfil the recent commitment of Madagascar to implement the Code of Conduct (CoC) (II, Meanwhile, Madagascar-INSTN is ensuring that radioactive sources are registered, localized, secured and controlled from cradle to grave concept including: (i) locate orphan and disused sources (ii) monitoring of border for detecting illegal movement of sources (iii) strengthening security during the transport of sources and (iv) collecting sources and keep them secure in an interim storage.

Under the project RAF/9/036 a national Steering Committee exists for addressing the security concern of nuclear and radioactive materials including illicit trafficking and malicious acts involving radioactive sources. The Committee consists of stakeholders from the regulatory authority, public security, Customs Department, civil defence and law enforcement agencies.

Legal framework of safety and security nuclear in Madagascar

The law 97-041 on protection against harmful effects of ionizing radiation and radioactive waste management in Madagascar was promulgated on January 1998 [3]. Four decrees to implement the law were approved by the government in 2002. The legislation was established to meet the requirements of the International Basic Safety Standards (BSS, IAEA Safety Series 115) and to be commensurate with the use of ionizing radiation in Madagascar. It is not fully consistent with current international standards (GS-R- I). According to this regulation, Madagascar-INSTN is ensuring the provisional functions of the Technical Body. The Law 2003-012 on Physical Protection of Nuclear Materials, Nuclear Facilities and other Radiation Sources was promulgated in 2003 and amended this year.

National Inventory of Radioactive Sources

National inventory of radioactive sources is recognized an important step towards material control and accounting as complimentary to licensing. It has been emphasized in the CoC as well as the IAEA's Project on Strengthening Radiation Protection Infrastructures. The Madagascar-INSTN has continued to improve inventory of radioactive sources since 1995. Records of shipments, acquisition, transfer, or export for disposal covers material type, activity, chemical and physical form, and any associated equipment are maintained. RAIS 3.0 software is used to maintain inventory. Table below summarize the category, type and number of radioactive sources in use.

Category 1		*Category 2*		*Category 3*	
Radionuclide	N°	Radionuclide	N°	Radionuclide	N°
^{60}Co	1	^{192}Ir	5	^{137}Cs	52
				^{241}Am-Be	16
				^{60}Co	1
				^{90}Sr	5

Illicit Trafficking Incidents

Madagascar started to experience illicit trafficking problems since 2003. For this purpose, a container screening has been installed at three international seaports in order to detect the presence of radioactive materials. Two incidents have been encountered and confirmed. In reality the number of incidents happening could likely be more than those which are reported due to the facts that currently our entry points lack both, detecting instruments and border control officers with a basic training on radioactive materials. Madagascar has joined the ITDB since 2004 and reports the incidents. Moreover, with six seaports of entry, four international airports and 5000 Ian coast, the possibility for illicit trafficking is relatively high.

References

[1] IAEA Code of conduct on the Safety and Security of Radioactive Sources, 2004.

[2] IAEA International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources. SS-115, Vienna, (1996).

[3] JOURNAL OFFICIEL DE LA REPUBLIQUE DE MADAGASCAR. Loi n° 97-041 du 02 janvier 1998 relative a1a protection contre les dangers des rayonnements ionisants et à la gestion des déchets radioactifs a Madagascar, n° 2475, (1998)

Nuclear Security Actions in Mexico for an Effective Protection System of Nuclear and Radioactive Facilities

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Abstract:

Nowadays physical security plays a very important role to prevent nuclear weapon proliferation and radioactive dispersal devices. In the case of radioactive facilities, México's main objective is to prevent the sabotage and theft of radioactive sources that could cause damages to society and/or the environment. In this matter the National Commission for Nuclear Safety and Safeguards (CNSNS) has decided to support the International Radiological Threat Reduction Program in cooperation with the USA Department of Energy. Until now CNSNS has already implemented a physical protection system in 23 out of 70 facilities, which were considered the most risky locations in the country, mainly with Category 1 and 2 sources. CNSNS with the support of the US DOE is planning to carry out the physical security upgrade in all the facilities with Category 1 and 2 sources by 2010. In this paper challenges found during the implementation of the physical protection system at radioactive facilities, as well the importance of establishing a security culture within the licensees organizations (medical, industrial or research installations), but who are not aware of the goals pursued by the effective physical protection of radioactive materials are presented.

Security for the Uranium Industry – A Challenge for Operator and Regulator

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Abstract:

Security for uranium mines and associated transport of uranium ore concentrate (UOC) has received relatively little attention from the international community. Australia has been assessing and guiding security for the uranium industry for more than 30 years and has developed a range of expertise for both small and large scale mines. While the risks of theft from uranium mines in general may be relatively low, it can not be discounted entirely. Also of concern is the risk of sabotage to vulnerable elements of the process cycle, including highly flammable solvents.

Although uranium mines present much lower risks than a power reactor, evaluating the full range of potential risks at mines - and proscribing appropriate regulations - is a serious challenge for regulators. Paper will discuss the range of risks, and security measures designed to address these risks.

Operators of nuclear facilities (including uranium producers) are faced with the challenge of meeting operational, safety and security imperatives. Just as successful businesses must be able to response quickly to changing circumstances in the economic environment, operators must also be able to maintain adequate but sustainable security standards in a changeable threat environment.

In setting security requirements for Australian licence holders, the Australian Safeguards and Non-Proliferation Office (ASNO) has established a scaleable threat/security model. In this model licences holders are required to establish advance plans and procedures that can be implemented at very short notice to reduce the residual risk. Paper will discuss the application of the model.

Compatibility of Safety and Security

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With regard to protection against sabotage, i.e. malicious acts that may entail radiological releases, safety and security share the same common objective to protect the health of man and the environment. The method is identical and includes a general aim of prevention of risks and limitation of the consequences. In both cases, priority is given to prevention. A certain number of fundamental principles are associated to this approach, in which there is a considerable amount of similarity between safety and security.

Moreover, it is essential to note that the acceptable risk is the same whether the initiating event of a given radiological release is following a natural event, equipment failure or a malicious act. The steps taken to provide protection against a malicious act naturally incorporate specific features related to physical protection but are also based on intrinsic provisions concerning safety.

Organizational principles are the same in terms of safety and security. The State must set up appropriate legislative and regulatory frameworks, in particular, to designate a competent authority both in the safety and security fields. The competent authority must define, for both safety and security, the goals to attain and perform a nuclear operator activity control and assessment mission.

Nuclear operators are the prime accountable for the safety and security of their installations. The State must verify that the responsibilities of each and everyone are clearly identified and accepted, both in the safety and in the security domain. Protection with regard to malicious acts requires, however, a different positioning and larger and more direct involvement of the State in security than in safety.

Safety culture and security culture are based on very similar principles. They must co-exist, back each other up and mutually enhance each other.

When considering the different design and operating situations of nuclear installations, similarities and differences appear in the application of the safety and security approaches.

Fundamental principles such as graded approach and defense in depth are used at design level of an installation, both for safety and security. However, the methods of application of these fundamental principles slightly differ in the two cases. In addition, design principles relative to safety such as redundancy and physical or geographical separations considerably reinforce the efficiency of the protection of an installation with regard to a malicious act.

The major principles governing operation of the installation are identical with regard to safety and security. However, the daily operation of an installation calls upon good practice rules, of which the conditions of implementations differ for safety and security. Nevertheless, some operating arrangements that depend on safety or security requirements may potentially be contradictory. Consequently, the operating rules and procedures must take into account the respective safety or security requirements and implement provisions satisfying both fields.

The large diversity of nuclear facilities needs to adapt, on a case by case basis, safety and security provisions to fit with the characteristics and the risks of each one. A well shared safety culture and security culture is the guarantee of a safe and secure operation of these facilities.

International Cooperation for Nuclear Safety and Security - The Nigerian Experience

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Abstract

By the responsibilities and powers conferred on it by the Nuclear Safety and the Radiation Protection Act 1995 (the Act) the Nigerian Nuclear Regulatory Authority (NNRA) shall amongst others, regulate the possession and application of radioactive substances and devices emitting ionizing radiation; advise the Federal Government on nuclear security, safety and radiation protection matters; and shall liaise with and foster cooperation with international and other organizations or bodies concerned having similar objectives. Since its inception in 2001, the NNRA has closely cooperated with the International Atomic Energy Agency (IAEA) in the establishment of its regulatory infrastructure and the development of its technical and human capabilities. IAEA support and guidance have included its INSServ Mission, Verified Inventory Mission, securing and repatriation of high-risk radioactive sources and enhancement of security through the donation and installation of Radiation Portal Monitor. Furthermore, Nigeria is cooperating with the United States Department of Energy [Global Threat Reduction Initiative (GTRI)] to reduce and protect vulnerable nuclear and other radioactive material in Nigeria. It is hoped that future cooperation shall result in the conversion of research reactor from HEU to LEU fuel and also protect at-risk nuclear and radiological materials from theft or sabotage. Nigeria is also negotiating similar cooperative agreements with other countries. Cooperation is required for enhancing border security including training more Frontline Officers for our numerous border posts and providing appropriate radiation detection equipment.

Complementarities between Nuclear Security, Safeguards and National System of Accounting for and Control

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Nuclear security deals with prevention against theft and diversion of nuclear materials and sabotage against nuclear materials or installations. It is based on provisions of physical protection of nuclear materials and facilities complemented by:

- Provisions for accounting for and control to prevent and, where appropriate, detect loss, theft or diversion of nuclear materials;
- The nuclear safety provisions to protect nuclear materials and facilities against sabotage.

Safeguards are based on the statements and accounting controls in the facilities. The respective aim of EURATOM and IAEA controls is to verify afterwards the respect for the declared use of materials or political commitments undertaken by States under the non-proliferation purpose.

However, EURATOM and IAEA controls are not exercised at all facilities (including those working for defence purposes) or in respect of all nuclear materials subject to the French national control. In addition, these international safeguards do not deal with physical protection of nuclear materials which is the sole responsibility of the State.

The national control, implemented in France, is positioned upstream to the international controls. It aims to prevent, deter and detect the loss, theft or diversion of nuclear materials in installations or during transport. It places the responsibility of a possible diversion at the operator level. It is made of different components that complement each other and form a coherent whole. This includes:

- physical protection;
- accounting for and control;
- inspections.

The physical protection system has to protect nuclear materials against a malicious act. Malicious act means a theft or diversion of nuclear material or an act of sabotage affecting nuclear materials or facilities which could lead to radiological releases into the environment.

The accounting for and control system of nuclear materials has to allow the continuous and accurate knowledge of the quantity, quality and location of nuclear materials to immediately detect any anomalies concerning the monitoring of these materials.

Under the first level of control, the operator has to ensure the monitoring, accounting and physical protection of all nuclear materials it holds in its facilities. The second level of control under the competent authority' responsibility has to check through the centralized accountability the consistency of stocks and movements of nuclear materials, and to verify that the protective measures provided for by the regulation are properly implemented.

According to that, the system established by the French legislation (Code of Defence) is able to acquire and to submit to the French authorities an overview of nuclear activities based on the national territory.

Progress on Regulatory Matters for Reducing the Threat

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The regulation on physical protection and security of radioactive sources began in 1995 when Convention on Physical Protection of Nuclear Material was approved by Peru [1]. Also, in the Radiation Safety Regulation approved in June 1999 a general provision on security of radiation sources was established. These legal measures were considered as being the first stage of developing the protection and security strategy.

Along the recent years the concern on the safety and security of radiation sources had been increasing growing so it was identified the need for improving and strength the legal framework. In order to cover all possible legal gaps, it was first issued the Law 27757 to control the importing of radiation sources and other sensitive material in May 2002, and the Law 28028 to regulate the Use of Ionizing Radiation Sources in July 2003 [2]. One of the specific features included in these legal tools is the obligation of users and owners to meet the requisites on physical protection and security of nuclear material and radioactive sources to request an authorization. The Law 28028 stresses and reinforces the authority of IPEN, as National Authority, for regulating, authorizing, controlling and enforcing the physical protection and security of nuclear material and radioactive sources material in the country.

In a lower legal level a Regulation on Physical Protection for Nuclear Material and Installations was approved in May 2002. This regulation has provisions specifically addressed to fulfill the commitments of Convention on Physical Protection. The technical requirements have been established to activities for using, storage and transport of nuclear materials with the purpose of preventing the removal of nuclear material and the sabotage of nuclear installations. Currently these provisions are being applied to the nuclear research reactors in operation.

The regulation of Law 28028 was approved by Supreme Decree first in December 2003 and then revised and amended in July 2008. This regulation establishes the procedures and requisites to obtain authorizations and also the regime for enforcement and sanctions. With regard to security of radioactive sources a Categorization has been established according to level of danger – following the IAEA recommendations – and also fulfillment of requisites on security measures are required to request an authorization grant. For nuclear installations the physical protection system due implemented is a requisite to be meet for granting a license for operating a nuclear reactor.

Also, the regulation has categorized the violations against the safety and security of radioactive sources and the physical protection of nuclear material imposing administrative sanctions.

The particular obligations on security are imposed through conditions and limits established into the granted license, mainly for danger radioactive sources. This mechanism has been adopted for the security of radioactive sources as specific regulation on type and extent of measures has not been yet established. In this matter, the IAEA recommendations on this subject are going to be considered.

In regard to practical improvements to the security and physical protection a collaborative effort has been implemented through a project for threat reduction with USA government. This project involves the most important nuclear and radioactive installations where are included the research reactors, waste plant, irradiator facilities and cobalt therapy facilities. Devices for deter, detection and response have been installed and also training has been provided to operators.

Also, a work agreement was established between Peru and IAEA to provide assistance of experts, training and equipment supply for implementing the program for nuclear security to be applied on the two major meetings are being carried out as Latin America and Caribbean – European Union meeting (ALC-UE 2008) and the Asian–Pacific Economic Cooperation (APEC 2008). This program is currently under development and has provided to be effective.

In the last year the government has been very concerned on the possible use of Mass Destruction Weapons (MDW) in the country so it has convened a Multi-organizational Committee in order to design and prepare a plan addressed to prevent and for preparing and response to possible attacks with MDW. This Committee is made up by representatives of national police, army forces, firemen, health ministry, civil defense and other related ministries. It is expected to have a prepared Plan for the next year.

Finally, the Code of Conduct on the Safety and Security of Radioactive Sources was explicitly supported by Perú in January 2006 and reaffirmed in 2007, as the regulation follows its recommendations and also the importing and exporting of radioactive sources are being carried out in agreement with its directive.

In despite of this advances many improvements need to be made to close the circuit of control. They have been identified to be in the regulatory field where specific rules by Category of radioactive sources need to be issued, and also in the personnel training for regulators to gain knowledge on assessment and inspection of security and physical protection systems. It is important to continue the cooperation not only from IAEA but of other countries having experience and resources to support the national programs as they will result in a world wide benefit.

References

[1] LEGISLATIVE RESOLUCION No. 26376, approving the Convention on Physical Protection of Nuclear Material, Lima, 1994

[2] LAW 28028, Law for Regulating the Use of Ionizing Radiation Sources, 2003

Regulation of Nuclear Security in Russian Federation: Implementation and Prospects

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State supervision of nuclear security implies activities of the Federal Environmental, Industrial and Nuclear Supervi sion of Russia (Rostechnadzor) and its regional administrations aimed at control of nuclear security. The main tasks of the state supervision are the following:

- control of fulfilment of the requirements of federal and other regulatory documents by the federal bodies of executive power, operating organizations and nuclear sites personnel;
- control of fulfilment of the licences validity conditions;
- submission to the above mentioned bodies and organizations information of the state of nuclear security.

The supervision is fulfilled during all the stages of the life cycle of nuclear facilities, nuclear materials and radioactive sources including transportation. Rostechnadzor develops federal regulations on nuclear security and its departmental (internal) regulatory documents on supervision.

The supervision includes:

- acquisition and analysis of information about the state of nuclear security;
- inspections and analysis of their results;
- sanctions according to the federal legislation in case of violation of the requirements.

The inspections have various kinds which depend on the number of the types of activities under control during each inspection and the goals of the inspection. The inspection intervals are different depending on the type of protected subject : nuclear material or radioactive source.

The inspection practice includes organizational procedures, conducting inspections and activities according to the inspection results: development of the inspection final documents and special documents in case of revealed violations.During inspections of the guard or response forces Rostechnadzor closely interacts with the Internal Troops of the Ministry of Interior or departmental guard forces (taking into account the type of guarding). The regional administrations of Rostechnadzor periodically present reports concerning the state of nuclear security and the results of inspections. Rostechnadzor has the right to apply the following sanctions:

- to issue orders to the nuclear sites with requirements to eliminate the violations to a certain date;
- to suspend or to cancel licences;
- to initiate a process to make the sites and individuals answerable for the violations according to Administrative Crime Code and Criminal Code.

Rostechnadzor takes steps to improve its supervisory activities by means of development and revising regulatory documents, development of various plans of measures, holding departmental and interdepartmental meetings to discuss the problems and suggestions.

Framework for Nuclear Security System in Serbia

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Abstract

Serbia is a country in transition with complex nuclear legacy of the past to be solved. It is situated in a sensitive region of Balkans. Turbulent changes in the past decade influenced its national capabilities and international relations. Realizing that responsibility for nuclear security rests entirely with individual State s the country is reestablishing. upgrading and strengthening national nuclear security system with national efforts . International assistance and international and regional collaboration are essential in reaching compliance with global directions, in particular after a period of absence in international cooperation. Modernization of national nuclear legislation and regulatory infrastructure is taking into account implementation of relevant international nuclear security legal instruments, standards and guidance. An adequate border control and illicit trafficking response mechanisms, management of nuclear and radioactive materials and orphan and other radioactive sources and a proper physical protection system are understood in a synergy with safety and safeguards.

Nuclear Security in the Slovak Republic

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The presentation gives comprehensive outline of the status of nuclear security in the Slovak Republic with focus on detection and response to nuclear and radioactive materials out of regulatory control.

The physical protection of nuclear materials and nuclear facilities has become more important after the threat to nuclear materials increased. The physical protection systems are continuously improved according to the recommendation of the IAEA and to the national legislation. Special attention is paid to training of the personnel. Various exercises with the aim to improve the capability of the defensive forces to combat terrorist's acts.

The nuclear materials safeguards system has been changed and improved after Slovakia became member state of the European Union. The Euratom, the IAEA and national regulatory authority (UJD) have implemented the Protocol Additional in 2005. Next task is the implementation of integrated safeguards.

The UJD together with other governmental bodies have created national system on detection and response to illicit trafficking in nuclear and radioactive materials. During last couple of years we detected several attempts to smuggle nuclear materials. In 2007 the police caught three criminals who tried to sell in Slovakia nuclear material. Except of this, we discovered number of nuclear and radioactive materials in scrap yards, laboratories and storages.

The co-operation with the IAEA started in 1993 after UJD was established. The experts from UJD participated in several international conferences and workshops dedicated to illicit trafficking issues. The UJD is Point of Contact of the IAEA l1licit Trafficking Database.

The UJD co-operates also with other organization mainly from the European Union. The main tasks of this co-operation is to train country' s staff in combating illicit trafficking of nuclear materials and to help specialized laboratories with analysis of the seized nuclear materials. In 2004 and 2007 the UJD organized national object lessons oriented to examination of national system. The results of the lessons showed, that the national system works well, however, we also recognized possible improvements.

The nuclear security issue is considered in Slovakia as an important part of national security system. The government of the Slovak Republic pays permanent attention to nuclear security.

Analysis of a Hypothetical Terrorist Action Against a Research Reactor

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Analysis of a hypothetical terrorist action against TRIGA research reactor at J. Stefan Institute, Ljubljana, is presented [1]. The analysis was performed within the scope of updating the reactor site security and emergency plan [2]. The reactor utilizes 20 % enriched fuel elements containing approximately 325 g of uranium each. Reactor power is 250 kW. The analysis is based on the assumption that the aim of the attack would be either stealing of fresh or irradiated nuclear fuel or causing severe radiological consequences, either at the site or elsewhere . The following scenarios of the consequences of the attack are presented:

- making of a nuclear fissile radiation device (NFRD, "reactor without shielding")
- making of a nuclear explosive device (low yield fission bomb)
- dispersion or radioactive material at the reactor site
- radiological dispersive device (ROD) made of irradiated fuel.

Analysis shows that approximately 100 fuel elements arranged in appropriate shape could become critical without additional moderator, in air. If appropriate moderator is added, this number is significantly decreased (to 45 in case of water, 18 in case of beryllium). The criticality analysis was performed for several combinations of various types of fuel elements and moderator (light water, heavy water, graphite, polyethylene, beryllium and air). The calculations were performed with Monte Carlo code MCNP [3]. It may be concluded that making of a nuclear fissile radiation device (NFRD, reactor without shielding) is feasible and simple even with a small number of *TRIGA* fuel elements. The power of the device can be more than I MW and it can operate for several hours before disintegration. The dose rates 10m from the device operating at 1 MW are approximately 80 Gy/h.

By using the low enriched uranium (20 %) it is impossible to make an efficient explosive device. However, the purpose of the explosive device can be disintegration and dispersion of the radioactive fuel of which it is made. TRIGA reactors are designed to operate without damage in the pulse mode, in which approximately 20 MWs of energy can be released within milliseconds. We investigated the condition s to operate a NFRO in pulse mode beyond this limit. In contrast to making a steady state NFRD, making of a pulse NFRD is neither simple nor effective as the released radiation is low (assessed dose in one pulse at a distance of 10m is approximately 70 mSv).

We analyzed possibility of stealing irradiated fuel element s to make a RDD. We performed parametric analysis of the activity and isotopic composition of the spent fuel elements in dependence on the burn-up and cooling time using ORIGEN code [4]. The results were used as source term for calculation of dose fields around a fuel element. The dose rates around one fuel element at 1m distance are in the range from 160 Gylh to 1.4 Gylh, depending on the cooling time of fuel before the manipulation. Due to relatively low dose rates, a desperate person could manipulate irradiated fuel elements without protection for several hours before receiving lethal dose.

Attack on the reactor containing irradiated fuel using explosive can cause the release of radioactive material and contamination of the reactor site and its surroundings. Similar effect will be achieved if the irradiated fuel is taken away from the site and dispersed elsewhere (ROD). The contamination and dose fields, produced by a ROD made of irradiated fuel were calculated using the HOTSPOT code [5]. They strongly depend on various parameters such as amount and type of explosive, amount and type of fuel (fission products retention properties, particle size after explosion, etc.) and atmospheric conditions (wind velocity and direction, atmospheric stability, rainout-wet deposition. relief, etc.). We performed a parametric analysis of the contamination and dose fields in dependence of spent fuel cooling time, wind velocity and direction, amount of explosive (TNT equivalent), atmospheric stability and the airborne fraction. We calculated the acute doses for one day after the use of RDD. Assuming that the spent fuel elements would disperse in large pieces approximately 50 m from the ROD, the average surface contamination would be approximately 200 Ci/m2 and the dose rates would be in the order of 3 Gy/h.

More detailed results arc presented in the paper. The results of our analysis are general and apply to all TRIGA reactors using low enriched fuel.

References

[1] http://www.rcp.ijs.si/ric/index-s.htm

[2] Matja1. Ravnik. Luka Snoj, Preprecevanje in zmanjsevanje posledic terori stieneganapada na raziskovalni reactor TRIGA, US-DP-9790, October 2006.

[3] J.J. Briesmeister, "MCNP5_A General Monte Carlo N-Particle Transport Code, Version 5 Los Alamos National Laboratory", March 2005

[4] ORIGEN2, Isotope Generation and Depletion Code, Oak Ridge Nacional Laboratory, 1980.

[5] Homann Steven, Hotspot 2.06, https:llwww-gs.lln1.gov/hotspot/index.htm, Lawrence Livermore National Laboratory, March, 2005.

Security in the Transport of Radioactive Materials

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Adequate security is an essential concern in the transport of radioactive materials for all the stakeholders involved - the countri es producing radioacti ve materials, the countries across which and to where the radioact ive materials are transported, and the transport industry.

Indeed, stringent security measures in the movement of radioact ive materia ls have been in place for many years. Regulators have recognised that specific radioactive materials transported require special security controls and measures in order to prevent illicit usc of such material. This need for protection is now even greater.

No industry is subject to more stringent levels of security. The transport of radioactive materials has traditionally been subject to specific national protection measures, as shown for instance by a State reserving its right to oversee the security measures taken during the transport of such materials originating from or carried through its territory. To prevent theft of radioactive materials during transport, a wide range of protection measures, including access control, employee screening and coordination with local and national security authorities, involving security forees, have been developed. Some of these provisions have a direct and considerable impact on how transports are organised. While State sovereignty on security matters is appreciated, and since international transport of radioactive materials is a common practice, greater harmonisation of security measures within and between countries should be encouraged in the interest both of security and efficiency. For example, a security official at an international border crossing may interpret requirements on the ground in a different way from authorities at the centre.

There appears to be a view among some potential transport service providers that the transport safety and security regulatory regimes are onerous or too complicated. It is the operator who experiences at first hand the differences of interpretation and approach, within and between national jurisdictions.

There is a synergistic relationship between the regulator whose responsibility it is to ensure thatmaterials are transported safely and securely, and the regulated-that is, those whose job it is to transport the materials in accordance with regulation. One has no meaning in practical terms without the other. Regulation only exists because of the need to transport; transpo rt cannot proceed if it is not done according to regulation. Each must take account of the interests and responsibilities of the other.

The World Nuclear Transport Institute (WNTI) represents 46 member companies drawn from a wide range of industry sectors, including major utilities, fuel producers and fabricators, transport companies, package producers, and the production and supply of large sources. Within WNTI, a sustaining shipments industry task force was set up to address the subject of denial and delay of shipments in a pro-active and positive way. Firstly, and importantly, we have sought on behalf of our industry members to support international efforts to address the issues of denial and delay. Exchanges have been initiated with port authorities in a number of countries. Meetings are organised with the insurance industry, maritime authorities and liner services.

This paper will expand on the issues highlighted above and suggest ways forward for those who develop and implement the regulations and standards, and for industry which must comply with these regulations and standards.

Enhanced Radialogical Detection Instrument Training

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Whether ensuring the security and safe use of recorded radioactive materials, or detecting, identifying and .responding to radioactive materials out of regu1slmy control the provision of an ever increasing range of radiological dosimeters, survey meters and .spectrometers does not, in of itself; enhance nuclear security. These tools are only as good as the ability of deployed personnel to operate than correctly. It is therefore: essential that training in the coordinated use of ouch instruments be as realistic and comprehensive as possible. However, there is an inherent difficulty in using the real radiological detection instruments for training because such devices requite radiological sources to generate response.

Systems that simulate radioactive materials using ultrasound, electromagnetic, or fluorescent, pouders/1iquids are already firmly established within the radiological instrument training community. These simulated radioactive sources / materials create a response in simulation detection instruments, or simulation probes attached to real detection instruments, to enable the opportunity to provide safe instruction in the use of specific devices as well as the correct procedures during their deployment.

In order to extend the opportunities for the comprehensive training of multiple personnel using multiple simulation instruments in a wide area field exercise scenario the PlumeSIM system has been developed by Argon Electronics LLP.

RAD PlumeSIM is a dedicated element within the broader PlumeSIM product family, enabling instructor management of the response ofrodiological simulator instruments to fully configurable ‘virtual plumes and hot spots’, in real time, over a training area defined by user selected mapping. Instructors are provided with the ability to select the parameters for the excercise (including the type of radiation hazard, the release of single sod multiple sources, and a full range of environmental conditions), and record the actions of trainees from a single location.

With three modes of system operalion - plannins, classroom, and ticld exercise – and additional features including post-event environmental simulalion and an after action review capability, consistent and auditable radiological instrument training can be safely and cost-effectively conducted without the restrictions imposed by the national and international regulations pertaining to the movememt and control of radioactive materials, benefiting both individual equipment operator groups and wider command and contorl response management structures.

The Importance of Technical Reachback in the Adjudication of Radiation Alarms

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The large scale deployment of radiation sensors at borders, ports-of-entry and other locations carries two disparate priorities: the reliable detection and identification of threat materials and the rapid characterization of non-threat materials comprised by Naturally Occurring Radioactive Materials (NORM) and radioactive materials in legitimate streams of commerce.

These priorities are partially achieved through the technologies contained in the detection systems and the procedures developed for their operation. However, questions and ambiguities will occur and without established capabilities and procedures for the operators of these detector systems to “reach back” to trained spectroscopists and appropriate subject matter experts, the system will likely experience an unacceptable number of response operations and level of delay in the process of resolving alarms.

Technical reachback operations need to be able to address the priories discussed above while causing minimal perturbations in the flows of legitimate streams of commerce. Yet when necessary, they need to be able to rapidly mobilize the appropriate response assets.

Key Elements of a Nuclear Security Culture Enhancement Program

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Nuclear security culture is defined in the IAEA Implementing Guide as:

> *The assembly of characteristics, attitudes and behavior of individuals, organizations and institutions which serves as a means to support and enhance nuclear security.*

The changing of attitudes and behaviors cannot be mandated and does not happen overnight. Instead, core values, including the importance of nuclear security, should be instilled in staff through a systematic nuclear security culture enhancement program. Many organizations look towards training and/or education of their staff as the first step in changing attitudes, behaviors, and beliefs. This may be a good starting point, but to most effectively achieve change and sustain the positively changed environment, a comprehensive approach should be taken with the goal of continuous improvement of nuclear security.

A successful nuclear security culture enhancement program should (1) be built on the successes of programs established for improving nuclear safety culture and (2) be consistent with industry practices. Using the implementing guide developed by the IAEA in their security series as a basis, a country can establish a nuclear security culture enhancement program that meets these two criteria. This paper will describe key elements of a comprehensive, sustainable nuclear security culture enhancement program, keeping in mind that these elements can be adopted in whole or in part as the specific scope of the country's nuclear program warrants.

Those key elements include:

- Baseline analysis to assist in focusing the direction of a nuclear security culture enhancement program
- Top management commitment to the importance of nuclear security
- Regulatory and inspection basis for nuclear security and a nuclear security culture enhancement program

- Assessment and lessons learned program so that nuclear security effectiveness can be improved on a continuous basis.

- Organization of the nuclear security culture enhancement program in an effective manner

- Educational and training programs to reinforce the importance of each individual's role in supporting nuclear security

- Promotional activities to remind employees of their responsibility to contribute to nuclear security effectiveness

Building on the success of safety programs and nuclear security culture enhancement programs in the U.S. and Russia, a country can develop its own comprehensive program taking into consideration the key elements defined within this paper. Conducting a baseline assessment will assist organizations with establishing the current level of nuclear security culture. The results of the baseline assessment can help guide an organization determine what type of nuclear security culture enhancement program is required to affect the necessary change. Periodic assessment of the nuclear security culture program will assist organizations with focusing their efforts to enhance nuclear security and allow them to modify the key elements of their nuclear security culture enhancement program over time to increase effectiveness.

References

[1] IAEA Nuclear Security Series, No7, Nuclear Security Culture, STI/PUB/1347, 2008, ISBN 978-92-0-107808-7

Radiation Monitoring at the Borders - Important Part of Nuclear Security

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Three factors place Central Asia and Uzbekistan as its part in a key global non –proliferation position: the proximity of nuclear neighbours, the proximity of states and other groups seeking nuclear/radioactive material and know-how, and indigenous sources of nuclear/radioactive material. The nuclear threat is of special concern because of the proximity of major nuclear states such as Russia and China, states with nuclear ambitions such as Iran, and non-state actors potentially seeking nuclear and/or radioactive material s. In addition, Central Asia possesses currently functioning nuclear facilities widely using powerful radioactive sources from Soviet times and active uranium mines. The geographical location of Uzbekistan is convenient for illicit trafficking of nuclear materials. In conditions of increasing threat of nuclear terrorism, when extremist organizations arc threatening to mankind with terrorist attacks including the use of nuclear devices or radiological dispersal and exposure devices ("dirty" bomb), the problem to stop illicit trafficking of nuclear and radioactive materials is becoming the world one. In the frame of the Second Line of Defence (SLD) Core Program which is part of the Office of the Second Line of Defence, in the Office of International Material Protection and Cooperation of the US Department of Energy's National Nuclear Security Administration Uzbekistan borders were equipped with radiation control devices. The mission of the Core Program is to rapidly reduce the risk of nuclear proliferation and illicit trafficking of special nuclear and other radiological materials by cooperating with host countries to improve their detection and interdiction capabilities at strategic international border crossings, mid-sized seaports, and airports. To solve the problem of radiation monitoring in Uzbekistan was possible by installing stationary portal radiation monitors at main customs border crossings or entry points. Their high sensitivity permits to detect signals exceeding background level on several percents in moving objects with recording these signals in computer and the object itself (vehicle, train or pedestrians) on video-camera. Up to date in Uzbekistan 27 checkpoints were equipped including 19 vehicle (118 monitors), 10 railway (40 monitors) ones and international Tashkent airport (12 monitors). The total amount of monitors is 175. Several cases of radioactivity detection in trucks and railway cars are analyzed. The Institute of nuclear physics of Uzbekistan Academy of Sciences provides stabile operation of these radiation monitors, technical assistance and consultancy in case of alarm signals, regular technical maintenance. Besides, in Institute of nuclear physics were elaborated and manufactured radiation monitors working on different basis than traditional ones. These radiation monitors are based on multi-detector system comprising scintillation detectors. For radioactivity detection in the objects big volume plastic scintillation detectors were used. For measuring energy spectra and identification of radionuclides NaI(Tl) crystal detectors were used. The detection of radioactivity is based on difference counting method [1] without connection to natural background level (there is no background constituent in resulting signal thus providing much lower level of false alarms: 1: 10000). This low level of false alarms remains constant during variations of background level. Besides, such radiation monitors do not need object sensor. For detection of fissile material s the method of gamma-gamma coincidences of prompt gammas produced in fission is used [2]. In these radiation monitors there is no need for special neutron detectors. Original high voltage transformers for photoelectron multipliers power supply were elaborated and manufactured together with voltage dividers, spectrometric preamplifiers and amplifiers. The modules of data acquisition and processing were manufactured on the basis of microcontroller e805l F41 1-GM from Silicon Laboratories (SiLabs) [3]. These microcontrollers of C805 lF4 lx family are completely integrated on one crystal systems for processing mixed (analog-digital) signals with low energy consumption.

References

[1] Shipilov, N.N., Fazylov, M.I., Podkovirin, A.I., Karimov, Yu.N., Petrenko, V.D., Yuldashev, B.S., Identification of radioactive materials in moving objects. Applied Radiation and Isotopes, 2005, 63, 783-787.

[2] Karimov, Yu.N., Shipilov, N.N., Fazylov, M.I., Petrenkn, V.D., Yuldashev, B.S. On the possibility of detecting fissile nuclear materials using coincident gamma rays. Applied Radiation and Isotopes, 2005, 63, 655-658.

[3] Mieroeontroller C805lF4I I-GM, Silicon Laboratories, http://www.silabs.ru

Predicting the Magnitude and Spatial Distribution of Potentially Exposed Populations during IND or RDD Terrorism Incidents

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The threat posed by terrorist incidents involving an Improvised Nuclear Device (IND) or Radiological Dispersion Device (RDD) underscores the need for tools that optimize rapid delineation of the magnitude and spatial distribution of potentially exposed populations typically associated with such release scenarios, ranging from at most a few kilometers to widespread dispersion across a major metropolitan area. Because clinical manifestations are contingent on the absorbed dose of radiation, predicting the likely size and location of populations potentially exposed to low dose ionizing radiation during terrorist incidents involving RDDs or low-yield INDs (≤20KT) or RDDs is necessary for effective medical response and incident management as part of the recovery process. Accurate estimates for the pool of potential human targets may prove to be the determining factor in selecting appropriate risk-based medical responses on a site-specific basis, following intentional releases of low-dose ionizing radiation especially when it is not possible to observe directly adverse health effects in the absence of acute radiation sickness (ARS).

The methodology for predicting the magnitude and spatial distribution of potentially exposed populations during IND or RDD terrorism incidents integrates total dose equivalent estimation and spatial interaction modeling. Estimated total dose equivalents (TEDE) are calculated for isopleths moving away from the detonation point for a 10KT IND and a 3.7 x 1013 Bq 241Am RDD. The methodology is applied to a set of illustrative daytime and nighttime release scenarios with varying meteorological parameters for wind speed, wind direction, and atmospheric stability. Population magnitude and distribution within the TEDE zones is estimated using Euclidean distances between zip code polygon centroids generated in ArcGIS version 9.1 with distance decay determined by regression analysis to apportion origin destination pairs to a population count and density matrix on a spatial basis for the daytime and night-time release scenarios. Data for a representative U.S. urban area (≈1.3M people; 1,612.27 km2 area) are used to demonstrate the application of the methodology.

The methodology is based on research sponsored by the U.S. Defense Threat Reduction Agency and the Air Force Research Laboratory under Cooperative Agreement FA8650-05-2-6523.

NSOI: Enhancing International Assistance to Combat Illicit Trafficking of Nuclear and Radioactive Materials

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Despite the efforts made over many years by numerous U.S. and international programs to combat the illicit smuggling of nuclear and radioactive materials, reported incidents of attempted smuggling of such materials continue to abound. As a result, the U.S. State Department developed in 2004 the Nuclear Smuggling Outreach Initiative (NSOI) to reduce the risk that nuclear or radioactive materials would be used for malicious purposes by helping states where the problem was greatest to enhance their capabilities to prevent, detect and respond to smuggling of such materials.

As part of the *Detecting and Responding to Radioactive Materials Out of Regulatory Control: Progress and Challenges* discussion, NSOI proposes to make a presentation to 1) describe how our program is addressing the threat of illicit trafficking in nuclear and radioactive materials, 2) provide an update on our country engagements and efforts to secure funding for assistance projects in those countries, and 3) highlight for potential donors project s that still need funding.

NSOI focuses intensively and comprehensively on those countries judged to be at greatest risk for having illicit smuggling of nuclear or radioactive materials occur on or through their territories. The effort involves two types of engagements. First, NSOI develops with each country a joint action plan specifying priority steps to enhance its anti-smuggling capabilities.

Second, NSOI engages the international community of assistance providers to identify donors for assistance projects to help the at-risk countries implement their joint action plans. In these engagements, NSOI seeks to incorporate the full range of information resulting from ongoing bilateral and multilateral interactions to determine where improvements are most needed, to identify the widest set of sources for assistance to foster those improvements, and to coordinate that assistance with other ongoing efforts to ensure that it is used as efficiently as possible.

NSOI thus far has engaged seven countries- Ukraine. Kazakhstan. Georgia, the Kyrgyz Republic, Tajikistan, Armenia, and Afghanistan-and has joint action plans in place with the first five. Eleven donors have been secured, including eight countries and the European Union, the International Atomic Energy Agency, and the United Nations Office of Drugs and Crime.

Thus far, 26 of 34 NSOI-developed projects have received at least partial funding. The U.S. government greatly appreciates the contributions that its eleven partners to date have made to NSOI projects. There is much more to do, however, and we hope that they will be willing to consider additional contributions and others will consider joining us as we fight this common global threat.

U.S. Nuclear Regulatory Commission Force-on-Force Inspections at Nuclear Power Plants

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As part of the global nuclear non-proliferation regime, the Nuclear Regulatory Commission (NRC) participates in United States (U.S.) government and international activities to account for and control nuclear material assigned to commercial and other peaceful purposes. The U.S. supports the Convention on Physical Protection of Nuclear Material (CPPNM) and its amendments to strengthen obligations for the physical protection of nuclear material in domestic use, storage, and transport, and for the protection of nuclear material and nuclear facilities from sabotage. The NRC has established a robust physical protection regime for nuclear and other radiological materials, which was enhanced following the events of September 11, 2001. One aspect of the protection of nuclear power plants (NPP) is performance verification. The NRC conducts Force-on-Force (FOF) inspections regularly at commercial operating Nuclear Power Plants (NPPs). These inspections are a performance based means to evaluate and verify the results of more traditional (baseline) inspection activity and assess effectiveness of plant security programs to defend against the characteristics and attributes of the Adesign basis threat (DBT).@ and to prevent radiological sabotage as required by NRC regulations (10 CFR Part 73). This program is consistent with description of a State's physical protection system as outlined in T*he Physical Protection of Nuclear Material and Nuclear Facilities (INFCIRC/225/Rev.4) Section 4.4 Evaluation of the Implementation of Physical Protection Measures.* Together, these efforts help make NPPs among the best protected private sector facilities in the U.S..

A full FOF inspection includes both table-top drills and simulated combat exercises between a mock commando-type adversary force and the nuclear plant security force. During the attack, the adversary force attempts to reach and damage key safety systems and components that protect the reactor=s core (containing radioactive fuel) or the spent nuclear fuel pool, potentially causing a radioactive release to the environment. The NPP=s security force, in turn, seeks to stop the adversaries from reaching the vital equipment and causing such a release. These exercises may include a wide array of Federal, State and local law enforcement and emergency planning officials in addition to plant operators and NRC personnel.

Before September 11, 2001, NRC conducted FOF inspections about once every eight years at all 65 NPP sites nationwide. After September 11, 2001, the NRC worked to strengthen its security programs while it re-evaluated its DBT and improved its FOF inspections. In one of its key decisions, the Commission decided to increase the frequency of security exercises starting in the fall 2004, so that NRC would evaluate a FOF exercise at each site once every three years. In November 2004, NRC began implementation of its redesigned, full-scale FOF program that incorporates experience and lessons learned since September 11, 2001. A key goal during FOF exercises is to balance personnel safety, while maintaining actual plant security during the exercise that is as realistic as possible.

A credible, well-trained, and consistent mock adversary force is vital to the NRC=s FOF program.

The NRC worked with the nuclear industry to develop a Composite Adversary Force (CAF) that is trained to standards issued by the Commission. The new adversary force has been used for all FOF exercises conducted after October 2004. The CAF is a significant improvement in ability, consistency, and effectiveness over the previous adversary forces. The CAF will be evaluated at each exercise using rigorous NRC performance standards issued in April 2004.

FOF exercises are an essential part of NRC=s oversight of NPP owner's security programs and their compliance with NRC security requirements. The agency continues to evaluate and strengthen its overall security program in response to changes in the threat environment, technological advancements, and lessons learned. As a result, substantial improvements to NPP security have been made to protect against terrorism and radiological sabotage including:

$ A well-trained security force,

$ Robust physical barriers,

$ Intrusion detection systems,

$ Surveillance systems, and

$ Plant access controls.

Continued verification of the improvements by NRC Inspection Staff and conduct FOF exercises continue to provide assurance that U.S commercial nuclear plants are well protected.

A Practical Approach to Assessing Nuclear Threats

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An important component of assuring adequate protection for Nuclear and Radiological materials is understanding the significance of potential threats. In a regulatory environment, there is a need for a consistent and transparent approach to determining the credibility and seriousness of a potential threat that can be used across the sector. In the United States, the Nuclear Regulatory Commission has established a small cadre of experts who are responsible for assessing threats made to the regulated nuclear industry. The Information Assessment Team (IAT) is available through the NRC Operations Center 24/7 and is made up of threat analysts, security specialists and, as needed, reactor and materials technical experts. This Team can also reach out to law enforcement and intelligence agencies, as well as the licensee personnel involved.

The objective of the IAT process to assess threats in a timely manner; determine the seriousness and credibility of the identified threat(s); and provide a recommendation and/or course of action to appropriate NRC staff and management. The IAT facilitates the flow and coordination of information related to threats via notifications and consultations, as appropriate, within the NRC and with other involved federal agencies thereby assuring a consistent, informed and appropriate NRC response to the threat. In addition, IAT Advisories may be issued based on available threat information. The IAT will also monitor the licensee's response to the threat to assure appropriate measures are in place in order to counter the threat.

The IAT is the NRC focal point for assessing all reported threats and threat-related information involving NRC licensed facilities, materials and activities.

A threat is defined as information – explicit or implied, written or verbal – that a malevolent act may be committed against licensed or certified nuclear facilities, materials or activities. A "threat" is distinct from acts that are in progress or that already occurred. The IAT is responsible for assessing threats or threat-related events, whereas responsibility for responding to safety or safeguards events that have already occurred, including a licensee's decision to implement their emergency plan, rests with the NRC Headquarters Operations Center and the NRC Incident Response Teams at the Headquarters and Regions. Although the IAT focuses on threats, the Team remains on-call during an agency response to assist NRC staff in reviewing events or to react to other incidents for threat-related implications.

In addition to coordinating actions associated with threats, there might be occasions when appropriate IAT members could be notified of a suspicious activity at licensee's facility that may require coordination with the Regions and/or other governmental agencies.

All members of the Team are trained, carry mobile phones and/or pagers and are responsible for responding to assess threats as quickly as possible, usually returning calls to the Operations Center within minutes. A handbook of potential scenarios and questions to consider has been developed. Examples are provided below:

Event Type: Suspected or Actual Intrusion (Unauthorized Entry)

<u>Factors to Consider:</u>

- Has the local law enforcement including the local FBI office, been notified and responding to the site?
- What were the circumstances that allowed the intruder to circumvent security?
- Is the intruder's location known?
- How much time has the intruder been inside the Protected Area without being observed or apprehended?
- Is there more than one intruder?
- Is there any evidence of "insider" involvement?
- Has the intruder gained access into vital areas?

Often the capability to quickly understand the credibility and seriousness of a potential threat will ensure that appropriate protective measures are in place, law enforcement can be engaged and the possibility of potential threats to other facilities or materials can be considered and dealt with. It is not practical to assess threats as they occur without a well-thought out program such as the Information Assessment Team.

U.S. Regulatory Initiatives in Enhancing Security of Radioactive Material

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As the lead U. S. regulatory agency for civilian uses of radioactive material, the United States Nuclear Regulatory Commission (USNRC) plays a key role in domestic and international security activities. The USNRC has consistently supported international efforts to enhance security of radioactive material.

The events of September 11, 2001 highlighted the need to enhance security to address potential terrorist threats. In response, USNRC took numerous immediate actions. The agency also initiated broader programs, designed to improve security in a comprehensive manner over the long-term. As with its other regulatory programs, USNRC utilized a risk-informed, graded approach to enhance security.

Consistent with the risk-informed approach, it was necessary to categorize radioactive sources and materials according to risk. USNRC cooperated with other domestic organizations and the International Atomic Energy Agency (IAEA) in revising and adopting the security principles and source categories in the IAEA Code of Conduct [1]. The highest risk sources were designated as Category 1 and 2.

Based on these categories, USNRC then developed and issued enhanced security requirements to U. S. licensees who possess Category 1 and 2 radioactive sources. The requirements were issued in phases, starting with the licensees possessing the largest quantities of high-risk sources; for example, large panoramic irradiators. USNRC worked closely with individual States in implementing these requirements, because the majority of materials licensees are regulated by the 35 “Agreement States”.

The USNRC is playing a lead role in addressing concerns regarding the use of cesium-137 chloride sources. Cesium-137 chloride has long been recognized as a high-risk material due to its high dispersibility and solubility. These concerns were highlighted in a National Research Council report published in 2008 [2]. The USNRC is coordinating with other organizations to explore ways to reduce the use of cesium chloride sources, recognizing that many of the sources are used for essential functions that must be continued. In September 2008, USNRC held a widely-attended workshop on cesium chloride, and is preparing policy options on continued use of that material.

At the same time, USNRC is working with Federal and State agencies, manufacturers, and licensees to conduct a pilot program, to implement low-cost security upgrades for self-contained irradiators which contain cesium-137 chloride sources. The upgrades are being installed on a voluntary basis, and are primarily funded by the U. S. government. It is anticipated that this program will enhance security through hardware upgrades which do not adversely affect normal operations or safety.

In parallel with these efforts, USNRC worked with other organizations to improve the overall nuclear security infrastructure. The U. S. Congress passed the Energy Policy Act of 2005, which created the Radiation Source Security and Protection Task Force. This Task Force is chaired by USNRC and is composed of representatives from 13 Federal agencies and 2 States. It is a primary vehicle for advancing source security issues across the U. S. government.

An important element of the security infrastructure is the National Source Tracking System (NSTS). The system was launched in late 2008 after several years of development. The NSTS maintains an inventory of all Category 1 and 2 sources in the U. S. Licensees are required to maintain their inventory data and report transfers online. This enhances security by allowing close tracking of the locations of sources, and identifying possible unauthorized transfers. For the future, NRC is considering: (1) expansion of the NSTS to include smaller sources, and (2) integration of the NSTS into a broader, electronic license verification system so that questions about sources and license authorization can be quickly resolved.

Although much has been achieved, the U. S. continues to pursue security improvements. USNRC implemented a fingerprinting program in 2008, which enhanced the background checks for personnel who use radioactive material. Also, a U. S. government investigation identified a vulnerability where a bogus organization could fraudulently obtain a materials license. In response to this investigation, USNRC has taken and is taking a number of steps to strengthen its licensing an inspection programs for radioactive material.

The USNRC believes that the accomplishments to date have significantly enhanced the security of radioactive materials. The USNRC will continue to work with the international community, and other U. S. domestic agencies and the Agreement States, to improve security of licensed radioactive material.

References

[1] INTERNATIONAL ATOMIC ENERGY AGENCY, “Code of Conduct on the Safety and Security of Radioactive Sources, IAEA, Vienna (2004).

[2] U. S. NATIONAL RESEARCH COUNCIL, “Radiation Source Use and Replacement”, National Academies Press, Washington, DC (2008).

The Concept of a National Tracking Center for Monitoring Shipments of HEU, MOX and Spent Nuclear Fuel

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Nuclear material safeguards specialists and instrument developers at Department of Energy National Laboratories in the United States, sponsored by the National Nuclear Security Administration (NNSA) Office of NA-24, have been developing devices to monitor shipments of UF_6 cylinders and other radioactive materials. [1], [2] Tracking devices are being developed that are capable of monitoring shipments of valuable radioactive materials in real-time, using the Geostationary Positioning System (GPS). We envision that such devices will be extremely useful, if not essential, for monitoring the shipment of valuable and important cargoes of nuclear material – including highly-enriched uranium (HEU), mixed plutonium/uranium oxide (MOX) and spent nuclear fuel. To ensure nuclear material security and safeguards it is extremely important to track these materials, because they contain so-called "direct-use material" – material that if diverted and processed could potentially be used to develop clandestine nuclear weapons. [3]

To make the fullest use of such tracking devices, we proposed a National Tracking Center. The following paper describes what the attributes of this would be and how the Center could ultimately be the prototype for an International Tracking Center – potentially to be based in Vienna, at the International Atomic Energy Agency (IAEA).

In the case of the United States, there are currently 103 operating nuclear power plants, as well as a considerable number of research reactors and other nuclear facilities operated by the United States Department of Energy (DOE) National Laboratory complex. Even though spent nuclear fuel is safely stored at these facilities, within the next one to two decades, it will be transferred to a spent fuel national repository, possibly at Yucca Mountain, Nevada. Current estimates are that there will be hundreds of such transfers of nuclear spent fuel in transfer casks from nuclear power plants to the national repository. The current GPS-tracking devices that have been developed by the U.S. DOE National Laboratories could monitor these shipments in real time and permit effective tracking. If shipments were stopped due to highway accidents or inclement weather, the status of the delay would be noted in real time, along with other data for the cargo – including external radiation, elevated temperature and excessive shock (due to collision). Considering the size of the United States, there should be at least two regional tracking centers to afford a level of redundancy. One could be based in the Western United States, perhaps at the DOE Idaho National Laboratory (INL), while the other is based in the Eastern United States, perhaps at the DOE Oak Ridge National Laboratory (ORNL), in the state of Tennessee. This would allow regional and over-lapping coverage for monitoring the shipments of direct-use material (HEU, MOX, or spent nuclear fuel). The National Spent Fuel Tracking Centers would be designed and constructed in the manner of the United States NASA Mission Control Center in Houston, Texas. They would be capable of receiving hundreds of real-time data feeds, regarding the shipment, location and status of direct-use nuclear materials being transferred in the United States. These data feeds would be suitably encrypted and transmitted across available internet band-widths. The date feeds would be decrypted at the Tracking Center, logged in the data servers and archival data base. The relevant data would be displayed on a number of manned monitoring stations, showing the real-time geographical location, progress along the planned route, and status of the cargo. There would also be screens to highlight alarm conditions that would indicate if any of the shipments experience, excessive shock, high radiation, or elevated temperature, due to a highway collision or other accident. This information would also be essential for interfacing with local fire and police departments to ensure they recognize the special nature and hazards of the material being shipped – especially if involved in an accident.

Although, we have focused our attention on the prospective shipments of the large amounts of spent nuclear fuel stored at nuclear power plants in the United States, the Tracking Center could similarly track other direct-use nuclear materials, such as highly-enriched uranium (HEU) and mixed uranium/plutonium oxide (MOX) material and fuel. Currently, HEU is being mixed with low enriched uranium and is being down-blended at facilities in Lynchburg, Savannah River, Oak Ridge and Portsmouth. [4] The Tracking Center could monitor transfers of HEU that are sent to these facilities for down-blending. In addition, the new Mixed Oxide (MOX) Fuel Fabrication Facility at the DOE Savannah River Site (SRS) is scheduled to begin operation circa 2016. This facility will produce fresh MOX fuel assemblies, which will be transferred to nuclear power plants licensed to handle such fuel. [5] The Tracking Center could track these transfers as well.

We envision that such a National Tracking Center for direct-use nuclear materials will be essential in countries with large numbers of nuclear facilities, and where such shipments are becoming more common, such as in the United States, Japan, the United Kingdom, France, and Russia. We also envision that such national tracking centers could ultimately establish the foundation for building an International Spent Fuel Tracking Center – for monitoring the shipments of nuclear direct-use material worldwide. Considering that international nuclear material security and safeguards is the purview of the International Atomic Energy Agency (IAEA), it seems logical to propose that this center be based at IAEA Headquarters in Vienna, Austria.

With the Nuclear Renaissance and the expanded use and transfer of direct-use nuclear materials, such as HEU, MOX and spent nuclear fuel, more effective tracking of such shipments in real-time is now technically possible and could be monitored in a National Spent Fuel Tracking Center. This would help guarantee that the transfer and shipment of such materials is safe and fully safeguarded.

References

[1] GOOD, M. S., et al.: "Functional Aspects of a Secure, Remote Unattended Monitor for the Interim Dry Storage of Spent Nuclear Fuel," U.S. DOE Pacific Northwest National Laboratory, Institute of Nuclear Materials Management (INMM) 49th Annual Meeting, Nashville, Tennessee, USA, July 13 – 17, 2008.

[2] MICHEL, K., et al.: "Integrated Geographic Positioning System (GPS) Radio Frequency Identification (RFID) Radiation Systems for Nuclear Material Safeguards and Secure Tracking," U.S. DOE Los Alamos National Laboratory, Fact sheet presented at the Enrichment Safeguards Technology Demonstration Workshop at the U.S. DOE National Laboratory at Oak Ridge, Tennessee, July, 2008.

[3] INTERNATIONAL ATOMIC ENERGY AGENCY (IAEA): *IAEA Safeguards Glossary – 2001 Edition,* International Nuclear Verification Series, No. 3, Section 4.25, "Direct-Use Material," Vienna, Austria, 2002.

[4] NUCLEAR NEWS MAGAZINE: "NNSA Eliminates 100 t of Weapons Grade Material," *Nuclear News*, page 26, October, 2008.

[5] NUCLEAR NEWS MAGAZINE: "The DOE's MOX Fuel Plant," *Nuclear News*, pp. 50 – 51, June, 2008.

The Role of the Nuclear Industry in Advancing Nuclear Security Instrumentation

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Development of new instrumentation for nuclear security is critical for the IAEA to cope not only with technical issues (emergence of new technologies and the inevitable obsolescence of system components) but also to support policy-related advances, including nuclear security policies. These development projects usually involve IAEA staff as well as research and development institutions and the private sector. Without a closely coordinated cooperation between all parties, the challenging task of timely developing, fielding, and maintaining new instruments and tools over their complete lifecycle would not be possible. The role of the private sector is usually focused on providing instrumentation and related services solutions, either developed by research and development institutions and then commercialized by industrial partners or developed within the private sector directly.

An example of the industry-IAEA collaboration is the development of the HS3 surveillance system. It is based on the long collaboration between the industry and the IAEA Safeguards Group, where the technologies originally developed for safeguards cameras have been adapted for a more general nuclear security mission. HS3 based systems are presently being deployed by the IAEA. An example of the industry-government agency (specifically the US Department of Homeland Security) is the Advanced Spectroscopy Portal Monitor.

In this paper we will outline the framework of cooperation between the industry and the nuclear security agencies, such as the IAEA or the US DHS. We will also discuss how that cooperative framework drives the development of the solutions using the abovementioned HS3 and ASP programs as examples. We will conclude with our vision of what works well within this framework and what other solutions we see needed in the near term.

Creating a Comprehensive, Efficient, and Sustainable Nuclear Regulatory Structure

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With the congressionally mandated U.S. Department of Energy's (DOE) Nuclear Material Protection, Control and Accounting (MPC&A) program milestones dates of 2008 (for site upgrade completion) and January 1, 2013 (for full transition to the Russian Federation) rapidly approaching, NNSA management directed its MPC&A program managers and team leaders 10 demonstrate that work in ongoing programs would lead to successful and timely achievement of these milestones. In the spirit of planning for a successful project completion, the NNSA review of the Russian regulatory development process confirmed the critical importance of an effective regulatory system to a sustainable nuclear protection regime and called for an analysis of the existing Russian regulatory structure and the identification of a plan to ensure a complete MPC&A regulatory foundation.

This paper describes the systematic process used by the U.S. DOE MPC&A Regulatory Development Project RDP) to develop an effective and sustainable MPC&A regulatory structure in the Russian Federation. The nuclear regulatory system addresses all non-military Category I and II nuclear materials at State Corporation for Atomic Energy "Rosatom," the Federal Service for Ecological, Technological, and Nuclear Oversight (Rostechnadzor, formerly Gosatomnadzor), the Federal Agency for Marine and River Transport (FAMRT, within the Ministry of Transportation), and the Ministry of Industry and Trade.

The approach used to ensure a complete and comprehensive nuclear regulatory structure included five sequential steps. The approach was adopted from DOE's project management guidelines and was adapted to the regulatory development task by the RDP. The following are a brief description of the five steps in the Regulatory Development Process:

1. Define MPC&A Structural Elements;

2. Analyze the existing regulatory documents using the identified Structural Elements;

3. Validate the analysis with Russian colleagues and define the list of documents to be developed;

4. Prioritize and schedule the development of documents;

5. Identify and develop processes to measure effectiveness of regulations.

Utilizing this process has resulted in an effective regulatory process that is understood and is being adopted by the four RF organizations. It is anticipated that the current regulatory development process will continue after U.S. support ends. Utilization of the systematic methodology will ensure regulatory development is based on required MPC&A structural elements and will support the continued maintenance and development of an effective regulatory base.

Global Threat Reduction Initiative's Reactor Conversion Programs Cooperation Methodologies and Approaches

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The Global Threat Reduction Initiative's (GTRi) Reactor Conversion program is a global effort whose prime objective is to reduce. and ultimately eliminate. The use of highly enriched uranium (HEU minimization) within civilian programs around the world. This GTRI program works in partnership with foreign countries and international organizations to develop replacement LEU technologies and obtain necessary regulatory approvals to support the implementation of HEU minimization programs. To implement the Reactor Conversion program. GTRI employs a variety of international agreements, memoranda of understanding and contractual vehicles through bilateral and multilateral efforts. The recent successes of the GTRI Reactor Conversion program will be used to promote additional nuclear threat reduction activities in member states. This presentation will present opportunities for developing new approaches to broaden international support for and participation in this nuclear threat reduction effort while at the same time ensuring the viability and sustainability of important civilian nuclear research and development programs of those facilities undergoing conversion.

U.S. Domestic security Upgrades to Reduce the Security Risk

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The purpose of this presentation will be to highlight the work being done by the Department of Energy/National Nuclear security Administration's (DOE/NNSA) Global Threat Reduction Initiative (GTRI), in cooperation with the Department of Homeland security's Domestic Nuclear Detection Office, the Nuclear Regulatory Commission and Agreement State Radiation Control Programs to enhance the security of U.S. licensed facilities that use high-risk radiological material. The objective of the GTRI domestic security program Is to further increase the protection of radiological sources and nuclear material located at public and commercial facilities in the United States. GTRI support is provided at no cost and implemented on voluntary basis. GTRI-funded services include:

• Security Training: GTRI conducts on-site training courses in a broad range of security subjects including vulnerability assessments, application of protection and accounting technologies, human reliability, and overall security program development

• Security Assessments: GTRI experts review existing security procedures and suggest voluntary modifications to further enhance security at sites

• Security Upgrades: GTRI provides funding and resources to install security upgrades at cooperating sites that will help improve deterrence, control, detection, delay, response, and sustainability

Sources and materials eligible for GTRI-funded voluntary security upgrades include those used in medical. educational research, and commercial applications.

Under the program, security experts from DOE's national laboratories, led by GTRI headquarters' staff, provide security assessments, share observations and make recommendations for enhancing security. When appropriate. DOE/NNSA pays for the installation of agreed upon security enhancements. Typical security enhancements include automated access control, motion sensors, radiation sensors, electronic seals, alarm control and display systems, remote monitoring to off-site response locations, enhanced guard force communications and protection equipment, delay elements, and transportation security enhancements, when appropriate.

Global Threat Reduction Initiative/Industry Technical Cooperation to Reduce Nuclear and Radiological Risk

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Abstract

During the past year, U.S. DOE/NNSA Global Threat Reduction Initiative (GTRI) officials have been working in cooperation with key producers and users of industrial, research and medical equipment containing large radiological sources that pose a security concern. GTRI believes that specific measures can be taken by industry to reduce the risk of theft of high risk radioactive material while allowing for full utilization of the source for its intended industrial, research or medical use. Two specific case studies of successful cooperative efforts are highlighted: the cooperative In-Device Delay security enhancement development and implementation with Best Theratronics, Ltd. (previously MDS Nordion), and the implementation of the Well Logging Security Initiative with the Oilfield Service Industry.

Introduction

The threat of radiological terrorism is a growing international security concern and a principle priority within the national security community. High-power radioactive sources could be attractive to terrorists attempting to develop a radiological dispersal device (RDD), commonly referred to as a “dirty bomb”. The use of such a device in a populated and/or symbolic area could cause widespread health, environmental, and psychological effects, as well as catastrophic worldwide economic repercussions.

Many foreign governments alone cannot ensure the security and control of the tens of thousands of radioactive sources currently used worldwide. These governments lack the resources to institute effective regulatory infrastructures with regard to the security and control of sources. Furthermore, these sources are used in a myriad of applications and are often used in very populous, public locations. Current government regulatory infrastructures, export control laws and physical upgrades may not be fully sufficient to prevent radioactive sources from being stolen and distributed to terrorist groups for potential malevolent purposes.

As governments struggle to maintain control and oversight of the radioactive source trade, industry could emerge as a crucial player in helping to stem illicit distribution and misuse of the most dangerous radioisotopes. An ingrained corporate responsibility exists among industry leaders to help prevent sources from falling into the hands of terrorists. Industry can expand their role as a major partner by establishing stricter self-regulation measures focused on greater adherence to physical security and control of sources. It is envisioned that existing government regulatory infrastructures can then be enhanced by adopting these industry self-regulation and self-policing measures. Leading manufacturers, users and distributors could spearhead interest of the entire radioactive source production and distribution industry, and facilitate the implementation of effective best practices approaches to security and promote the concept of voluntary industry self-regulation.

Integrating major commercial manufacturers, users, and distributors of radioactive sources with Government could greatly reduce the threat of theft of high-power radioactive sources and markedly enhance the security of sources worldwide.

References

[1] National Research Council. 2008. *Radiation Source Use and Replacement*. Washington, DC: National Academies Press.

U.S. Nuclear Regulatory Commission Efforts to Improve the Safety – Security Interface

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We agree with the broad international recognition that improving the interface between safety and security and utilizing synergies is critical to efficient and effective regulation of nuclear and radio active materials and associated facilities. The United States Nuclear Regulatory Commission (NRC) is implementing a number of efforts in rulemaking, licensing and inspection to recognize, establish and improve this interface. The NRC has been working multilaterally with the IAEA and bilaterally with our international partners to promote this concept.

Safety has always been the primary pillar of NRC's regulatory programs. In the current threat environment, there has been a renewed focus on security, and NRC has issued enhanced security requirements for radioactive sources and nuclear materials and associated facilities. Regulatory authorities, whether regulating safety and/or security, share a common purpose of protecting public health and safety. In today's environment, safety and security activities are closely intertwined, and it is critical that consideration of these activities must be integrated so as not to diminish or adversely impact either safety or security. While many safety and security activities complement each other or are synergistic, there remain potential areas of conflict where mechanisms must be established to resolve these conflicts if optimal protection of public health and safety and prompting common defense and security is to be assured.

NRC is implementing a number of efforts to promote safety and security interfaces. For example in June 2007, NRC developed draft guidance on safety-security interfaces at Nuclear Power Plants (N? P). NRC also published a proposed rule amending its NPP security requirements, which includes specific enhancements to the safety-security interface (10 CFR 73.58). Once finalized, these requirements wilt mandate that licensee's be responsible to ensure that adequate programs for assessing, managing, and coordinating proposed changes and activities, are established such that adverse interfaces between safety and security are identified and appropriate compensatory or mitigative actions arc taken to maintain both safety and security. Activities of interest include, but are not limited to, operations, engineering, work control and planning, emergency preparedness, fire protection, chemical safety, industrial safety, environmental protection, and security. This proposed rule is currently under review by the Commission and should be issued as final later this year. Once implemented, these requirements will serve as a significant advancement in fostering an improved safety-security interface.

As with many countries, regulatory responsibility for various safety and security aspects involve multiple agencies in the U.S. The U.S. government has established interface and coordination mechanisms to consider the interrelationship of security and safety issues such as the inter-agency Radiation Source Security and Protection Task Force and the Department of Homeland Security' s Critical Infrastructure Nuclear Government Coordinating Council. For example in the radioactive material area, the NRC and the National Nuclear Security Administration arc working on security enhancements to certain self-shielding irradiators. The development and evaluation of these proposed security enhancements is being extensively coordinated with security specialists and safety reviewers to ensure that security modifications do not negatively affect safety aspects such as shielding and serviceability. As part of the process to develop and implement new security requirements, NRC involves a broad range of stakeholders to ensure integrated and implementable solutions. Also, NRC has established multidiscipline groups to review safety-security issues resulting from issuance of enhanced security measures for NPP and radioactive material licenses.

Practices on Nuclear Security and International Cooperation

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Nuclear terrorism has been a great threat against the safety and security of the world. It has been reached the consensus by international community to strengthen the nuclear security regime to protect the nuclear and other radiological materials and related facilities.

Protection of the security of nuclear and other radiological materials in use, storage and transport and related facilities is always a important issue faced by each country and it depends on the technologies, funds and human resources can be utilized.

As nuclear technology has been widely used in different area, China competant authorities have issued a series of regulations, implementation rules and guidelines on security of nuclear and radioactive materials and related facilities. China supports and has taken an active part in the international efforts to strenghen the international nuclear security regime to combat nuclear terrorism. China has paid great importance on international cooperations on nuclear security with IAEA and other countries. More than 10 various national workshops and training courses on nuclear security and physical protection were delivered per year, which provided a communication platform for Chinese facility operators and managers to know the international technology-development and share the research achievements.

In cooperation with the IAEA, China has held a great number of regional and national training courses on physical protection and nuclear security since 1998. Different types of training, such as training on awareness, Design Basis Threat (DBT), physical security system design, equipments operation and vulnerability analysis, benefited the administrators, facility operators, engineers and technical staff in charge of physical security system design, operation and maintainance from China and regional countries. Under the framework of the bilateral agreement on Peaceful Use of Nuclear Technology (PUNT), China and U.S. jointly conducted a Technical Demo on Integrated Management of Nuclear Materials to introduce modren technology development on nuclear safeguards, material accounting and control, and physical protection in October 2005. After the Tech Demo, a series of cooperation projects on nuclear safeguards and security were developed.

To support the security of 2008 Beijing Summer Olympic Games, China Atomic Energy Authority (CAEA), worked with IAEA and the U.S. Department of Energy/National Nuclear Security Administration (DOE/NNSA), carried out trainings for the officials from public security, border control and customs, etc. for strengthening the response capabilities to the Major Public Events (MPEs) and implemented physical security upgrades and radioactive sources recovery at facilities near Olympic venues.

As a partner state of the Global Initiative to Combat Nuclear Terrorism, China organized a scenario-based workshop on radioactive detection and emergency response in cooperation with U.S. in December 2007, more than 60 Participants from 20 more countries participated the workshop.

To strenthen the training capability on nuclear safeguards and security, CAEA and the IAEA jointly established a "CAEA-IAEA Joint Training Center on Nuclear Safeguards and Security" in December 2006, located at China Institute of Atomic Energy (CIAE).

International Cooperation is a very important element in developing global nuclear security regime. China is willing to make continuous efforts to promoting the development of nuclear security through international cooperation.

Nuclear Security Information: A Balancing Act between Confidentiality and Transparency

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Nuclear information security - the control of access to sensitive information as well as classification and control measures for nuclear security information - is one of the principles of nuclear security culture. On the other hand the genera l public should be aware, that security is a key consideration for nuclear plant operation and transports of nuclear material.

The internet has influenced society and today in all areas access to information is quite easy and taken for granted. Nuclear security is no exception and general information about security is necessary. It is clear that details relating to sensitive security arrangements cannot be divulged to the general public but the release of appropriate information can be helpful in acquiring public confidence and support for nuclear security. The particular content and mode of disseminating this information is a balancing act between confidentiality and transparency. It may vary according to local and national circumstances, the particular public being addressed and prevailing circumstances and conditions.

Taking up examples from the nuclear and the non-nuclear field, the paper will focus on some reflections on what could or should be observed, when giving information in sensitive areas and in particular on nuclear security matters. Reflections such as:

> When evaluating the pros and cons of a transparent policy in the field of nuclear security and trying to evaluate what information may be disclosed, we have to be aware, that we are acting in the delicate field of the nuclear discussion. Further our behaviour will be compared with the information policy in nuclear safety, where in general absolutely open information is applied.
>
> Information in general is spread by Medias. When entering in the information business. we have to understand and care about how the Medias work and behave. We have to decide who will enter in contact with the Medias and which information has to be given to whom, at what time and under which circumstances.
>
> In order to clarify these questions and to lay down the responsibilities for giving information’s, an information management has to be developed.
>
> In an information management concept, we have to make the distinction between common everyday information and information in special situations e.g. emergency cases. Both have their own characteristics to be observed, both have to be carefully prepared in advance as far as possible.

Being aware of the problems which may arise when giving information in sensitive areas and making reflections how to handle them in advance will help to raise the credibility in the institutions and persons concerned and - in the case of an emergency - help to hinder that the emergency is expanding to an emergency in the information field.

The Euratom Treaty and the 3S Approach

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The 3S concept concerns the adoption of an approach by national authorities to legislation and regulation in the areas of nuclear safety, security, and safeguards which treats these closely related areas in an integrated fashion, rather than as three separate Islands. The benefits from adopting such an integrated approach lire the avoidance of legislative or regulatory gaps, and what is equally important: the avoidance of legislative or regulatory overlaps - particularly where conflicts may be concerned.

The European Union possesses extensive legislative competences In relation to protecting the health and safety *of* workers and the public against Ionizing radiation. It also possesses competences in relation to ensuring that nuclear materials are not diverted from their declared uses. In both of these areas there is a nexus with the security of nuclear materials end radioactive materials more generally. The European Commission is currently elaborating a legislative proposal to consolidate the European Basic Standards legislation, which includes the Directive on the control of High Activity Sealed Sources, into a single, integrated legal Instrument. This paper also takes note of current activities in the area of safeguards, which although intended to improve safeguards controls, are also expected to improve security of nuclear materials in the EU. The paper also briefly analyses overlaps between safeguards and safety.

Nuclear Security Incident Analysis: Towards an Integrated and Comprehensive Approach

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Abstract. As the International Community seeks a more comprehensive understanding of the threats and risks to the emerging global nuclear security regime, it is important not only to examine the most recent assessments of trends and patterns, but also to reflect on the evolution of our own analytical programmes in order to prepare for the next phase of our information agenda. This paper will draw on unique information systems such as the IAEA Illicit Trafficking Database and analysis of information contained therein to provide an overview of lessons learned from illicit trafficking and other unauthorized activities involving nuclear and other radioactive materials and associated facilities. This assessment will address the Agency's work on these topics focusing on those incidents exhibiting criminal intent and in particular malicious intent.

An Integrated Approach for Securing a Nuclear Power Plant for Electricity Generation

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It is expected that the nuclear fission energy would be one of the mostly needed options for electric power generation due to the high operating performance of nuclear power plants [NPPs], with significant improvements in reliability and enhanced levels of nuclear safety. Also, measures to guard against radiation and criticality hazards when dealing with nuclear materials [NMs] and other radioactive materials [RMs] are essential to be considered [1,2].

In recent years, nuclear security has become a major concern in the world. Re-evaluation of security in the nuclear industry sector is becoming an extremely important task in order to achieve better control and protection of NMs and RMs and higher level of protection for their associated facilities.

The purpose of this study is to develop an integrated approach for securing a nuclear power plant [NPP] for electricity generation. It focuses on investigating measures of some fundamental nuclear safety parameters in a NPP together with measures of the nuclear security system of the facility, and to study how such measures could ensure the nuclear security of the NPP.

The idea is that measures of the NPP security system should be implemented under control of the national nuclear security regime of the concerned State. Such measures integrated to measures of nuclear engineering safety system, nuclear physical protection [PP] system and nuclear materials accountancy and control [ACC/C] system should be implemented –in real time mode- from the start of design phases of the NPP to the phases of full operation up to the decommissioning phases of the NPP, with well coordinated manner and consistently. Schematic representation of the approach is given in Fig. 1.

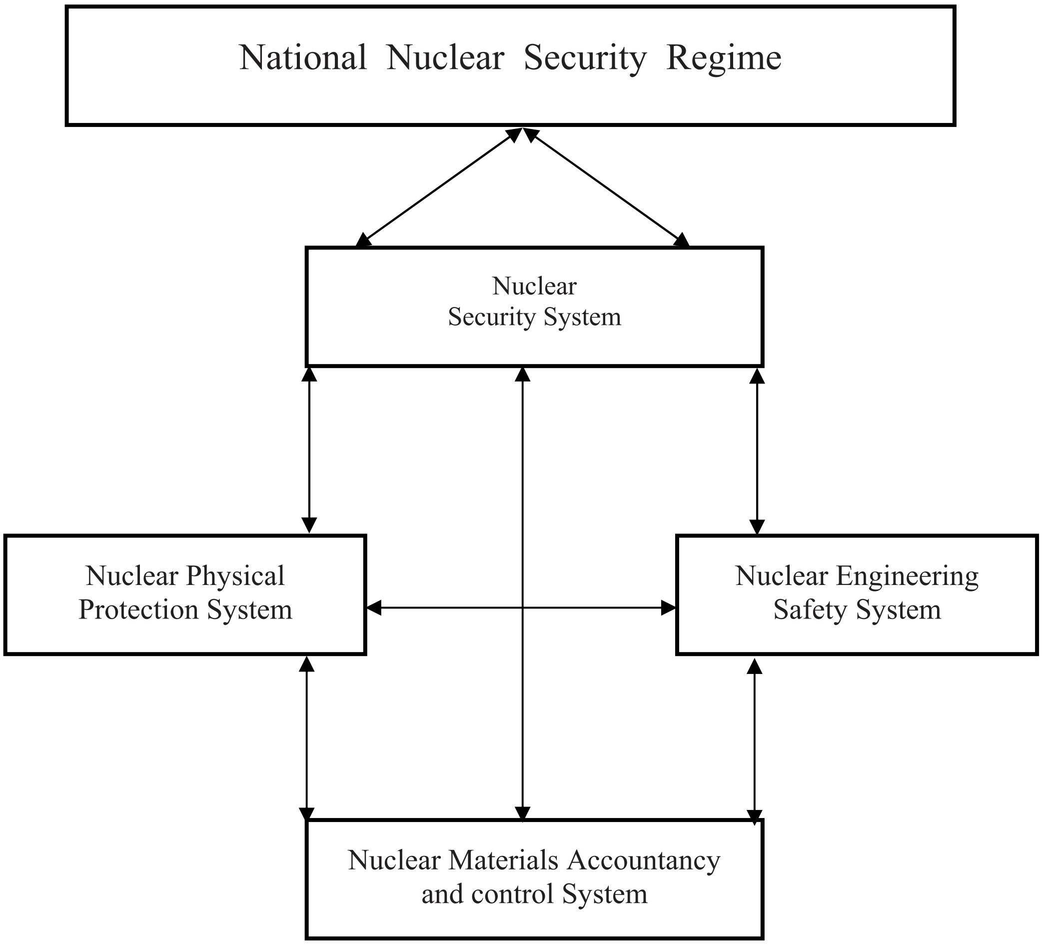

FIG. 1. Schematic representation of an integrated approach for securing a nuclear power plant for electricity generation.

References

[1] EL-BARADEI, M., "Nuclear Power Changing Picture", IAEA Bulletin, No. 49/1, pp 18-21, Vienna-Austria (2007).

[2] BADAWY, I., Risk Prevention for Nuclear Materials and Radioactive Sources, Proc. International 9th Conf. of Nucl. SC. and Applications, Sharm El-Sheihh, Sinai-Egypt (2008).

[3] IAEA, Safety Fundamentals, The Safety of Nuclear Installations, IAEA Safety Series No. 110, Vienna- Austria (1993)

[4] BADAWY, 1., M.K Mobasher and V.M. Naguib, A Real-time System of Accounting and Control of Nuclear Materials and Radioactive Sources, Proc. Symposium on International Safeguards; Addressing Verification Challenges, IAEA-CN-148/l45P, Vienna-Austria (2006).

International Initiatives and Efforts: UNSCR 1540

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United Nations Security Council Resolution 1540 established, for the first time, important obligations on States under Chapter VII of the UN Charter to develop and enforce appropriate legal and regulatory measures against the proliferation of Weapons of Mass Destruction (WMD) and their means of delivery. Outreach to regional, sub-regional, and international organizations, as well as through bilateral outreach, training, and capacity-building, will help other countries enhance their implementation of UNSCR 1540.

We want to move beyond general outreach events (although this will need to continue) to raise States' awareness of UNSCR 1540 to more practical implementation steps, such as gaining regional agreement on action plans to implement 1540, and building technical capacity in cooperation with organizations like the IAEA and OPCW. Implementation of UNSCR 1540 is important because it obligates States to prevent and deter illicit access to WMD, their means of delivery, and related materials. Implementing the requirements of 1540 also will benefit regions that seek to be key global economic suppliers of goods and services.

The UNSCR 1540 Committee's report outlining efforts since 2006 was completed in July 2008 and notes that IAEA efforts to complement UN activities in this field are welcome and that institutional relationships are important. To further promote implementation of UNSCR 1540 by the IAEA, this presentation will discuss U.S. views on how to capitalize on the IAEA in 1540-related work with ideas such as a cost-free expert who would work as the IAEA's 1540 contact to strengthen the IAEA's capacity to help interested states address their UNSCR 1540 obligations. Other approaches could help the IAEA cooperate with the 1540 Committee under UNSCR 1540 to promote the role of the IAEA in nuclear non-proliferation and fight against nuclear terrorism; increase awareness of the IAEA Member States of the significance of 1540 resolution and to develop the relationship between the 1540 Committee with the IAEA in the sphere of non-proliferation and fight against WMD terrorism, and; help to build synergies between IAEA, 1540 Committee and Member States on improving Member States mechanisms to meet challenges of WMD proliferation and terrorism. The 1540 Committee has stressed the importance of regional implementation of UNSCR 1540 (2004) in resolutions 1673 (2006) and 1810 (2008) and welcomes the opportunity to strengthen its dialogue with the IAEA.

The JRC Support to EU Policy in the Field of Nuclear and Radiological Security

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The activities of the EU to fight nuclear and radiological terrorism are based on the European Security Strategy adopted in December 2003 by the European Council. This strategy identifies proliferation of weapons of mass destruction (WMD) and terrorism among the key threats to Europe and to our society. The EU Counter Terrorism Strategy adopted in December 2005 gives further policy guidelines.

Inside the EU, a list of measures which should be taken by the Member States and/or by the European Commission is under discussion in the working groups of the CBRN Task Force. Their objective is to limit the risk of malicious acts, including terrorism, and involving radiological nuclear materials. This list should become part of the European Commission's 2009 CBRN policy package.

The JRC, in accordance to its mission to provide technical and scientific support to the EU policies, is closely associated to the related CBRN policy (for its RN part). JRC has carried out a Radiological Vulnerability Risk Assessment Study in EU 27, which supported the work within the CBRN Task Force. Moreover, in support to MS in the field of detection, JRC is working on the ITRAP+10 project in which world -wide equipment will be tested for their performances and limits. Finally, as the training on security matters is a key issue in the CBRN agenda, the JRC is going to establish a European Security Training Centre which will focus at its starting phase on nuclear and radiological security. This training centre should in the future broaden its scope beyond nuclear security to include trainings on bio and chemical security, dual use and export control. The JRC will involve the MS expertise in all domains.

Outside EU, various instruments have been established by the European Commission, such as the Instrument for Stability which provides funds and mechanisms to address global and trans-regional threats. The Instrument for Nuclear Safety finances measures to support the promotion of a high level of nuclear safety, radiation protection and the application of efficient and effective safeguards of nuclear material in third countries. Moreover the JRC will continue to implement the EC projects related to nuclear safeguards and fight the illicit trafficking of nuclear and radioactive materials. The Instrument of Stability has no geographical limitation (in comparison to the TACIS program) new regions will be supported via many projects in the field of non proliferation of WMD and CBRN risk reductions. The JRC is supporting the European Commission in the definition of projects through fact finding mission in countries from Middle East and Asia.

This paper is an outlook of some JRC activities in support of the EU security challenges.

Experience and Recent Developments in Nuclear Forensics at the Institute of Isotopes

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Based on experience with nuclear material confiscated in Hungary from illicit trafficking activities in the nineties it has been decided that traditional gamma-spectrometry should be complemented by destructive analytical techniques. The 17/1996 (I. 31.) Korm. Governmental Decree delegated the identification, categorization and characterization tasks to the Institute of Isotopes, Budapest.

Routine gamma-spectrometric methods have been further developed aiming at the

i) age (production date) determination of seized samples and complete (non-dismountable) uranium-bearing items (such as fresh fuel bundles and fission chambers) by HRGS technique,

ii) improvement of measurement accuracy and reliability.

Starting in 2005 mass spectrometry (ICP-SFMS) and scanning electron microscopy have been implemented to characterize nuclear samples in more detail and to analyze environmental samples both for isotopic and elemental composition focusing on long-lived radioactive isotopes including actinides.

Current developments include application of laser ablation assisted mass spectrometry of seized pellets and single particles, sample preparation techniques for transuranic nuclides, such as Am-241 and Pu isotopes, age (production date) determination and swipe analysis.

Measurement techniques used have been validated by participating in intercomparison exercises (round-robins) and comparing measurement results of independent techniques. Joint analysis of three uranium oxide pellets (seized in Hungary) with the Institute for Transuranium Elements (JRC-ITU, Karlsruhe, Germany) served this purpose as well.

Some other research topics (mostly by-products of other fundamental research projects) may also have potential applications in combating nuclear terrorism:

i) cold neutron activated prompt gamma (PGAA) detection and 3D image of shielded (hidden) uranium in combination with neutron tomography

ii) gamma-spectrometric and neutron counting methods for the determination of the quantity and isotopic composition of plutonium (e.g. in Pu-Be neutron sources)

iii) pulsed neutron activation techniques to detect and identify nuclear material.

Illicit Trafficking of Nuclear and other Radioactive Material in Paraguay

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In order to be effective, a defence system must be designed on the basis of real conflict hypotheses, that is, on the basis of well identified real possibilities of occurrence of aggressions against national interests. Threat assessment and analysis depend on complete and correct information. By making an accurate appreciation of the strategic situation we can identify quite precisely current or potential conflicts that could genuinely affect national interests and be prepared to meet them in the form best suited to their nature, rationally using the budget resources allocated to defence.

Lack of preparation to counterattack real threats implies being absolutely defenceless. On the other hand, being prepared without knowing exactly what for is a waste of people's money[1].

A growing concern, not only of G8 countries but also of affected countries, is governance and lawless areas, or areas where the State is absent. The concept of lawless areas in particular has been time and again used by the Ministries of Foreign Affairs of several European countries, by the Pentagon and by the US Department of State to refer to lawless areas or areas without government in Latin America, Africa, Asia and even Central Europe, where presumably there exist groups of terrorists and traffickers of weapons and other illicit materials. In such as areas some terrorist group can be actively seeking nuclear weapons or the materials and knowledge need to make them or to make Radiation Dispersion Artefacts RDA, improvised nuclear artefacts (INA). At the end of March 2008 the Colombian Police seized at least 66 pounds (30 kg) of uranium from the terrorist group FARC. This is new for Latin America and could bring the FARC into the major leagues of black market terrorist transactions.

In Latin America, one of these areas is the Tri-Border Area; the other is the Leticia-Tabatinga area between Colombia and Brazil[2]. Recently, the countries of the 3 + 1 Agreement signed a joint declaration[3] ratifying the inexistence of terrorist groups operating in these areas, but confirming the existence of strong evidence of the remittance of foreign currency to extremist Arab groups. Illegal activities in this area are notorious: weapons trafficking, money laundering, drug trafficking, and other types of traffic (nuclear and radioactive materials) cannot be dismissed. The problem is that authorities from no country would wish to have

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[1] Santa María J. *Nuevas amenazas, hipótesis de conflicto y política de defensa en Paraguay.IIK.* Arbeitspapiere des IIK Nr. 24. Januar 2005. See http://www.duei.de/iik/shop/arbeitspapiere

[2] Labaqui I. *Estados Unidos y Los Países del MERCOSUR después del 1 de Septiembre* en *Bajo la Mirada del Halcón.* Carlos Fuentes Ed. FLACSO. Nov. 2004. 260p.

[3] Counterterrorism Office Washington, DC *Communiqué of the 3 + 1 Group on Tri-Border Area Security* December 6, 2004

nuclear or radiological materials stolen or misplaced in them and then used to fabricate a "dirty" bomb to perpetrate attacks.

This document analyzes the situation of sector policies (international binding and non-binding agreements legal instruments, internal security policies, defence programs and plans, etc.); global and national threats; the nature of actions taken by the Paraguayan Government through effective mechanisms for coordination including planning, implementation and monitoring, and relevant collaborative actions implemented with the International Atomic Energy Agency – IAEA.

Safeguards-by-Design: 3S Integration

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Design and construction of a nuclear energy system, particularly the first of its kind – or the first for a given host state – is an immensely complex undertaking. Additionallysafeguards, security, and safety each have significant requirements that must be properly addressed by the facility and system design effort. However, the requirements are often in apparent conflict. A simple example would be the safety requirement for emergency egress doors contrasted against the physical security requirement to limit and control access points. This conflict is significant, even as it is often understated [1]. The potential for conflict is increased when different parties are responsible for each component, as in the International Atomic Energy Agency (IAEA) performing safeguards while the host state provides for safety and security.

Early and complete identification of requirements is critical to design success. This allows consideration of intrinsic design features that can satisfy all parties. The majority of the cost to design and build a facility is committed by the end of the conceptual design. As the design progresses, the cost to change the facility via retrofits is increasingly, even prohibitively, expensive, both in money and time. Conflicts among the safeguards, security, and safety design requirements must be resolved early to allow optimal design solutions, and to avoid costly backfits.

The Safeguards-by-Design (SBD) project currently underway in the United States is developing a design process that will fully integrate safeguards (to include state and international safeguards, and proliferation barriers) and security into the facility design process, with close coordination with safety [2]. The SBD process includes key features such as early safeguards and security input to the facility requirements documents, a systems approach to nonproliferation and security considerations within the design effort, and agreed upon timelines for communicating with the IAEA.

The integration of nuclear safeguards, safety, and security (3S), is a logical and important step in the evolution of the design process, as has been recognized by the IAEA and member states [3]. Integrating SBD with tight links tosafety as well takes advantage of the maturity of the nuclear safety experience, properly coordinates the safety requirements with the safeguards and security requirements, and minimizes the negative impact of retrofits during design and construction.

REFERENCES

[1] Letter from the Chairman of the International Nuclear Safety Group, IAEA Publications, GC(51)/INF/11, September 17, 2007.

[2] T. A. Bjornard, et. al., Institutionalizing Safeguards-by-Design – High-Level Framework, Idaho National Laboratory, INL/EXT-08-14777, 2008.

[3] Communication dated 16 July 2008 received from the Resident Representative of Japan to the Agency concerning an International Initiative on 3S-Based Nuclear Energy Infrastructure, IAEA Publications, INFCIRC/732, July 29, 2008.

Direct Alpha Analysis for Forensic Samples (DAAFS)

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The goal of the DAAFS project is to deliver a field deployable direct alpha sample spectrometry system. This system is designed to rectify current gaps in pure alpha emitting material detection. The system comprises, firstly, an evaluation of multiple innovative methods for rapid on-site sample collection of difficult to detect alpha RN contamination. Secondly, the incorporation of an experimental alpha spectrometry analysis software suite, "ADAM" , is provided for performing the required on-site deconvolution of the complex alpha spectra arising from the direct sample measurement. Software simulation of collected alpha spectra will be handled by "AASI", which will simulate alpha spectra as a training and analysis verification tool. Thirdly, a Concept of Operations (ConOps) for the system implementation in RN field teams is included.

This combination of the swipe methodology, advanced swipe treatment equipment, mobile field laboratories, and the state of the art analysis software suite will provide RN response teams with the capability to identify and rapidly {i.e., hours as opposed to days) quantify low activity and difficult to detect alpha emitters. Further expert analysis support is available to field teams by sharing of raw spectral data via email with off-site laboratories.

The proposed system provides the solution to this identified capability gap, specifically, a field-deployable real-time alpha detection system. The system comprises: a non-destructive particle sampler, standardized swipe sampling methods, a self-contained field alpha spectrometry system and an integrated data management/communications tool allowing for real-time raw-data tracking and data sharing. This system also provides responders with the type/quantity of RN material for improved safeguards, forensics, and contamination mitigation applications.

Laser Induced Breakdown Sepctroscopy (LIBS) use in Nuclear Security and Compliance

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Laser Induced Breakdown Spectroscopy (LIBS) uses optical emission spectroscopy of the induced plasma to identify elements. It is an analytical method that is growing in use by research groups and industry alike, because of its characteristics of requiring no sample preparation, small and rapid sample taking, real time results, in-situ and stand off analysis, and minimum operator training required. Because of these traits, the Canadian Safeguards Support Program (CSSP) recognized this technology could be used by lAEA inspectors and security staff in performing their duties.

Laboratory results have shown the technology can identify nuclear indicators and signatures of nuclear clandestine activities, even will low intensity laser power. The findings, as well as the quick identification of yellowcake, U_3O_8, by using pattern recognition chemometric procedures arc reported within this paper. In addition, it will present the progression made in the development of a hand-held instrument for field operations by inspectors, nuclear security personnel and border crossing staff.

Examining Self-Protection Requirements: Methods to Improve Security of HEU materials

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Preventing non-state actors from obtaining highly enriched uranium (HEU) is critical to impeding nuclear terrorism, yet security levels at civil sites with HEU on the premises continue to vary greatly throughout the globe. One critical problem thwarting efforts to improve the physical protection of this material is the lack of an international assessment of I) the conversion time (the time which would be required to convert the material concerned into the metallic components of an explosive device) of spent fuel and other irradiated HEU materials, such as target waste, in particular giving due consideration to the fact that long cooling times may have reduced significantly radiation levels required to deter and/or prevent theft and subsequent handling, and 2) clear recommendations on the ways to evaluate the adequacy of related physical protection measures. While this issue has been studied in some detail for spent fuel from power reactors [1, 2], with particular emphasis on Pu [3], similar assessments have not been completed for HEU fuel types, such as those used in more than 130 research reactors and numerous naval installations, in addition to other fuel cycles [4].

This paper provides a preliminary assessment of "self-protection" standards, by examining the level of radiation needed to incapacitate a would-be thief within hours. The inadequacy of current standards has been suggested by previous assessments with respect to HEU targets used for Mo-99 production [5]. The basis for the evaluation includes historical data on fuel burn-up from the IAEA Research Reactor database, the results of modelling fuel parameters for nuclear submarines [6], and data on target waste for radioisotope production. These categories of spent materials arc known to be stored at numerous sites in all parts of the world, leading to security concerns [7].

The paper offers an overview of the number of sites that may have spent HEU materials, including non-defueled, decommissioned facilities. The radionuclide inventory is described for various reactors using the specific U-235 consumption (g/ MWd) and specific production of the most relevant Isotopes, such as ^{137}Cs, ^{90}Sr and $^{239,\,241}$Pu (Bq/ MWd), and converted m. toradiation fields. In this study, the ENDFI B-6 library has been applied as part of the HELIOS together with MICROSHIELD© for analysing subsequent shielding factors. HELIOS and MICROSHIELD© has been extensively qualified by comparisons with experimental data and international benchmark problems for reactor physics codes as well as through feedback from applications. The assessment of the diversion risk has been completed on the basis of the possible capabilities of potential proliferators in line with earlier assessments of proliferation potential of fissile materials [8].

The conclusions indicate that current "self-protection" standards, as applied, are not an adequate barrier to diversion. Based on the above assessments, the authors suggest basic recommendations for improving and simplifying decisions as to when to consider materials no longer "self-protecting." Finally, it provides broad recommendations for security measures and practices that might effectively be adopted for materials that do not meet this standard.

References

[1] BRAGIN, V, ONG L. Radiation levels associated with nuclear reactor fuel. STR287.Vienna: International Atomic Energy Agency, 1992.

[2] LLOYD W.R., SHEAFFER M.K., SUTCLIFFE, W.G. Dose Rate Estimates from Irradiated Light-Water-Reactor Fuel Assemblies in Air, Lawrence Livermore National Laboratory. UCRL-ID-115199, 1994.

[3] CARLSON, John et al., Plutonium Isotopics - Non-Proliferation And Safeguards Issucs,IAEA-SM-351/64.

[4] RE1STAD, O. ., Hustveit S. HEU Fuel Cycle Inventories and Progress on GlobalMinimization, Nonproliferation Review, July 2008.

[5] VANDEGRIFT G., BAKEL A., THOMAS J. Overview o f2007 ANL Progress for Conversion of HEU Based Mo-99 Production as Part of the U.S. Global Threat Reduction-Conversion Program: ' (Proc. RERTR 2007 International Meeting, Prague, 2007).

[6] REISTAD, O ., STAMM'LER F., GUSSGARD K. Modeling design and operating parameters for Russian naval PWR reactors using the HELlOS reactor code. Submitted for publication in Science and Global Security, January 30, 2008.

[7] BUNN M., Securing the Bomb 2007 (Cambridge: Harvard, 2007).

[8] GLASER A. 2006. On the proliferation potential of uranium fuel for research reactors at various enrichment levels. Science & Global Security 2006; 14(1): 1-24.

Terrorist Threat to Nuclear Facilities and the Role of the Public in Countering them

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The general public is an important stakeholder whose vital interests are consistent both with the prevention of terrorist attempts to attack nuclear power infrastructure and appropriate mitigation of the consequences of any such attack. Terrorist attacks can easily bring about systemic disasters characterized by a series of uncertain, interconnected and disruptive events that would affect the population at large as well as a wide range of societal institutions. Hence, the public must no longer be looked upon just as potential victim s or panicked masses but rather as an important contributing factor to better nuclear security throughout all stages of any potential incident. By getting the public on board and recognizing it as an important stakeholder, a meaningful risk communication strategy and other relevant arrangements must be developed and implemented in pursuance of five interrelated objectives:

1. Reach a common risk assessment enabling the public to be educated and prepared.

2. Encourage a well-informed and well-moticated public to contribute to a healthy nuclear security culture not only at the nuclear plant and associated units but also nationally .

3. Build up public vigilance, persuading citizens to cooperate more closely with law enforcement.

4. Reduce the immediate and long-term physical and psychological impact of a terrorist incident by fencing off panic, boosting morale, maintaining credibility, and providing guidance.

5. Integrate acts of nuclear terrorism into the general scheme of All-Hazards approach.

The success of this public focused campaign would depend on its ability to develop a balanced and realistic understanding of the risk and the relationship between safety and security as two sides of the same process which is trouble-free operation of the nuclear power infrastructure under any conceivable circumstances. To this end, it is imperative to use as many public channels as possible, reaching groups that differ educationally socially, professionally, and politically. Ultimately, public involvement in the efforts to improve nuclear security and their recognition of the importance of this mission must be regarded as part-and-parcel of strengthening civic democratic society.

Buidling Momentum to Minimize Highly Enriched Uranium Use, Improve Nuclear Security and Combat Nuclear Terrorism

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Much has been done to reduce the risk of nuclear terrorism under the auspices of international programs such as the G-8 Global Partnership, the Global Initiative to Combat Nuclear Terrorism, and the Global Threat Reduction Initiative. Despite the practical progress in removing the threat that terrorist groups could obtain the fissile material for an improvised nuclear device, however, much more work remains. In 1980, the 59 states participating in the International Nuclear Fuel Cycle Evaluation agreed that the civilian use of highly enriched uranium (lIEU) should be minimized.

Decades later, and despite dramatic new threats to world peace, the pledge to forego the use of HEU is not yet universal or legally binding. Nor have improvements to the physical security of this material been sufficient in many locations. This paper surveys the international measures that have been taken towards the formation of an international norm to minimize BEU risks through established mechanisms and suggests several additional approaches that may help to solidify support for practical measures and accelerate the process of civil HEU minimization and improved security globally.

HEU reduction requires global cooperation: eliminating a small holding of HEU at a single facility or upgrading its security does not greatly reduce terrorist risks overall. Policymakers must be sure that their counterparts in other states arc engaged in similar efforts. A global HEU minimization norm would validate each nation's efforts, no matter how small, and provide a disincentive for inaction.

Clearer standards for the security of this material and commitments to meet these standards would serve the same purpose. While each failure 10 act poses its own risks, it also erodes the usefulness of BEU elimination programs elsewhere and sends the wrong political message to the rest of the world. Moreover, it is technically impossible to minimize the largest REU holdings-those at fuel cycle facilities-until the end users of HEU no longer demand this material. And it should be noted that nearly all HEU trafficking cases involve material originating from fuel cycle facilities.

Both practical and political considerations demand greater high level attention to minimizing HEU and improving its security. Great technological progress has been made since programs were initiated to convert reactors and medical isotope production processes, remove and reduce nuclear materials worldwide, and protect at-risk nuclear materials from theft and sabotage. The new technical capabilities have not been translated into significant reductions in HEU use, however, due to a lack of overarching political solutions. To date, only a few countries have indicated formally their support for HEU minimization, among them Iceland, Kyrgyzstan, Lithuania, Norway, and Sweden in the context of the Treaty on the Non-

Proliferation of Nuclear Weapons review process [l], though there have been international calls for HEU minimization in other fora, including the G-8 "Action Plan on Non-proliferation" issued at the Sea Island summit of 2004 and the 2007 Astana joint statement of the Global Initiative to Combat Nuclear Terrorism. New measures are needed, however, to make these commitments real.

With this in mind, the James Martin Center for Non-proliferation Studies has led an effort to draft HEU guidelines, modeled in part on the Guidelines for the Management of Plutonium (INFCIRC/549).There is international interest in such guidelines. France, for example, called for the adoption of HEU guidelines at the 2007 Preparatory Committee meeting for the 2010 NPT Review Conference. HEU guidelines would codify best management practices, allow states to commit to national management strategies, and provide updated security recommendations, as this paper discusses in detail.

While HEU guidelines are voluntary measures aimed at states, there arc also ways that nuclear enterprises and other stakeholder groups can move the policy process forward. The adoption of resolutions by such groups can be good for business and encourage states to make firm political commitments to HEU minimization. This paper will review the resolutions that have been adopted by the California Medical Association and Malaysian Medical Association, as well as prospects for additional such measures. It will also propose elements of an HEU code of conduct, which includes a commitment to eliminate HEU use as soon as possible, that could be adopted either by individual organizations such as nuclear enterprises or universities, or by states.

With political determination the risks posed by HEU could be largely eliminated within a decade. Many world leaders have stated that they arc committed to reducing the threat of nuclear terrorism; now a framework is needed to support the practical steps needed to eliminate HEU use wherever possible, consolidate remaining holdings, and provide this material with the best possible security.

References

[1] "Combating the Risk of Nuclear Terrorism by Reducing the Civilian Use of Highly Enriched Uranium," working paper submitted by Iceland, Lithuania, Norway, and Sweden at the 2005 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons, NPT/CONF.2005/MC.IlUWP.5.

Evolution of Nuclear Security Regulatory Activities in Brazil

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The changing of the world scenario in the last 15 years has increased worldwide the concerns about overall security and, as a consequence, about the nuclear and radioactive material as well as their associated facilities. Considering the new situation, in February 2004, the Brazilian National Nuclear Energy Commission (CNEN), decided to create the Nuclear Security Office. This Office is under the Coordination of Nuclear Safeguards and Security, in the Directorate for Safety, Security and Safeguards (Regulatory Directorate). Before that, security regulation issues were dealt in a decentralized manner, within that Directorate, by different licensing groups in specific areas (power reactors, fuel cycle facilities, radioactive facilities, transport of nuclear material ...). This decision was made in order to allow a coordinated approach on the subject, to strengthen the regulation in nuclear/radioactive security, and to provide support to management in the definition of institutional security policies. The CNEN Security Office develops its work based in the CNEN Physical Protection Regulation for Nuclear Operational Units - NE-2.01, 1996 [I] , the Convention on the Physical Protection of Nuclear Material, the INFCIRC 225 and other documents.

This paper aims at presenting the activities developed and the achievements obtained by this new CNEN office, as well as identifying the issues and directions for future efforts.

Nuclear Security in Major Public Events : The XV Pan-American Games and the III Para Pan American Games in Brazil

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The organization of a major public event involving large numbers of spectators and participants, presents important security challenges. Taking this into consideration, the Brazilian Nuclear Energy Commission (CNEN) has been requested, by the National Secretary of Public Security/ Ministry of Justice (SENASP/MJ), by the end of 2006, to participate on the security actions to be implemented in both the XV Pan-American Games and III Para Pan American Games.

The XV Pan American Games 2007 and the III Para Pan American Games were held in Rio de Janeiro, Brazil from 13 to 29 July 2007 and from 12 to 19 August 2007, respectively. Those events had 8700 participants between athletes, coaches and referees from 42 countries. More than 300 competition events were held at 17 different venues and were covered by 4910 professionals from TV, radio and Mitten press. Around 2 million tickets have been sold or distributed and 18,000 volunteers participated on the organization.

The participation of CNEN was concentrated on the implementation of specific nuclear and radiological security measures to be applied at those events. This was part of a multi-institutional plan for the security of the Games, coordinated by the National Secretary of Public Security of the Ministry of Justice (SENASP/MJ). The support provided by IAEA under a Cooperation Arrangement with the Brazilian authorities was a key factor for the success of the whole operation.

The actions taken and the lessons identified by the Brazilian Nuclear Energy Commission related to nuclear and radiological security for the Pan American Games and for the Para Pan American Games are presented.

Prevention of Nuclear Terrorism as an Important Element of National and International Security

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Ukraine has identified prevention of nuclear terrorism as a priority line of its national and international policy.

International terrorism has been recognized by the global community as one of the most dangerous challenges of modernity.

Intensification worldwide of activities targeted against terrorist activity prompts the development of nationwide, and on their basis also sectoral, efforts aimed to protect national interests against encroachments of international terrorist organisations and their emissaries in Ukraine.

Analysis of information related to threat assessment demonstrates that potentially hazardous nuclear energy facilities are among principal likely targets of terrorist attacks.

This has a number of reasons, the most important being the scale of adverse radiological consequences of terrorist acts at these facilities, as well as dependence of safety of activity of local population on their reliable and sustainable operation.

Nuclear terrorism against nuclear energy and nuclear industry facilities is one of the most dangerous types of terrorist activity considering the likelihood of disastrous consequences (radioactive contamination of extensive territories, water supply sources and life support systems). Theft, smuggling and illicit handling of nuclear and radioactive materials is another serious threat to international security.

The stepping-up of actual threat of nuclear and radiological terrorism and recognition of profoundness of this threat poses particular requirements regarding government efforts in provision of security of nuclear facilities whose integral part is physical protection of nuclear materials, nuclear facilities, radioactive wastes, and other sources of ionising radiation.

Considering the above-referenced targets of terrorist groups there is also an objective need for counterterrorism protection and security of nuclear industry facilities.

N. Klos

Counterterrorism Protection of Nuclear Energy Facilities Vulnerable to Terrorist Attacks as a Package of Regulatory, Logistical (Including Financial), and Operative Measures Aimed to Secure Their Sustainable, Reliable, and Safe Operation

Another distinct aspect of addressing the aforesaid task is the need, prompted by the contemporary context, to focus on development of methods for holistic counterterrorism protection of nuclear energy facilities and the long-term forecasting of their condition.

The Ukrainian Ministry of Fuel and Energy carries out routine counterterrorism activities, with one of the Deputy Ministers being responsible for implementation of requirements and measures to prevent terrorism and a relevant division within the Ministry appointed to exercise public administration of the said sphere.

As stipulated by relevant Ministry guidelines, companies, enterprises and organisations subordinate to the Ministry have established local Nuclear Terrorism Prevention Headquarters and worked out preventive action plans (including regular reporting procedures). These include:

- stepped-up control over nuclear material and other radioactive substance accounting and control systems, transportation of weapons, munitions and explosives;

- improvement of physical protection systems, facility-level security and access control procedures at nuclear facilities;

In planning preventive actions executive personnel is instructed to pay special attention to assurance of prevention of possible use by adversaries of vehicle bombs.

- desktop and special tactical exercises at potentially hazardous power and energy facilities jointly with SBU (Security Service) and Ministry of Interior aimed to practise aspects of prevention of terrorist attacks and minimisation of their consequences;

- revision of Acts of Intergovernmental Commissions aimed to improve systems of protection of potentially hazardous power and energy facilities;

- joint inspections of the status of protection and security of nuclear facilities potentially hazardous from terrorist attack standpoint;

- creation of a joint workgroup involving representatives of special services and other ministries and agencies, aimed to improve systems of protection and security of potentially hazardous nuclear facilities and identify relevant funding sources;

- establishment and improvement of regulatory framework for physical protection and prevention of terrorism.

Arrangements by Ministry of Fuel and Energy of Ukraine in Stepping-Up Level of Counterterrorism Protection of Ukrainian Nuclear Energy Facilities

Will be discussed during the Forum

Security System of Radioactive Sources in Albania

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Abstract

The paper intends to present the evolution and actual situation of security of radioactive sources infrastructure in Albania, focusing in its establishing and functioning in accordance with IAEA TECDOC-1355 other important documents. There are described the legal framework security of radioactive sources , the role of regulatory authority, the efforts to upgrade the system of security.

Introduction

The issue of the establishing and functioning of the security system of Radioactive sources in Albania was considered as one of two very important columns in the process of licensing of radioactive sources especially Security Group 1 and 2. The existence of the adequate legislation, regulations, the regulatory authority and functioning is based manly in IAEA TECDOC-1355, which gives the necessary condition for the security of radioactive sources.

The first document on security of radioactive sources in Albania is " Regulations on physical protection of radioactive materials" No 2518 date 20/06/2008 .In the process of application of licensing the security measures are very important aspects to be completed in advance. Radiation Protection Commission was established to supervise all security measures through inspector of the radiation Protection Office.

References

[1] Regulation on " On Physical protection of radioactive sources "

[2] IAEA Tecdoc series 1355..

[3] INTERNATIONAL ATOMIC ENERGY AGENCY, International BSS for Protection against Ionizing Radiation and for the Safety of Radiation Sources, IAEA, Safety Series No. 115, Vienna, (1996).

[4] Radiological Protection Act, 8025 date 9/11/1995

[5] RASSIA Report for ALBANIA IAEA Document

The Implementation of Nuclear Security Program and the Improvement of Physical Protection in Indonesia: Progress and Challenges

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Non Proliferation of Nuclear Weapon Treaty (NPT), and the comprehensive safeguards agreements regime on IAEA model INFCIRC/153 Corr., nuclear safeguards systems have been operated for over three decades. Indonesia ratified the NPT agreement by Act No. 8 Year 1979. The government of the Republic of Indonesia is committed to general contribution in achieving a condition of safe, secure and peace the world in relation of nuclear energy utilization and to continue its strong support for the principles of the treaty. At that time Indonesian nuclear program was not as big as present programs. By time changes, the utilization of nuclear energy for peaceful purposes was significantly increasing based on the world's nuclear research and technology development. Nowadays, Indonesia has three research reactors and other nuclear installations for research activities. The first nuclear power plant is planned will operating on year 2016.

National Nuclear Energy Agency (BATAN) as promoting body in Indonesia has several reactor research centers. They are located at different province such as Bandung nuclear research center, Yogyakarta nuclear research center and Serpong nuclear research center. As the research and development institution belongs to government BATAN has also develop research by using radioactive substances for peaceful purpose. At three reactor research center are used nuclear materials with different nuclear category. The biggest research reactor in Indonesia is located in national center for science and technology development or called PUSPIPTEK, Serpong district, Province of Banten. In Serpong nuclear research center comprise several nuclear installation such as research reactor G.A. Siwabessy (30 Mw thermal), fuel element production installation, experimental fuel element installation, radio metallurgy installation, radioisotopes installation, radioactive waste installation. The Serpong whole area is wide approximately 24 ha and including supporting facilities. The nuclear material and its installation is potential target in the facilities so that they needed physical protection measures in prevention and protection of nuclear material and radioactive source against theft and sabotage. The implementation of physical protection of nuclear material and radioactive sources in Indonesia complied with the international instruments such as the Convention of the Physical Protection on Nuclear Material and Facilities, amended on July 2005, and INFCIRC/225/Rev. 4, (corrected), the physical protection of nuclear material and nuclear facilites, June 1999.

The application of nuclear energy for power program generation involve in the management of nuclear materials and other radioactive substance. According to international regulation and convention, an effective physical protection system is needed to protect nuclear materials and its facilities against theft and sabotage for both non-proliferation and radiation safety purpose.

Further to implementation of the IAEA nuclear security program in the region, Indonesia received two nuclear security services, IPPAS and INSServ mission. Based on the expert mission recommendation, therefore Indonesia improved their physical protection system on nuclear material and facilities against theft and sabotage.

One thing that should be considered by the Government of Indonesia is human resource development programmes. So far, some effort has developed to enhance the knowledge of the employee who deals with nuclear material and radioactive substances. It still needed to increase the awareness in particular to personal and other related agencies as well.

The Department of Energy's National Nuclear Security Administration discussed security assistance with Indonesia's National Nuclear Energy Agency, BATAN. These upgrades not only reduced the threat of theft at the three research reactors, but also provided local physical protection expertise to use during the concept, design, and operation of Indonesia's future power reactors.

References

[1]. Act Number 10, Nuclear Energy.

[2]. Chairman Decree of BATAN Number 392/Ka/XI/2005 concerning Organization and Administration of BATAN.

[3]. Chairman Decree of BAPETEN Number: 02-P/Ka.-BAPETEN/VI-99 concerning the Guidance of Physical Protection on Nuclear Materials.(draft revision 2008).

[4]. IAEA, IPPAS Mission Recommendations on February 5-15, 2001.

[5]. Convention on The Physical Protection of Nuclear Material and Facilities, Amended July 2005.

[6]. IAEA-INFCIRC/225/Rev. 4, (Corrected), June 1999, Physical Protection of Nuclear Material and Facilities

[7]. IAEA-TECDOC-967, Guidance and Considerations for The implementation of INFCIRC/225/Rev.4, The Physical Protection of Nuclear Material and Nuclear Facilities

[8]. Recommendations of the IAEA International Physical Protection System Advisory Services (IPPAS) Mission, Sept 2007

[9]. IAEA-NSS 6, Combating Illicit Trafficking in Nuclear and other Radioactive Material.
IAEA-NSS 7, Nuclear Security Culture

Contemporary Approaches of Practical Work in the Field of Preventing Illicit Trafficking of Nuclear and Radioactive Materials at the Border

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Combating illicit trafficking nuclear and radioactive materials at the border count for much in the connection with the measures provided by the global community against world terrorism.

In connection with the existence and constant increase of amount and scale of contemporary challenges and threats to the international security system there is a necessity of the contemporary approaches of solving the problem of illicit trafficking of nuclear and radioactive materials at the border.

On the purpose of solving this problem State Border Guard Committee of the Republic of Belarus has worked out and has been implementing the Conception of Nuclear and Radiation Security Provision. The Conception involve the development of the United Informational Analytical System of Radiation Control at the Border. The System presents:

- Information receipt from different radiation control devices: portal radiation monitors, search radiation pagers, radiation identification devices (RID) from the independent user groups (Border Guard Service, Customs, Emergency, Police) by means of the contemporary informative technologies;

- Radiation incident investigations (identification of the alarm reasons) by means of developing regional mobile laboratories of operational response;

- Transfer of the investigation data to the remoted command centre for online expert support.

The lecture will expose the structure of the radiological data transfer from the devices at the border to the remoted command centre, the work of regional and central command centres using geoinformational system "NPNet" for online expert support of the investigation considering the realization results of the IAEA CRP-contract No14938.

Taking into account the results of the practical work in the field of prevention illicit trafficking nuclear and radioactive materials reached in consequence of the job at the border between Belarus and the European Union it`s planning to uncover the arrangements of the Unified Informational Analytical System of Radiation Control and all the pecularyties needful on each level of the job.

There are expected to be shown some outputs of the mobile radiological laboratory of operational response and the algorythm of work of the command centre coordinating the activity of the establishments responsible for a radioactive incident investigation, data processing and analysis, taking expert desicion of the further usage of the detained materials.

The method of the radiation incident expert assessment by the command centre experts including involved external experts of national and international scientific centres.

The approaches of the solvation of illicit trafficking of nuclear and radioactive materials are able to upgrade the existing methods of work, to increase prevention of illicit trafficking nuclear and radioactive materials efficiency, to make facility for the legal transfer of the goods across the border and at the same time to guarantee the reliable barrier against illegal trafficking of nuclear and radioactive materials. The expounded experience can be used in organization of radiation control in the IAEA state-parties.

References

[1] IAEA-TECDOC-1313.

[2] The IAEA CRP-contract No14938 outputs.

French Emergency Response Against Nuclear and Radiological Terrorism

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The French response in case of nuclear or radiological terrorism threat is organized around a technical response group DCI (Interministerial Central Detachment). This group is in charge of search, diagnostic, assess and neutralize a nuclear or radiological improvised device.

The DCI was set up on 6 March 1995 to deal with the threat of terrorist attacks using CBRN devices, or following the discovery of a device suspected of containing CBRN or similar materials for terrorist or criminal purposes. This group is able to deploy anywhere in France, and is made of people from Homeland security Minister (Police squad, scientific police and civilian security), Defense Minister (EOD teams), and French Atomic Commission - Military Application Division (CEA/DAM).

Upon proposal of the Prime Minister's National Defence General Secretariat, the head of the RAID (special police force) is appointed by the Ministers of Homeland Security and Defense. He assumes command of the DCI and choose his deputy in regard with the threat; for the nuclear and radiological threat, the deputy who will assist the Chief of the group is issued from CEA/DAM.

The group deals with search, assesment and render safe any such device (containement and neutralization). It's objective is to assess the threat level and to advise the Prefet or Military Authority in charge of the crisis on the best technical solutions to deal with the incident and to realise technicals actions in order to rend safe the device. For that it will provide its expertise and relies on specific technical means of dealing with CBRN incidents, which it alone is able to deploy at the national level The DCI has the capacity to deal with CBRN cases such as the use of a CBRN device used in a terrorist related workplace blackmail.

A second role undertaken by the group since its inception is that of bringing a level of technical expertise to the Police, Gendarmerie or Customs Services in the fight against trafficking.In support of the police and the Gendarmerie, the DCI has dealt with many such cases, such as trafficking in radioactive substances, either in urgent cases or in lengthy enquiries or those undertaken under the orders of the Public Prosecutor.

Furthermore, the DCI plays a role in the "Council's National Cell", set up in the wake of the recent spate of letters suspected of carrying anthrax spores (or other CBRN related substances). This Cell is intended to assist the Police and Gendarmerie when dealing with cases of suspect mail.

In recognition of the CBRN threat, the DCI has a role in the preventive measures which are systematically put in place during large scale events, such as the football or rugby World Cup, the G8 Summit in Evian, the 60th Anniversary Ceremonies relating to D Day and the Liberation of France, the visit of the Pope, the NATO Summit etc. This purpose is something important for such a group, this allowed them to work together without the pressure of crisis and this give them the opportunity to know them better.

The paper will show the organization of the different stage of the crisis management from the search of a device up to the render safe. The paper will be illustrated by different views of the teams working in different situations and will show the common work done by the different services of DCI to reach the objective in some different situation such as exercices or real situations. It will explain how people coming from very different purpose such as military, policemen or scientifics for CEA can work together to give the best response to the threat.

Pakistan's Nuclear Security Action Plan

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Introduction:

The Government of Pakistan approved a five year plan to strengthen the nuclear security regime in the country which is being implemented since July 2006 . The objective of this Project is to strengthen and enhance the existing regulatory capabilities of PNRA to discharge its responsibilities towards safety and security of nuclear/radioactive materials and facilities.

Areas of Focus:

The project covers following five areas :

Area-1: Management of Radioactive Sources in Cateaorv 1- 3. evaluation of vulnerable facilities and supporting their efforts: The out corne of the area would be Assessment of security levels at the licensed facilities, identification of weaknesses, propagation of the security culture , up-gradation of the security effort and strengthening of PNRA effectiveness and vigilance .

Area-2: Establishment of PNRA Nuclear Safety/Security Training Center: The outcome of this area would be a permanent train ing facility for sustainable system at national level for providing training in nuclear safety & security to manpower in PNRA and other national organizations.

Area-3: National Nuclear Security Emergency Co-ordination Center (NuSECC): The outcome of this area would be the capability to assess , control , and respond and co-ordinate in case of an emergency pertaining to nuclear security.

Area-4: Locating and Securing Orphan Radioactive Sources : The outcome of this area would be the establishment or restoration of regulatory control over orphan sources, disposing and putting these sources out of reach of perpetrators and saboteurs. Provision of clean metal and environment to the public.

Area-5: Provision of Detection Eguipment at Strategic Points : The outcome of this area would be better cont rol of illicit trafficking of nuclear/rad ioactive material and prompt response to radiological emergency.

A Methodology for Self-Assessment of Nuclear Security Risks

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Urenco has developed a methodology for assessing the risks involved in running its uranium enrichment business. This methodology has been used to assess risks in a wide range of areas, for example: financial, commercial, logistics and projects. Recently, this methodology has been introduced for categorising and assessing nuclear security risks. The likelihood and magnitude of consequence of each risk is evaluated using a simple scoring system. A colour-coded chart is used to present a summary of the risk assessment to company management. Such a manner of displaying clearly the overall rating of security risks makes for an easy-to-use system, which shows clearly the importance of each nuclear risk as regards the successful operation of the business. This gives a good basis for deciding on the need for and focus of any action plan to improve nuclear security. This methodology could be utilised for a self-assessment of nuclear security risks in any branch of the nuclear industry world-wide.

Nuclear Safeguards and Security: Analytical Evaluation of Material Control and Accountability Systems

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A nuclear Material Control and Accountability System Effectiveness Tool (MSET) has been developed in the United States for use in evaluating Material Control and Accountability (MC&A) systems in nuclear facilities. The project was commissioned by the National Nuclear Security Administration's Office of International Material Protection and Cooperation to potentially evaluate MC&A in Russian facilities. MSET was developed by U.S. personnel with experience spanning more than six decades in both the U.S. and international nuclear programs and with experience in probabilistic risk assessment in the nuclear power industry.

MSET contains five major components:

1. A functional model that shows how to design, build, implement, and operate a robust nuclear material control and accountability system. The model defines 151 fundamental elements that are needed for a comprehensive MC&A system. An extensive description, along with performance metrics and standards, was developed for each fundamental element.

2. A fault tree of the operating MC&A system that adapts probabilistic risk assessment methodology to analyze system effectiveness and give a relative risk of failure assessment of the system.

3. A questionnaire that is used to develop documentation on the facility's current MC&A system. It provides data to rate the quality of the system and the level of performance of each basic MC&A task that is performed throughout the material balance area.

4. A formal process of applying expert judgement to convert the facility MC&A data into numeric values repesenting the performance level of each basic event for use in the fault tree risk assessment calculations.

5. A software system that performs the fault tree risk assessment calculations and produces risk importance factor reports on the facility's MC&A system. The software is widely used in the aerospace, chemical, and nuclear power industries.

MSET was peer reviewed in 2007 and validated in 2008 by benchmark testing in two material balance areas at the Idaho National Laboratory in the United States. The MSET documents and logic diagrams were translated into Russian and provided to Rosatom in July of 2008, and MSET is currently being evaluated for potential application in Russian Nuclear Facilities. MSET offers significant potential benefits for improving nuclear safeguards and security in any nation with a nuclear program.

MSET provides a design basis for developing an MC&A system that functions to protect against insider theft or diversion of nuclear materials. MSET analyzes the MC&A system and identifies several risk importance factors that show where sustainability is essential for optimal performance and where performance degradation has the greatest impact on total system risk. Areas of potential system improvements are identified, the risk reduction that is achievable with potential upgrades is shown, and reevaluation after completion of upgrades shows the actual risk reduction that was achieved.

Russian University Education in Nuclear Safeguards and Security

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As safeguards and security (S&S) systems are installed and upgraded in nuclear facilities throughout Russia, it becomes increasingly important to develop mechanisms for educating future Russian nuclear physicists and engineers in the technologies and methodologies of physical protection (PP) and nuclear material control and accounting (MC&A). As part of the US Department of Energy's (DOE) program to secure nuclear materials in Russia, the Education Project supports technical S&S degree programs at key Russian universities and non-proliferation education initiatives throughout the Russian Federation that are necessary to achieve the overall objective of fostering qualified and vigilant Russian S&S personnel.

The Education Project supports major educational degree programs at the Moscow Engineering Physics Institute (MEPhI) and Tomsk Polytechnic University (TPU). The S&S Graduate Program is available only at MEPhI and is the world's first S&S degree program. Ten classes of students have graduated with a total of 79 Masters Degrees as of late 2008. At least 84% of the graduates over the ten years are still working in the S&S field. Most work at government agencies or research organizations, and some are pursuing their PhD. A 5½ year Engineering Degree Program (EDP) in S&S is currently under development at MEPhI and TPU. The EDP is more tailored to the needs of nuclear facilities. The program's first students (14) graduated from MEPhI in February 2007. Similar sized classes are graduating from MEPhI each February. All of the EDP graduates are working in the S&S field, many at nuclear facilities. TPU also established an EDP and graduates its first class of approximately 15 students in February 2009.

For each of these degree programs, the American project team works with MEPhI and TPU to develop appropriate curriculum, identify and acquire various training aids, develop and publish textbooks, and strengthen instructor skills. The project has also supported the instruction of policy-oriented non-proliferation courses at various Russian universities. These courses are targeted towards future workers in the nuclear field to help build an effective non-proliferation awareness within the nuclear complex. A long-range goal of this project is to assist the educational programs at MEPhI and TPU in becoming self-sustainable and therefore able to maintain the three degree programs without DOE support. This paper describes current development of these education programs, new initiatives, and sustainability efforts. The paper also describes general nonproliferation education activities supported by DOE that complement the more technical S&S degree programs.

IAEA Nuclear Security Human Resource Development Program

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The IAEA is at the forefront of international efforts to strengthen the world's nuclear security framework. The current Nuclear Security Plan for 2006–2009 was approved by the IAEA Board of Governors in September 2005.

This Plan has three main points of focus: needs assessment, prevention, detection and response. Its overall objective is to achieve improved worldwide security of nuclear and other radioactive material in use, storage and transport, and of their associated facilities. This will be achieved, in particular, through the provision of guidelines and recommendations, human resource development, nuclear security advisory services and assistance for the implementation of the framework in States, upon request.

The presentation provides an overview of the IAEA nuclear security human resource development program that is divided into two parts: training and education. Whereas the training program focuses on filling gaps between the actual performance of personnel working in the area of nuclear security and the required competencies and skills needed to meet the international requirements and recommendations described in UN and IAEA documents relating to nuclear security, the Educational Program in Nuclear Security aims at developing nuclear security experts and specialists, at fostering a nuclear security culture and at establishing in this way sustainable knowledge in this field within a State.

The presentation also elaborates on the nuclear security computer based learning component and provides insights into the use of human resource development as a tool in achieving the IAEA's long term goal of improving sustainable nuclear security in States.

Nuclear Security Education and Training at Naif Arab University for Security Sciences

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Naif Arab University for Security Sciences (NAUSS) was established in 1978 as an Arab institution specialized in security sciences to fulfill the needs of the Arab law enforcement agencies for an academic institution that promotes research in security sciences, offers graduate education programs and conduct short-term training courses, which should contribute to the prevention and control of crimes in the Arab world. NAUSS is a regional organization providing education and training in all security disciplines to students from all the 22 Arab countries. NAUSS is operated by board of directors reporting directly to the Council of Arab Ministers of Interiors (CAMI). HRH Prince Naif Bin Abdul Aziz, the Saudi Minister of interior is the chairman of board of directors.

Terrorism is a global phenomenon endangering the geopolitical and socioeconomic stability of many peaceful countries all over the world. The crucial contribution of educational institutions in confronting terrorism is parallel to the role played by security apparatus in its combat. This confirms the central role of universities, institutions of academic and professional training, security research organizations and sanctuaries of worship in the over all confrontation against terrorism. Unique among these universities is NAUSS which has made tremendous contributions to fight against crime and terrorism through its academic endeavors. NAUSS designed special curricula and professional training programs to identify, prevent and combat terrorism. Apart from the academic activates at NAUSS, special attention is given to enhance the public awareness about the evil act of terrorism through organizing open lectures, seminars and other mass media channels.

Terrorism is a very old phenomenon, which maintain the same meaning all of these years, but has improved by its tools which started with knifes and swords and now by chemical and nuclear bombs and even with civilian airplanes. After the tragic events of September 11, 2001, there has been an increasing concern among the international community concerning the use of nuclear and radioactive sources in malicious acts, and that is what is known as nuclear terrorism. This has encouraged the International Atomic energy Agency (IAEA) to develop and engaged in a series of activities for the protection and prevention against nuclear terrorism. These activities are coordinated through the agency's Office of Nuclear Security.

The IAEA and thought its office of nuclear security approached NAUSS, as a leader in security sciences in the Arab world, to form a partnership aiming at combating nuclear terrorism through conducting training and education programs in nuclear security. This resulted in signing a practical arrangement which calls for: Promote institutional exchanges by inviting scholars and delegates; Organize Symposia, conferences, meetings and training on relevant issues; Exchange information pertaining to developments in the areas of mutual concern in our respective institutions; Carry out other joint programs and activities of cooperation as may be agreed upon by the parties.

As a result of this arrangement, NAUSS and the IAEA organized the first workshop on nuclear security on November, 2006, which aimed to explore and improve the nuclear security culture awareness through the definitions of the nuclear security main pillars, Prevention, Detection and Response. The workshop was attended by more that seventy participants of law enforcement background from many Arab countries. Also NAUSS participated in the yearly nuclear security seminar organized by the IAEA in collaboration with United States government at Argonne national laboratory, and presented a paper on the forensic analysis of explosive. In addition, NAUSS and IAEA organized a very important training course on April, 2008 on combating nuclear terrorism titled “Protection against nuclear terrorism: Protection of radioactive sources”. More than sixty five participants attended the training course from ministries of interior, justice and health from most of the Arab countries.

In the past two years, IAEA has put tremendous efforts to develop an education program in nuclear security, which may lead into Master’s degree in nuclear security, where NAUSS helped in this project through the participation in the IAEA organized consultancy and technical meetings for the development of this program along with many other academic, security and law enfacement experts and lawyers from many different institution in the world. NAUSS is very much interested in the implementation of these educational programs through its offered academic security sciences graduate programs. For this purpose NAUSS and IAEA drafted a work plan for the next coming two years which should lead into the gradual implementation of these educational programs at NAUSS. The plan starts with the incorporation of an introductory course in nuclear security into the existing gradate studies security sciences program at the police sciences department of the college of gradate studies at NAUSS. In a next step the plan calls for the development of a one-semester certificate program in nuclear security, which hopefully will lead into the establishment of a full Master’s degree in nuclear security. The plan also calls for the needed technical assistant from IAEA in the providing teachers, training of NAUSS faculty members, translation of all the related materials into Arabic language and providing the technical assistant for the establishment of needed nuclear security laboratories.

NAUSS also continues to participate in several local conferences and symposiums related to the peaceful application of nuclear power in the gulf region, and the need for a human resources development programs to fulfill the scientific and security needs which will arise from building nuclear power plants. NAUSS participated in the International Symposium on the Peaceful Application of Nuclear Technology in the GCC countries, organized by King Abdulaziz University in the city of Jeddah, Saudi Arabia. Also NAUSS participated in the Annual Energy Conference (Nuclear Energy in the Gulf” organized by the Emirates Center for Strategic Studies and research, held at the city of Abu Dhabi, United Arab Emirates.

International Forensics Cooperation: Reviewing Frameworks, Goals and Capabilities

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There have been many recent calls for increased international cooperation in the field of nuclear forensics. While much is already being done, for example by the International Technical Working Group on Nuclear Smuggling and International Atomic Energy Agency, more effort is needed as cooperation on real-world incidents is often *ad hoc*. As a result, incidents – particularly diversions of nuclear material – are not effectively investigated, and opportunities to keep dangerous materials out of the hands of terrorists or proliferators are missed.

Forensics techniques can be used to investigate many types of incidents involving illicit uses of nuclear or radiological material, but the need for cooperation can be seen most clearly in the area of illicit trafficking where collaboration is needed now. Here governments have had some success interdicting smuggled material but diversions are not usually effectively investigated.

Forensics cooperation is often cast simply as information-sharing, but cooperation between governments also requires connecting experts that do not often work together, e.g. connecting law enforcement officials that seized material in Country A with atomic energy experts in Country B that can potentially determine the source of diversion.

Opportunities for cooperation also vary by event, i.e. forensics techniques that support prosecuting a seizure – which is often merely a national effort, are different than the techniques applied to investigating a diversion – which often involves more than one country. Similarly, techniques applied to investigating dispersal of radioactive material or detonation of an improvised nuclear device are different from those for investigating a seizure or diversion.

Finally, national capabilities required to support forensics cooperation need to be more fully articulated. It is not economical for all governments to maintain the equipment and expertise required for detailed forensics analysis. Nonetheless, there are capabilities that all governments should have including:

- a national plan for responding to illicit uses of nuclear or radiological material;
- the ability to characterize alleged, interdicted or illicitly-used nuclear or radiological material;
- the ability to safely transport, store and present at trial illicitly-used nuclear or radiological material consistent with chain-of-custody requirements; and,
- a forensics library of nuclear and radiological material within a country.

In order to promote nuclear security, this presentation will review in more detail the frameworks, goals and capabilities needed to facilitate forensics cooperation on real-world cases involving illicit uses of nuclear or radiological material.

«Rosatom» Sites Vulnerability Analysis and Assessment of their Physical Protection Effectiveness. Methodology and «Tools»

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Enhancement of physical protection (PP) efficiency at nuclear sites (NS) of State Corporation (SC) « Rosatom » is one of priorities. This issue is reflected in a series of international and Russian documents.

PP enhancement at the sites can be achieved through upgrades of both administrative procedures and technical security system. However, in any case it is requisite to initially identify the so called «objects of physical protection», that is, answer the question of what we need to protect and identify design basis threats (DBT) and adversary models. Answers to these questions constitute the contents of papers on **vulnerability analysis (VA)** for nuclear sites.

Further, it is necessary to answer the question, to what extent we protect these «objects of physical protection» and site as a whole; and this is the essence of assessment **of physical protection effectiveness**. In the process of effectiveness assessment at specific Rosatom sites we assess the effectiveness of the existing physical protection system (PPS) and the proposed options of its upgrades. Besides, there comes a possibility to select the optimal option based on «cost-efficiency» criterion. Implementation of this work is a mandatory requirement as defined in federal level documents.

In State Corporation «Rosatom» there are methodologies in place for vulnerability analysis and effectiveness assessment as well as «tools» (methods, regulations, computer software), that make it possible to put the above work into practice. There are corresponding regulations developed and approved by the Rosatom senior management.

Special software for PPS effectiveness assessment called **«Vega-2»** developed by a Rosatom specialized subsidiary – State Enterprise «Eleron», is designed to assess PPS effectiveness at fixed nuclear sites. It was implemented practically at all the major Rosatom nuclear sites. As of now, this «Vega-2» software has been certified and prepared for forwarding to corporation's nuclear sites so that site security personnel could use it independently and continuously monitor their site PPS effectiveness.

«Polygon» software (version for material transportation application), also developed by «Eleron», is designed to assess PPS effectiveness (including the results of a combat action between protective force and intruders) for nuclear materials during transportation by trucks and railway cars. This program was used to substantiate the expediency of proposed administrative procedures and technical activities (like second security car, etc.). In 2008, in the framework of US-Russian cooperation, this software was handed over to Lunyovo Training Center of the Russian MVD – Internal Troops as a training simulator to be used for personnel advanced training. In accordance with JCC resolution, within the US-Russian cooperation, it is planned to disseminate «Polygon» software in 15 MVD-IT units as analytical tool and simulator. The software is state - certified and is recommended as baseline software by the « Rosatom» Order.

In order to answer the question of physical protection adequacy, at each specific Rosatom nuclear site there is a standard automated workstation for security service analyst designed to accumulate all the data pertaining to condition of PPS as a whole and its constituent elements (technical equipment, etc.). Assessment of PPS status at all Rosatom sites in order to provide for targeted funding to upgrade physical protection with due regard to a site's significance and real status of physical protection system, is done on the automated workstation that is installed at «Rosatom» Headquarters. It is planned to complete the work on implementation of such two-level information system in the year 2009.

It should be noted that PPS effectiveness assessment software and the above information system can be successfully applied in the process of implementation of Sustainability program.

In conclusion, we may ascertain that State Corporation «Rosatom» has methodology and the requisite «tools» available to perform vulnerability analysis of nuclear sites and assess their PPS effectiveness as well as integrally assess the level of nuclear sites protection. The above work has been implemented practically at all the major sites of the State Corporation.

Optimization of Activities Purposed to Enhance the Security of Nuclear Materials and Installations

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Assurance of the security for sites belonging to the atomic science, industry, and energy of the Russian Federation is based on the number of principles the top-priority of which is prevention of nuclear terrorist acts using political, communications, socioeconomic, administrative and technical, legal, and other measures.

The following activities in the security area as applied to critical sites are being performed:

1. Development of the state regulations and definition of security levels for protection of critical sites from a terrorist threat (primarily hazardous nuclear sites). Introduction of unification requirements for newly designed and constructing sites.

2. Transition from "programming-adaptive method" of management to the management by objectives according to the scheme - "predictor-reviser".

3. Monitoring and prevention of a terrorist threat of a direct or indirect character based on the list of potential threats developed for each specific site. Preventive activities are identified by the adversary model (number of people, used equipment and weapons, and awareness) and the adversary scenario (terrorist act).

4. All critical sites are classified by categories depending on the degree of terrorist act after-effects (damage). The damage is estimated in monetary terms based on the approved methods.

5. A complex factor is determined for an evaluation of the site protection effectiveness, namely, **"a probability of undesirable event".**

6. A standard risk is evaluated for each critical site. The risk is equal to the product of multiplication of a probability of undesirable event by the damage. The "risk management" means that the risk reduction may be accomplished by the reduction of the probability of undesirable event or the damage value.

7. Differentiation of spheres of activities and distribution of responsibilities in the area of sites security have been established, in particularly:
   - security technology customers;
   - security technology designers;
   - security technology users;
   - security technology evaluators.

V. Prostakov

A security level and the effectiveness of physical protection of nuclear materials and installations in Rosatom are identified in accordance with the requirements of government and international normative legal documents and regulations.

JSC “Atomenergoprom” ’s Efforts to Establish PP Corporative Standards in Developing Effective Approaches to PP of NPP under Construction

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Joint Stock Company "Atomic Energy Power Corporation" (JSC AEP) is a joint stock company of the State Atomic Energy Corporation "Rosatom" and was established for integration in it enterprises and organizations of the civil sector of the Russian atomic branch. Its activities are regulated by a complex of unique standards which guarantee maintenance of the State governance and integrity of the Russian atomic branch including the international obligations of Russian Federation on physical protection of nuclear material and nuclear facilities. Ensuring physical protection is one of the main types of the Company's activities.

Physical protection system of a nuclear site is destined for protection from consequences of unauthorized actions against NMs and nuclear facilities, and the more serious possible consequences of such actions are in the conditions of modern threats the more important is effectiveness of physical protection and its adequacy to the threats.

Following international standards and developing Russian norms and regulations taking into account the peculiarities of its activities JSC AEP fulfils the search and development of effective approaches to creation of physical protection systems of the nuclear generating units under construction. These approaches are implemented in the form of corporative standards and methodological recommendations for the management of nuclear sites.

One of the standards is a standard which regulates the structure and the order of implementation of obligatory procedures on designing physical protection systems during pre-design and design stages of the investment phase of NPP construction (fig. 1). Such obligatory procedures include: categorizaton of protected objects, choice of design basis threat, choice of a specialized organization, vulnerability analysis of the site and evaluation of physical protection system effectiveness.

In the conditions of economic crisis and in the context of optimization of costs for creation of physical protection system on the design stage according to the cost-effectiveness criterion this standard regulates the structure and the order of activities of investor, customer, general designer, contract specialized organizations in the process of implementation of the above mentioned procedures in the order existing in JSC AEP.

According to the Russian regulation designing of a new nuclear facility without taking into account the requirements of physical protection of nuclear materials and facilities is forbidden, and the design of PPS is fulfilled as a separate section in the design documentation on the facility construction. Before submission to the State expertise the PPS section is subject to a special expertise with the goal to check its correspondence to the requirements of the Russian regulatory basis, requirements of corporative standard, to evaluate the technical and financial components, to include necessary corrections. The investor organizes implementation of the special expertise, and in this implementation an independent specialized organization is involved which has a special license for expertizing the designing, construcion and technological documentation on physical protection and which has passed a competitive selection in JSC AEP (fig. 2).

Experience in Development and Specific Features of the Nuclear Security Educational Programs

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Abstract. The paper considers the 15-year experience gained by MEPhI experts in developing and implementing the educational programs of different graduate levels in the area of Nuclear Security. The following aspects are discussed in the paper: specific features of the Master of Science Graduate Program and Engineer Degree Program; overview of the programs curricula and the special laboratories; experience in collaboration with Russian (Tomsk University) and Ukrainian (Sevastopol University) higher schools in developing similar graduate programs; experience in developing the educational programs for staff re-training and qualification upgrading; perspectives for further advancement of the graduate programs in the area of nuclear security with application of the competence approach.

IAEA and Nuclear Forensics

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Nuclear forensics can provide information about the history, intended use and potentially the origin of nuclear or radioactive material. For these reasons, it is an important tool for improving nuclear security and combating illicit trafficking of nuclear and other radioactive materials. The IAEA is currently working on enhancing knowledge, techniques, procedures and cooperation in the field of nuclear forensics. Some of the work currently being undertaken by the IAEA includes the development of a five day training workshop on basic methods for radiological crime scene activities, to ensure adequate control of evidence, including for nuclear forensics purposes, a coordinated research project on the application of nuclear forensics in illicit trafficking, and a proposal for international cooperation with nuclear forensics databases and the development of guidelines for establishing databases. Nuclear forensics will continue to be an important topic for nuclear security and we anticipate that the results of this work will increase State's understanding of and ability to apply nuclear forensics.

Improving the Detecting Performances of Radiation Portal Monitors Using Matched Filter Algorithm

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Introduction: Radiation Portal Monitors (RPM) are used for monitoring transportation of illicit radioactive materials. The application requires detection of radioactive materials while the vehicle is passes through a portal, thus having limited time for monitoring the passing vehicle. The pattern of the RPM detector readings, caused by measuring a moving source versus the background provides an opportunity to employ an algorithm based on matched filter technique for improving the detecting performances.

Method: Matched filter is a process used for detecting a known signal in the presence of additive stochastic noise, and thereby maximizing the detected signal to noise ratio (SNR). For RPM's the matched filter is implemented by correlating a known signal, which is distance dependent, with the RPM readings. Convolving those readings, which combine the signal and the noise, with a time-reversed version of the signal, improves the RPM performances. To validate this concept a detection configuration was established according to measuring time limit and Minimal Detectable Activity (MDA) defined by ANSI 42-35 regulation. A mathematical software simulation was performed, followed by an experiment with a scale down configuration in order to confirm the benefits of the suggested algorithm. The experimental setup contained a NaI(Tl) scintillator based radiation detector, a radioactive source located on a moving toy train and a proximity sensor.

Results: The detection performances obtained by both the simulation and the experiment with and without the matched filter algorithm were compared. The software simulation has shown a major improvement of up to six-fold decrease in miss alarm rate. Similar results where obtained by the experiments.

Conclusions: The implementation of the matched filter in RPM detection algorithm improves its performances. The method provides either a) a higher detection reliability level, b) the ability to detect lower activity level, c) the need for fewer detectors to achieve the same MDA obtained without the matched filter. The proposed method is almost costless for implementation and requires minor hardware modifications. A future research will evaluate the advantage of the matched filter in cases of a spread source and a source which is not located at the center of the moving vehicle.

International Cooperation in Recovering and Securing Disused Radioactive Sources

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Abstract. Many countries need assistance to recover and secure disused radioactive sources because

i) they do not have adequate technical capabilities and

ii) the sources are of foreign origin.

International assistance is therefore needed to render disused sources safe and secure in these countries. The IAEA is organizing and providing such international assistance by managing source recovery projects using funding offered by donor MSs and organizations such as the EU and technical means and expertise from MSs where the sources were manufactured. As a result of these projects a large number of disused radioactive sources have been recovered, conditioned and placed in safe and secure storage facilities or repatriated in the country of origin. The IAEA is also cooperating with MSs in developing new equipment specifically designed for source recovery and conditioning operations such as the mobile hot cell, which will be used for securing high activity sources. Examples of such projects can be given depending on the time available.

IAEA/EU Joint Action — Partnership in Improving Nuclear Security

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Abstract. In December 2003, the European Council adopted the European Union Strategy against Proliferation of Weapons of Mass Destruction, under which — beginning 2004 — four Joint Actions have been contracted between the European Community, represented by the Commission of the European Communities and the IAEA by signing a special Contribution Agreement for each Joint Action. Three Joint Actions were successfully completed by the end of 2008. The purpose of the EU Joint Actions is to support IAEA efforts to assist States, on request, in strengthening their nuclear security infrastructure and implementation.

The programme — with a budget for all three completed Joint Actions was € 14 238 000, making the EU of one of the biggest contributors to the Nuclear Security Fund — assists countries and includes both Member States and non-member States of the IAEA. These three Joint Actions provided support and assistance to 47 of 73 eligible countries in South-Eastern Europe, Central Asia, the Caucasus, the Middle East and Africa. The fourth Joint Action with a budget of € 7 703 000 started in October 2008 and includes, additionally, eleven countries in South East Asia.

Under the three Joint Actions, 209 different tasks have been implemented on legislative and regulatory matters, the strengthening of security and control and other radioactive material, the physical protection of nuclear material, nuclear facilities, radioactive material in non-nuclear applications, safeguards (additional protocols) and the strengthening of States' capabilities for detection and response to illicit trafficking. Technical assistance includes equipment installation, expert consultations, missions, training, and assistance in developing legal and regulatory national infrastructure.

Nuclear Security and the 2008 Olympic Games

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The organization of a Major Public Event, for sports, political or other gatherings, presents important security challenges for the Host State. A Cooperation Arrangement was signed by the IAEA and the China Atomic Energy Authority on 13 July 2007, on joint nuclear security activities, including for the 2008 Beijing Olympic Games. The nuclear security measures were integrated into the overall security system for the event and were aimed at protecting the participants and the public effectively from the consequences of criminal or unauthorized acts involving nuclear or other radioactive material. This was accomplished by performing an assessment of the existing security arrangements, an assessment of the nuclear security needs and the development of a joint action plan. The resulting actions implemented by the IAEA included providing options for concepts and strategies for detection, interdiction and response to criminal or unauthorized acts involving nuclear or other radioactive materials, the provision of radiation detection equipment for use during the Olympic Games and training on all aspects of nuclear security.

Strengthening Colombia's Capabilities to Detect and Respond to Nuclear Trafficking: Lessons Learned

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IAEA supports States in strengthening their capabilities to prevent, detect and respond to illegal and unauthorized acts involving nuclear and other radioactive material. This poster presentation provides an account of the IAEA support to Colombia. In March-April 2008, in response to several incidents of illicit trafficking and other unauthorized activities reported by Colombia to the IAEA Illicit trafficking Database (ITDB), the IAEA, at the request of the Government of Colombia, conducted a mission to assess Colombia's needs in the area of nuclear security, provide technical assistance and identify areas of subsequent support. The IAEA donated to Colombia a number of radiation detection and radionuclide identification instruments and conducted two national training courses in the areas of detection and response. The seizure of radioactive materials by Colombian authorities in August 2008 showed that the support was bearing fruit. The implementation of the Integrated Nuclear Security Support Plan (INSSP) being developed by the IAEA and Colombia will achieve the sustainability of the country's capabilities to detect and respond to illicit nuclear trafficking.

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